APPENDIX I

NMFS Workshop on the Effects of Fishing Gear on Marine Habitats Off the Northeastern United States

Northeast Fisheries Science Center Reference Document 02-01

Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts

by

Northeast Region
Essential Fish Habitat
Steering Committee

February 2002

Recent Issues in This Series:

01-03 **Assessment of the Silver Hake Resource in the Northwest Atlantic in 2000.** By J.K.T. Brodziak, E.M. Holmes, K.A. Sosebee, and R.K. Mayo. [A report of Northeast Regional Stock Assessment Workshop No. 32.] March 2001.

01-04 **Report of the 32nd Northeast Regional Stock Assessment Workshop (32nd SAW): Public Review Workshop.** [By the 32nd Northeast Regional Stock Assessment Workshop.] April 2001.

01-05 **Report of the 32nd Northeast Regional Stock Assessment Workshop (32nd SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.** [By the 32nd Northeast Regional Stock Assessment Workshop.] April 2001.

01-06 **Defining Triggers for Temporary Area Closures to Protect Right Whales from Entanglements: Issues and Options.** By P.J. Clapham and R.M. Pace, III. April 2001.

01-07 **Proceedings of the 14th Canada-USA Scientific Discussions, January 22-25, 2001, MBL Conference Center, Woods Hole, Massachusetts.** By S. Clark and R. O'Boyle, convenors. May 2001.

01-08 **TRAC Advisory Report on Stock Status: A Report of the Fourth Meeting of the Transboundary Resources Assessment Committee (TRAC), St. Andrews Biological Station, St. Andrews, New Brunswick, April 17-20, 2001.** [By the 4th Transboundary Resources Assessment Committee Meeting.] July 2001.

01-09 **Results of a Field Collection of Biopsy Samples from Coastal Bottlenose Dolphin in the Mid-Atlantic.** By J. Nicolas, D.C. Potter, C.W. Potter, and P.E. Rosel. July 2001.

01-10 **Assessment of the Georges Bank Atlantic Cod Stock for 2001.** By L. O'Brien and N.J. Munroe. [A report of the 4th Transboundary Resources Assessment Committee Meeting.] July 2001.

01-11 **Protocol and Guide for Estimating Nucleic Acids in Larval Fish Using a Fluorescence Microplate Reader.** By E.M. Caldarone, M. Wagner, J. St. Onge-Burns, and L.J. Buckley. July 2001.

01-12 **Northeast Fisheries Science Center Publications, Reports, and Abstracts for Calendar Year 2000.** By L. Garner and J.A. Gibson. August 2001.

01-13 **Elemental Composition of Fish Otoliths: Results of a Laboratory Intercomparison Exercise.** By V.S. Zdanowicz. September 2001.

01-14 **Identification of Seasonal Area Management Zones for North Atlantic Right Whale Conservation.** By R.L. Merrick, P.J. Clapham, T.V.N. Cole, P. Gerrior, and R.M. Pace, III. October 2001.

01-15 **Bycatch Estimates of Coastal Bottlenose Dolphin (*Tursiops truncatus*) in U.S. Mid-Atlantic Gillnet Fisheries for 1996 to 2000.** By D.L. Palka and M.C. Rossman. November 2001.

01-16 **Causes of Reproductive Failure in North Atlantic Right Whales: New Avenues for Research -- Report of a Workshop Held 26-28 April 2000, Falmouth, Massachusetts.** By R.R. Reeves, R. Roland, and P.J. Clapham, editors. November 2001.

01-17 **Collected Abstracts of the Northeast Fisheries Science Center's Seventh Science Symposium, Westbrook, Connecticut, December 11-13, 2001.** By R. Mercaldo-Allen, J. Choromanski, M.S. Dixon, J.B. Hughes, D.R. Lanyon, C.A. Kuropat, C. Martin, and J.J. Ziskowski, compilers. December 2001.

01-18 **Report of the 33rd Northeast Regional Stock Assessment Workshop (33rd SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.** [By Northeast Regional Stock Assessment Workshop No. 33.] December 2001.

01-19 **Report of the 33rd Northeast Regional Stock Assessment Workshop (33rd SAW): Public Review Workshop.** [By the 33rd Northeast Regional Stock Assessment Workshop.] December 2001.

01-20 **Assessment of 19 Northeast Groundfish Stocks through 2000: A Report to the New England Fishery Management Council's Multi-Species Monitoring Committee.** By Northern Demersal and Southern Demersal Working Groups, Northeast Regional Stock Assessment Workshop. December 2001.

Northeast Fisheries Science Center Reference Document 02-01

Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts

by

Northeast Region Essential Fish Habitat Steering Committee

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
Northeast Fisheries Science Center
Woods Hole, Massachusetts

February 2002

Northeast Fisheries Science Center Reference Documents

This series is a secondary scientific series designed to assure the long-term documentation and to enable the timely transmission of research results by Center and/or non-Center researchers, where such results bear upon the research mission of the Center (see the outside back cover for the mission statement). These documents receive internal scientific review but no technical or copy editing. The National Marine Fisheries Service does not endorse any proprietary material, process, or product mentioned in these documents.

All documents issued in this series since April 2001, and several documents issued prior to that date, have been copublished in both paper and electronic versions. To access the electronic version of a document in this series, go to *http://www.nefsc.nmfs.gov/nefsc/publications/series/crdlist.htm*. The electronic version will be available in PDF format to permit printing of a paper copy directly from the Internet. If you do not have Internet access, or if a desired document is one of the pre-April 2001 documents available only in the paper version, you can obtain a paper copy by contacting the senior Center author of the desired document. Refer to the title page of the desired document for the senior Center author's name and mailing address. If there is no Center author, or if there is corporate (*i.e.*, non-individualized) authorship, then contact the Center's Woods Hole Laboratory Library (166 Water St., Woods Hole, MA 02543-1026).

This document may be cited as:

Northeast Region Essential Fish Habitat Steering Committee. 2002. Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States, October 23-25, 2001, Boston, Massachusetts. *Northeast Fish. Sci. Cent. Ref. Doc.* 02-01; 86 p. Available from: National Marine Fisheries Service, 166 Water St., Woods Hole, MA 02543-1026.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

This report was produced by the Northeast Region Essential Fish Habitat Steering Committee to detail the workshop panel discussions and conclusions. The EFH Steering Committee consists of the following individuals: Bob Reid, co-Chair (NMFS, Northeast Fisheries Science Center), Lou Chiarella, co-Chair (NMFS, Northeast Regional Office), Dianne Stephan (NMFS Northeast Regional Office), Mike Pentony (New England Fishery Management Council), Tom Hoff (Mid-Atlantic Fishery Management Council), and Carrie Selberg (Atlantic States Marine Fisheries Commission). Korie Johnson (NMFS Office of Habitat Conservation) joined the Committee for purposes of this workshop. David Stevenson, John McCarthy and Meredith Lock, contractors for NMFS, also assisted in the development of the workshop and report preparation.

The EFH Steering Committee would like the thank the workshop panel (listed in Appendix A) for their hard work and dedication to having a successful workshop. Thanks to Kathie Ciarametaro for her assistance with workshop logistics. Thanks to Jeff Citrin of Resolve, Inc. for providing workshop facilitation services.

The workshop was sponsored by NOAA / National Marine Fisheries Service, New England Fishery Management Council and Mid-Atlantic Fishery Management Council.

The views expressed herein are those of the workshop panel and do not necessarily reflect the views of the EFH Steering Committee members, the agencies they represent, or the sponsors.

INTRODUCTION

The 1996 Amendment to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) tasked the National Marine Fisheries Service (NMFS) and federal fishery management councils with identifying and describing essential fish habitat (EFH) for all species that are managed under a federal fishery management plan (FMP). Additionally, each FMP is required to identify and assess the impacts of all fishing gears on EFH, and where practicable, minimize any adverse effects caused by fishing.

Assessing gear impacts and implementing management measures that will minimize the effects of fishing requires scientific information documenting the following: the effects of different fishing gears and practices used in the region; the distribution of fishing effort; the distribution of habitats within the region; the recovery rates of the effected habitats; and any reduction of an essential fish habitat's capacity to support exploited marine resources as a result of fishing. Studies have been conducted in the Northeast region and in other geographic areas around the world which address some of these questions, but to date there has been little attempt to evaluate all of the available information in order to identify adverse impacts to the specific habitat types of the Northeast region. For the purposes of the workshop, the Northeast region encompasses the area from Maine through North Carolina. The uncertainty regarding the identification of adverse impacts on the various habitat types found within the Northeast has resulted in reluctance to implement risk-averse habitat protection measures.

The workshop convened a panel of experts in the fields of benthic ecology, fishery ecology, geology, fishing gear technology, and fisheries gear operations (List of Participants in Appendix A). The purpose of the panel was to assist the New England Fishery Management Council (NEFMC), the Mid-Atlantic Fishery Management Council (MAFMC) and NMFS with: 1) evaluating the existing scientific research on the effects of fishing gear on benthic habitats; 2) determining the degree of impact from various gear types on benthic habitats in the Northeast; 3) specifying the type of evidence that is available to support the conclusions made about the degree of impact; 4) ranking the relative importance of gear impacts on various habitat types; and 5) providing recommendations on measures to minimize those adverse impacts. The workshop was held from October 23 - 25, 2001, in Boston, Massachusetts (Workshop Agenda in Appendix B).

Although the workshop was entitled "The Effects of Fishing Gear on Marine Habitats of The Northeastern United States," the workshop focused on benthic habitats. The goal of the workshop was to evaluate the impacts of fishing gear used in federally regulated fisheries on habitats of the Northeast shelf ecosystem, and to recommend management measures that will reduce those impacts (Appendix C). Only impacts to habitat were considered; effects of fishing on exploited species populations were not considered. Definitions of terms, such as "adverse effect", that were used to focus the discussions are provided in Appendix D.

There will be two final products as a result of this workshop. The first is this workshop report which summarizes panel discussions and conclusions relating to the effects of fishing gears on benthic habitats in the Northeast region. The second product will be a peer reviewed document produced by NMFS staff which describes gear types used in federal and state waters in the

Northeast region, the spatial distribution of fishing trips made by each gear type in federal waters, oceanographic regimes and habitat types in the region, and the results of scientific studies of the effects of fishing gear on benthic habitats in the Northeast U.S. and elsewhere. Preliminary Draft copies of this document (White Paper) were distributed to panel members in advance of the meeting to assist them in achieving workshop objectives. These documents will be available for use by the NEFMC and MAFMC to fulfill their MSFCMA requirements to include an assessment of fishing gear impacts on EFH in all of their FMPs.

WORKSHOP FORMAT

Although there are many fishing gear types utilized in the Northeast region, the workshop focused on gear types that are federally managed under the MSFCMA. An exception to this was made for lobster pots due to their widespread use in both state and federal waters. The following gear categories were evaluated:

- Bottom-tending Static Fishing Gear
    - Pots and Traps
    - Sink Gill Nets, Bottom Long Lines
- Bottom-tending Mobile Fishing Gear
    - Clam Dredges (hydraulic and non-hydraulic)
    - Otter Trawls
    - Sea Scallop Dredges
    - Beam Trawls
- Pelagic Fishing Gears (Static and Mobile)

The panel was provided a set of 15 questions, in advance, to guide the workshop discussions (Appendix E). These questions were divided into four categories: gear descriptions, gear effects on habitat, strength of evidence supporting the effects, and management actions. Individual panelists led the discussion for each gear type, guided by the questions. Some discussion leaders provided short presentations on their assigned gears which were then followed by group discussions. During the first two evenings, the discussion leaders held individual sessions with selected experts and workshop staff to further evaluate the available information and to prioritize the effects of each gear type in different habitats. On the third and final day the panel reviewed the results of these sessions.

A gear impact matrix was completed for each gear type which summarized the degree of impact for three substrate types, mud, sand, and gravel (Appendix D for definitions). The panel evaluated the types of impact caused by the gear for each substrate type, the degree of each impact, the duration of the impact, and the type of evidence available to support these conclusions. Four types of impacts were considered for each gear type and habitat: 1) removal of physical features; 2) impacts to biological structure; 3) impacts to physical structure and; 4) changes to benthic prey (Appendix D for definitions). After the matrices for each gear type were completed, the panel ranked the relative significance of each gear and impact type for all three substrate types. Once the types of impacts and habitats of greatest concern were identified, the panel recommended management actions that could be considered by the Councils to reduce the adverse effects of fishing gear on benthic habitats in the Northeast region.

This report clearly identifies when panel consensus was reached, and when points are attributed to individual panelists. The workshop began with introductory remarks by representatives of NMFS, MAFMC and NEFMC. The following sections summarize the introductions, discussions, conclusions and recommendations of the panel.

INTRODUCTORY PRESENTATIONS

NMFS Welcoming Address

Peter D. Colosi, Jr., Assistant Regional Administrator for Habitat Conservation

I am excited to welcome you to this workshop on the effects of fishing gear on fish habitat with such a panel of knowledgeable scientists, gear technologists, and fishermen.

As most of you are aware, with the 1996 Amendment to the Magnuson-Stevens Fishery Conservation and Management Act, the National Marine Fisheries Service and fishery management councils have had the task of identifying and describing essential fish habitat for all federally managed species. Additionally, we have had to identify and assess the relative impacts of all fishing gears on essential fish habitat for all of our fishery management plans, and where practicable, minimize any adverse effects from fishing.

Assessing gear impacts and implementing management measures to minimize impacts has been a very daunting task when faced with limited scientific information related to gear impacts on specific habitats, recovery rates, and the applicability of research conducted in other locations to the Northeast. Additionally, we are currently unable to quantify the intensity of gear interaction on specific habitat types in the Northeast. This has lead to much uncertainty regarding the identification of adverse impacts to the various habitat types found within the Northeast as well as apprehension to implement risk-averse habitat protection measures.

This panel has been convened to assist in interpreting the existing scientific research, determining the applicability of existing studies to the Northeast and evaluating the strength of that evidence. Your deliberations over the next three days, will provide valuable information to the New England and Mid-Atlantic Fishery Management Councils for use in fulfilling the habitat requirements of the Magnuson-Stevens Act.

I would also like to take this time to thank the Northeast Region EFH Steering Committee, which is comprised of staff from the National Marine Fisheries Service's Regional Office and Northeast Fisheries Science Center, the Mid-Atlantic and New England Fishery Management Councils and the Atlantic States Marine Fisheries Commission, for their hard work in organizing this workshop.

Good Luck over the next several days and I look forward to your results.

Mid-Atlantic Fishery Management Council Welcoming Address

Gary Caputi, Vice-Chairman, Ecosystem Planning Committee

On behalf of the Mid-Atlantic Fishery Management Council, its members and staff, I'd like to welcome this distinguished group of scientists, fishery managers and fishermen to this important workshop. It is our hope that the documents and the recommendations for future research produced by this gathering of specialists will help us move forward with the responsibilities placed on our shoulders by the Sustainable Fisheries Act.

With the passage of the Act in 1996, Congress and the Administration charged the eight regional management councils with identifying essential fish habitat and addressing threats to the health and viability of that habitat. One perceived threat was specifically identified in the language of the Act and was, therefore, required to receive a heightened level of investigation and action in FMP amendments. That is the impact of fishing gear on EFH or its subset, habitat areas of particular concern (HAPCs).

In trying to meet this mandate, the Mid-Atlantic Council has run into a problem caused by the lack of targeted scientific data addressing specific gear types used in the wide ranging fisheries we are responsible for managing. This poses a dilemma for managers because we have found ourselves unable to identify whether specific gears pose a threat or have no impact on the wide range of marine habitats exposed to their use. The problem is a double-edged sword. Our inability to justify positions on gear impacts has generated disapprovals of portions of recent plan amendments in which we identified no discernable impacts as well as those in which we identified possible impacts. Without adequate scientific documentation, the decisions we make are unsupported and, therefore, cannot be approved by the Agency and the Secretary. That is why this workshop was developed and why we have asked for this distinguished panel to convene. We desperately need scientific documentation to support the management objectives we assume under the Sustainable Fisheries Act so we can we do our jobs better.

In the past, a lot of scientific investigation was performed and scholarly papers were published on a wide variety of subjects. Many did little to provide fishery managers with the bedrock work they need to make better management decisions. This is not to say that such work was not important, or that it did not serve a purpose in furthering our understanding of the marine environment and its workings. But when it comes to the work the Councils are charged with performing, scientific research and documentation is required that specifically addresses our needs. It is in the management process that the scientific rubber meets the road and that is why the steering committee has worked so diligently to make it clear what we as managers need from you as scientists to make our efforts to rebuild and maintain sustainable fisheries and protect the marine environment more successful.

In the past two years, the Mid-Atlantic Council has seen the "Gear Impacts" sections of four major FMPs disapproved. They include *Summer Flounder, Scup and Black Sea Bass*; *Surfclams and Ocean Quahogs*; *Squid, Mackerel and Butterfish* and the *Bluefish FMP*. The amount of work involved in writing these plan amendments, incorporating entirely new sections detailing EFH and then trying to divine whether there are or are not threats to the identified important habitat from fishing gear, with little or no scientific data to fall back upon, was a frustrating exercise. One that we do not want to see repeated. Our inability to adequately identify gear impacts has lead to the Council and the Agency being criticized by constituencies on all sides of this rather volatile issue.

Not only have we experienced amendment disapprovals in major plans, but we have also been unable to justify the incorporation of "gear restricted areas" in the *Tilefish FMP*. Tilefish represent possibly the most habitat dependent of all the species of finfish the Mid-Atlantic Council is responsible for managing. It is a sedentary species that is believed to spend a major portion of its life cycle in relationship to burrows in the clay bottom located near the major canyon heads and along the edge of the continental shelf. After a great deal of examination of the existing data, it was "divined" that the doors of bottom tending mobile gear presented a potential negative impact to tilefish burrows. Therefore boundaries were developed to identify areas known to have concentrations of burrows and the Council proposed a restriction on the use of bottom tending mobile gear in those areas. Did the Council go too far? By proposing this action, based on impressions gleaned from the limited scientific study available, did the Council overstep its bounds? Apparently so because the gear restricted area concept was found to be unjustifiable after lengthy public hearings.

Without concise documentation, fishery managers are damned if they do and damned if they don't act. Is it possible that there is sufficient published literature to justify some actions or inactions, but it simply has not been compiled into documents that will stand up under Agency and possible judicial review? That is for you to determine.

It is our desire to see this workshop produce a comprehensive compendium of the work already done on identifying gear impacts to marine habitat and also identify areas where additional work is necessary that directly addresses the needs of managers so that we may accomplish our mandates in a more accurate and timely manner. With that, we wish you Godspeed and good luck in your endeavor.

New England Fishery Management Council Welcoming Address

Doug Hopkins, Chairman, Habitat Committee

Good morning and thank you for the invitation to speak to you as you begin these important deliberations on the effects of fishing gear on fish habitat.

My name is Doug Hopkins. I am wearing four hats, those of New England Council member, Chair of the Council's Habitat Committee, Environmental Defense staff member, and lawyer. So the lens through which I view these issues may be a little different from yours.

Yes, you will identify many, many unanswered scientific questions related to the effects of fishing gear on marine habitat and will conclude that much additional research is needed. Nevertheless, you can play a critical role in helping the regional councils, the National Marine Fisheries Service and the scientific community to avoid paralysis, and I urge you to do so.

Let's look closely at the Magnuson-Stevens Act mandate. The law, as amended by the Sustainable Fisheries Act (SFA), allows – actually it requires -- action by the councils and NMFS to protect habitat from harmful fishing impacts even in the absence of thorough scientific understanding.

Yours is not a forensic undertaking whose aim is to present evidence for a jury to conclude beyond a reasonable doubt what gear should be convicted of assault and battery on Essential Fish Habitat (EFH). Congress has already reached the conclusion that many of today's fishing gears and practices adversely affect EFH.

It is now the managers' job to implement all practicable measures to minimize harm by fishing gear to EFH. This is what the SFA requires. So what do we, as managers, need from you, the scientific experts, so that we can do our jobs effectively? We need a diverse menu of measures that singly or together will reduce the adverse effects of fishing on habitat. We also need good explanations that let us, fishermen and the general public understand how these measures will provide benefits to fish habitat. In addition, and very importantly, we need as much help as possible prioritizing these proposed measures by characterizing the relative expected benefits of each.

Finally, and crucially, since the Magnuson-Stevens Act requires that any fishery management plan must "minimize to the extent practicable adverse effects on . . . [essential fish] habitat caused by fishing," the regional councils and NMFS need your help to systematically evaluate the practicability of each of the measures you propose. To do this you may have to include in your deliberations fishery economists and other experts who are not present today for this workshop.

Addressing a few other points, first I believe the New England Council would welcome suggestions for creating incentives for fishermen to develop and adopt new fishing practices and gear that would reduce harmful habitat impacts, so long as they would in fact benefit habitat. In other words we seek your help identifying ways to harness the enormous, proven ability of fishermen to solve problems and increase their efficiency through innovations in gear and fishing methods.

Next, I wish to highlight an example of a proposed measure that needs additional scientific input to adequately evaluate its potential. The New England Scallop Oversight Committee and the full Council are considering a measure for possible inclusion in Amendment 10 to the Scallop FMP that would bar future scallop fishing from the historically least productive scallop grounds. The pertinent scientific question then is whether data exist to determine whether the historically least productive scallop grounds can be distinguished from the historically most productive? The initial designation of the least productive grounds would not have to be perfect, only scientifically supported and practicable. If subsequent surveys disclosed that a rare but significant set of scallops had occurred in an area initially closed as within the historically least productive grounds, a subsequent framework adjustment to the FMP could always reopen the area.

Touching on research needs, I want to emphasize that the regional councils and NMFS clearly need significant input from the scientific community to identify and prioritize additional research that would help to answer important questions related to minimizing the adverse effects of fishing on EFH. That said, identifying research needs should not become an excuse for management inaction. You can help the Councils and NMFS determine how best to encourage valuable research. For example, we need to know: How can the New England Council and NMFS best utilize the Research Steering Committee? Should we be considering creating Habitat Research Areas where fishing activity would be barred except as specifically allowed for research? If so where should these be sited and how large should they be? How important would it be to have baseline benthic surveys done and how should the survey areas be prioritized, recognizing that funding won't allow them to be completed all at once?

When it comes to research, engendering accurate expectations of the benefits of specific research projects will be critical. The Councils, the fishing communities and the general public need accurate information as to how long any particular research activity will likely take to yield results relevant to management decisions. Is it two years, five years or 20 years? Unrealistic expectations can damage scientific credibility among non-scientists and erode public confidence in fishery management.

In conclusion, Congress has determined that fishing gear and practices can and must evolve to reflect the scientific understanding we have of the high and unnecessary cost of fishing on the marine environment. Fishing yields food for people to eat and money and livelihoods for fishermen and their communities. You can help the fishery managers and fishermen to figure out better ways to provide these yields more sustainably than current fishing practices allow. The technology and practices used to catch fish in New England have not changed significantly for decades, while scientific understanding of the stresses on marine ecosystems caused by fishing has grown dramatically during this time. This imbalance is simply wrong. Your scientific advice will be crucial to helping managers and fishermen change fishing gear and practices to dramatically decrease their ecological and economic costs.

Thank you, and good luck in your deliberations over the next three days.

HABITAT CHARACTERIZATION

Dr. Page Valentine (U.S. Geological Survey) summarized major marine habitat characteristics applicable to the Gulf of Maine, Georges Bank, southern New England and mid-Atlantic Bight and their variability in terms of topography, sediment texture and hardness, substrate roughness and surface area, substrate dynamics, water column characteristics, habitat usage, and fishing impacts (Table 1). This is information that could be considered when evaluating the setting, function, and vulnerability of various habitats. Additional information was presented for eleven different geographical habitat types on Georges Bank and in the Gulf of Maine using these generalized habitat characters (Appendix F). No detailed information was presented for habitat types in southern New England and the mid-Atlantic Bight.

Panel members concluded that this was very useful information and recommended that: 1) detailed habitat types between Cape Cod and Cape Hatteras also be described, and 2) several new characters be added to the habitat type descriptions. It was noted that information is available for certain habitats (e.g., soft corals) south of Cape Hatteras. Additional habitat characters that were suggested by panel members were the principal types of fishing activity, estimates of the area covered by each habitat type, and depth range. Dr. Valentine pointed out that there is some information on the areal extent of some of the offshore habitats he described in the Gulf of Maine – Georges Bank region, particularly for Georges Bank itself, but thorough maps are not available.

Table 1. Habitat Characteristics and Variability

HABITAT CHARACTER	VARIABILITY
TOPOGRAPHY	FEATURELESS -- FEATURES
SEDIMENT TEXTURE [and HARDNESS]	FINE -- COARSE ---------------------------- [SOFT] -- [HARD] ---------------------------- MUD ------------------------ SAND ------------ GRAVEL; SHELLS; BEDROCK
SUBSTRATE ROUGHNESS [and SURFACE AREA] · PHYSICAL · BIOLOGICAL	SMOOTH -- ROUGH [LOW] --- [HIGH] MUD ------------------------ SAND ---------------- SHELLS; GRAVEL; BEDROCK | --BURROWS-- | | ---------- BEDFORMS ------ | | --STRUCTURES (TUBES and ATTACHED EPIFAUNA) -------------------
SUBSTRATE DYNAMICS · PHYSICAL mud, sand, shells · BIOLOGICAL ------------------------------------- · PHYSICAL hard bottom · BIOLOGICAL	WEAK CURRENTS -- STRONG CURRENTS -------------------------------- TIDAL; STORM; OTHER -------------------------------- STABLE SUBSTRATE ----------------------------------- UNSTABLE SUBSTRATE MUD ----------------- | SAND ---------------------- | ------------------- SAND and SHELL MOVEMENT ---- ADAPTED TO STABLE ----------- and/or ------MOVING SEDIMENT------------- STABLE SUBSTRATE -- GRAVEL MOUNDS, BEDROCK, GRAVEL PAVEMENT --------------------------- ADAPTED TO NON-MOVING SUBSTRATE
WATER COLUMN PRODUCTIVITY WATER DEPTH	STRATIFIED --- MIXED LOW -- HIGH DEEP -- SHALLOW
HABITAT USAGE · by FAUNA · by FISHERS	 SPAWNING, JUVENILE SURVIVAL, ADULT POPULATION ROUNDFISH, FLATFISH, BIVALVES (EPIFAUNAL, INFAUNAL) TARGET SPECIES and/or HABITATS using MOBILE GEAR, STATIONARY GEAR
FISHING IMPACTS · PHYSICAL · BIOLOGICAL	 TOPOGRAPHIC FEATURES, TEXTURE, ROUGHNESS and SURFACE AREA, SUBSTRATE DYNAMICS ROUGHNESS and SURFACE AREA (TUBES and ATTACHED EPIFAUNA), BIODIVERSITY

EFFECTS OF FISHING GEAR

CLAM DREDGES

Gear Description

Mr. Dave Wallace (Wallace and Associates) presented a thorough description of the evolution and current use of the hydraulic clam dredge for the surfclam and ocean quahog fisheries. A brief discussion of "dry dredges" used in the Maine "mahogany" ocean quahog fishery was led by Mr. Wallace with contributions from the workshop panelists. This section of the report summarizes his presentation and the panel discussion.

Hydraulic clam dredges have been used in the surfclam fishery for over five decades and in the ocean quahog fishery since its inception in the early 1970s. These dredges are highly sophisticated and are designed to: 1) be extremely efficient (80 to 95% capture rate); 2) produce a very low bycatch of other species; and 3) retain very few undersized clams.

The typical dredge is 12 feet wide and about 22 feet long and uses pressurized water jets to wash clams out of the seafloor. Towing speed at the start of the tow is 2.5 knots and declines as the dredge accumulates clams. The dredge is retrieved once the vessel speed drops below 1.5 knots, which can be only a few minutes in very dense beds. However, a typical tow lasts about 15 minutes. The water jets penetrate the sediment in front of the dredge to a depth of about 8 - 10 inches, depending on the type of sediment and the water pressure. The water pressure that is required to fluidize the sediment varies from 50 pounds per square inch (psi) in coarse sand to 110 psi in finer sediments. The objective is to use as little water as possible since too much pressure will blow sediment into the clams and reduce product quality. The "knife" (or "cutting bar") on the leading bottom edge of the dredge opening is 5.5 inches deep for surfclams and 3.5 inches for ocean quahogs. The knife "picks up" clams that have been separated from the sediment and guides them into the body of the dredge ("the cage"). If the knife size is not appropriate, clams can be cut and broken, resulting in significant mortality of clams left on the bottom. The downward pressure created by the runners on the dredge is about 1 psi.

It was pointed out by a panel member that the high water pressure associated with the hydraulic dredge can cause damage to the flora and fauna associated with bottom habitats. However, water pressure greater than that required for harvesting will reduce the quality of the clams by loading them with sand and increase the rate of clam breakage. Therefore, water pressure is usually self regulated.

There are currently two types of hydraulic dredges used in the fishery, stern rig dredges and side rig dredges. The chain bag on a side rig dredge drags behind the dredge and helps smooth out the trench created by the dredge. The chain bag results in significantly more damage to small clams and other bycatch than occurs with the stern rig dredge. With the stern rig dredge, which is basically a giant sieve, small clams and bycatch fall through the bottom of the cage into the trench and damage or injury is minimal. Improvements in gear efficiency have reduced bottom time and helped to limit the harvest of surfclams to a relatively small area in the mid-Atlantic Bight.

Prior to 1990, the resource was managed by controlling the number of hours a vessel could fish. Consequently, towing speeds were maximized to catch as many clams as possible regardless of the damage done to the clams or the habitat. Cutting and breakage of discarded clams were estimated to be as high as 90% in some locations and under some conditions decomposition of dead clams caused reduced oxygen concentrations in sediments to the point that clams were killed. Incidental mortality is currently estimated to be well under 10% because quota management has removed the need for vessels to catch as many clams as possible as quickly as possible.

Concurrent with the change in harvesting practices that occurred after 1990, there has also been a significant reduction in fishing effort and a shift to stern rig dredges. About 60 side-rig vessels pulling 80 dredges were taken out of the fishery after 1990. The number of surfclam vessels decreased from 128 in 1990 to 31 in 2000, while the number of vessels that landed ocean quahogs (excluding the Maine fishery) dropped from 56 in 1990 to 29 in 2000. Currently there are only 4 side rig vessels pulling five dredges left in the fleet.

Surfclams live mostly in sand which is disturbed and re-suspended by storms and, in some locations, by strong bottom currents. Ocean quahogs live at greater depths, mostly in finer sand and silt/clay substrates which are less affected by natural physical disturbances. Surfclams and ocean quahogs are not found in commercial quantities in gravel or mud habitats or in depths greater than 300 feet.

Hydraulic clam dredges can be operated in areas of large grain sand, fine sand, sand and small grain gravel, sand and small amounts of mud, and sand and very small amounts of clay. Most tows are made in large grain sand. Dredges are not fished in clay, mud, pebbles, rocks, coral, large gravel greater than one half inch, or seagrass beds. Boat captains will not dredge in areas with very soft or hard substrate where they run the risk of losing or damaging the gear. The fishery is also limited to sandy sediment because the processors do not want mud blown into the clam bodies by the dredge.

The spatial scale of fishing effort varies depending on which species is the target: surfclams are harvested primarily in a small area off the New Jersey coast whereas ocean quahogs are harvested over a larger area that includes offshore waters. Areas with denser concentrations of clams would presumably be dredged more intensively, i.e., a higher percentage of the bottom would be affected. Because surfclams are concentrated in a very defined area off the New Jersey coast where the bottom is so homogeneous, a high proportion of the bottom over this large contiguous area is affected by dredging. Surfclams grow much more rapidly than ocean quahogs and surfclam beds are dredged every few years. Areas dredged for ocean quahogs are left untouched for many years. Ocean quahogs are much more likely to be dredged from a number of more or less discrete patches that are surrounded by undisturbed areas. It was noted, as a general rule, that once 50% of the harvestable clams are removed from an area, the catch rates drop to a point where it is no longer economically feasible for fishing to continue there.

In federal waters, the amount of bottom area directly impacted by the hydraulic clam dredge fleet in 2000 was about 110 square miles (Table 2). An additional 15 square miles were dredged in State waters of New Jersey, New York, and Massachusetts. The predominant substrate on the southern New England/Mid-Atlantic Bight shelf is sand. Thus, during any given year, this fishery is conducted in a very small proportion of a habitat type that characterizes most of the 40,000 square miles of continental shelf between the Virginia/North Carolina border and Nantucket Island (69˚ W longitude). The Georges Bank region has been closed to clam harvesting since 1990 because of the potential of paralytic shellfish poisoning.

Table 2. Estimated area in federal waters towed by hydraulic clam dredges in 2000 (Source: Dave Wallace).

	Quahogs	Surfclams
Hours at sea per year	28,440[a]	19,907[a]
Setting & hauling gear (25%)	7,110	4,977
Hours fished per year	21,330	14,930
Average speed/tow (nmi/hr)	2	2
Total distance towed (nmi)	42,660	29,860
Ft per nmi	6076	6076
Total distance towed (ft)	2.385×10^9	1.814×10^9
Average dredge width (ft)	9.2	9.2
Area towed per year (ft^2)	2.385×10^{10}	1.669×10^{10}
Square ft per n mile	3.69×10^7	3.69×10^7
Area towed per year (nmi^2)	64.6	45.2
a = From clam vessel logbook data, excludes Maine quahog fishery		

The dry dredge used in the Maine fishery is a cage with wide skis and a series of teeth about 6 inches long in the front. These dredges are used on smaller boats (about 30 to 40 feet long) and are pulled through the seabed using the boat's engine. The cutter bar is limited to a width of 36 inches by State law. This fishery takes place in small areas of sand and sandy mud found among bedrock outcroppings in depths of 30 to > 250 ft in state and federal coastal waters north of 43˚ 20' N latitude. The dredges scoop up clams and sediment, and the vessel's propeller wash is used to clean out the sand and mud.

Effects and Evidence

Dr. James Weinberg (Northeast Fisheries Science Center - NEFSC) led the discussion of the direct physical and biological effects of hydraulic clam dredging, and Dr. Roger Mann (Virginia Institute of Marine Science - VIMS) led the discussion on the available evidence. Most of the evidence for dredging impacts that was considered by the panel was from the Northeast U.S., but there are studies from other areas that show the same effects. It was noted that early studies done in the Northeast region were conducted during development of the fishery, when clam dredging was more damaging to the habitat than it is now.

According to these studies, the direct physical effects of hydraulic clam dredging are basically two-fold. First, a trench about 8 inches deep is left behind the dredge and windrows of sediment and organisms are formed on either side of the trench. The second direct physical effect is the resuspension of sediment. If a dredge goes through silt or loose sediment, it produces a sediment cloud. In the panel's judgement, fine sediment may take as long as 24 hours to resettle and would end up outside the trench, while heavier particles would settle much more rapidly, primarily back into the trench. The evidence for physical effects (trench, windrows, and sediment re-suspension) is strong because these effects are so obvious.

Physical impacts to bottom habitat last longer (months) in low energy environments than in high energy environments (hours). In sand, the sides of the trench start to erode as soon as it is cut; this happens more rapidly when bottom currents are strong. The rate at which it fills in depends on the grain size of the sediment, water depth, and the strength and frequency of storms and bottom currents. It was noted that there are permanent, longshelf, sand ridges with low elevation off the New Jersey coast, but there is no evidence to indicate that clam dredges remove them, even though they may be towed through them.

The direct biological effects of hydraulic dredges vary, depending on whether organisms are hard-bodied like clams or soft-bodied like amphipods or polychaetes. What happens when a clam dredge goes through an area is not fully known and more study is needed. It was noted that structure-forming epifauna such as anemones and sponges would clearly be removed. Emergent epifauna growing on shell beds in the mid-Atlantic Bight is known to provide cover for juvenile fish species like black sea bass. Removal of these organisms, or their burial by re-suspended sediments, could therefore cause the loss of habitat for some species of juvenile fish.

It is not clear what happens to soft-bodied organisms that are moved by the dredge or pass through the trench and are deposited back on the seafloor. Often, after an area is dredged, scavengers move in rapidly and eat broken clams and soft-bodied organisms that are removed from the substrate. However, the panel considered that evidence for effects on infaunal prey organisms was weak because there aren't many studies that link changes in benthic community structure in dredged areas to the food supply for fish, and those that do exist do not show definitive results. The panel concluded that infaunal communities would be likely to recover more quickly than emergent epifauna, and therefore removal of structure-forming organisms was judged to be more of a concern. However, one panelist noted that the potential loss of secondary production of benthic invertebrates which are prey for bottom-feeding fish is the effect that is least understood, and that any reduction in prey abundance – if it occurs – would not necessarily be limited to the dredge tracks themselves, but would affect the entire dredged area. Moreover, the effects of fluidizing the sediment on benthic infauna are unknown and may be important.

The panel noted that there may be cumulative physical and biological effects in areas that are dredged several times annually. As previously stated, surfclams grow much more rapidly than ocean quahogs and surfclam beds are dredged every few years, whereas areas dredged for ocean quahogs are left untouched for many years. It was also noted that benthic organisms that occupy muddy bottom in deep water are less adapted to physical disturbance and therefore would presumably take longer to recover from dredging than organisms in sandy bottom areas in shallower water.

Conclusion

The panel concluded that the habitat effects of hydraulic dredging were limited to sandy substrates, since the gear is not used in gravel and mud habitats (Table 3). Two effects -changes in physical and biological structure – were determined to occur at high levels. The evidence cited for these two effects was a combination of peer-reviewed scientific literature, gray literature, and professional judgement. There are no effects of hydraulic dredges on major physical features in sandy habitat because, in the panel's view, there are no such features on sandy bottom. Panel members evaluated changes to benthic prey as unknown.

The temporal scale of the effects varies depending on the background energy of the environment. Recovery of physical structure can range from days in high energy environments to months in low energy environments, whereas biological structure can take months to years to recover from dredging, depending on what species are affected.

Table 3. Impacts of Clam Dredges on Benthic Habitat

TYPE OF IMPACT	DEGREE OF IMPACT	DURATION	TYPE OF EVIDENCE	COMMENTS
MUD				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	N/A			
Impacts to Physical Structure	N/A			
Changes in Benthic Prey	N/A			
SAND				
Removal of Major Physical Features	Unknown			
Impacts to Biological Structure	XXX	Months - Years1	PR, GL, PJ	1 Dependent upon species composition (eg. Amphipod tubes < 1 yr recovery)
Impacts to Physical Structure	XXX2	Days - Months	PR, GL, PJ	2 Represents major alteration to regime for soft bodied organisms
Changes in benthic prey	Unknown			
GRAVEL				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	N/A			
Impacts to Physical Structure	N/A			
Changes in benthic prey	N/A			

KEY: X = Effect can be present, but is rarely large; XX = Effect is present and moderate; XXX = Effect is often present and can be large; N/A = Effect is not present or not applicable; Unknown = effects are not currently known; (H) = High energy environment; (L) = Low energy environment; PR = Peer reviewed literature; GL = Grey literature; PJ = Professional judgement. For definitions of Substrate Type and Type of Impact see Appendix D.
NOTE: Ongoing Canadian studies for clam dredges are near completion and will contribute substantially to this discussion.

The panel agreed that hydraulic dredges have important habitat effects, but even in a worse case scenario, where there were known to be severe biological impacts, only a small area is affected and therefore this gear type is less important than other gear types like bottom trawls and scallop dredges which affect much larger areas. It was also pointed out, however, that even though the effects of dredging (at least for surfclams) are limited to a relatively small area, localized effects of dredging on EFH could be very significant if the dredged area is a productive habitat for one or more managed fish resource. The same would be true if dredging in a particular area coincided with a strong settlement of larval fish. A major question for this gear is "what are its long-term biological impacts" *i.e.*, how, and to what extent, are benthic communities altered in heavily dredged areas, particularly the prey organisms, and how long does it take for them to recover once dredging ceases?

Management

Dr. William DuPaul (VIMS) led the discussion on the types of management actions that could be taken to minimize adverse impacts of hydraulic dredging to benthic habitat.

The effectiveness of the Individual Transferable Quota (ITQ) management program since 1990 and the opinion that the two resources are underfished, led the panel to conclude that reductions in effort are probably not practicable. Nor is it likely that gear substitutions or modifications are practical since the current gear is highly efficient at harvesting clams. Therefore spatial area management seems to be the only practicable approach to minimizing gear impacts, if necessary.

It was emphasized that hydraulic dredges are designed to operate in sandy substrate. This gear could be very destructive if fished in the wrong sediment type or in structured environments like gravel beds or tilefish pueblo villages. The panel emphasized the gear should not be used in sediment types where it would cause more damage. Areas of known structure-forming biota should be mapped and set aside as a priority. It was emphasized that since we really do not know what the effect of this gear is to soft-bodied benthic organisms, a possible precautionary measure would be to restrict the fishery to areas of high clam productivity. Seasonal closures were mentioned if times and areas of high recruitment could be detected.

SCALLOP DREDGES

Gear Description

Dr. DuPaul led the discussion on scallop dredges. The New Bedford scallop dredge was described during a general review of scallop dredges and their use. This dredge is the primary gear used in the Georges Bank and mid-Atlantic sea scallop (*Placopecten magellanicus*) fishery. The scallop dredge used in coastal waters of the Gulf of Maine was also described briefly. The European scallop dredge was briefly discussed.

The forward edge of the dredge includes the cutting bar, which rides above the surface of the substrate, creating turbulence that stirs up the substrate and kicks objects up from the surface of the substrate (including scallops) into the bag. Shoes on the cutting bar are in contact with and ride along the substrate surface. The bag is made up of metal rings with chafing gear on the bottom and twine mesh on the top, and drags on the substrate when fished. New Bedford dredges are typically 14 feet wide; two of them are towed by a single vessel at speeds of 4 to 5 knots. Dredges used along the Maine coast are smaller (5.5 to 8.5 ft). Towing times are highly variable, depending on how many marketable sized scallops are on the bottom and the location. Scallops are shucked at sea, but small amounts (< 50 baskets) are returned to shore whole for specialty markets.

In the Northeast region, scallop dredges are used in high and low energy sand environments, and high energy gravel environments. Although gravel exists in low energy environments of deepwater banks and ridges in the Gulf of Maine, the fishery is not prosecuted there.

Effects and Evidence

Dr. Valentine led the discussion on the effects of scallop dredging and Dr. Weinberg led the discussion on the available evidence. The panel noted that much of the scientific literature is based on the European dredge, which differs in structure and use from the New Bedford dredge. The leading edge of the European dredge contains teeth which dig into the substrate. This type of gear is used by smaller vessels that are not able to tow a non-toothed dredge fast enough (4-5 knots is necessary) to fish effectively. The panel noted that because of these differences, research using the European dredge was not completely relevant to North American scallop fisheries or the habitats in which they are found, and should only be applied in a limited fashion.

An analysis of vessel monitoring system (VMS) data for vessels in the scallop fishery provided to panel members at this workshop revealed that the scallop fishery is highly concentrated. Total fishing activity (dredges and trawls) in year 2000 was dispersed throughout 12,800 one square nautical mile sub-areas, but 81% of the total catch was harvested in only 2,946 of these sub-areas. A full description if this information that includes plots of fishing activity in 1998 and 1999 is in Appendix G. One panelist noted that based on his analysis of logbook data from the mid 1980s to the mid 1990s, the distribution of fishing effort for scallop dredges in the Northeast U.S. was patchy, with areas that were fished intensively and other areas that were fished very lightly, and generally did not overlap with areas that were fished heavily with bottom trawls.

The findings of the studies summarized in the white paper which took place in the Northeast region were discussed and considered to be applicable to other areas of similar habitat type within the region. These findings included:

- disruption of amphipod tube mats and decline in dominant megafaunal species in gravelly sand in the Gulf of Maine from fishing (Langton and Robinson 1990);
- increased epifauna (hydroids, bryozoans, sponges, serpulid worms and sea cucumbers) on a cobble/shell bottom in an area on the Maine coast closed to dredging and trawling in 1983 (Auster et al. 1996);
- disturbance of storm-created coarse sand ripples (10-20 cm high) by scallop dredges on Stellwagen Bank, in the southwestern Gulf of Maine (Auster et al. 1996);
- increased abundance of emergent sponges inside a sandy area closed to dredging and trawling for 4.5 years (Almeida et al. 2000);
- redistributed gravel, pebbles, and boulders, flattened sand and mud bedforms, and resuspended fine sediments caused by mussel and scallop dredging in lower Narragansett Bay, Rhode Island (DeAlteris et al. 1999);

- reduced epifaunal community, smoother bottom, and disturbed and overturned boulders in gravel areas on Georges Bank affected by dredges and trawls compared to unfished areas (Valentine and Lough 1991);
- reduced densities, biomass, and species diversity of megabenthic organisms in disturbed gravel habitat on Georges Bank (Collie et al. 1997);
- higher percent cover of emergent colonial epifauna in undisturbed gravel habitat sites on Georges Bank (Collie et al. 2000).

A number of international studies were also discussed. Although the gear differed in some of these studies as described above, findings in these studies were considered to be relevant. The findings were as follows:

- long-term shifts in benthic community composition in the Wadden and Irish Seas following the introduction of scallop dredging (Reise and Schubert 1987, Hill et al. 1999);
- increased abundance of some epifaunal species (sea urchins and some crustaceans) in gravel areas closed to dredging in the Irish Sea (Bradshaw et al. 2000);
- mortality of large epifauna and sand lance (*Ammodytes*) in the path of the trawl in high energy sand in Scotland, with no significant effects on abundance of mollusc or crustacean infauna (Eleftheriou and Robertson 1992);
- loss of emergent tubes and sediment ripples and decreased density of common macrofauna from dredging in sub-tidal sand flats in New Zealand, with complete faunal recovery within a few months (Thrush et al. 1995);
- reduced abundance of 6 of the 10 most common benthic infaunal species from dredging, with recovery within 6 months for most, but greater than 14 months for a few, in mud and sand habitat in Australia (Currie and Parry 1996).

The panelists agreed that effects and their significance vary by habitat type, and that research results could not be applied widely across habitat type. The panelists also agreed that the first pass of a dredge over an undisturbed area is expected to have more significant effects than subsequent passes and that the return of cut shell-stock to the environment could enhance sea floor structure and provide substrate for settling scallop larvae. There was some discussion about the discarding of viscera from shucked scallops and its value to EFH, but no consensus was reached.

Several studies conducted on Georges Bank were discussed in detail. Valentine and Lough (1991) compared trawled and dredged gravel areas with undisturbed gravel areas and noted that the epifaunal community was more diverse with abundant attached organisms at the undisturbed sites. Subsequent research by Collie et al. (2000) in gravel pavement habitat showed that *Filograna implexa*, a colonial, rock-encrusting polychaete, and bushy colonial epifauna such as bryozoans and hydroids, were more abundant in the undisturbed areas. The study by Almeida et al. (2000) showed an increased abundance of emergent sponges (*Suberites ficus* and *Polymastia* sp.) on sandy bottom at stations inside Groundfish Closed Area II four and a half years after it was closed, compared to stations just outside the area that have remained open to bottom fishing.

The panel clarified that the results of the studies done on gravel bottom on Georges Bank could be applied to dredged areas in the Gulf of Maine where the same taxa are present in hard bottom habitats, but not to sandy scallop fishing grounds in southern New England and the mid-Atlantic Bight where different emergent epifaunal species are present and where there are fewer epifaunal organisms growing on the bottom. Panel members agreed that structure-forming biota that are present in sandy habitats are just as vulnerable to scallop dredging as in gravel habitats, but that the biological impacts of dredging on emergent epifauna are less significant in high energy sand environments because the organisms are better adapted to sediment disturbances caused by storms and strong bottom currents and therefore recover more quickly from dredging. It was noted that hard bottom benthic habitats in the Gulf of Maine and in deeper water on Georges Bank are more vulnerable to bottom mobile gear than sand bottom habitats south of Cape Cod because they support more diverse and prolific epifaunal communities and because recovery times are slower. It was also noted that long-term effects are more significant than short-term effects and are harder to differentiate from effects caused by environmental changes.

There was some discussion about the indirect biogeochemical effects of sediment resuspension caused by dredging and trawling. It was noted that the re-suspension of fine sediments (clay, silt and fine-grained sand) could have important effects on habitat quality by releasing nutrients, metals and contaminants that are "trapped" in anaerobic bottom sediments. These effects would be negligible in shallow water, coarse sand habitats. The release of nutrients could be beneficial, but the release of metals and other contaminants could have adverse effects on pelagic and benthic habitats. Most of the research that has been done on this subject is in inshore coastal and estuarine waters, not in deeper, offshore waters.

There was also some discussion about the effects of scallop dredging on the functional value of benthic habitats for exploited marine resource populations. Two habitat functions mentioned were: 1) cover from predators provided for juvenile fish and prey species by emergent epifauna; and 2) the bio-energetic benefits of sand ripples and waves for bottom fish (e.g., flounders) that seek refuge from bottom currents. The panel noted that some studies have been conducted in these two subject areas and others are in progress.

Conclusion

The panel determined that the effects of scallop dredging were of greatest concern in the following three habitat types: high and low energy sand and high energy gravel. Scallop fishing does not generally occur in deep water, low energy gravel habitats. The basis for all the panel's conclusions regarding the degree of impact and recovery time estimates were a combination of peer reviewed literature, gray literature, and the panelists' professional judgement.

Low energy sand habitat occurs in deeper water, where the bottom is unaffected by tidal currents and where the only natural disturbance is caused by occasional storm currents. In this habitat type, the primary physical bottom features are shallow depressions created by scallops and other benthic organisms. Reduction of biological structure and changes in physical structure were both considered to occur at a high level as a result of scallop dredging (Table 4). Recovery of physical structure was expected to vary from days to months depending on how long it takes different species of animals to create new depressions in the seafloor. The degree of impact to biological structure in low energy sand habitats was judged to be high because emergent epifauna is more abundant in this more stable environment. Recovery from reduction in structural biota was expected to take from months to years.

Table 4. Impacts of Scallop Dredges on Benthic Habitat

TYPE OF IMPACT	DEGREE OF IMPACT	DURATION	TYPE OF EVIDENCE	COMMENTS
MUD				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	N/A			
Impacts to Physical Structure	N/A			
Changes in Benthic Prey	N/A			
SAND				
Removal of Major Physical Features	Unknown			
Impacts to Biological Structure	XXX (L) X (H)	Months - Yrs	PR, GL, PJ	
Impacts to Physical Structure	XXX (H, L)	Days - Months	PR, GL, PJ	Cut (shucked) shell provides additional structure.
Changes in Benthic Prey	Unknown			Disposal of shucked scallop viscera may alter local food sources - impacts unknown.
GRAVEL				
Removal of Major Physical Features	Unknown			
Impacts to Biological Structure	XXX (H) N/A (L)	Several Years (H)	PR, GL, PJ	(L)=deepwater banks, gravel ridges in GOM; fishery is not prosecuted here
Impacts to Physical Structure	XXX (H) N/A (L)	Months - Years (H)	PR, GL, PJ	(L)=deepwater banks, gravel ridges in GOM; fishery is not prosecuted here. Cut shell provides additional structure.
Changes in Benthic Prey	XXX (H) N/A (L)	Months - Years (H)	PR, GL, PJ	(L)=deepwater banks, gravel ridges in GOM; fishery is not prosecuted here

KEY: X = Effect can be present, but is rarely large; XX = Effect is present and moderate; XXX = Effect is often present and can be large; N/A = Effect is not present or not applicable; Unknown = effects are not currently known; (H) = High energy environment; (L) = Low energy environment; PR = Peer reviewed literature; GL = Grey literature; PJ = Professional judgement. For definitions of Substrate Type and Type of Impact see Appendix D.
NOTE: Ongoing Canadian experiments will be able to provide additional information in the near future.

In high energy sand habitats, effects on biological structure were considered to be low, since organisms in this environment would be adapted to a high degree of natural disturbance. Changes to physical structure such as smoothing out of sand ripples, sand waves, and sand ridges were rated as high. The range of recovery times for physical structure in high energy sand habitat was based on the rapid recovery time for sand ripples that are produced by bottom currents (days) and a longer time (months) for storm-created sand waves and ridges. Similar to low energy sand, recovery time for biological structure was expected to range from months to years. The range in recovery time was based on how long it would take for amphipod tubes to re-form compared to the growth rates of sponges and other longer-lived species. The panel did not have enough information to evaluate the effects of scallop dredging on benthic prey in sandy bottom and therefore concluded that the degree of this effect was unknown in both low and high energy habitats**.**

In high energy gravel habitat, the panel concluded that the degree to which biological structure was reduced by scallop dredging was high, as were changes in physical structure, and changes in benthic prey. Dredging disturbs gravel and pebbles, breaches gravel "pavement," and redistributes cobbles and small boulders. Recovery of physical structure in this habitat type was estimated to take anywhere from months to a year. Once gravel pavement is breached, it re-forms fairly quickly as the underlying exposed sand is removed by bottom currents leaving gravel behind as the predominant substrate. Attached epifauna known to be removed by scallop dredges in high energy gravel habitats include sponges, bryozoans, hydrozoans, and colonial polychaetes. Recovery times for biological structure were estimated as years (but fewer than ten years).

Since many of the structure-forming organisms that are removed from high energy gravel habitat by scallop dredges are either preyed upon by bottom-feeding fish or provide cover for invertebrates and small fish that are consumed by bottom-feeding fish, habitat impacts caused by changes in prey species composition and abundance were rated as high in this habitat type, with recovery times of months to several years, depending on which taxa are affected. Panel members noted that it was difficult to evaluate impacts to benthic prey in the absence of information linking known alterations in the species composition and abundance of benthic organisms to changes in the food supply for fish.

The panel acknowledged that impacts of scallop dredging to sand and gravel habitats represent two extremes in a continuum of effects (gravel being more vulnerable) and that what happens to mixed sediment habitat types that fall in between these two extremes is harder to evaluate. It was also pointed out that the more important question may not be what happens in the dredge path itself and how quickly the seafloor and the benthic community in the dredge path recovers, but instead what is the net impact of dredging on the affected environment and its value to marine resources?

Management

Dr. Michael Fogarty (NEFSC) led the discussion on the management of scallop dredge impacts. Three main approaches to minimizing habitat impacts were discussed: effort reduction, gear modification, and area management. Panelists noted that maintaining a high biomass of scallops would reduce harvesting time and therefore reduce the amount of bottom time devoted to dredging. Panelists also noted, however, that the high initial impact of the gear on habitat (from the first tow) could confound attempts to minimize impacts by reducing effort.

Suggestions for gear modifications included innovations to "float" the ring bag so it does not drag along the bottom. Use of a "hard dredge" which only has two skids in contact with the bottom was also discussed; however, panelists did not agree that this would be feasible since rigid frame dredges are reportedly difficult to use and cause a higher non-harvest mortality of scallops. Other gear modifications discussed included development of a foil that uses a vacuum to harvest scallops.

Many panelists spoke favorably about the use of area based management. Based on the distribution of scallop dredge fishing trips (Appendix G), the panel noted that there are many locations where scallop dredging does not occur. The panel discussed focusing fishing effort in productive areas and areas without sensitive habitats. Since scallop recruitment is episodic, some panelists felt that it was important that all areas be available for fishing. In a rotational area management system, the panel discussed keeping sensitive areas closed for a longer period of time. Panelists also noted that a comprehensive approach to area management that included consideration of the habitat impacts of gears used in other fisheries (e.g., bottom trawls) should be considered.

OTTER TRAWLS

Gear Description

Mr. Frank Mirarchi (Boat Kathleen A. Mirarchi, Inc.) and Mr. James Lovgren (F/V Sea Dragon) identified the types of otter trawl gear used in the northeast. They stressed the diversity of otter trawl types used in this region, explaining that the diversity of gear types was a result of the diversity of fisheries prosecuted and bottom types in the region. The specific gear design used is often a result of the target species (whether they are found on or off the bottom) and the composition of the bottom (smooth versus rough and soft versus hard). The presenters described the various components of otter trawls, including the sweeps, the net body, bycatch reduction devices, bridles or ground cables, and the doors. The sweeps can be chain-wrapped wire, rubber cookies, rockhoppers, rollers, street-sweepers, or tickler chains. The net body depends upon the head rope height, the amount of overhang, and the mesh sizes of the various net panels. Bycatch reduction devices include the Nordmore grate and mesh panels. Types of bridles include chain, bare wire, covered wire, or seine rope. Trawl doors can be polyvalent, flat, or vee type.

Small mesh nets are used to target whiting and squid, and these configurations usually employ a light chain sweep. Flatfish are primarily targeted with a mid-range mesh flat net that has more ground rigging and is designed to get the fish up off the bottom. A high rise or fly net is also used with larger mesh. There are three components of the otter trawl that come in contact with the bottom: the doors; the ground rigging behind the doors; and the sweep.

The panel members discussed these descriptions, noting that otter trawls are actually very complex systems designed to target specific types of fish rather than simple sieves used to collect everything in their path. Fish herding is an important aspect of trawl design and depends upon the hydrodynamic forces of the doors and the sediment clouds generated by the ground rigging and sweep. Panel members reported that roller gear is obsolete in the Northeast, having been replaced by rockhopper gear. Rockhopper gear is no longer used only on hard bottom habitats, but is actually quite versatile for use on a variety of habitat types.

The panel considered the weight in water of the different otter trawl configurations, relative to their weight on land. Contrary to some assumptions, rockhopper gear is not the heaviest type of otter trawl in use in this region as it loses 80% of its weight in water (i.e., a rockhopper rig that weighs 1000 pounds on land may only weigh 200 pounds in water). Streetsweeper gear is much heavier due to the use of steel cores in the brush components. Cookie gear can be heavier as it retains 80-85% of its weight in water. Plastic-based gear has the smallest weight in water to weight on land ratio, at approximately 5%. The panel agreed that the weight of the gear in water is a very important consideration in understanding the relative effects of different otter trawl configurations.

Effects and Evidence

The discussion leaders for the effects of otter trawling were Dr. Robert Van Dolah (South Carolina Department of Natural Resources) and Dr. Ellen Kenchington (Department of Fisheries and Oceans, Canada). At the outset of the discussion, the panel agreed to two general points: first, otter trawls are one of the most studied fishing gear types; and second, otter trawls are one of the most widely used fishing gears. The effects of otter trawls are believed to vary by the specific configuration used, by the intensity of the trawling activity, and by the type of habitat in which the gear is used. Some of the panel members were of the opinion that benthic habitats are dynamic systems, and the changes that result from otter trawling may not necessarily be detrimental.

The panel members discussed a variety of direct effects of the gear operating on the bottom. These effects included: 1) the scraping or plowing of the doors on the bottom, sometimes creating furrows along their path; 2) sediment resuspension resulting from the turbulence caused by the doors and the ground gear on the bottom; 3) the removal or damage to non-target species such as benthic or demersal predators; and 4) the removal or damage to structure-forming biota. The relative significance and/or duration of these effects often depends upon whether the gear is used on low versus high energy environments (these environments could also be thought of as stable versus unstable). It was mentioned during discussion that with the exception of the doors, the trawl gear has to be relatively light on the bottom to maintain its shape and effectiveness. If it rides too heavily on the bottom the gear would collapse in on itself.

Some panel members stated that even relatively light trawl gear will still have an impact on structure forming taxa. Discussion included the opinion that static weight of the gear alone is not the only factor to consider, but that the horizontal and vertical forces on the gear (i.e., the speed of the vessel) are also important considerations. It was agreed that more research is needed to better understand the relationships of gear weight and the forces on the bottom and the differences between gear types.

The panel members also discussed some potential indirect effects of the gear operating on the bottom. The indirect effects included: 1) altered trophic function of benthic communities, primarily caused by a reduction or change in large biota, a reduction or change in predators, or a reduction or change in epiphytes; and 2) altered demersal communities, primarily caused by a loss of structure-forming biota and an alteration of physical features.

The most significant potential effects of otter trawls identified by the panel included long-term changes in bottom structure and long-term changes in benthic trophic function or ecosystem function. The panel suggested that these changes may result either from a reduction of organisms or the replacement of organisms. The potential replacement of some organisms with other organisms is significant because this may prevent the ecosystem from being able to return to its original state, even in the complete absence of fishing activity.

The panel discussed a proposed model for determining the degree of effect on various habitats. The model ranked habitat types along a continuum from mud/sand with no major epifauna or structure-forming biota in a high energy environment to gravel/hard bottom with abundant epifauna and/or structure-forming biota, and suggested that the degree and duration of the effects on these habitat types ranged from lowest for the mud/sand with no major epifauna or structure-forming biota in a high energy environment to highest for the gravel/hard bottom with abundant epifauna and/or structure-forming biota. This model utilized a variation of the major categories of effects previously described: 1) removal of physical features, 2) reduction of structural biota (impacts to biological structure), and 3) reduction of habitat complexity and sea floor structure (impacts to physical structure). Generally, there was a low level of concern for the effects of trawling in mud and sand habitats without major epifauna or structure-forming biota, but a high level of concern for gravel and hard bottom habitats with epifauna and/or structure-forming biota. There was some discussion among the panel members as to whether mud deserved its own category, based on the deep-water basins in the Gulf of Maine that contain long-lived epifauna, but there was no consensus on this issue. The degree and duration of a fourth category of effect, changes in benthic prey, was suggested as being case specific. This conceptual model is discussed in more detail in a subsequent section.

The panel discussion identified several indirect effects of otter trawls on different habitat types, including the attraction/movement of scavengers into the area behind the trawl and changes in diatoms and other primary producers. It was suggested that although scavengers are attracted to areas recently trawled, they do not move in from great distances. Rather, the scavengers that are already in the general vicinity do well, but there are not significant increases in the numbers of these scavengers. It was also suggested that there may be important cascading effects of the changes in diatoms and other primary producers.

The panel discussed the changes in habitat complexity resulting from the tracks made by the doors in further detail. The door tracks themselves create an increase in complexity at the scale for small organisms, but there is a net loss in complexity due to the reduction of biogenic structure. The panel also discussed the duration of effects and agreed to define “long-term” as whenever the recovery period is longer than the natural period of disturbance. The panel agreed that the duration of effect would be greater in habitats toward the gravel/hard bottom with epifauna and/or structure-forming biota end of the continuum identified above.

Following the discussion on the types and relative importance of the different effects of otter trawling on benthic habitats, the panel discussed the strength of the scientific evidence for these effects. This discussion was led by Dr. James Lindholm (Stellwagen Bank National Marine Sanctuary). The panel agreed that there is a great deal of literature to apply to otter trawl fishing activities in the northeast. Most of the available information can be applied to otter trawls in general and deals with chronic effects rather than acute effects. The most difficult issue remains establishing the link between the alteration of the habitat and the effects on biological communities.

It was suggested that ultimately, to make real progress on these issues, we need to be able to look at the differential effects of fishing gear on different types of habitats, and be able to do this by the type of otter trawl rather than only considering otter trawls in general. The current situation is limited to the generalized effects of otter trawls, without the ability to tease out the good and bad elements of these fishing activities. This situation also creates a problem for conservation engineering because there are no specific objectives or problems to solve, only generalities.

In spite of this problem, there was agreement that the general principles and results of the worldwide body of literature on the effects of otter trawling on benthic habitats were applicable to the northeast, even though the gear used might be slightly different. Of all the gears the panel has been charged with considering, otter trawls represent the type where the results of studies from other areas are the most applicable. The panel generally agreed that there was strong evidence in the scientific literature for each of the four primary types of effects as identified earlier.

Conclusion

The panel concluded that the greatest impacts from otter trawls occur in low and high energy gravel habitats and in hard clay outcroppings (Table 5). In gravel, the greatest effects were determined to be on major physical features, and physical and biological structure of the habitat. The panel found it was unable to reach consensus on the degree of impact for sand and low energy mud habitats, but a majority of panel members agreed upon the final conclusions in Table 5.

In gravel and other hard bottom habitats, the degree of impact of otter trawls on major physical features, physical structure, and biological structure were all considered to be high in both low and high energy environments. Major physical features in this habitat type are boulder mounds, which can be knocked down by trawls. Once this happens, the mounds can never be re-formed, and the resulting changes are permanent. Trawls also cause alterations to physical structure by redistributing cobbles and boulders and breaching gravel pavement. Impacts to biological structure in gravel were of greater concern to the panel than impacts to biological structure in other habitats because structural biota is more abundant on gravel bottom. Effects to physical and biological structure of these habitats were judged to last from months to years. The basis for all the panel's conclusions were professional judgement, peer-reviewed literature, and gray literature. Changes to benthic prey caused by trawling were considered to be unknown. In mud habitats, the panel distinguished between hard clay outcroppings that occur in deep water on the outer continental shelf and soft mud (silt and clay) sediments found in deep water basins in the Gulf of Maine and many shallower locations on the shelf. Bottom trawling takes place in both of these habitat types.

Clay outcroppings are found on the slopes of submarine canyons that intersect the shelf on the southern edge of Georges Bank and the New York Bight. These outcroppings provide important habitat for tilefish (*Lopholatilus chamaelonticeps*) and other benthic organisms which burrow into the clay. Based on the panel's professional judgement, removal of this material by trawls was considered to be a permanent change to a major physical feature, and was rated as a high degree of impact. The panel determined that trawls could also cause a high degree of impact to the physical structure of hard clay habitat that could last from months to years. This determination was based on peer reviewed and gray literature, and the panel's professional judgement. Due to a lack of information, the panel was not able to rate impacts to biological structure or benthic prey in this habitat type.

The panel did not reach consensus on the degree to which otter trawls affect physical and biological structure in soft mud habitats. However, most panelists agreed that impacts to biological structure (including worm tubes and burrows) and physical structure were moderate. Panelists agreed that these impacts would be expected to last from months to years. Peer reviewed and gray literature and professional judgement were relied on to make determinations about impacts to physical structure, while professional judgement was the only basis for determination of impacts to biological structure. A lack of information prevented the panel from drawing conclusions about impacts to benthic prey. Panelists determined that removal of major physical features was not a concern in this relatively featureless habitat.

Determining the impacts from trawling on sand habitat was particularly difficult for the panel. There was no consensus on the degree of impact to biological or physical structure, or to benthic prey, in high and low energy environments. However, with one exception, the panelists agreed that these impacts were moderate. Trawl induced changes to physical structure in high energy sand were rated as low. Recovery times for biological structure and prey were considered to range from months to years, and for physical structure from days to months. The basis for all determinations was peer reviewed and gray literature, and professional judgement. The panel determined that removal of major physical features was not an impact that applied in what is a relatively featureless environment.

There was a general consensus that the acute impacts of bottom trawls (i.e., impacts caused by a single tow) on physical and biological structure are less severe than for a scallop dredge, but the chronic impacts resulting from repeated tows are more severe for trawls because a greater bottom area is affected by trawling than is affected by scallop dredging. Additionally, otter trawls are towed repeatedly in the same locations, much more so than scallop dredges and clam dredges. One panel member pointed out that the only part of a trawl that disturbs the bottom in the same manner as a scallop dredge is the door - the rest of the trawl behaves very differently. Another panel member reiterated that there are a large variety of trawls in use in the Northeast U.S. Some (squid nets, high rises) are very light trawls that barely contact the bottom at all, whereas others (flatfish nets) "hit hard" which makes it difficult to generalize the impacts associated with this gear. It is important to recognize that the greatest challenge the panel faced in drawing their conclusions is the fact that there is such a wide variety of otter trawl gear in use over a very wide range of habitat types and known impacts from trawl gear is aggregated and not typically attributed to a specific gear configuration.

Table 5. Impacts of Otter Trawls on Benthic Habitat

TYPE OF IMPACT	DEGREE OF IMPACT	DURATION	TYPE OF EVIDENCE	COMMENTS
MUD				
Removal of Major Physical Features	XXX (H) N/A (L)	Permanent	PJ	(H) in Mud referrs to clay (i.e., tilefish burrows) in all cases
Impacts to Biological Structure	Unknown (H) XX* (L)	Months - Yrs	PJ	(L) opinions ranged from X-XXX
Impacts to Physical Structure	XXX* (H) XX* (L)	Months - Yrs	PR, GL, PJ	(L) opinions ranged from XX-XXX and unknown
Changes in Benthic Prey	Unknown			
SAND				
Removal of Major Physical Features	N/A	N/A	N/A	
Impacts to Biological Structure	XX* (H, L)	Months - Years	PR, GL, PJ	(H) opinion ranged from X-XXX (L) opinion ranged from XX-XXX
Impacts to Physical Structure	X* (H) XX* (L)	Days - Months	PR, GL, PJ	(H, L) opinion ranged from X-XXX
Changes in Benthic Prey	XX* (H, L)	Months - Years	PR, PJ, GL	(H) opinions were XX or unknown (L) ranged from X-XXX and unknown
GRAVEL				
Removal of Major Physical Features	XXX (H, L)	Permanent	PR, GL,PJ	
Impacts to Biological Structure	XXX (H, L)	Months - Years	PR, GL, PJ	
Impacts to Physical Structure	XXX (H, L)	Months - Years	PR, GL, PJ	Rocks altered or relocated
Changes in Benthic Prey	Unknown			

KEY: X = Effect can be present, but is rarely large; XX = Effect is present and moderate; XXX = Effect is often present and can be large; N/A = Effect is not present or not applicable; Unknown = effects are not currently known; (H) = High energy environment; (L) = Low energy environment; PR = Peer reviewed literature; GL = Grey literature; PJ = Professional judgement. For definitions of Substrate Type and Type of Impact see Appendix D.

NOTE: Ongoing Canadian experiments will be able to provide additional information in the near future.

* This does not represent a consensus among the panel

Management

Dr. Joseph DeAlteris, (University of Rhode Island) was the discussion leader for the management section and offered a framework of management approaches that could be considered for reducing the impacts associated with otter trawls on benthic habitats. The approaches included effort reductions, area restrictions, and gear improvements. He acknowledged that fishing effort by bottom-tending mobile gear has been reduced approximately 50% in the Northeast over the last ten years. He also acknowledged that the existing year-round closed areas (Georges Bank Closed Areas I and II, the Nantucket Lightship Closed Area, and the Western Gulf of Maine Closed Area) have been effective at reducing fishing-related impacts within the areas. He suggested that there are ways to make fishing gear more “habitat-friendly” by lowering the associated turbulence and making the gear lighter on the bottom, but stressed that these efforts would require cooperative work with the fishing industry and specific goals and objectives. Overall, the panel agreed with the discussion leader on these points as general principles.

The panel discussed these management approaches. Panel members suggested that reductions in effort do not necessarily translate into similar reductions in impacts, while area closures guarantee protection to the areas closed that effort reductions cannot. Panel members also suggested that what is really needed is an adjustment to fishing capacity, and that over-capacity in the fleet is forcing people to fish in ways and in areas that they otherwise would not. Excess fishing power results in people fishing very inefficiently at lower catch-per-unit-effort (CPUE) than would otherwise occur and this results in increased fishing time. The panel members suggested that conservation engineering is a key management factor to develop fishing gears that have less impact on benthic habitats. It was also suggested that the concept of closed areas should be revisited to target specific habitats and bycatch concerns, and that the areas closed could be more discrete.

The panel also identified the link between effort reduction and specific closed areas as an important consideration in evaluating the effectiveness of management measures. By itself, effort reduction may not accomplish the objective of reducing impacts to habitat. Ideally, the three components identified by the discussion leader (effort reduction, closed areas, gear improvement) would be used together to manage fishing activities. The panel was cautioned that the concept of effort reduction is not necessarily as simple as it sounds. Managers must be able to deal with latent effort and changes in fishing behavior, the differences between nominal effort and effective effort, and issues related to effort displacement. For example, in response to a reduction in the allowable fishing effort, vessels may move inshore, but this could increase the impacts to inshore habitats.

The panel agreed that another management challenge will be the need to consider how to protect habitat from adverse impacts from otter trawls and other fishing gears in the context of a rebuilt fishery when fishing effort would likely increase.

POTS AND TRAPS

Gear Description

Pots and traps were described by Mr. Arnold Carr (Massachusetts Division of Marine Fisheries). Mr. Carr's descriptions focused on lobster, seabass, scup, red crab and hagfish pots. Even though the intent of the workshop was to focus only on gears used in federally-managed fisheries, lobster pots were included because they are by far the most commonly used gear in this category and because they could potentially affect habitats that support federally-managed resources.

Lobster Pots: Mr. Carr pointed out that these are fished as either 1) a single pot per buoy (although two pots per buoy are used in Cape Cod Bay, and three pots per buoy in Maine waters), or 2) a "trawl" or line with up to 100 pots. It was also pointed out that habitat impacts are probably due mostly to the pots and the mainline between pots, not the buoy line. Other important features of lobster pots and their use were the following:

- About 95% of lobster pots are made of plastic-coated wire.
- Floating mainlines may be up to 25 feet off bottom.
- Sinklines are sometimes used where marine mammals are a concern - neutrally buoyant lines may soon be required in Cape Cod Bay.
- Soak time depends on season and location - usually 1-3 days in inshore waters in warm weather, to weeks in colder waters.
- Offshore pots are larger (more than 4 ft long) and heavier (~ 100 lb.), with an average of ~ 40 pots/trawl and 44 trawls/vessel; they usually have a one-week soak and a floating mainline.
- There has been a three-fold increase in lobster pots fished since the 1960s, with more than four million pots now in use.

Other Pots: Seabass/scup and red crab pots are similar in design to lobster pots. Seabass/scup pots are usually fished singly or in trawls of up to 25 pots, in shallower waters than the offshore lobster pots and red crab pots. Pots may be set and retrieved 3-4 times/day when fishing for scup. The red crab fishery uses 400-600 pots/vessel, hauled on a daily basis, and operates on the continental slope and canyons. Hagfish pots (40 plastic gallon barrels) are fished in deep waters, on mud bottoms.

Effects and Evidence

Mr. Carr led the discussion on the habitat effects that can be attributed to pots. Most of the discussion focused on lobster pots. The primary direct impacts of any kind of pot are the scouring of the bottom and injury or death to benthic organisms that occur directly under the pot or in its path when it is retrieved. The total impact is thus the aggregate effect of the pot's "footprint," the area through which it is dragged when it is hauled (which may be 2-3 times larger than its footprint), any damage caused by the mainline in a trawl of pots, the number of pots that are in use in any period of time, and the number of times each pot is hauled. Although panel members agreed that the habitat impacts caused by individual lobster pots were minimal, they believed that the cumulative effects of so many pots could be significant, especially in sensitive habitat areas of high structural complexity. Panel members also mentioned that lobster pots normally remain on the same place on the bottom for days at a time and that they are set repeatedly in certain heavily-fished areas; both of these factors further magnify their site-specific impacts on benthic habitats.

Lobsters concentrate in coastal, hard substrate areas, offshore canyons, and in mud substrate with a high clay content where they produce burrows. The types of habitat that the panel considered most vulnerable to alteration by pot fishing were complex hard bottom habitats with abundant structural biota. The panel did not consider high-energy sand habitats to be vulnerable, and pointed out that lobster pots are usually not fished there except during times of the year when lobsters move across open areas of bottom.

Other observations made by panel members included the following:

- Sinking mainlines can turn over rocks and shear off epifauna when pots are hauled.
- Lobstermen tend to avoid using sinklines in rocks.
- Attached epifauna in low energy mud and sand habitats are susceptible to damage from sinklines, which are used in relatively flat, featureless bottoms.
- Baits used in pots enrich benthic ecosystems and may increase the abundance of infaunal benthic organisms in heavily-fished locations.
- Pots may also act as reef habitat, though this effect is reduced by their frequent retrieval.
- At certain times of year, pots indirectly provide some habitat protection by making areas inaccessible to mobile gear.

Dr. Doug Rader (Environmental Defense) led the discussion of the evidence and pointed out that there is some published evidence from Florida and the Caribbean of damage to hard substrates, benthic epifauna, and submerged aquatic vegetation. He also mentioned an evaluation of the habitat impacts of fish pots in the Gulf of Mexico as ranging from "an impact" to "a significant impact" (as opposed to "no impact" or an "extreme impact). The panel agreed that there is a paucity of information for the Northeast U.S., but studies from other regions are applicable if they address impacts to analogous species of emergent epifauna or types of biogenic structure.

Conclusion

The panel concluded (Table 6) that the degree of impact caused by pots and traps to biological and physical structure and to benthic prey in mud, sand and gravel habitats was low. In both mud and sand, the duration of impacts to biological structure could last for months to years, whereas physical structure and benthic prey should recover in days to months. Professional judgement was used to make the evaluations for benthic prey, while the panel relied on grey literature for the other types of impacts. In gravel, reduction of structural biota and changes in seafloor structure and benthic prey could all persist for months to years. Again, the panel relied on professional judgement to assess changes to benthic prey, while grey literature was also considered for the other impacts. In all three habitats, changes in benthic prey could be negative, due to damage by the gear, and may be positive or negative due to nutrient enrichment or food availability from bait.

Table 6. Impacts of Pots and Traps on Benthic Habitat

TYPE OF IMPACT	DEGREE OF IMPACT	DURATION	TYPE OF EVIDENCE	COMMENTS
MUD				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	X	Months - Years	GL, PJ	
Impacts to Physical Structure	X	Days - Months	GL, PJ	
Changes in Benthic Prey	X	Days - Months	PJ	Enrichment mediated effects, damage mediated effects due to baited gear
SAND				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	X	Months - Years	GL, PJ	
Impacts to Physical Structure	X	Days - Months	GL, JP	
Changes in Benthic Prey	X	Days - Months	PJ	Enrichment mediated effects, damage mediated effects due to baited gear
GRAVEL				
Removal of major physical features	N/A			
Impacts to Biological Structure	X	Months - Years	GL, PJ	
Impacts to Physical Structure	X	Months - Years	GL, PJ	
Changes in benthic prey	X	Months - Years	PJ	Enrichment mediated effects, damage mediated effects due to baited gear
KEY: X = Effect can be present, but is rarely large; XX = Effect is present and moderate; XXX = Effect is often present and can be large; N/A = Effect is not present or not applicable; Unknown = effects are not currently known; (H) = High energy environment; (L) = Low energy environment; PR = Peer reviewed literature; GL = Grey literature; PJ = Professional judgement. For definitions of Substrate Type and Type of Impact see Appendix D.				

Management

The strongest recommendation made by the panel to minimize adverse effects of pots and traps was a reduction of effort, although it was recognized that reducing the total number of pots in use is not a complete solution since the remaining pots could be set more often or left for longer set times. Other suggestions made by panel members were:

- "Zoning" habitats (i.e., identifying zones within each habitat type for various uses, including habitat protection) and protecting sensitive areas (e.g., clay pipes).
- If pots can be made lighter without lifting off the bottom, impacts could be reduced.
- Minimizing the amount of line on the bottom would also be helpful.
- Fewer pots per string would reduce impacts of dragging the gear across the bottom.

These observations focused on lobster pots, but some apply to other types of pots as well. Pot fisheries for black sea bass and conch in certain locations are also characterized by a high density of pots which maximizes the likelihood of site-specific habitat impacts.

SINK GILL NETS AND BOTTOM LONGLINES

Gear Description

These two gears were described by Mr. Carr. Other types of bottom static gear (e.g., stake gill nets, handlines, electric or hydraulic reels) were not covered because they are not used extensively in federal waters.

Sink/Anchor Gill Nets: Individual gill nets are typically 300 feet long, and are usually fished as a series of 5-15 nets attached end-to-end. Gill nets have three components: leadline, webline and floatline. Fishermen are now experimenting with two leadlines. Leadlines used in New England are ~65 lb/net; in the Middle Atlantic leadlines may be heavier. Weblines are monofilament, with the mesh size depending on the target species. Nets are anchored at each end, using materials such as pieces of railroad track, sash weights, or Danforth anchors, depending on currents. Anchors and leadlines have the most contact with the bottom. Some nets may be tended several times/day, e.g., when fishing for bluefish in the Middle Atlantic; for New England groundfish, frequency of tending ranges from daily to biweekly.

Bottom Longlines: Mr. Carr was most familiar with longlines fished off Chatham, MA, where about six vessels use them. Up to six individual longlines are strung together, for a total length of about 1500 ft, and are deployed with 20-24 lb anchors. The mainline is parachute cord or sometimes stainless steel wire. Gangions (lines from mainline to hooks) are 15 inches long and 3-6 ft apart. The mainline, hooks, and gangions all come in contact with the bottom. Circle hooks are potentially less damaging to habitat features than other hook shapes. These longlines are usually set for only a few hours at a time. Other panelists noted that: 1) the soak time is regulated, such that the longlines cannot remain in the water for very extended periods; 2) longlines for tilefish in deep water may be up to 25 miles long, are stainless steel or galvanized wire, and are deployed in a zig-zag fashion; and 3) in the Southeast, longlines are prohibited in waters less than 300 ft deep (except for sharks), and are also prohibited in the wreckfish fishery (which is generally prosecuted in depths from about 1200-2000 ft). The prohibition is due to evidence of damage to corals, lost gear, and conflicts with other gears.

Effects and Evidence

Discussions of effects and strength of evidence were led by Dr. Robert Diaz (VIMS) and Dr. DeAlteris. It was noted that both gears are dragged over the bottom when they are retrieved. In addition, gill nets move around to some extent while they are on the bottom and longlines can be moved back and forth across the bottom if there is enough current or when hooked fish pull on the mainline. Dr. Diaz noted that direct effects could include alteration of physical structure and injury or death of emergent epifauna, while indirect effects could include alterations of benthic assemblages toward species that provide less cover or prey for demersal fish. He also pointed out that the amount of damage will depend on the frequency and duration of sets, and the amount and type of structure present. Mr. Carr, who has done research on lost or abandoned gill nets in New England, observed damage to bottom habitats caused by trapped schools of dogfish dragging the nets across the bottom.

Dr. DeAlteris noted that observations in an area off Alaska indicated that the effects of bottom longlines could be of the same type and magnitude as those caused by mobile gear, if longlines are used intensively in areas with abundant biological structure. However, these gears cause relatively little harm when used in non-sensitive habitats that have little or no vertical physical or biological structure. Vulnerable areas are those with 1-3 ft tall structure. Dr. DeAlteris also noted that in order to fully evaluate the significance of the habitat impacts of these two gear types in the Northeast region, the types of gear used and how they are used need to be matched up with the types of habitat where they are used. Two other factors to consider are the amount of gear used and the total area affected.

Except for observations of "ghost" gill nets, there are no studies of the habitat impacts of either of these gear types in the Northeast region. However, in the opinion of Dr. DeAlteris, studies from other areas could be applied to the Northeast, as long as the gear was used in the same type of habitat.

Several panel members noted that tilefish are unusually important in structuring the bottom in offshore canyon head areas. These areas then become important habitat for lobsters, crabs and other species, and that removal of these fish (with longlines) should perhaps be considered a habitat effect, as it may lead to reduced burrow-forming and maintenance. It was noted that part of the continental shelf break habitat for golden tilefish in the Southeast U.S. is now protected, and research is being done on the value of this habitat.

Conclusion

The panel concluded that sink gill nets and longlines cause some low degree impacts in mud, sand and gravel habitats (Table 7). In mud the impacts to biological structure could last for months to years. Duration of impacts to physical structure could be days to months on soft muds, and permanent if impacts were on hard bottom clay structures found in deep water on the continental slope. Impacts to physical structure in mud would be caused by lead lines and anchors used with sink gill nets, not by longlines. In the panel's judgement, impacts in sand would be limited to biological structure and would last days to months. The panel's evaluations of impacts in mud and sand habitats were based on professional judgement alone. Impacts in gravel would also be to biological structure, and the duration could be months to permanent (the latter if the damage involved corals), as indicated by peer review and gray literature, as well as professional judgement.

Table 7. Impacts of Sink Gill Nets and Bottom Longlines

TYPE OF IMPACT	DEGREE OF IMPACT	DURATION	TYPE OF EVIDENCE	COMMENTS
MUD				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	X	Months - Years	PJ	
Impacts to Physical Structure	X	Permanent[1] Days - Months[2]	PJ	[1] Refers to clays [2] Soft bottom muds
Changes in Benthic Prey	N/A			
SAND				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	X	Days - Months	PJ	
Impacts to Physical Structure	N/A			
Changes in Benthic Prey	N/A			
GRAVEL				
Removal of Major Physical Features	N/A			
Impacts to Biological Structure	X	Months - Permanent[1]	PR, GL, PJ	[1] corals
Impacts to Physical Structure	N/A			
Changes in Benthic Prey	N/A			

KEY: X = Effect can be present, but is rarely large; XX = Effect is present and moderate; XXX = Effect is often present and can be large; N/A = Effect is not present or not applicable; Unknown = effects are not currently known; (H) = High energy environment; (L) = Low energy environment; PR = Peer reviewed literature; GL = Grey literature; PJ = Professional judgement. For definitions of Sediment Type and Type of Impact see Appendix D.

Management

The panel agreed that better information is needed on the distribution of habitats that are sensitive to alteration from sink gill nets or bottom longlines, and recommended that sensitive habitats be protected through closures. It was also pointed out that there are areas where emergent epifauna would naturally grow, but has been removed by mobile bottom gear. The panel also suggested that gill net and longline vessels should have observers to record bycatch of benthic structural material.

BEAM TRAWLS

Description

Dr. Chris Glass (Manomet Center for Conservation Sciences) and Mr. Mirarchi led the panel discussion on beam trawls. The panel was unaware of any beam trawls being used in the Northeast U.S. at this time. A few beam trawls were used in the 1970s to catch monkfish, but the fishery was unsuccessful. In the mid 1990s, a number of boats off New Bedford used what were referred to as beam trawls, but the gear more closely resembled a scallop dredge rather than the traditional, European beam trawls. There are a few boats that are currently coded as beam trawls in the fishery landings database, but the panel felt that these were most likely miscoded and were otter trawls being deployed from the side of the vessels.

The panel also felt that it is unlikely that fishermen would begin using beam trawls in the Northeast U.S. Beam trawls are prevalent in the North Sea where the water is dark and murky and the fisheries target flatfishes, which sit slightly under the sediments. In these fisheries, the beam trawl acts to sieve the fish up off the seafloor. The lack of conventional herding effect and small mouth opening of the beam trawl would not be effective for harvesting U.S. target species. Furthermore, most vessels being used in the Northeastern U.S. do not have the size or power required to handle a beam trawl.

Effects and Evidence

There has been long standing concern (dating back to the 14th century) about the adverse effects resulting from the use of beam trawls. Therefore, there exists a large body of good information on the effects of this gear on different habitats.

Management

No management measures are necessary at this time. This issue should be revisited if beam trawls start being used in the Northeast in the future.

PELAGIC GEAR

Description

Dr. DeAlteris discussed a number of pelagic gear types used in the Northeast, including pelagic trawls, drift gill nets, purse seines and longlines. The discussion focused on the fact that, if operated correctly, pelagic fishing gear should only incidentally come into contact with the seafloor. Pelagic trawls, for example, are not designed to touch the seafloor and would be damaged by such contact. Furthermore, the trawl doors would be unstable and would not fish correctly. Purse seines are fished primarily in offshore areas to target tunas. Only a small number of vessels (5 or 6) use purse seines to fish for tunas in coastal waters. Drift (i.e., floating) gill nets and longlines (which are fished in deep waters) only inadvertnetly contact the seafloor. Paired midwater trawls have been banned except for herring, and drift gill nets, once employed for swordfish, are no longer in use.

Effects and Evidence

Dr. DeAlteris and Dr. Fogarty led the discussions on effects and evidence. It was stated that if pelagic gear were to incidentally contact the seafloor, the trawl doors, footropes, leadlines of stationary or floating nets, the nets themselves, or components of longlines could drag across benthic habitats or become entangled on benthic structures. Occasionally boats fishing with purse seines follow fish into shallow water depths where the height of the net (the only one the boat is equipped with) could cause dragging along the seafloor. In the Northeast, purse seines were permitted into Groundfish Closed Area II in 2000 and 2001 with observers. No benthic materials came up in the nets during those observed trips. A few boats observed in 1996 captured benthic materials in the net when it was fished in the shallow waters of Massachusetts Bay. This contact with the bottom is accidental and normally is avoided to prevent damage to the nets.

The opinion of the panel was that pelagic gear has a lower priority than gear that is intentionally dragged across the seafloor. There would be more concern over the potential effects of pelagic fishing gears if seafloor contact was other than incidental, or if there was evidence that contact occurred frequently. Therefore, the panel concluded that we need a better understanding of how often contact occurs. For example, West Coast fisheries that use purse seines such that they frequently contact bottom habitats are monitored with 100% observer coverage.

The panel also discussed ecosystem implications of pelagic gear due to removal of pelagic prey items. It was determined, however, that this issue would be more appropriately addressed through the population management provisions of the Magnuson-Stevens Act, rather than the EFH provisions of the Act.

Management

No management measures are necessary at this time, however, Councils and NMFS should consider increasing observer coverage to track, to the extent possible, the frequency that pelagic gear comes into contact with the seafloor.

CONCEPTUAL HABITAT IMPACT MODEL

Dr Fogarty and Dr. DeAlteris presented a conceptual habitat impact model which was partially described in the previous Otter Trawl section. Although this model has not been extensively reviewed and discussed by the panel, the panel agreed that the model did relate habitat impacts, structural complexity of habitats and recovery time rather well. Based upon the panel's agreement as to the merits of this conceptual model it is presented here in greater detail.

Habitat Classification and Assessment

The potential impacts of fishing gear on a habitat type are a function of the structural complexity of the habitat, the expected recovery time following a disturbance, and characteristics of the gear itself. Habitats characterized by high structural complexity (including emergent biological structures (EBS) such as attached macroalgae, epibenthic organisms etc.) are expected to exhibit higher levels of vulnerability to disturbance. The expected recovery time for a habitat is a function of its physical and biological characteristics and geological structure. For habitats with high complexity attributable to biological structure, the life history and generation times of the emergent or attached organisms will critically determine recovery times. Disturbance to geological structures such as cobble/boulder mounds may effectively be permanent. The expected recovery times for certain organisms that contribute to structural complexity of the environment (e.g. hard and soft corals) may be measured on decadal time scales. Conversely, disturbance to sand/mud substrates without emergent biological structure is expected principally to involve short term impacts and rapid recovery times.

Although a number of habitat classification schemes are possible (e.g. Auster 1998), most involve consideration of grain size characteristics and the presence or absence of biogenic structure. For the purposes of assessing priority for protection, we propose a simple classification scheme with the following categories:

- mud/sand without emergent biological structure
- mud/sand with emergent biological structure
- small gravel (< 2cm) without emergent/attached biological structure
- small gravel (< 2cm) with emergent/attached biological structure
- shell aggregations and/or reefs without emergent/attached biological structure
- shell aggregations and/or reefs with emergent/attached biological structure
- cobble/boulder without emergent/attached biological structure
- cobble/boulder with emergent/attached biological structure

We expect a general relationship between the structural complexity of these habitat types and recovery time from a disturbance. The specific geological and biogenic structures impacted by particular fishing gears will of course determine if recovery is possible and, if so, the expected time scales. Highest vulnerability to fishing gear occurs in habitat types with high structural complexity and long recovery times. Although the specific biological and geological characteristics of particular habitats must be assessed to determine vulnerability to fishing gear, we propose a general conceptual model for the purpose of defining areas of potential high vulnerability (Figure 1).

Consideration of the physical oceanographic characteristics in the habitats will also be critical. In high energy environments, we anticipate coarser grain size and biological communities adapted to disturbance. The expected impact of additional anthropogenic disturbance due to fishing activities must be assessed with respect to rates and magnitude of natural disturbance. In low energy environments, we anticipate biological communities that are not adapted to natural disturbance regimes and these communities may be particularly vulnerable to fishing gear impacts.

Consideration of priorities for protection must also consider the relative availability of particular habitat types. Rarer habitat types should be accorded high priority for protection with the highest priority assigned to those habitats with low availability and high expected recovery times (Figure 2). In the Northeast region, habitat with low structural complexity and short recovery times are relatively abundant. Conversely, habitats with high structural complexity and long recovery times are comparatively less abundant. These characteristics lead to the shape of the curve depicted in Figure 2. Types of protection can range from constraints on particular gear types in specific habitats to the establishment of marine protected areas in which all extractive activities are prohibited.

Figure 1. Conceptual model of the relationship between vulnerability to fishing gear (structural complexity and recovery time) and habitat availability for the Northeast region.

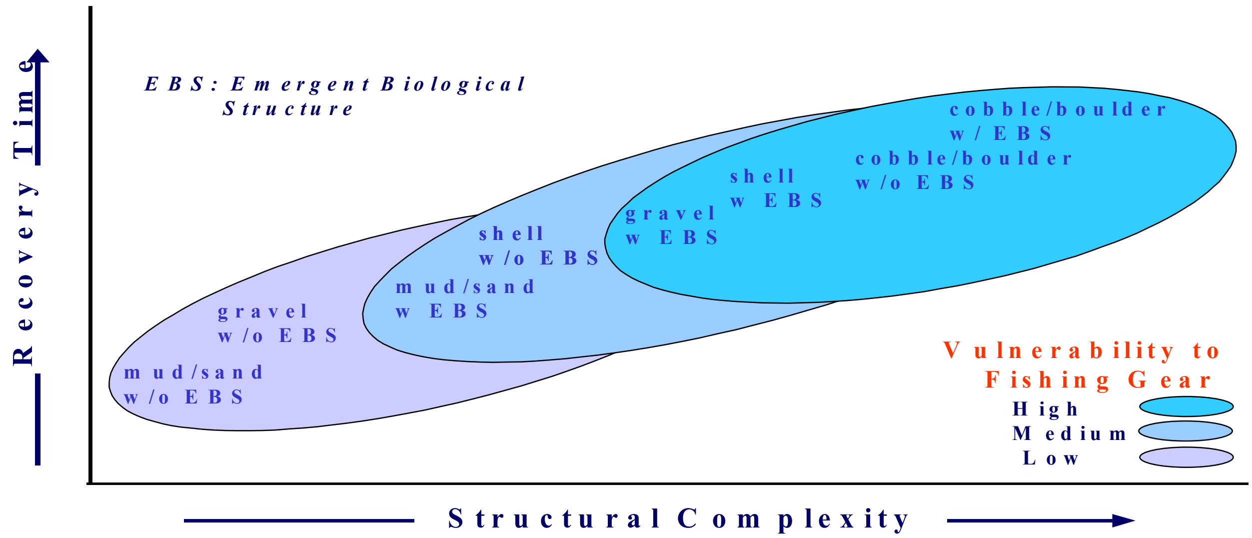
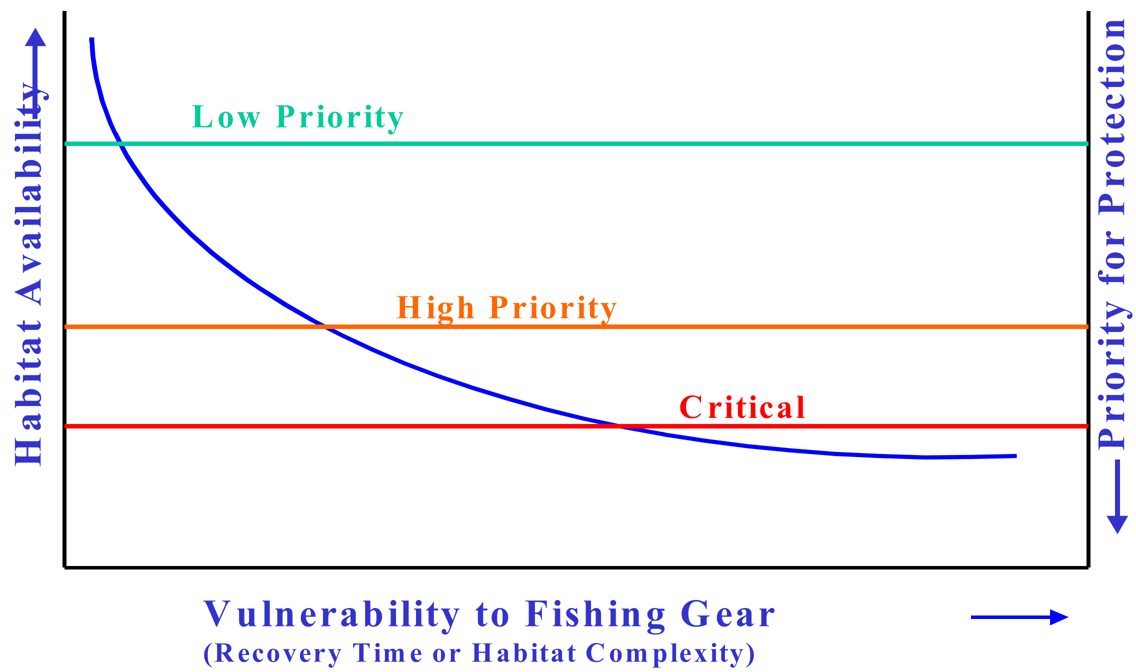


Figure 2. Conceptual model of the relationship between vulnerability to fishing gear (structural complexity and recovery time), habitat availability, and priority for protection.



PRIORITIZATION OF IMPACTS

The workshop participants were asked to participate in an exercise to rank the relative importance of various gear impacts on habitat. The panelists considered the three general habitat types of mud, sand and gravel, and within those habitat types four impacts 1) Removal of major physical features, 2) Impacts to biological structure, 3) Impacts to physical structure, and 4) Changes in benthic prey.

All of these impacts and habitat types were tabulated on a large chart. The panelists were allowed seven votes each. They voted by placing stickers on the chart next to the combinations of impacts and habitats that they felt were the most critical. They could allocate their votes as they saw fit based on any criteria they chose. Some panelists did not specify the type of impact and simply voted by gear type and habitat type. The results from this exercise are found in Tables 8 and 9.

Table 8. Prioritization of Habitat Impacts: Votes Cast by Panel

HABITAT	TYPE OF IMPACT	PANEL RANKING (number of votes, N = 84)					
		Scallop Dredge	Otter Trawl	Nets & Lines	Pots & Traps	Clam Dredges	Total
MUD	Any Impacts	.	5	.	1	.	6
	Removal of major physical features	.	3	.	.	.	3
	Impacts to biological structure	.	1	.	.	.	1
	Impacts to physical structure	.	2	.	.	.	2
	Changes in benthic prey	.	.	.	.	.	.
SAND	Any Impacts	.	.	.	.	1	1
	Removal of major physical features	.	.	.	.	.	.
	Impacts to biological structure	7	4	.	.	2	13
	Impacts to physical structure	2	1	.	.	4	7
	Changes in benthic prey	.	.	.	.	.	.
GRAVEL	Any Impacts	8	11	.	.	.	19
	Removal of major physical features	.	1	.	.	.	1
	Impacts to biological structure	9	10	5	.	.	24
	Impacts to physical structure	4	3	.	.	.	7
	Changes in benthic prey	.	.	.	.	.	.
TOTAL		30	41	5	1	7	84

Table 9. Priority Ranking of the Level of Concern Over Potential Adverse Impacts to Benthic Habitats

Concern by Sediment Type

Rank	Sediment Type	Percentage	Votes
1	Gravel	61%	51/84
2	Sand	25%	21/84
3	Mud	14%	12/84

Concern by Type of Effect

Rank	Type of Effect	Percentage	Votes
1	Impacts to biological structure	65%	38/58
2	Impacts to physical structure	28%	16/58
3	Reduction of physical features	7%	4/58

Concern by Type of Gear

Rank	Type of Gear	Percentage	Votes
1	Otter trawls	49%	41/84
2	Scallop dredges	36%	30/84
3	Clam dredges	8%	7/84
4	Nets and Lines	6%	5/84
5	Pots and Traps	1%	1/84

Concern by Sediment Type and Effect Combination

Rank	Sediment Type - Effect	Percentage	Votes
1	Gravel - Impacts to biological structure	41%	24/58
2	Sand - Impacts to biological structure	22%	13/58
3	Sand - Impacts to physical structure	12%	7/58
3	Gravel - Impacts to physical structure	12%	7/58
5	Mud - Reduction of physical features	5%	3/58
6	Mud - Impacts to physical structure	3%	2/58
7	Mud - Impacts to biological structure	2%	1/58
7	Gravel - Reduction of physical features	2%	1/58

Concern by Sediment Type and Gear Type Combination

Rank	Sediment Type - Gear Type	Percentage	Votes
1	Gravel - Otter trawls	30%	25/84
2	Gravel - Scallop dredges	25%	21/84
3	Mud - Otter trawls	13%	11/84
4	Sand - Scallop dredges	11%	9/84
5	Sand - Clam dredges	8%	7/84
6	Sand - Otter trawls	6%	5/84
6	Gravel - Nets and Lines	6%	5/84
8	Mud - Pots and Traps	1%	1/84

Several conclusions can be drawn from this evaluation. First of all, gravel habitat was clearly considered to be most at risk, followed by sand and mud (Figure 3). Secondly, impacts to biological structure were of greatest concern, particularly in gravel habitat, followed by any impacts to gravel habitat (Figure 4). Impacts to physical structure ranked third and removal of major physical features ranked fourth. Thirdly, otter trawls and scallop dredges were of much greater concern than clam dredges, gill nets and longlines, and pots and traps (Figures 5). Otter trawls and scallop dredges were judged to have the greatest impacts on gravel habitat (Figure 6). Additionally, otter trawl effects were of concern in all three habitat types, whereas scallop dredge effects are limited to gravel and sand, and clam dredging impacts are limited to sandy bottom. Sink gill nets and bottom longlines were only of concern in gravel. Changes in benthic prey received no votes at all and only one vote was cast for pots and traps. Overall, the panelists stated that this was a valuable exercise and that the results were consistent with their discussions throughout the workshop.

Figure 3. Priorities by Habitat Type

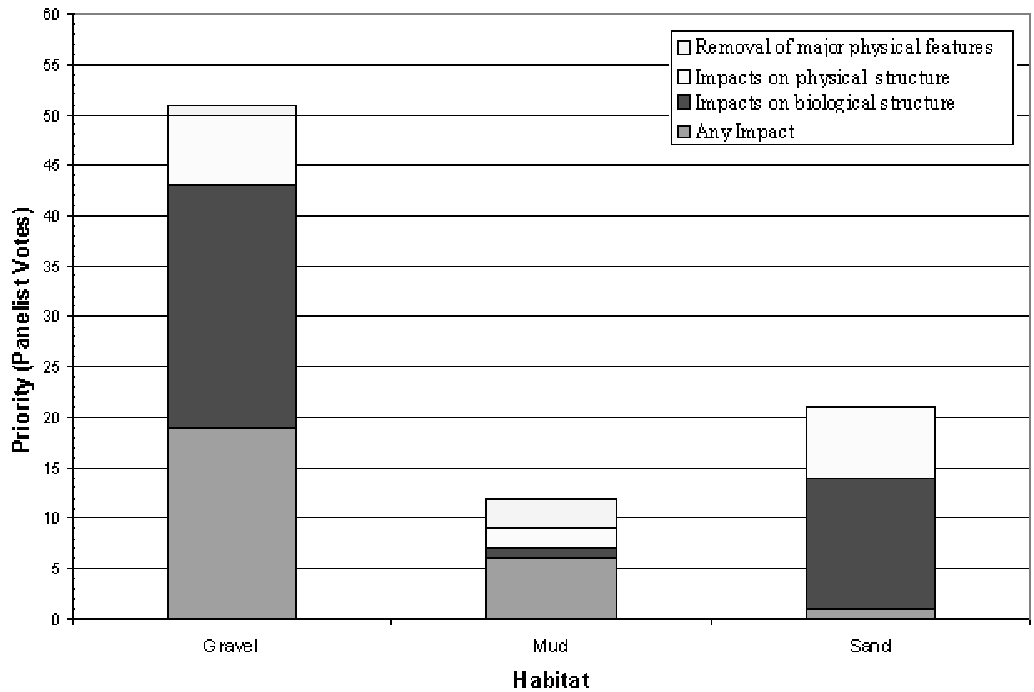


Figure 4. Priorities by Impact Type

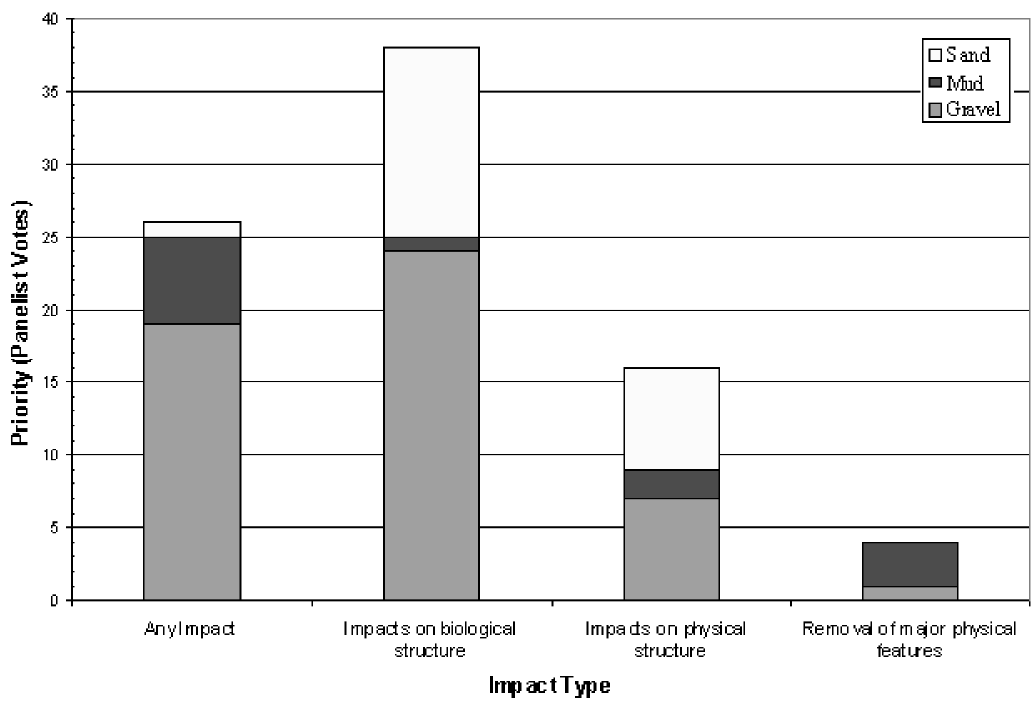


Figure 5. Priorities by Gear

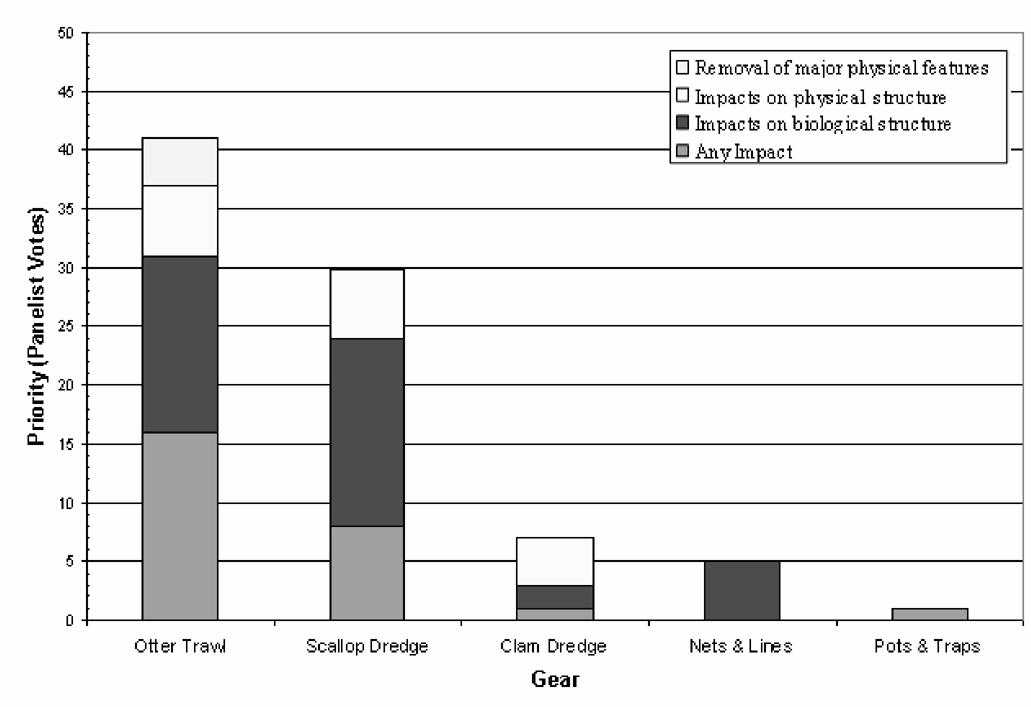
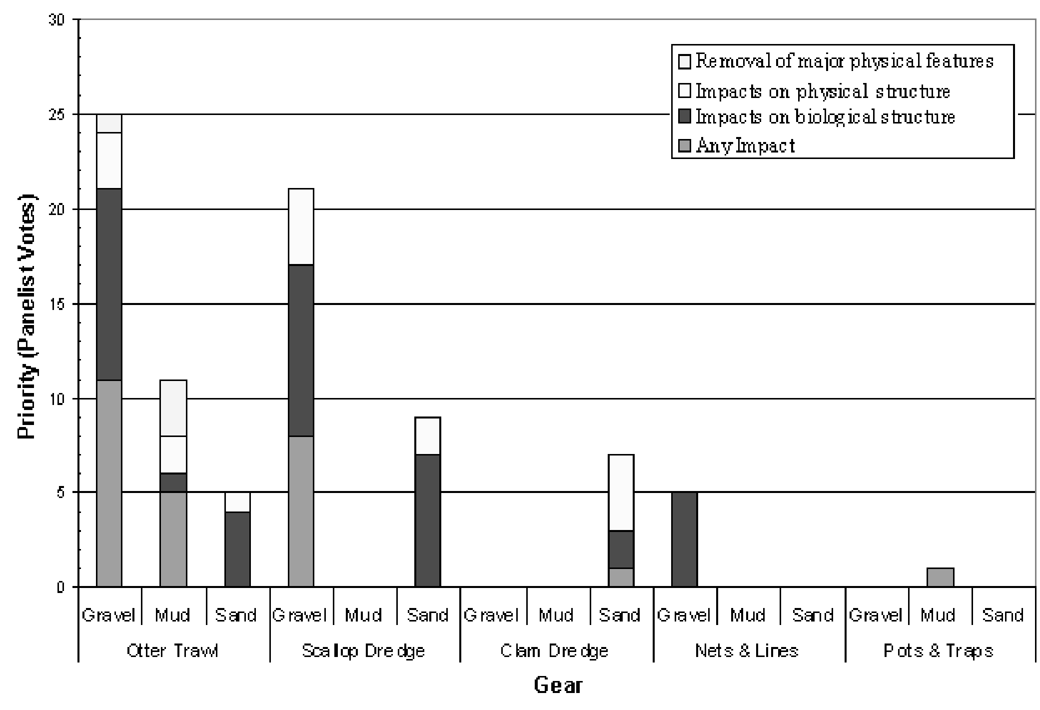


Figure 6. Priorities by Gear and Habitat



RECOMMENDATIONS FOR ACTION

Overall the panel stressed a theme throughout the workshop that in order to protect habitat from gear impacts three management measures deserve consideration: 1) effort reduction, 2) spatial closures, and 3) gear modification. During this specific session of the workshop these themes were raised again and the panel also made several other and more specific suggestions related to gear impacts and habitat. The panel members were free to suggest anything they thought appropriate but were asked to consider both research and management recommendations. For the most part the panel reached consensus on each of these recommendations. When they did not reach consensus, it is noted and the reasons for differing opinions are explained. Many of the recommendations focused in three areas, spatial closures, increased mapping, and effort data. The discussions supporting these three types of recommendations along with the other recommendations offered by the panel are included below. The panel recommended:

Spatial Closures: To protect critical and/or vulnerable habitat areas as an important tool to minimize gear impacts on habitat. The panel indicated that some closed areas need to be closed to all gear types in order to protect critical habitat while other areas only need to be closed to gear types that significantly impact the bottom. Some panel members argued that long term and even permanent closed areas were needed for habitat protection as well as for research. Other panel members thought that short term or more temporary closed areas, which adapted to changing conditions in the habitat or fishery, were sufficient. While all panel members agreed that areas should be closed to protect critical or vulnerable habitat , some panel members emphasized the need to protect portions of representative habitat types in the Northeast region; such closures would include habitats that may not be as vulnerable to alteration from fishing. All panel members agreed that the selection of closed areas should be based on scientific information. Some panel members felt it was important to extend the duration of the current closed areas on Georges Bank and the western Gulf of Maine in order to continue habitat protection which is already in place and to allow established research programs to continue. Other panel members indicated that these areas were chosen for fishery resource management rather than habitat protection purposes and therefore new areas should be considered.

Mapping: The habitats in the Northeast region should be mapped. This mapping effort should begin with the most critical habitats but then should eventually encompass the entire region.

Effort Data: Effort data for the various fishing fleets, especially otter trawls and clam dredges, should be gathered and mapped as has been done in the scallop fishery. While systems such as VMS are currently installed on some vessels for enforcement purposes, the panel agreed that collection of real time trip data was not necessary; instead, any mechanism to gather information that could be mapped at a later date would be sufficient.

Effort Reduction: The panel noted that for many overexploited species, resource management measures which require reductions in fishing effort to maximize yield will have the added benefit of protecting habitat.

Gear Modification: Continued gear research and modification. Throughout the workshop, gear modification was mentioned as a possible way to reduce the impact of certain gears on critical or vulnerable habitats.

Enforcement: Law enforcement for current and any future closed areas should be improved.

Reduce damage to habitat in low yield areas: Identifying areas of low yield of bottom dwelling resources and prohibiting fishing with bottom-tending gear in those areas. This would reduce habitat damage while at the same time minimizing socioeconomic impacts to fishing communities. Some panel members disagreed with this recommendation, indicating that if an area is not productive for fishery resources than it is most likely not productive habitat.

Research: Funding should be provided to support additional research that would address information deficiencies identified in this workshop. Some panel members recommended that greater use be made of observers to collect detailed information on bycatch and the distribution of fishing effort. Additionally it was noted that deep water corals, the continental shelf break, and the heads of submarine canyons are also very important habitats that require more research to understand their importance and provide appropriate protection measures.

BIBLIOGRAPHY

Abernathy, A. ed. 1989. Description of the Mid-Atlantic environment. U.S. Dept. of the Interior, Minerals Management Service, Herndon, VA. 167 p. plus appendices.

Ambrose, W.G., Jr., M. Dawson, C. Gailey, P. Ledkovsky, S. O'Leary, B. Tassanari, H. Vogel, C. Wilson. 1998. Effects of baitworm digging on the soft-shelled clam, *Mya arenaria*, in Maine: shell damage and exposure on the sediment surface. Journal of Shellfish Research 17(4):1043-1049.

Appledoorn, R.S., M. Nemeth, J. Vasslides, and M. Scharer. 2000. The effect of fish traps on benthic habitats off La Parguero, Puerto Rico. Report to the Caribbean Fishery Management Council, Hato Rey, Puerto Rico.

Ardrizzone, G.D., P. Tucci, A. Somaschini, and A. Bellauscio. 2000. Is bottom trawling partly responsible for the regression of *Posidonia oceanica* meadows in the Mediterranean Sea? Pp. 37-46 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Auster, P.J. 1998. A conceptual model of the impacts of fishing gear on the integrity of fish habitats. Conservation Biology 12(6): 1198-1203.

Auster, P.J. 2001. Defining thresholds for precautionary habitat management actions in a fisheries context. North American Journal of Fisheries Management 21:1-9.

Auster, P.J. and R.W. Langton. 1999. The effects of fishing on fish habitat. Pp. 150-187 in L. Benaka, ed. Fish habitat: essential fish habitat and rehabilitation. American Fisheries Society, Symposium 22, Bethesda, Maryland.

Auster, P.J. and R.J. Malatesta. 1995. Assessing the role of non-extractive reserves for enhancing harvested populations in temperate and boreal marine systems. Pp. 82-89 in N. Shackell and J.J.M. Willison, eds. Marine Protected Areas and Sustainable Fisheries. Science and Management of Protected Areas Association, Wolfville, Nova Scotia.

Auster, P.J., R.J. Malatesta, R.W. Langton, L. Watling, P.C. Valentine, C.L.S. Donaldson, E.W. Langton, A.N. Shepard, and I.G. Babb. 1996. The impacts of mobile fishing gear on seafloor habitats in the Gulf of Maine (northwest Atlantic): implications for conservation of fish populations. Reviews in Fisheries Science 4(2):185-202.

Auster, P.J. and N.L. Shackell. 2000. Marine protected areas for the temperate and boreal Northwest Atlantic: the potential for sustainable fisheries and conservation of biodiversity. Northeastern Naturalist 7(4):419-434.

Auster, P.J., L. Watling, and A. Reiser. 1997. Comment: The interface between fisheries research and habitat management. North American Journal of Fisheries Management 17:591-595.

Ball, B., B. Munday, and I. Tuck. 2000. Effects of otter trawling on the benthos and environment in muddy sediments. Pp. 69-82 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Barnes, D., K. Chytalo, and S. Hendrickson. 1991. Final Policy and Generic Environmental Impact Statement on Management of Shellfish in Uncertified Areas Program. NY Department of Environment and Conservation. 79 p.

Barnette, M.C. 2001. A review of the fishing gear utilized within the Southeast Region and their potential impacts on essential fish habitat. NOAA Technical Memorandum NMFS -SEFSC - 449.

Beardsley, R.C., B. Butman, W.R. Geyer, and P. Smith. 1996. Physical oceanography of the Gulf of Maine: an update; pp. 39-52 in Wallace, G.T. and E.F. Braasch, eds. Proceedings of the Gulf of Maine Ecosystem Dynamics: A Scientific Symposium and Workshop. Regional Association for Research on the Gulf of Maine (RARGOM) Report 97-1.

Behnken, L. 1994. Southeast Alaska trawl closure: a case study in risk-averse management. Sea Win: Ocean Voice International 7(1):8-14.

Bergman, M.J.N, M. Fonds, M. Hup, and A. Stam. 1990. Direct effects of beam trawl fishing on benthic fauna in the North Sea. ICES C.M. 1990/MINI:11.

Bergman, M.J.N., and M. Hup. 1992. Direct effects of beam trawling on macrofauna in a sandy sediment in the southern North Sea. ICES Journal of Marine Science 49:5-11.

Bergman, M.J.N., and J.W. Van Santbrink 2000. Fishing mortality of populations of megafauna in sandy sediments. Pp. 49-68 in M.J. Kaiser and S. J. de Groot. The effects of fishing on non-target species and habitats. Blackwell Science.

Blaber, S.J.M., D.P. Cyrus, J.-J. Albaret, Chong Ving Ching, J.W. Day, M. Elliott, M.S. Fonseca, D.E. Hoss, J. Orensanz, I.C. Potter and W. Silvert. 2000. Effects of fishing on the structure and functioning of estuarine and nearshore ecosystems. ICES Journal of Marine Science 57:590-602.

Black, K.P. and G.D. Parry. 1994. Sediment transport rates and sediment disturbance due to scallop dredging in Port Phillip Bay. Memoirs of the Queensland Museum 36(2):327-341.

Black, K.P. and G.D. Parry. 1999. Entrainment, dispersal, and settlement of scallop dredge sediment plumes: field measurements and numerical modelling. Canadian Journal of Fisheries and Aquatic Science 56:2271-2281.

Boesch, D.F. 1979. Benthic ecological studies: macrobenthos. Chapter 6 in Middle Atlantic outer continental shelf environmental studies. Conducted by Virginia Institute of Marine Studies under contract AA550-CT6062 with the Bureau of Land Management. 301 p.

Botsford, L.W., J.C. Castilla, and C.H. Peterson. 1997. The management of fisheries and marine ecosystems. Science 277:509-515.

Bradshaw, C., L.O. Veale, A.S. Hill, and A.R. Brand. 2000. The effects of scallop dredging on gravelly seabed communities. Pp. 83-104 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Bradstock, M. and D.P. Grodon. 1983. Coral-like bryozoan growths in Tasman Bay, and their protection to conserve commercial fish stocks. New Zealand Journal of Marine and Freshwater Research 17:159-163.

Brambati, A. and G. Fontolan. 1990. Sediment resuspension induced by clam fishing with hydraulic dredges in the Gulf of Venice (Adriatic Sea). A preliminary experimental approach. Bollettino Di Oceanologia Teorica Ed Applicata 8(2):113-121.

Breen, P.A. 1990. A review of ghost fishing by traps and gillnets. Pp. 571-599 in R.S. Shomura and M.L. Goldfrey (Editors). Proceedings of the Second International Conference on Marine

Debris 2-7 April 1989, Honolulu, Hawaii. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC 154.

Bridger, J.P. 1972. Some observations on penetration into the seabed of tickler chains on a beam trawl. ICES CM 1972/B:7. Gear and Behavior Committee, 9 p.

Brooks, D.A. 1996. Physical oceanography of the shelf and slope seas from Cape Hatteras to Georges Bank: A brief overview; pp. 47-75 in Sherman, K., N.A. Jaworski, and T.J. Smayda, eds. The northeast Shelf Ecosystem – Assessment, Sustainability, and Management. Blackwell Science, Cambridge, MA. 564 p.

Brown, B. 1993. A classification system of marine and estuarine habitats in Maine: An ecosystem approach to habitats. Part I: Benthic Habitats. Maine Natural Areas Program, Dept. of Economic and Community Development, Augusta, ME. 51 p. + 1 appendix.

Brown, B., W.H. Wilson, Jr. 1997. The role of commercial digging of mudflats as an agent for change of infaunal intertidal populations. Journal of Experimental Marine Biology and Ecology 218:49-61.

Brylinsky, M., J. Gibson, and D.C. Gordon, Jr. 1994. Impacts of flounder trawls on the intertidal habitat and community of the Minas Basin, Bay of Fundy. Canadian Journal of Fisheries and Aquatic Sciences 51:650-661.

Bullimore, B.A., P.B. Newman, M.J. Kaiser, S.E. Gilbert, and K.M. Lock. 2000. A study of catches in a fleet of “ghost-fishing” pots. Fishery Bulletin 99:247-253.

Butcher, T., J. Matthews, J. Glaister, and G. Hamer. 1981. Study suggests scallop dredges causing few problems in Jervis Bay. Australian Fisheries 40():9-12.

Caddy, J.F. 1968. Underwater observations on scallop (*Placopecten magellanicus*) behavior and drag efficiency. Journal of the Fisheries Research Board of Canada 25(10):2123-2141.

Caddy, J.F. 1973. Underwater observations on tracks of dredges and trawls and some effects of dredging on a scallop ground. Journal of the Fisheries Research Board of Canada 30:173-180.

Cahoon, L.B. 1999. The role of benthic microalgae in neritic ecosystems. Oceanography and Marine Biology 37:47-86.

Canadian Department of Fisheries and Ocean. 1993. Seabed disturbances from fishing activities. Unpublished Report. Canadian Department of Fisheries and Oceans. Scotia-Fundy Region. Industry Services and Native Fisheries Branch. 4 p.

Cappo, M., D.M. Alongi, D. Williams, and N. Duke. 1998. A review and synthesis of Australian fisheries habitat research. Volume 2: Scoping Review, Issue 4: Effects of Harvesting on Biodiversity and Ecosystems. FRDC 95/055.

Carr, H.A., E.A. Amaral, A.W. Hulbert, and R. Cooper. 1985. Underwater survey of simulated lost demersal and lost commercial gill nets off New England. Pp. 438-477 in R.S. Shomura and H.O. Yoshida. Proceedings of the Workshop on the Fate and Impact of Marine Debris, 26-29 November 1984, Honolulu, Hawaii. NOAA-TM-NMFS-SWFC-54.

Carr, H.A. and H. Milliken. 1998. Conservation engineering: Options to minimize fishing’s impacts to the sea floor. Pp. 100-103 in E.M. Dorsey and J. Pederson, editors. Effects of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation. Boston, Massachusetts. 160 pp.

Chenoweth, S. and D. Dennison. 1993. The ocean quahog in Maine: fishery and biology. Maine Dept. of Marine Resources, Augusta, ME.

Chesapeake Bay Program. 1995. Guidance for protecting submerged aquatic vegetation in Chesapeake Bay from physical disruption. Annapolis, Maryland. 28 p.

Churchill, J.H. 1989. The effect of commercial trawling on sediment resuspension and transport over the Middle Atlantic Bight continental shelf. Continental Shelf Research 9(9):841-864.

Coen, L.D. 1995. A review of the potential impacts of mechanical harvesting on subtidal and intertidal shellfish resources. Unpublished Report. South Carolina Department of Natural Resources, Marine Resources Research Institute.

Collie, J.S. 1998. Studies in New England of fishing gear impacts on the sea floor. Pp. 53-62 in E.M. Dorsey and J. Pederson, editors. Effect of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation. Boston, Massachusetts. 160 p.

Collie, J.S., G.A. Escanero, L. Hunke, and P.C. Valentine. 1996. Scallop dredging on Georges Bank: Photographic evaluation of effects on benthic epifauna. International Council for the Exploration of the Sea. Mini-Symposium on Ecosystem Effects of Fisheries. ICES CM 1996/Mini:9. 14 p.

Collie, J.S., G.A. Escanero, and P.C. Valentine. 1997. Effects of bottom fishing on the benthic megafauna of Georges Bank. Marine Ecology Progress Series 155(0):159-172.

Collie, J.S., G.A. Escanero, and P.C. Valentine. 2000(b). Photographic evaluation of the impacts of bottom fishing on benthic epifauna. ICES Journal of Marne Science 57:987-1001.

Collie, J.S., S.J. Hall, M.J. Kaiser, and I.R. Poiners. 2000(a.) A quantitative analysis of fishing impacts on shelf-sea benthos. Journal of Animal Ecology 69:785-798.

Colvocoresses, J.A. and J.A. Musik. 1983. Species associations and community composition of middle Atlantic bight continental shelf demersal fishes. Fish. Bull. 82(2): 295-313.

Connor, W.G. and J.L. Simon. 1979. The effects of oyster shell dredging on an estuarine benthos community. Estuarine and Coastal Marine Science 9:749-758.

Cook, S.K. 1988. Physical oceanography of the middle Atlantic bight. Pp. 1-50 in A.L. Pacheco, ed. - Characterization of the middle Atlantic water management unit of the northeast regional action plan. NOAA Tech. Mem. NMFS-F/NEC-56. Woods Hole, MA. 322 p.

Cooper, R.A., H.A. Carr, and A.H. Hulvert. 1988. Manned submersible and ROV assessment of ghost gillnets on Jeffries and Stellwagen Banks, Gulf of Maine. Research Report 88-4. NOAA Undersea Research Program.

Cooper, R.A., P.C. Valentine, J.R. Uzmann, and R.A. Slater. 1987. Submarine canyons. Pp. 52-63 in R.H. Backus and D.W. Bourne, eds. Georges Bank. MIT Press, Cambridge, MA.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service Publication FWS/OBS-79/31. Washington, DC. 103 p.

Creaser, E.P., Jr., D.A. Clifford, M.J. Hogan and D.B. Sampson. 1983. A commercial sampling program for sandworms, Nereis virens Sars, and bloodworms, Glycera dibranchiata Ehrens, harvested along the Maine Tidal Coast. NOAA Tech. Rep. NMFS SSRF-767, 56 ppWallace, D.E. 1997. The molluscan fisheries of Maine. NOAA Tech. Rept. NMFS 127:63-85.

Currie, D.R. and G.D. Parry. 1996. Effects of scallop dredging on a soft sediment community: a large-scale experimental study. Marine Ecology Progress Series 134:131-150.

Currie, D.R. and G.D. Parry. 1999. Impacts and efficiency of scallop dredging on different soft substrates. Canadian Journal of Fisheries and Aquatic Science 56:539-550.

Daan, N. 1991. A theoretical approach to the evaluation of ecosystem effects of fishing in respect of North Sea benthos. ICES CM 1991/L:27. 6 p.

Dayton, P.K., S.F. Thrush, M.T. Agardy, and R.J. Hofman. 1995. Environmental effects of marine fishing. Aquatic Conservation: Marine and Freshwater Ecosystems 5:205-232.

DeAlteris, J. 1998. Training Manual: Fisheries Science and Technology, prepared for the NOAA Corps Officer Program.

DeAlteris, J., L. Skrobe, and C. Lipsky. 1999. The significance of seabed disturbance by mobile fishing gear relative to natural processes: a case study in Narragansett Bay, Rhode Island. Pp. 224-237 in L. Benaka, ed. Fish habitat: essential fish habitat and rehabilitation. American Fisheries Society, Symposium 22, Bethesda, Maryland.

deGroot, S.J. 1984. The impact of bottom trawling on the benthic fauna of the North Sea. Ocean Management 9:177-190.

deGroot, S.J. and J.M. Appledorn. 1971. Some experiments on the influence of the beam trawl on the bottom fauna. ICES CM 1971/B:2.

Demestre, M., P. Sanchez, and M.J. Kaiser. 2000. The behavioural response of benthic scavengers to otter-trawling disturbance in the Mediterranean. Pp. 121-129 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Drew, S.C., and R.E. Larsen. 1994. Worldwide trawl and dredge study. Unpublished Report. Marine Data Systems. Plymouth, Massachusetts. 8p.

Dyekjaer, S.M., J.K. Jensen, and E. Hoffmann. 1995. Mussel dredging and effects on the marine environment. ICES CM 1995/E:13.

Eleftheriou, A. and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands Journal of Sea Research 30:289-299.

Engel, J. and R. Kvitek 1998. Effects of otter trawling on a benthic community in Monterey Bay National Marine Sanctuary. Conservation Biology 12(6):1204-1214.

Eno, N.C., D.S. MacDonald, J.A.M. Kinnear, S.C. Amos, C.J. Chapman, R.A. Clark, F.P.D. Bunker, and C. Munro. 2001. Effects of crustacean traps on benthic fauna. ICES Journal of Marine Science 58:11-20.

Erzini, K., C.C. Monteir, J. Ribero, M.N. Santos, M. Gaspar, P. Monteiro, and T.C. Borges. 1997. An experimental study of gill net and trammel net 'ghost fishing' off the Algarve (southern Portugal). Marine Ecology Progress Series 158:257-265.

Flint, R.W. and J.A. Younk. 1983. Estuarine benthos: long-term community structure variations, Corpus Christi Bay, Texas. Estuaries 6(2):126-141.

Floderus. S. and L. Pihil. 1990. Resuspension in the Kattegat: impact of variation in wind climate and fishery. Estuarine, Coastal and Shelf Science 31:487-498.

Fogarty, M.J. and S.A. Murawski. 1998. Large-scale disturbance and the structure of marine systems: fishery impacts on Georges Bank. Ecological Applications 8(1):S6-S22, Supplement.

Fonds, M. and S. Groenewold. 2000. Food subsidies generated by the beam-trawl fishery in the southern North Sea. Pp. 130-150 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Fonseca, M.S., G.W. Thayer, A.J. Chester and C. Foltz. 1984. Impact of scallop harvesting on eelgrass (*Zostera marina*) meadows: implications for management. North American Journal of Fisheries Management 4:286-293.

Fonteyne, R. 2000. Physical impact of beam trawls on seabed sediments. Pp. 15-36 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitat. Blackwell Science.

Fraser, S., V. Gotceitas and J. A. Brown. 1996. Interactions between age-classes of Atlantic cod and their distribution among bottom substrates. Can J Fish Aquat Sci 53:305-314.

Freeland, G.L. and D.J.P. Swift. 1978. Surficial sediments: MESA New York bight monograph 10. New York Sea Grant Institute. Albany, NY.

Freese, L., P.J. Auster, J. Heifetz, and B.L. Wing. 1999. Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. Marine Ecology Progress Series 182:119-126.

Frid, C.L.J. and R.A. Clark 2000. Long-term changes in North Sea benthos: discerning the role of fisheries. Pp. 198-216 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitat. Blackwell Science.

Frid, C.L.J., R.A. Clark and J.A. Hall. 1999. Long-term changes in the benthos on a heavily fished ground of the NE coast of England. Marine Ecology Progress Series 188:13-29.

Frid, C.L.J., and S.J. Hall. 1999. Inferring changes in North Sea benthos from fish stomach analysis. Marine Ecology Progress Series 184:184-188.

Friedlander, A.M., G.W. Boehlert, M.E. Field, J.E. Mason, J.V. Gardner, and P. Dartnell. 1999. Sidescan-sonar mapping of benthic trawl marks on the shelf and slope off Eureka, California. Fishery Bulletin 97:786-801.

Fuller, S. and P. Cameron. 1998. Marine benthic seascapes: fishermen's perspectives. Marine Issues Committee Special Publication. Vol. 3. Ecology Action Centre. Halifax, Nova Scotia. 64 p.

Futch, C.R. and D.S. Beaumariage. 1965. A report on the bait shrimp fishery of Lee County, Florida. Florida Board of Conservation Marine Laboratory Maritime Base, Bayboro Harbor, St. Petersburg, Florida. FBCML No.:65-1.

Garrison, G. 1997. St. John, U.S. Virgin Islands fish trap study, 1992-1994. Unpublished Report. Biological Resources Division, USGS, Virgin Islands National Park.

Garrison, G. 1998. Reef fishes of St. John, U.S. Virgin Islands. in Mac, M.J., P.A. Opler, C.E. Puckett Haecker, and P.D. Doran, Eds. Status and Trends of the Nations' Biological Resources. U.S. Department of Interior, U.S. Geological Survey. Washington, DC.

Glemarec, M., Y. LeFaou, and F. Cuq. 1996. Long-term changes of seagrass beds in the Glenan Archipelago (South Brittany). Oceanologica Acta 20(1):217-227.

Glude, J.B. and W.S. Landers. 1953. Biological effects on hard clams of hand raking and power dredging. USFWS Special Science Reports on Fisheries, 110:1-43.

Godcharles, M.F. 1971. A study of the effects of a commercial hydraulic clam dredge on benthic communities in estuarine areas. State of Florida Department of Natural Resources Marine Resources Laboratory Technical Series No. 64.

Goñi, R. 1998. Ecosystem effects of marine fisheries: an overview. Ocean and Coastal Management 40(1):37-64.

Gordon, D.C., Jr., P. Schwinghamer, T.W. Rowell, J. Prena, K. Gilkinson, W.P. Vass, and D.L. McKeown. 1998. Studies in eastern Canada on the impact of mobile fishing gear on benthic habitat and communities. Pp. 63-67 in E.M. Dorsey and J. Pederson, editors. Effect of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation. Boston, Massachusetts. 160 p.

Gotceitas, V. and J. A. Brown. 1993. Substrate selection by juvenile Atlantic cod (*Gadus morhua*): effects of predation risk. Oecologia 93:31-37.

Gotceitas, V, S. Fraser and J. A. Brown. 1995. Habitat use by juvenile Atlantic cod (*Gadus morhua*) in the presence of an actively foraging and non-foraging predator. Mar Biol 123:421-430.

Gotceitas, V., S. Fraser and J. A. Brown. 1997. Use of eelgrass beds (*Zostera marina*) by juvenile Atlantic cod (*Gadus morhua*). Can J Fish Aquat Sci 54:1306-1319.

Goudley, C.A. and G. Loverish. 1987. Reducing the bottom impact of Alaskan groundfish trawls. Pp. 632-637 in Proceedings Oceans '87. The Ocean -An International Work Place. Halifax, Nova Scotia. September 28 - October 1, 1987.

Gray, J.S. 2000. The measurement of marine species diversity, with an application to the benthic fauna of the Norwegian continental shelf. Journal of Experimental Marine Biology and Ecology 250(1 2): 23 49.

Greene, H.G., M.M. Yoklavich, R.M. Starr, V.M. O'Connell, W.W. Wakefield, D.E. Sullivan, J.E. McRea, Jr., and G.M. Cailliet. 1999. A classification scheme for deep seafloor habitats. Oceanologica Acta 22(6): 663-678.

Greenstreet, S.P.R. and S.J. Hall. 1996. Fishing and groundfish assemblage structure in the northwestern North Sea: an analysis of long-term and spatial trends. Journal of Animal Ecology 65:577-598.

Greenstreet, S.P.R., F.B. Spence, A.M. Shanks, and J.A. McMillan. 1999. Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. II. Trends in fishing effort in the North Sea by UK registered vessels landing in Scotland. Fisheries Research 40:107-124.

Gregory, R. S. and J. T. Anderson. 1997. Substrate selection and use of protective cover by juvenile Atlantic cod *Gadus morhua* in inshore waters of Newfoundland. Mar Ecol Prog Ser 146:9-20.

Gusey, W.F. 1977. The fish and wildlife resources of the Georges Bank Region. Shell Oil Company, Houston, TX.

Guthrie, J.F. and C.W. Lewis. 1982. The clam-kicking fishery of North Carolina. Marine Fisheries Review 44(1):16-21.

Hall, S.J. 1994. Physical disturbance and marine benthic communities: life in unconsolidated sediments. Oceanography and Marine Biology: An Annual Review 32:179-239.

Hall, S.J. 1999. The Effects of Fishing on Marine Ecosystems and Communities. Blackwell Science. Oxford, United Kingdom. 274 p.

Hall, S.J., D.J. Basford, and M.R. Robertson. 1990. The impact of hydraulic dredging for razor clams *Ensis* sp. On an infaunal community. Netherlands Journal of Sea Research 27(1):119-125.

Hall, S.J., M.R. Robertson, D.J. Basford, and S.D. Heaney. 1993. The possible effects of fishing disturbance in the northern North Sea: an analysis of spatial patterns in community structure around a wreck. Netherlands Journal of Sea Research 31(2):201-208.

Hall-Spencer, J.M., C. Froglia, R.J.A. Atkinson, and P.G. Moore. 1999. The impact of Rapido trawling for scallops, *Pecten jacobaeus* (L.), on the benthos of the Gulf of Venice. ICES Journal of Marine Science 56:111-124.

Hall-Spencer, J.M. and P.G. Moore. 2000. Impact of scallop dredging on maerl grounds. In: Effects of Fishing on Non-Target Species and Habitats: Biological, Conservation, and Socio-economic Issues (M.J. Kaiser and S.J. de Groot (eds.). Blackwell Science Ltd., Oxford, England.

Harris, A.N. and I.R. Poiner. 1991. Changes in species composition of demersal fish sauna of Southeast Gulf of Carpentaria, Australia, after 20 years of fishing. Marine Biology 111(3)503-519.

Hayes, D.F., G.L. Raymond, and T.N. McLellan. 1984. Sediment resuspension from dredging activities. Pp. 72-82 in Proceedings of the ASCE Specialty Conference. Dredging ‘84. Clearwater, Florida.

Hayes, M.L. 1983. Active fish capture methods, in Fisheries Techniques. Nielson, L.A. and D.L. Johnson, eds. American Fisheries Society, Bethesda, Maryland.

Heiftez, J. 1997. Workshop of the potential effects of fishing gear on benthic habitat. NMFS AFSC Processed Report 97-04. 17 p.

Hewitt, J.E., S.F. Thrush, V.J. Cummings, and S.J. Turner. 1998. The effect of changing sampling scales on our ability to detect effects of large-scale processes on communities. Journal of Experimental Marine Biology and Ecology 227(2):251 264.

High, W.L. 1998. Observations of a scientist/diver on fishing technology and fisheries biology. NOAA, NMFS, AFSC Processed Report 98-01. 47 p.

Hill, A.S., L.O. Veale, D. Pennington, S.G. Whyte, A.R. Brand, and R.G. Hartnoll. 1999. Changes in Irish Sea benthos: possible effects of 40 years of dredging. Estuarine, Coastal and Shelf Science 48(6):739-750.

Hubert, W.A. 1983. Passive capture techniques, in Fisheries Techniques. Nielson, L.A. and D.L. Johnson, eds. American Fisheries Society, Bethesda, Maryland.

Hutchings, P. 1990. Review of the effects of trawling on macrobenthic epifaunal communities. Australian Journal of Marine and Freshwater Research 41:111-120.

ICES. 1973. Effects of trawls and dredges on the seabed. ICES, Gear and Behavior Committee. ICES CM 1973 /B:2.

ICES. 1991. Report of the study group on ecosystem effects of fishing activities, Copenhagen, Denmark, International Council for the Exploration of the Sea. Study Group on Ecosystem Effects of Fishing Activities. ICES CM 1991/G:7.

ICES. 1992. Report of the Study Group on Ecosystem Effects of Fishing Activities, Copenhagen, 7-14 April, 1992. International Council for the Exploration of the Sea. Study Group on Ecosystem Effects of Fishing Activities. ICES CM 1992/G:11. 144 p.

ICES. 1993. Report of the Working Group on Ecosystem Effects of Fishing Activities. International Council for the Exploration of the Sea. Working Group on Ecosystem Effects of Fishing Activities ICES CM 1993/G:4. 9 p.

ICES. 1995. Report of the study group on ecosystem effects of fishing activities, Copenhagen, Denmark, 7-14 April 1992. ICES Cooperative Research Report, Number 200, 120 pp.

ICES. 1999. Report of the working group on fishing technology and fish behavior. ICES, Fisheries Technology Committee. ICES CM 1999. 51 p.

ICES. 2001. Effects of different types of fisheries on North Sea and Irish Sea Benthic Ecosystems. Report of the ICES Advisory Committee on the Marine Environment, 2000. ICES Cooperative Research Report Number 241, 27 pp.

Ismail, N.S. 1985. The effects of hydraulic dredging to control oyster drills on benthic macrofauna of oyster grounds in Delaware Bay, New Jersey. Internationale Revue der Gesamten Hydrobiologie 70(3):379-395.

Jenning, S., J. Alvsvag, A.J.R. Cotter, S. Ehrich, S.P.R. Greenstreet, A. Jarre-Teichmann, N. Mergardt, A.D. Rijnsdorp, and O. Smedstad. 1999. Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. III. International trawling effort in the North Sea: an analysis of spatial and temporal trends. Fisheries Research 40:125-134.

Jennings, S. and A.J.R. Cotter. 1999. Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. I. Introduction. Fisheries Research 40:103-106.

Jennings, S. and M.J. Kaiser. 1998. The effects of fishing on marine ecosystems. Advances in Marine Biology 34:201-352.

Jennings, S. and N.V.C. Polunin. 1996. Impacts of fishing on tropical reef ecosystems. Ambio 25:44-49.

Jolley, J.W., Jr. 1972. Exploratory fishing for the sunray venus clam, *Macrocallista nimbosa*, in northwest Florida. Florida Department of Natural Resources Technical Series No. 67:1-42.

Kaiser, M.J. 1996. Starfish damage as an indicator of trawling intensity. Marine Ecology Progress Series 134:303-307.

Kaiser, M.J. 1998. Significance of bottom-fishing disturbance. Conservation Biology 12(6):1230-1235.

Kaiser, M.J. 2000. The implications of the effects of fishing on non-target species and habitats. Pp. 383-392 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Kaiser, M.J., G. Broad, S.J. Hall. 2001. Disturbance of intertidal soft-sediment benthic communities by cockle hand raking. Journal of Sea Research 45:119-130.

Kaiser, M.J., B. Bullimore, P. Newman, K. Lock, and S. Gilbert. 1996c. Catches in 'ghost fishing' set nets. Marine Ecology Progress Series 145:11-16.

Kaiser, M.J., K. Cheney, F.E. Spence, D.B. Edwards, and K. Radford. 1999. Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. VII. The effects of trawling disturbance on the fauna associated with the tubeheads of serpulid worms. Fisheries Research 40:195-205.

Kaiser, M.J., D.B. Edwards, P.J. Armstrong, K. Radford, N.E.L. Lough, R.P. Flatt, and H.D. Jones. 1998. Changes in megafaunal benthic communities in different habitats after trawling disturbance. ICES Journal of Marine Science 55:353-361.

Kaiser, M.J., D.B. Edwards and B.E. Spencer. 1996b. Infaunal community changes as a result of commercial clam cultivation and harvesting. Aquatic Living Resources 9:57-63.

Kaiser, M.J., A.S. Hill, K. Ramsay, B.E. Spencer, A.R. Brand, L.O. Veale, K. Pruden, E.I.S. Rees, B.W. Munday, B. Ball, and S.J. Hawkins. 1996a. Benthic disturbance by fishing gear in the Irish Sea: A comparison of beam trawling and scallop dredging. Aquatic Conservation: Marine and Freshwater Ecosystems 6(4): 269-285.

Kaiser, M.J. and K. Ramsay. 1997. Opportunistic feeding by dabs within areas of trawl disturbance: possible implications for increased survival. Marine Ecology Progress Series 152:307-310.

Kaiser, M.J., K. Ramsay, C.A. Richardson, F.E. Spence, and A.R. Brand. 2000a. Chronic fishing disturbance has changed shelf sea benthic community structure. Journal of Animal Ecology 69: 494-503.

Kaiser, M.J. and B.E. Spencer. 1993. A preliminary assessment of the immediate effects of beam trawling on a benthic community in the Irish Sea. ICES CM 1993/B:38. 9 p.

Kaiser, M.J. and B.E. Spencer. 1993. Opportunistic feeding on benthos by fishes after the passage of a 4-m beam trawl. ICES CM 1993/G:27. 13 p.

Kaiser, M.J. and B.E. Spencer 1994. Fish scavenging behavior in recently trawled areas. Marine Ecology Progress Series 112:41-49.

Kaiser, M.J. and B.E. Spencer. 1996. Behavioural responses of scavengers to beam trawl disturbance. Pp. 116-123 in S.P.R. Greenstreet and M.S. Tasker, editors. Aquatic Predators and Their Prey. Blackwell Scientific Publications, Oxford.

Kaiser, M.J. and B.E. Spencer. 1996. The effects of beam-trawl disturbance on infaunal communities in different habitats. Journal of Animal Ecology 65(3):348-358.

Kaiser, M.J., B.E. Spencer, and P.J. Hart. 2000b. Fishing-Gear Restrictions and Conservation of Benthic Habitat Complexity. Conservation Biology 14(5):1512-1525.

Keats, D. W, S. H. Steele and G. R. South. 1987. The role of fleshy macroalgae in the ecology of juvenile cod (*Gadus morhua* L.) in inshore waters off eastern Newfoundland. Can J Zool 65:49-53.

Kenchington, E.L.R., J. Prena, K.D. Gilkinson, D.C. Gordon Jr., K. MacIssace, C. Bourbonnais, P.J. Schwinghamer, T.W. Rowell, D.L. McKeown, and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. Canadian Journal of Fisheries and Aquatic Science 58:1043-1057.

Kenchington, T.J. 1995. A summary of the published evidence relating to habitat modification by fish draggers. Pp. 109-116 in The Canadian Maritimes Fishing: Let's Fix It, An Action Plan. SW Nova Scotia Fixed Gear Association. Shelburne, Nova Scotia, Canada.

Koslow, J.A. and K. Garrett-Holmes. 1998. The seamount fauna off southern Tasmania: benthic communities, their conservation and impacts of trawling. Final report to Environment Australia and the Fisheries Research Development Corporation. FRDC Project 95/058.

Kroencke, I. 1995. Long-term changes in North Sea benthos. Senckenbergiana Maritima 26(1-2):73-80.

Krost, P., M. Bernard, F. Werner, and W. Hukriede. 1990. Otter trawl tracks in Kiel Bay (Western Baltic) mapped by side-scan sonar. Meeresforschung 32:344-353.

Langton, R.W. 1998. The effect of dredge harvesting on eastern oysters and the associated benthic community. Pp. 108-110 in E.M. Dorsey and J. Pederson, editors. Effect of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation. Boston, Massachusetts. 160 p.

Langton, R.W. and P.J. Auster. 1999. Marine fishery and habitat interactions: to what extent are fisheries and habitat interdependent? Fisheries 24(6):14-21.

Langton, R.W., P.J. Auster, and D.C. Schneider. 1994. A spatial and temporal perspective on fish distributions: improving our definition of fisheries habitat in the Gulf of Maine; pp. 25-50 in Stevenson, D. and E. Braasch, eds. Gulf of Maine Habitat Workshop Proceedings. RARGOM Report no. 94-2.

Langton, R.W., P.J. Auster, and D. C. Schneider. 1995. A spatial and temporal perspective on research and management of groundfish in the northwest Atlantic. Reviews in Fisheries Science 3(3):201-229.

Langton, R.W. and W.E. Robinson. 1990. Faunal associations on scallop grounds in the western Gulf of Maine. Journal of Experimental Marine Biology and Ecology 144:157-171.

Langton, R.W., R.S. Steneck, V. Gotceitas, F. Juanes, and P. Lawton. 1996. The interface between fisheries research and habitat management. North American Journal of Fisheries Management 16(1):1 7.

Langton, R.W. and J.R. Uzmann. 1990. A photographic survey of megafauna of the central and eastern Gulf of Maine. Fish. bull. 87(4): 945-954.

LaSalle, M.W. 1990. Physical and chemical alterations associated with dredging: An overview. Pages1 12 in Effects of Dredging on anadromous Pacific Coast Fishes. Workshop Proceedings, Seattle, September 8 9, 1988. REP. WASH. SEA GRANT.

Lenihan, H.S. and C.H. Peterson. 1998. How habitat degradation through fishery disturbance enhances impacts of hypoxia on oyster reefs. Ecological Applications 8(1):128-140.

Levin, L.A. 1984. Life history and dispersal patterns in a dense infaunal polychaete assemblage: community structure and response to disturbance. Ecology 65(4):1185-1200.

Lindeboom, H.J., and S.J. De Groot, 1998. Impact II. The effects of different types of fisheries on the North Sea and Irish Sea benthic ecosystems. NIOZ Rapport 1998-1. 404 p.

Lindholm, J.B., P.J. Auster, and L.S. Kaufman. 1999. Habitat-mediated survivorship of juvenile (0-year) Atlantic cod *Gadus morhua*. Mar. Ecol. Prog. Ser. 180: 247-255.

Lindholm, J. B., P. J. Auster, M. Ruth and L. Kaufman. 2001. Modeling the effects of fishing and implications for the design of marine protected areas: Juvenile fish response to variations in seafloor habitat. Conservation Biology 15:424-437.

Lindley, J.A., J.C. Gamble, and H.G. Hunt. 1995. A change in zooplankton of the central North Sea (55 to 58 N): a possible consequence of changes in the benthos. Marine Ecology Progress Series 119:299-303.

Linehan, J. E., R. S. Gregory and D. C. Schneider. 2001. Predation risk of age-0 cod (*Gadus*) relative to depth and substrate in coastal waters. J Exp Mar Biol Ecol 263:25-44.

Lough, R.G., P.C. Valentine, D.C. Potter, P.J. Auditore, G.R. Bolz, J.D. Neilson, and R.I. Perry. 1989. Ecology and distribution of juvenile cod and haddock in relation to sediment type and bottom currents on eastern Georges Bank. Mar. Ecol. Prog. Ser. 56: 1-12.

MacKenzie, C.L., Jr. 1982. Compatibility of invertebrate populations and commercial fishing for ocean quahogs. North American Journal of Fisheries Management 2:270-275.

Maier, P.P., P.H. Wendt, W.A. Roumillat, G.H. Steele, M.V. Levisen, and R. Van Dolah. 1995. Effects of subtidal mechanical clam harvesting on tidal creeks. South Carolina Department of Natural Resources, Marine Resources Division. Final Report. 38 p.

Manning, J.H. and E.A. Dunnington. 1955. The Maryland soft-shell clam fishery: a preliminary investigational report. Proceedings of the National Shellfisheries Association 46:100-110.

Margetts, A.R. and J.P. Bridger. 1971. The effect of a beam trawl on the sea bed. ICES Council Meeting. 1971/B:8.

Mayer, L.M., D.F. Schick, R.H. Findlay and D.L. Rice. 1991. Effects of commercial dragging on sedimentary organic matter. Marine Environmental Research 31:249-261.

McAllister, D.E. 1991. Questions about the impact of trawling. Sea Wind: Ocean Voice International 5(2):28-32.

McAllister, D.E. and G. Spiller. 1994. Trawling and dredging impacts on fish habitat and bycatch. Pp. 1709-1718 in Coastal Zone Canada 1994, Cooperation in the Coastal Zone. Conference Proceedings, Volume 4. Coastal Zone Canada Association, Dartmouth, Nova Scotia.

McConnaughey, R.A., K.L. Mier and C.B. Dew. 2000. An examination of chronic trawling on soft bottom benthos of the eastern Bering Sea. ICES Journal of marine Science 57:1388-2000.

McShane, P. 1981. The effect of scallop dredging on macrobenthos of a muddy environment in Port Phillip Bay. Marine Science Laboratories, Queenscliff Technical Reports 4:1-16.

Medcof, J.C. and J.F. Caddy. 1971. Underwater observations on the performance of clam dredges of three types. ICES CM 1971/B:10.

Messieh, S.N., T.W. Rowel, D.L. Peer, and P.J. Cranford. 1991. The effects of trawling, dredging and ocean dumping on the eastern Canadian continental shelf seabed. Continental Shelf Research 11(8-10):1237-1263.

Meyer, D.L., M.S. Fonseca, P.L. Murphey, M.W. LaCroix, P.E. Whitfield, D.R. Colby and G.W. Thayer. 1991. Impact of bait shrimp trawling on seagrass beds and fish bycatch in Tampa Bay, Florida. Unpublished Report submitted by NMFS, Southeast Fisheries Center, Beaufort Laboratory to Florida Department of Natural Resources, Marine Research institute. DNR Contract #C4488. 28 p.

Meyer, T.L., R.A. Cooper and K.J. Pecci. 1981. The performance and environmental effects of a hydraulic clam dredge. Marine Fisheries Review 43(9):14-22.

Mirarchi, F. 1998. Bottom trawling on soft substrates. Pp. 80-84 in E.M. Dorsey and J. Pederson, editors. Effects of Fishing Gear on the Sea Floor on New England. Conservation Law Foundation. Boston, Massachusetts. 160 p.

Moore, D.R., and H.R. Bullis, Jr. 1960. A deep-water coral reef in the Gulf of Mexico. Bulletin of Marine Science of the Gulf and Caribbean 10(1):125-128.

Moran, M.J. and P.C. Stephenson. 2000. Effects of otter trawling on macrobenthos and management of demersal scalefish fisheries on the continental shelf of north-western Australia. ICES Journal of Marine Science 57:510-516.

Morgan, M.J., E.M. DeBlois, and G.A. Rose. 1997. An observation on the reaction of Atlantic cod (*Gadus morhua*) in a spawning shoal to bottom trawling. Canadian Journal of Fisheries and Aquatic Sciences 54(Supplement1):217-223.

Mountain, D.G., R.W. Langton, and L. Watling. 1994. Oceanic processes and benthic substrates: influences on demersal fish habitats and benthic communities; pp. 20-25 in Langton, R.W., J.B. Pearce, and J.A. Gibson, eds. Selected Living Resources, Habitat Conditions, and Human Perturbations of the Gulf of Maine: Environmental and Ecological Considerations for Fishery Management. NOAA Tech. Memo. NMFS-NE-106. Woods Hole, MA. 70 p.

Murawski, S.A. and F.M. Serchuk. 1989. Environmental effects of offshore dredge fisheries for bivalves. ICES CM 1989/K:27. 12 p.

New England Fishery Management Council (NEFMC). 1998. Amendment #11 to the northeast multispecies fishery management plan (FMP), amendment #9 to the Atlantic sea scallop FMP, amendment #1 to the monkfish FMP, amendment #1 to the Atlantic Salmon FMP, components of the proposed Atlantic herring FMP for essential fish habitat. Volume 1. NEFMC. Newburyport, MA. 388 p.

Norse, E.A. and L. Watling. 1999. Impacts of mobile fishing gear: the biodiversity perspective. Pp. 31-40 in L. Benaka, ed. Fish habitat: essential fish habitat and rehabilitation. American Fisheries Society, Symposium 22, Bethesda, Maryland.

Northeast Fisheries Science Center (NEFSC) 2000a. Report of the Spring 2000 NEFSC Stock Assessment Workshop (30th SAW). NMFS, NEFSC, Woods Hole Laboratory Ref. Doc.00-03.

NEFSC 2000b. Report of the Fall 2000 NEFSC Stock Assessment Workshop (31st SAW). NMFS, NEFSC, Woods Hole Laboratory Ref. Doc.00-15.

NPFMC. 1992. Final Supplemental environmental Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives (Amendment 18/23) to the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Island and the Gulf of Alaska. North Pacific Fishery Management Council, 605 W. 4th Avenue, Suite 306, Anchorage, AK 99501.

Ohman, M.C., A. Rajasuriya, and O. Linden. 1993. Human disturbance on coral reefs in Sri Lanka: a case study. Ambio 22:474-480.

Orth, R.J., K.A. Moore, D.J. Wilcox and J.R. Fishman. 1998. Chincoteague Bay, Virginia: effectiveness of the SAV sanctuary and revegetation of SAV habitat disturbed by clam dredging. Unpublished Report to the Virginia Marine Resources Commission. 6 p + figures.

Overholtz, W.J. and A.V. Tyler. 1985. Long-term responses of the demersal fish assemblages of Georges Bank. Fish. Bull. 83(4): 507-520.

Pacheco, A.L. ed. 1988. Characterization of the middle Atlantic water management unit of the northeast regional action plan. NOAA Tech. Mem. NMFS-F/NEC-56. Woods Hole, MA. 322 p.

Pederson, J. and M. Hall-Arber. 1999. Fish habitat: a focus on New England fishermen's perspectives. Pp. 188-211 in L. Benaka, ed. Fish habitat: essential fish habitat and rehabilitation. American Fisheries Society, Symposium 22, Bethesda, Maryland.

Philippart, C.J.M. 1998. Long-term impact of bottom fisheries on several bycatch species of demersal fish and benthic invertebrates in the southeastern North Sea. ICES Journal of Marine Science 55:342-352.

Pickett, G. 1973. The impact of mechanical harvesting on the Thames Estuary cockle fishery. MAFF Laboratory Leaflet. No. 29. 21 p.

Poppe, L.J., J.S. Schlee, B. Butman, and C.M. Lane. 1986. Map showing distribution of surficial sediment, gulf of Maine and Georges bank. U.S. Geol. Surv. Misc. Invest. Ser., MapI-1986-A, scale 1:1,000,000.

Pranovi, F. and O. Giovanardi. 1994. The impact of hydraulic dredging for short-necked clams, *Tapes* spp., on an infaunal community on the lagoon of Venice. Scientia Marina 58(4):345353.

Pranovi, F., S. Raicevich, G. Franceschini, M.G. Farrace, and O. Govanardi. 2000. Rapido trawling in the northern Adriatic Sea: effects on benthic communities in an experimental area. ICES Journal of Marine Science 57:517-524.

Pratt, S. 1973. Benthic fauna. Pp. 5-1 to 5-70 in Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals University of Rhode Island, Marine Publication Series No. 2. Kingston, RI.

Prena, J., P. Schwinghamer, T.W. Rowell, D.C. Gordon, Jr., K.D. Gilkinson, W.P. Vass, and D.L. McKeown. 1999. Experimental otter trawling on a sandy bottom ecosystem of the Grand Banks of Newfoundland: analysis of trawl bycatch and effect on epifauna. Marine Ecology Progress Series 181:107-124.

Probert, P.K., D.G. McKnight and S.L. Grove. 1997. Benthic invertebrate bycatch from a deep-water trawl fishery, Chatham Rise, New Zealand. Aquatic Conservation: Marine and Freshwater Ecosystems 7(1):27-40.

Quandt, A. 1999. Assessment of fish trap damage on coral reefs around St. Thomas, USVI. Independent Project Report, UVI, Spring 1999. 9 p.

Ramsay, K., M.J. Kaiser, and R.N. Hughes. 1996. Changes in hermit crab feeding patterns in response to trawling disturbance. Marine Ecology Progress Series 144(1-3):63-72.

Ramsay, K., M.J. Kaiser, and R.N. Hughes. 1998. Responses of benthic scavengers to fishing disturbance by towed gears in different habitats. Journal of Experimental Marine Biology and Ecology 224:73-89.

Reid, R.N. and F.W. Steimle, Jr. 1988. Benthic macrofauna of the middle Atlantic continental shelf. Pp. 125-160 in A.L. Pacheco, ed. - Characterization of the middle Atlantic water management unit of the northeast regional action plan. NOAA Tech. Mem. NMFS-F/NEC-56. Woods Hole, MA. 322 p.

Reimann, B. and E. Hoffman. 1991. Ecological consequences of dredging and bottom trawling in the Limfjord, Denmark. Marine Ecology Progress Series 69:171-178.

Reise, K. 1982. Long term changes in the macrobenthic invertebrate fauna of the Wadden Sea: Are polychaetes about to take over? Netherlands Journal of Sea Research 16:29-36.

Reise, K. and A. Schubert. 1987. Macrobenthic turnover in the subtidal Wadden Sea: the Norderaue revisited after 60 years. Helgolander Meeresunters 41:69-82.

Rester, J.K. 2000. Annotated bibliography of fishing impacts on habitat. Gulf States Marine Fisheries Commission. Number 73. Ocean Springs, Mississippi. 168 p.

Riesen, W. and K. Reise 1982. Macrobenthos of the subtidal Wadden Sea: revisited after 55 years. Helgolander Meeresunters 35:409-423.

Rijnsdorp, A.D., A.M. Buys, F. Storbeck, and E.G. Visser. 1998. Micro-scale distribution of beam trawl effort in the southern North Sea between 1993 and 1996 in relation to the trawling frequency of the sea bed and the impact on benthic organisms. ICES Journal of Marine Science 55:403-419.

Rijnsdorp, A.D. and P.I. Van Leeuwen. 1996. Changes in growth of North Sea plaice since 1950 in relation to density, eutrophication, beam trawl effort, and temperature. ICES Journal of Marine Science 53:1199-1213.

Rijnsdorp, A.D. and B. Vingerhoed. 2001. Feeding of plaice *Pleuronectes platessa* L. And sole *Solea solea* (L.) In relation to the effects of bottom trawling. Journal of Sea Research 45:219-229.

Rogers, S.I., M.J. Kaiser, and S. Jennings. 1998. Ecosystem effects of demersal fishing: A European perspective. Pp. 68-78 in E.M. Dorsey and J. Pederson, editors. Effect of Fishing Gear on the Sea Floor of New England. Conservation Law Foundation. Boston, Massachusetts. 160 p.

Rogers, S.I., D. Maxwell, A.D. Rijnsdorp, U. Damm, and W. Vanhee. 1999. Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. IV. Can comparisons of species diversity be used to assess human impacts on demersal fish faunas? Fisheries Research 40:135-152.

Rothschild, B.J., J.S. Ault, P. Goulletquer, and M. Heral. 1994. Decline of the Chesapeake Bay oyster population: a century of habitat destruction and overfishing. Marine Ecology Progress Series 111:29-39

Ruffin, K.K. 1995. The effects of hydraulic clam dredging on nearshore turbidity and light attenuation in Chesapeake Bay, MD. Master's Thesis. University of Maryland. 79 p.

Rumohr, H. 1998. Information on impact of trawling on benthos in Kiel Bay. Annex to Eighth Report of the Benthos Ecology Working Group. ICES CM 1989/L:19. p. 80.

Rumohr, H. and P. Krost. 1991. Experimental evidence of damage to benthos by bottom trawling with special reference to *Arctica islandica*. Meeresforschung 33(4):340-345.

Sainsbury, J.C. 1996. Commercial Fishing methods: An introduction to vessels and gears, 3rd Ed. Fishing News Books, Oxford, England.

Sainsbury, K.J. 1988. The ecological basis of multispecies fisheries and management of a demersal fishery in tropical Australia. Pp. 349-382 in J.A. Gulland, ed. Fish Population Dynamics, 2nd edition. John Wiley and Sons, London.

Sainsbury, K.J., R.A. Campbell, R. Lindholm, and A.W. Whitelaw. 1997. Experimental management of an Australian multispecies fishery: examining the possibility of trawl-induced habitat modification. Pp. 107-112 in E.K. Pikitch, D.D. Huppert, and M.P. Sissenwine, editors. Global trends: fisheries management. American Fisheries Society, Symposium 20, Bethesda, Maryland.

Sainsbury, K.J., R.A. Campbell, and A.W. Whitelaw. 1993. Effects of trawling on the marine habitat on the north west shelf of Australia and implications for sustainable fisheries management. Pp. 137-145 in D.A. Hancock, ed. Sustainable fisheries through sustaining fish habitat. Canberra, Australia, Australian Government Publishing Service.

Sanchez-Jerez, P. and A.A. Ramos Espla. 1996. Detection of environmental impacts by bottom trawling on *Posidonia oceanica* (L.) Delile meadows sensitivity of fish and macroinvertebrate communities. Journal of Aquatic Ecosystem Health 5(4):239-253.

Schoellhamer, D.H. 1996. Anthropogenic sediment resuspension mechanisms in a shallow microtidal estuary. Estuarine, Coastal and Shelf Science 45(5):533-548.

Schwinghamer, P., D.C. Gordon, Jr., T.W. Rowell, J. Prena, D.L. McKeown, G. Sonnichsen, and J.Y. Guigne. 1998. Effects of experimental otter trawling on surficial sediment properties of a sandy-bottom ecosystem of the Grand Banks of Newfoundland. Conservation Biology 12(6):1215-1222.

Scott, J.S. 1982. Selection of bottom type by groundfishes of the Scotian shelf. Can. J. Fish. Aquat. Sci. 39: 943-947.

Sherman, K.J., N.A. Jaworski, T.J. Smayda, eds. 1996. The Northeast Shelf Ecosystem – Assessment, Sustainability, and Management. Blackwell Science, Inc. Cambridge, MA. 564 p.

Simenstad, C.A. 1990. Summary and conclusions from workshop and working group discussions. Pp. 144-152 in Simenstad, C.A., ed. Effects of dredging on anadromous Pacific coast fishes. Workshop Proceedings, University of Washington and WA Sea Grant Program.

Smolowitz, R. 1998. Bottom tending gear used in New England, in Effects of Fishing Gear on the Sea Floor of New England. E.L. Dorsey and J. Pederson, eds. Conservation Law Foundation, Boston, Massachusetts.

Steimle, F.W., C.A. Zetlin, P.L. Berrien, D.L. Johnson, and S. Chang. 1999. Tilefish, *Lopholatilus chamaeleonticeps*, life history and habitat characteristics. NOAA Tech. Mem. NMFS-NE-152. 30 p.

Stephan, C.D., R.L. Peuser, and M.S. Fonseca. 2000. Evaluating fishing gear impacts to submerged aquatic vegetation and determining mitigation strategies. ASMFC Habitat Management Series #5. 38 p.

Stevenson, J.C. and N.M. Confer. 1978. Summary of available information on Chesapeake Bay submerged vegetation. FWS/OBS - 78/66.

Stewart, P.A.M. 1999. Gear modification as a management tool to limit ecosystem effects of fishing. ICES/SCOR Symposium, Ecosystem Effects of Fishing, April 1999, St. John's, Newfoundland. 20 p.

Stumpf, R.P. and R.B. Biggs. 1988. Surficial morphology and sediments of the continental shelf of the middle Atlantic bight, pp. 51-72 in A.L. Pacheco, ed., Characterization of the middle Atlantic water management unit of the northeast regional action plan. NOAA Tech. Mem. NMFS-F/NEC-56. Woods Hole, MA. 322 p

Sutherland, D.L., G.L. Beardsley, and R.S. Jones. 1983. Results of a survey of the South Florida fish-trap fishing grounds using a manned submersible. Northeast Gulf Science 6(2):179-183.

Tabb, D.C. 1958. Report on the bait shrimp fishery of Biscayne Bay, Miami, Florida. Florida State Board of Conservation, Marine Lab, University of Miami. 16 p.

Taylor, R.G. and R.H. McMichael, Jr. 1983. The wire fish-trap fisheries in Monroe and Colier Counties, Florida. Florida Marine Research Publication. No. 39. 19 p.

Thompson, G. 1993. Impacts of trawling on the seabed and benthic community. Appendix F. Amendment 24, Bering Sea/Aleutian Islands Groundfish Fishery Management Plan. 5 p.

Thrush, S.F., J.E. Hewitt, V.J. Cummings, and P.K. Dayton. 1995. The impact of habitat disturbance by scallop dredging on marine benthic communities: What can be predicted from the results of experiments? Marine Ecology Progress Series 129(1-3):141-150.

Thrush, S.F., J.E. Hewitt, V.J. Cummings, P.K. Dayton, M. Cryer, S.J. Turner, G.A. Funnell, R.G. Budd, C.J. Milcurn, and M.R. Wilkinson. 1998. Disturbance of the marine benthic habitat by commercial fishing: impacts at the scale of the fishery. Ecological Applications 8(3):866-879.

Tilmant, J.T. 1979. Observations on the impact of shrimp roller frame trawls operated over hardbottom communities in Biscayne Bay, Florida. National Park Service Report Series No. P-553. 23 p.

Townsend, D.W. 1992. An overview of the oceanography and biological productivity of the Gulf of Maine; pp. 5-26 in Townsend, D.W. and P.F. Larsen, eds. The Gulf of Maine, NOAA Coastal Ocean Program Regional Synthesis Series Number 1. Silver Spring, MD 135 p.

Tuck, I.D., S.J. Hall, M.R. Robertson, E. Armstrong, and D.J. Basford. 1998. Effects of physical trawling disturbance in a previously unfished sheltered Scottish sea loch. Marine Ecology Progress Series 162:227-242.

Tupper, M. and R. G. Boutilier. 1995a. Size and priority at settlement determine growth and competitive success of newly settled Atlantic cod. Mar Ecol Prog Ser 118:295-300.

Tupper, M. and R. G. Boutilier. 1995b. Effects of habitat on settlement, growth, and postsettlement survival of Atlantic cod (*Gadus morhua*). Can J Fish Aquat Sci 52:1834-1841.

Turner, S.J., S.F. Thrush, J.E. Hewitt, V.J. Cummings, and G. Funnell. 1999. Fishing impacts and the degradation or loss of habitat structure. Fisheries Management and Ecology 6:401-420.

USGS. 2001. USGS East-Coast Sediment Analysis: Procedures, Database, and Georeferenced Displays. USGS Open-File Report 00-358. Woods Hole, MA.

Valentine, P. C. and R. G. Lough. 1991. The influence of geological and oceanographic environmental factors on the abundance and distribution of fisheries resources of the northeastern United States continental shelf: The seafloor environment and the fishery of eastern Georges Bank. Open File Report 91-439, US Geol. Surv. 25 p.

Valentine, P.C., E.W. Strom, R.G. Lough, and C.L. Brown. 1993. Maps showing the sedimentary environment of eastern Georges bank. U.S. Geol. Surv. Misc. Invest. Ser., Map I-2279-B, scale 1:250,000.

Van der Knapp, M. 1993. Physical damage to corals caused by trap fishing on reefs of Bonaire, Netherlands Antilles. Environmental Conservation 20(3):265-267.

Van Dolah, R.F., P.H. Wendt, and M.V. Levisen. 1991. A study of the effects of shrimp trawling on benthic communities in two South Carolina sounds. Fisheries Research 12:139-156.

Van Dolah, R.F., P.H. Wendt, and N. Nicholson. 1987. Effects of a research trawl on a hard-bottom assemblage of sponges and corals. Fisheries Research 5:39-54.

Van Marlen, B. 2000. Technical modifications to reduce the by-catches and impacts of bottom fishing gears. Pp. 198-216 in M.J. Kaiser and S.J. de Groot. The Effects of Fishing on Non-target Species and Habitats. Blackwell Science.

Veale, L.O., A.S. Hill, S.J. Hawkins, and A.R. Brand. 2000. Effects of long-term physical disturbance by commercial scallop fishing on subtidal epifaunal assemblages and habitats. Marine Biology 137(2):325 337.

Watling, L., J. Dearborn, and L. McCann. 1988. General distribution patterns of macrobenthic assemblages in the Gulf of Maine. Pp. 109-119 in I. Babb and M. Deluca, eds. Benthic Productivity and Marine Resources of the Gulf of Maine. U.S. Dept. Commerce, Natl. Undersea Res. Prog. Res. Rep. 88-3.

Watling, L. and E. A. Norse. 1998. Disturbance of the seabed by mobile fishing gear: a comparison to forest clearcutting. Conservation Biology 12(6):1180-1197.

West, B. 1987. Bering Sea trawling impact project. Pp. 626-631 in Proceedings Ocean '87 The Ocean - An International Workplace. Halifax, Nova Scotia. September 28 - October 1, 1987.

Wion, D.A. and R.A. McConnaughey. 2000. Mobile fishing gear effects on benthic habitats: A bibliography. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-116. 163 p.

Witbaard, R. and R. Klein. 1993. A method to estimate the bottom trawl intensity independently from fisheries itself by using internal molluscan growth lines ICES CM 1993.

APPENDICES

APPENDIX A

WORKSHOP PARTICIPANTS

Mr. H. Arnold Carr
Massachusetts Division of Marine Fisheries
Pocasset, MA

Dr. Joseph DeAlteris
Department of Fisheries and Aquaculture
University of Rhode Island
Kingston, RI

Dr. Robert Diaz
Virginia Institute of Marine Science
Gloucester Point, VA

Dr. William DuPaul
Virginia Institute of Marine Science
Gloucester Point, VA

Dr. Michael Fogarty
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, MA

Dr. Chris Glass
Manomet Center for Conservation Sciences
Manomet, MA

Dr. Ellen Kenchington
Department of Fisheries and Oceans
Marine Environmental Sciences Division
Dartmouth, Nova Scotia, Canada

Dr. James Lindholm
National Ocean Service
Stellwagon Bank National Marine Sanctuary
Scituate, MA

Mr. James Lovgren
Captain, F/V Sea Dragon
Brick, NJ

Dr. Roger Mann
Virginia Institute of Marine Sciences
Gloucester Point, VA

Mr. Frank Mirarchi
Boat Kathleen A. Mirarchi, Inc.
Scituate, MA

Dr. Doug Rader
Environmental Defense
Raleigh, NC

Dr. Page Valentine
U.S. Geological Service
Woods Hole, MA

Dr. Robert Van Dolah
South Carolina Dept. of Natural Resources
Division of Marine Resources
Charleston, SC

Mr. Dave Wallace
Wallace and Associates
Cambridge, MD

Dr. James Weinberg
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, MA

Dr. Robert Whitlatch
Department of Marine Sciences
University of Connecticut
Groton, CT

WORKSHOP STEERING COMMITTEE

Louis Chiarella
NMFS, Northeast Regional Office
Habitat Conservation Division
1 Blackburn Drive
Gloucester, MA 01930

Robert Reid
NMFS, Northeast Fisheries Science Center
Ecosystems Processes Division
James J. Howard Laboratory
74 Magruder Rd.
Highlands, NJ 07732

Dianne Stephan
NMFS, Northeast Regional Office
Habitat Conservation Division
1 Blackburn Drive
Gloucester, MA 01930

Michael Pentony
New England Fishery Management Council
50 Water Street
Newburyport, MA 01950

Dr. Thomas Hoff
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, DE 19904-6790

Carrie Selberg
Atlantic States Marine Fisheries Commission
1444 Eye Street, N.W., Sixth Floor
Washington, D.C. 20005

Korie Johnson
NMFS, Office of Habitat Conservation
1315 East-West Highway
Silver Spring, MD 20910

Dr. David Stevenson
NMFS, Northeast Regional Office
Habitat Conservation Division
1 Blackburn Drive
Gloucester, MA 01930

John McCarthy
NMFS, Northeast Fisheries Science Center
Ecosystems Processes Division
James J. Howard Laboratory
74 Magruder Rd.
Highlands, NJ 07732

APPENDIX B.

FINAL AGENDA
Effects of Fishing Gear on Fish Habitat in the Northeastern U.S.
October 23 -25, 2001
Boston, MA
Hilton Boston Logan Airport (617) 568 -6700

Tuesday 10/23

9:30-10:00	*COFFEE*
10:00 - 10:30	Welcome and Introductions (Colosi, Hopkins, Caputi)
10:30 - 11:15	Overview of Meeting Format and Products (Chiarella, Citrin)
11:15 - 11:45	Habitat Description and Overview (Valentine Lead)
11:45 - 12:45	Effects of Fishing Gear: Bottom Static, Pots and Traps (Panel)
12:45 - 2:00	LUNCH
2:00 - 4:15	Effects of Fishing Gear: Clam Dredges (Panel)
3:30 - 3:45	*Coffee Break*
4:15 - 5:15	Effects of Fishing Gear: Pelagic Gear (Panel)

Wednesday 10/24

8:00 - 9:00	Effects of Fishing Gear: Bottom Static, Nets and Hook Gear (Panel)
9:00 - 12:15	Effects of Fishing Gear: Scallop Dredges (Panel)
10:20 - 10:35	*Coffee Break*
12:15 - 1:30	LUNCH
1:30 - 4:45	Effects of Fishing Gear: Otter Trawls (Panel)
2:50 - 3:05	*Coffee Break*
4:45 - 5:45	Effects of Fishing Gear: Beam Trawls (Panel)

Thursday 10/25

8:00 - 8:45	Peer Review of White Paper (Panel and Staff)
8:45 - 11:30	Conclusions of Last Two Days (Panel and Staff)
9:45 - 10:00	*Coffee Break*
11:45 - 1:00	Relative Importance of Impacts (Panel)
1:00 - 2:00	LUNCH
2:00 - 3:30	Recommendations for Action (Panel)
3:30 - 4:00	Wrap-Up, Adjourn

APPENDIX C.

Workshop Goals and Objectives

Goal: Evaluate the impact of fishing gear used in federally regulated fisheries on habitats of the Northeast shelf ecosystem, and ways to reduce impacts.

Objective 1: Peer review background document prepared by the Workshop Steering Committee.

Objective 2: Evaluate the applicability of national and international fishing gear effects research to the Northeast.

Objective 3: Evaluate the strength of evidence regarding the effects of different types of gear and fishing practices on marine habitats in the Northeast.

Objective 4: Identify and evaluate types of management measures that could reduce the impacts of fishing gear on marine habitats in the Northeast.

Objective 5: Provide advice and recommendations to the New England and Mid-Atlantic Fishery Management Councils for minimizing adverse effects of fishing gear on marine habitats in the Northeast.

APPENDIX D.

DEFINITIONS

Essential Fish Habitat *(Magnuson-Stevens Act , MSA)*
"EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Adverse Effect *(EFH Interim Final Rule, IFR)*
"Adverse effect means any impact which reduces quality and/or quantity of EFH. Adverse effects may include direct (e.g. contamination or physical disruption), indirect, (e.g. loss of prey, or reduction of species' fecundity), site-specific or habitat-wide impacts including individual, cumulative, or synergistic consequences of actions."

"Adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem."

"**Identifiable" Adverse Effect** *(IFR)*
1. "Impacts from fishing practices that justify the implementation of management measures should be identifiable"
2. "Identifiable means both more than minimal and not temporary in nature…"
3. "Intent is to regulate fishing gears that reduce an essential habitat's capacity to support marine resources, not practices that produce inconsequential changes in the habitat."

Substrate Types

1. Mud - For purposes of the workshop this category consisting of clays and silts. Particle sizes range from 0.001 - 0.004 mm for clay and 0.004 mm - 0.062 mm for silt. *(USGS 2001)*

2. Sand - Sediment particles ranging from 0.062 mm - 2.00 mm *(USGS 2001)*

3. Gravel - For purposes of the workshop this category includes pebbles, cobbles, boulders, as well as hard bottom (ledge) and hard corals. Pebbles are the smallest particles in this category and range from 2.0 mm - 64.0 mm. Cobbles range from 64.0 mm - 256.0 mm. Boulders are > 256.0 mm *(USGS 2001)*

Type of Impact Used in Gear Impact Tables *(Modified from ICES, 2001):*

1. Removal of Major Physical Features - Fishing gear may cause the loss or dispersal of physical features in the environment such as peat banks or boulder reefs. These changes are always permanent, and lead to an overall reduction in habitat diversity. This, in turn, can lead to the local loss of species and species assemblages dependant upon such features, for example, attached bryozoan/hydroid turf and important fish habitat. Even when substantial quantities of the habitat feature remain, if the habitat has become highly fragmented, this may compromise the viability of populations dependent upon it. *(ICES 2001)*

2. Impacts to Biological Structure - Fishing gear can cause the loss of structure-forming organisms such as colonial bryozoans, *Sabellaria,* hydroids, seapens, sponges, mussel beds, and oyster beds. These changes may be permanent, and can lead to an overall loss of habitat diversity. This in turn, can lead to the local loss of species and species assemblages dependent upon such biogenic structure, for example, important fish habitat for juvenile gadoids. The viability of populations dependent on biogenic features may be compromised even if the feature remains but has become highly fragmented. *(ICES, 2001)*

3. Impacts to Physical Structure - Fishing gear can cause a reshaping of seabed features such as sand ripples, and damage to burrows and associated structures (e.g. mounds and casts, microhabitats, and shell windrows). These features provide important habitats for smaller animals (meiofauna) and can be used by fish to reduce their energy requirements. These changes are not likely to be permanent. Fishing gear can cause the redistribution and mixing of surface sediments which can lead to a decrease in the physical patchiness of the sea floor (i.e., decreased heterogeneity) within the fishing grounds. These changes are not likely to be permanent. *(ICES 2001)*

4. Changes in Benthic Prey - Fishing gear can cause reductions in the abundance and/or species composition of benthic invertebrate populations that are consumed by bottom feeding fish. These changes have the potential to affect habitat suitability for growth, survival, and reproductive capacity of predatory fish.

APPENDIX E.

Questions for the Workshop Panel:

I. Introductory Questions. (Habitat Overview)

1. What types of habitat are found in the Northeast region?
2. What are the characteristics of the habitats in the Northeast region and how do these differ in the Gulf of Maine, Georges Bank, Southern New England shelf, and Mid-Atlantic Bight?

II. Questions on Fishing Gear Types.

The categories of fishing gears used for the workshop include the following:

Bottom-Tending Static Fishing Gears -- Pots and Traps

Bottom-Tending Mobile Fishing Gears -- Clam Dredges (hydraulic and non-hydraulic)

Bottom-Tending Static Fishing Gears – Gill Nets, Long Lines, Hooks

Bottom-Tending Mobile Fishing Gears -- Sea Scallop Dredges

Bottom-Tending Mobile Fishing Gears -- Otter Trawls

Bottom-Tending Mobile Fishing Gears -- Beam Trawls

Pelagic Fishing Gears (Static and Mobile)

The Workshop Panel is asked to answer specific questions about the effects of different fishing gears and the applicability of available information to the Northeast Region. The following set of questions apply to each of the above categories of fishing gear used in the Northeast Region.

1. What fishing gears in this category are used in the Northeast?
2. How are fishing gears in this category used in the Northeast?
3. What, if any, components or elements of fishing gears in this category come in contact or interact with the sea floor?
4. What are the direct effects of fishing gears in this category on different habitats?
5. What are the principal indirect biological effects of gear induced habitat alterations on exploited resource populations?
6. What effects of fishing gears in this category are most significant?
7. Which habitats are most or least vulnerable to effects of fishing with fishing gears in this category?
8. How do we judge the temporal scale of the effects of fishing gears in this category on different habitats?
9. What studies or elements of studies of the effects of fishing gears in this category are applicable to the Northeast? Why?
10. What studies or elements of studies of the effects of fishing gears in this category are <u>not</u> applicable to the Northeast? Why not?
11. How strong is the evidence for the potential effects of fishing gears in this category on different habitats in the Northeast?

12. What are the most important overall potential effects of fishing gears in this category in the Northeast?

13. What types of management actions would be most effective to mitigate the potential adverse effects of fishing gears in this category in the Northeast?

14. Would any changes to fishing practices with fishing gears in this category reduce their interaction with or contact with the bottom, or in some other way reduce the impacts to habitat associated with fishing gears in this category?

15. Are there any design modifications that could be made to fishing gears in this category that would reduce their interaction with or contact with the bottom, or in some other way reduce the impacts to habitat associated with fishing gears in this category?

In addition, the following questions apply to the pelagic categories of fishing gear:

16. Relative to impacts from other gear types on sea floor habitats, how important are potential impacts from pelagic gears to the water column?

17. Would there be more or less concern over the potential effects of pelagic fishing gears if they were used in contact with the bottom, either intentionally or accidentally?

APPENDIX F.

Descriptions of some representative habitats as presented by Dr. Page Valentine, USGS.
Note: This is not a complete listing of habitats of the Northeastern United States

A. GEORGES BANK – Northeastern Edge

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Featureless gravel except for few large sand ridges**
B. Sediment texture and hardness	**Gravel pavement (hard bottom); small areas of gravel with sand veneer; sand**
C. Substrate roughness and surface area (undisturbed)	
• **Physical**	**Gravel pavement: pebbles, scattered cobbles and boulders; little rippled sand** **Sand ridges with ripples**
• **Biological**	**Gravel pavement: calcareous worm tubes, bryozoa/hydrozoa, sponges, and anemones attached to gravel** **Sand:**
D. Substrate dynamics	**Strong tidal and storm currents winnow sand from gravel pavement, move shells, and move surfaces of sand deposits;**
E. Water column	**Generally mixed; high productivity; shallow**
F. Possible fishing impacts	**Disturb gravel pavement, reduce hard bottom and expose sand for movement; move cobbles and boulders; disturb epifauna; alter biodiversity**

B. GEORGES BANK – Central Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Sand bedforms ranging from small ripples to very large sand ridges**
B. Sediment texture and hardness	**Sand; shell beds; small areas of gravel between sand ridges**
C. Substrate roughness and surface area (undisturbed)	
• **Physical**	**Sand bedforms of varying sizes; associated shell beds** **Gravel: pebbles, cobbles, boulders**
• **Biological**	**Sand bedforms: amphipod tubes, sand dollar concentrations and burrowing anemones** **Gravel: minimal epifauna due to sand movement**
D. Substrate dynamics	**Strong tidal and storm currents build bedforms and shell beds; daily sand transport; large stable sand ridges are oriented parallel to direction of current flow; bi-directional sand movement**
E. Water column	**Mixed; high productivity; shallow**
F. Possible fishing impacts	**Disturb sand bedforms and shell beds; disturb amphipod tubes and burrowing anemones and expose sand for movement**

C. GEORGES BANK – Southern Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	Featureless sand except for patches of ripples from intermittent storms
B. Sediment texture and hardness	Sand
C. Substrate roughness and surface area (undisturbed)	
• Physical	Depressions in sand formed by benthic fauna; scattered shells
•	
• Biological	Erect yellow sponges attached to shell fragments; amphipod tubes
D. Substrate dynamics	Weak tidal currents do not move sediment; intermittent strong storm currents form sand ripples
E. Water column	Mixed or seasonally stratified; high productivity; shallow
F. Possible fishing impacts	Disturb sand depressions, erect sponges, and amphipod tubesl break shells

D: GEORGES BANK – Large Submarine Canyons on Southern Margin

HABITAT CHARACTER	DESCRIPTION
A. Topography	Deep incision into continental shelf edge; gentle to steeply sloping canyon walls; sand bedforms in canyon axis
B. Sediment texture and hardness	Sand and gravel on canyon rims and in axis; gravel pavement common on eastern rims; clay layer and rock outcrops on canyon walls
C. Substrate roughness (undisturbed)	
• Physical	On canyon rims: depressions in sand formed by benthic fauna; scattered shells; sand bedforms; gravel pavement of pebbles and scattered cobbles and boulders In canyon: sand bedforms; scattered pebbles, cobbles, and boulders; clay burrows (formed by crustaceans, fish, worms …); irregular rock outcrops
• Biological	Sponges, bryozoa/hydrozoa, soft corals attached to gravel and rock outcrops; burrowing anemones; …
D. Substrate dynamics	Moderate currents move sand from shelf onto canyon walls; strong tidal currents form sand bedforms in canyon axis
E. Water column	Stratified; low productivity; shallow to deep
F. Possible fishing impacts	Disturb gravel pavement, reduce hard bottom and expose sand for movement; move cobbles and boulders; disturb hardbottom epifauna; disturb clay burrows; disturb burrowing anemones

E. GULF OF MAINE – Central Deep Water Banks

HABITAT CHARACTER	DESCRIPTION
A. Topography	Banks, ridges, hills, mounds
B. Sediment texture and hardness	Gravel and bedrock with intermittent thin veneer of mud; patches of mud; hard and soft bottom
C. Substrate roughness and surface area (undisturbed)	
• Physical	Gravel: pebbles, cobbles, boulders, and bedrock outcrops; scour depressions around cobbles and boulders Mud: mud burrows (crustaceans, fish, worms, …)
• Biological	Gravel: sponges, brachiopods, and anemones attached to gravel Mud: burrowing anemones, sea pens
D. Substrate dynamics	Very weak currents; little or no sediment transport
E. Water column	Stratified; low productivity; deep
F. Possible fishing impacts	Flatten small gravel mounds; move cobbles and boulders; re-suspend fine sediment and increase turbidity; disturb epifauna; disturb mud burrows; disturb burrowing anemones and sea pens

F. GULF OF MAINE – Central Deep Water Basins

HABITAT CHARACTER	DESCRIPTION
A. Topography	Featureless mud except for small mounds
B. Sediment texture and hardness	Mud; soft bottom
C. Substrate roughness and surface area (undisturbed)	
• Physical	Mud: mud burrows (crustaceans, fish, worms, …)
•	
• Biological	Mud: burrowing anemones; sea pens, “amphipod” tubes
D. Substrate dynamics	Very weak currents; little or no sediment transport
E. Water column	Stratified; low productivity; deep
F. Possible fishing impacts	Disturb burrows; re-suspend fine sediment and increase turbidity; disturb burrowing anemones and sea pens

G: GREAT SOUTH CHANNEL REGION – Central Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Featureless gravel; gravel mounds; bedforms ranging from small ripples to very large sand ridges**
B. Sediment texture and hardness	**Gravel pavement; gravel between large sand ridges; gravel with thin veneer of sand; sand**
C. Substrate roughness and surface area (undisturbed)	
• Physical	**Gravel pavement and mounds: pebbles, scattered cobbles and boulders; shell beds** **Sand bedforms of varying sizes**
• Biological	**Gravel: bryozoa/hydrozoa, sponges, attached anemones** **Sand:**
D. Substrate dynamics	**Strong tidal and storm currents; daily sand transport; sand ridges relatively stable and oriented normal to direction of current flow;** **bi-directional sand movement**
E. Water column	**Mixed; high productivity; shallow**
F. Possible fishing impacts	**Disturb gravel pavement, expose sand for movement; flatten small gravel mounds; move cobbles and boulders; disturb gravel epifauna; disturb small bedforms and shell beds**

H. GREAT SOUTH CHANNEL REGION – Northern Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Featureless gravel with veneer of rippled sand**
B. Sediment texture and hardness	**Gravel with mobile patchy sand veneer**
C. Substrate roughness and surface area (undisturbed)	
• Physical	**Gravel: Pebbles, cobbles, and boulders; current scours around boulders** **Sand: rippled sand patches; rippled sand deposits streaming downcurrent from boulders**
• Biological	**Gravel: little attached epifauna due to sand movment** **Sand:**
D. Substrate dynamics	**Strong tidal and storm currents; sand moving through gravel**
E. Water column	**Generally mixed; high productivity; shallow**
F. Possible fishing impacts	**Move cobbles and boulders; disturb attached epifauna; disturb sand ripples**

I. GREAT SOUTH CHANNEL REGION – Northeastern Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Featureless except for storm sand ripples**
B. Sediment texture and hardness	**Coarse sand and gravel**
C. Substrate roughness and surface area (undisturbed)	
• **Physical**	**Sand: storm-generated ripples** **Gravel: pebble gravel pavement in ripple troughs; scattered cobbles and boulders**
• **Biological**	**Gravel: sponges and bryozoa/hydrozoa attached to gravel** **Sand:**
D. Substrate dynamics	**Moderate tidal currents; strong storm currents transport sand and form ripples**
E. Water column	**Mixed or seasonally stratified; high productivity; shallow**
F. Fishing impacts possible	**Disturb sand ripples and gravel pavement; move cobbles and boulders; disturb gravel epifauna**

J. GREAT SOUTH CHANNEL REGION – Southwestern Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Featureless gravelly sand except for widely spaced very large sand ridges**
B. Sediment texture and hardness	**Gravelly coarse sand between sand ridges; sand on ridges**
C. Substrate roughness and surface area (undisturbed)	
• **Physical**	**Gravelly coarse sand: depressions in sand formed by benthic fauna; scattered shells** **Sand ridges with ripples**
• **Biological**	**Gravelly coarse sand: erect yellow sponges, attached anemones, amphipod tubes** **Sand:**
D. Substrate dynamics	**Moderate tidal currents; strong storm currents transport surfaces of relatively stable sand ridges; bi-directional sand movement**
E. Water column	**Generally mixed; high productivity; shallow**
F. Fishing impacts possible	**Disturb depressions in gravelly coarse sand, erect sponges, attached anemones, and amphipod tubes**

K. GREAT SOUTH CHANNEL REGION – Western Part

HABITAT CHARACTER	DESCRIPTION
A. Topography	**Featureless**
B. Sediment texture and hardness	**Mussel bed; hard bottom**
C. Substrate roughness and surface area (undisturbed)	
• **Physical**	**Mussel shells**
• **Biological**	**Mussel bed with attached epifauna**
D. Substrate dynamics	**Strong tidal and storm currents**
E. Water column	**Mixed; high productivity; shallow**
F. Possible fishing impacts	**Disturb living mussels, shells, and attached epifauna; expose underlying sediment to strong currents**

APPENDIX G.

Spatial Distribution of Fishing Effort for Sea Scallops: 1998-2000

Prepared for

Effects of Fishing Gear on Fish Habitat in the Northeastern U.S.
October 23 - 25, 2001
Boston, MA

Paul Rago[1] and Michael McSherry[2]

Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, MA, 02540, USA and [2]Northeast Regional Office, National Marine Fisheries Service, Gloucester, MA, 01930

Introduction

Precise information on the spatial pattern of fishing by commercial vessels is available for few fisheries. Such information is critical for assessment of potential impacts of fishing gear on target and non-target species. The short report summarizes recent information on the spatial distribution of the US sea scallop fishery and estimates the area-specific landings and revenue. Additional information related to this report may be found in Rago et al. (2000).

Methods

Each vessel that participates in the limited access fishery for Atlantic sea scallops is required to use a vessel monitoring device. This device identifies the position of each vessel at intervals of one hour or less. Positions are tracked by a geosynchronous satellite and the information is relayed to ground-based stations. Vessel speed can be computed as the distance between successive position divided by the duration between position reports. The combination of vessel tracking devices, satellite and ground-based monitoring, and associated databases and software define the vessel monitoring system (VMS) for sea scallops. The VMS database was originally designed as an enforcement tool to track time at sea accurately, and to identify possible violations of closed areas. The potential uses of such data for assessment and management, however, are far-reaching. We present a few examples related to development of a synoptic map of fishing activity.

Estimates of area-specific fishing activity by calendar year were derived by overlaying a grid of 1 nm^2 squares over a region extending from Georges Bank to Virginia. Total fishing time in each cell was estimated as the sum of vessel-hours where speed is less than 5 knots (scallop vessel typically fish at 4-5 knots). Speed is estimated as the Euclidian distance between successive position reports divided by the time between observations. This estimate of fishing activity includes haul back time as well as any other time spent processing catch or cessation of fishing during bad weather or mechanical breakdowns. Fishing activity is assigned to the 1 nm^2 cell in which the report is received. In theory however, the fishing activity could have occurred within a five nautical mile radius of the recorded position. In practice, vessels tend to concentrate fishing activity around locations were capture rates are high. The effects of uncertainty in specification of fishing activity time could be examined via various smoothing procedures and through more detailed analysis of individual vessel tracks. For the purposes of this summary, we felt that the overall pattern of vessel activity was sufficiently characterized.

Total fishing activity hours by cell were estimated by quartiles (Table 1) and coded by color (red >75%-ile, 50%-ile<yellow <75%-ile, 25%-ile < green < 50%-ile, blue < 25%-ile. An upper bound on area swept can be obtained as the product of fishing time (hr), an estimated average speed of 4.5 knots while towing, and an industry norm of two 15 ft wide dredges. This product provides a measure of potential bottom contact area, but the actual area covered is determined by the number of times that the bottom is repeatedly towed. The VMS data alone are insufficient to estimate this quantity.

The spatial distribution of landings and revenue was approximated by linking vessel monitoring data with dealer records of landings and total value. Landings associated with each trip were distributed in proportion to time fished over set of 1 nm^2 cells that comprise the area fished. The sum over all trips provides an estimate of the landings per unit area. An equivalent procedure was used to estimate the revenue per unit area. This procedure does not account for the non-uniform distribution of fishing success over the course of a trip. Since most landings are likely to come from the areas fished the most intensively, it is likely that the application of the average success rate (i.e., lbs/hr) to all cells in a trip will overestimate the landings and revenue from marginal areas. Although the VMS reports record all trips, not all VMS trips can be matched with dealer records. The degree of matching exceeded 90% in all years. Unmatched records arise from a variety of sources and can generally be resolved by investigation of individual trips. In some instances it is necessary to combine several "trips" that give rise to a single landing event. Multiple VMS "trips" can arise when a vessel moves back and forth across inshore demarcation lines during a single trip.

Results

The scallop fishery is highly concentrated and the degree of concentration is consistent across years. The spatial distribution of fishing effort in 1998 and 1999 is depicted in Fig. 1. Fishing effort quartiles were estimated for the set of all cells (1 nm^2) in which fishing occurred in 1998 and 1999. Cells below the median hours of fishing activity experienced less than 9 hours of fishing activity per year. The upper quartile of fishing effort was highly concentrated in a zone of about 3000 square miles in all three years (Table 1). Estimated mean fishing activity in these areas was about 110 hr in 1998 and 1999. The fishing activity in cells below the median level is largely incidental and constitutes only about 4% of the total landings per year. It is hypothesized that such fishing activity is exploratory to recheck old fishing sites or to identify overlooked scallop concentrations. The most heavily fished areas produced the 77 to 88% of the total landings. Hence, the VMS data provides a heretofore unknown quantification of the concentration of fishing activity. The implications of this concentration may be important for bycatch and habitat issues (e.g., the environmental "footprint" of fishing effort).

Discussion

Monitoring of fleet behavior during the reopening of area II also revealed the importance localized concentrations of scallops on the distribution and intensity of fishing effort. The observed pattern of effort was consistent with the predicted "limiting distribution of fishing effort" described by Beverton and Holt (1957, p. 162). The concentration of effort on high abundance patches also suggests a reason why predicted yields based on *average* densities may not be realized. The ability to locate and exploit scallop beds will tend to maintain high average catch rates, while at the same time, reduce the true average density faster than would be predicted.

The long term value of the Vessel Monitoring System has been only partially exploited. At a minimum, it provides a common language for fishermen and scientists to gain insights into fishing behavior and resource distribution. Fishermen cannot argue that scientists don't know where the fleet actually fishes and what the catch is. Moreover, scientists cannot dismiss fishermen's observations as anecdotal fragments of the whole. In such circumstance the strengths and weaknesses of each others tenets can be evaluated. Cursory examination of the areal distribution of effort suggests coherence with substrate types. Such coherence may ultimately allow prediction of habitat impacts and bycatch considerations. Managers will find it easier to evaluate the effects of management measures in real time and make short-term corrections when appropriate.

References

Beverton, R. J. H. and S. J. Holt. 1957 On the dynamics of exploited fish populations. Chapman and Hall, London. Facsimile reprint. 1993.

Murawski, S.A., R. Brown, H.-L.Lai, P. J. Rago, and L. Hendrickson. 2000. Large-scale closed areas as a fishery-management tool in temperate marine ecosystems: the Georges Bank experience. Bulletin of Marine Science 66:775-798

NRC [National Research Council]. 1998. Improving fish stock assessments. National Academy Press, Washington DC, 174 pp.

Rago, P., S. Murawski, K. Stokesbury, W. DuPaul, and M. McSherry. 2000. Integrated Management of the Sea Scallop Fishery in the Northeast USA: Research and Commercial Vessel Surveys, Observers, and Vessel Monitoring Systems. International Council for the Exploration of the Sea. CM 2000/W:13. Brugge Belgium.

Appendix

Background on Sea Scallop Biology and Fishery

Sea scallops, *Placopecten magellanicus*, are found in western North Atlantic continental shelf waters from Newfoundland to North Carolina. Principal USA commercial fisheries in the EEZ are conducted primarily on Georges Bank, and in the Mid-Atlantic offshore region at depths between 40 and 100 m where water temperatures are less than 20º C. In terms of total revenue, the sea scallop fishery is the second most valuable fishery in the Northeast USA with annual values in excess of $100 million USD. Average price per kg of adductor muscle (meat) increases with average size with small scallops (~10 g) fetching approximately $8.80/kg and large scallops (>45g) valued at about $15.40/kg.

Scallops grow rapidly during the first several years of life. Between ages 3 and 5, scallops commonly increase 50 to 80% in shell height and quadruple their meat weight. During this time span, the number of meats per kg is reduced from greater than 220 to about 50. Maximum size is about 23 cm shell height, but scallops larger than 17 cm are rare. Sexual maturity commences at age 2, but scallops younger than age 4 probably contribute little to total egg production. Spawning occurs in late summer and early autumn; spring spawning may also occur in the Mid-Atlantic region. Eggs are buoyant, and larvae remain in the water column for four to six weeks before settling to the bottom.

Approximately 250 vessels participate in the year round commercial fishery for scallops. Nearly all landings are taken with dredges (89%) and otter trawls (10%). The USA fishery is managed under the New England Fishery Management Council's Fishery Management Plan for Atlantic Sea Scallops (*Placopecten magellanicus*). Current management measures include a moratorium on permits, days-at-sea limits, and restrictions on gear and crew size. Since the 1998 fishing year, vessels have been restricted to a maximum of 120 days at sea. Days at sea are monitored via a satellite tracking system that logs the position of all full-time scallop vessels on an hourly basis. Scallop dredges must use 3.5 inch (89mm) diameter steel rings to reduce capture of smaller scallops. Crew size is limited to seven individuals. As scallops are shucked by hand at sea, the crew size limitation constrains the daily landings rate during periods of high abundance. The minimum ring size was intended to reduce the catch of undersized scallops to improve yield per recruit, but the efficacy of this measure in the fishery was difficult to isolate in stock assessments (e.g., NEFSC 1997). In addition to these effort reduction measures, closed areas have excluded scallops from traditional harvest areas. Three large areas of Georges Bank were closed to scallop fishing in December 1994 to protect groundfish resources (Murawski et al. 2000). Later, in April 1998, two areas in the Mid-Atlantic were closed to protect undersized scallops present in these areas.

The National Marine Fisheries Service has conducted a stratified random survey of the scallop resource from Virginia to Georges Bank since 1975. In general, the relative biomass indices from scallop survey closely track the landings from the fishery. This is due largely to the intensity of the fishery which rapidly harvests recruiting size classes. The growth potential of sea scallops and the implications of reduced fishing mortality for management have been demonstrated in the closed areas of the Mid-Atlantic and Georges Bank regions (Murawski et al. 2000). Between 1994 and 1998, relative biomass indices from research vessel surveys increased between 5-15 fold in the Georges Bank areas closed to fishing compared to those areas open to fishing. Comparisons of the size structure between 1994 and 1998 for population inside and outside of the closed areas revealed the virtual absence of scallops greater than 110 mm shell height except in the closed area. By 1998 nearly 80% of the total scallop biomass resided in the closed areas. On Georges Bank the closed areas, which historically held about 50% of the total biomass, now had almost 90% of the total. Average densities in August 2000 in Georges Bank closed areas were approximately 4.5 times greater than densities in open areas. Similarly, relative densities of scallops in the Mid-Atlantic were about four times higher than in areas open to fishing (preliminary data from 2000 R/V survey) after only 27 months of closure.

Limited Reopening of Closed Areas in 1999

Partly as a result of information from cooperative studies, standard R/V surveys, and observer sea sampling, the New England Fishery Management Council voted to reopen a portion of Closed Area II south of 41° 30' N to limited scallop fishing. The reopening was subject to strict controls that included a total allowable catch of scallops (4,257 mt), a total allowable bycatch of yellowtail flounder (387 mt), individual vessel trip limits (4.54 mt/trip) , a restriction on the total number of trips per vessel (3 before Oct. 1; 3 after Oct, 1, 1999) , an intermediate decision date for authorization of additional trips (Oct. 1), a requirement for 8 inch (20.3 cm) mesh in the top panel of dredges to reduce yellowtail flounder bycatch, and a requirement that each trip, regardless of its duration, would use 10 of the 120 days-at-sea allotted to the vessel. Moreover, total scallop landings and yellowtail flounder bycatch were to be monitored on a daily basis. Under the plan, the area would be closed whenever the scallop landings or yellowtail flounder bycatch limits were attained. A 10 nm-wide "buffer" area around Area II was closed to improve enforcement of closed areas. The Council also specified a target level of 25% observer coverage for trips to the closed area.

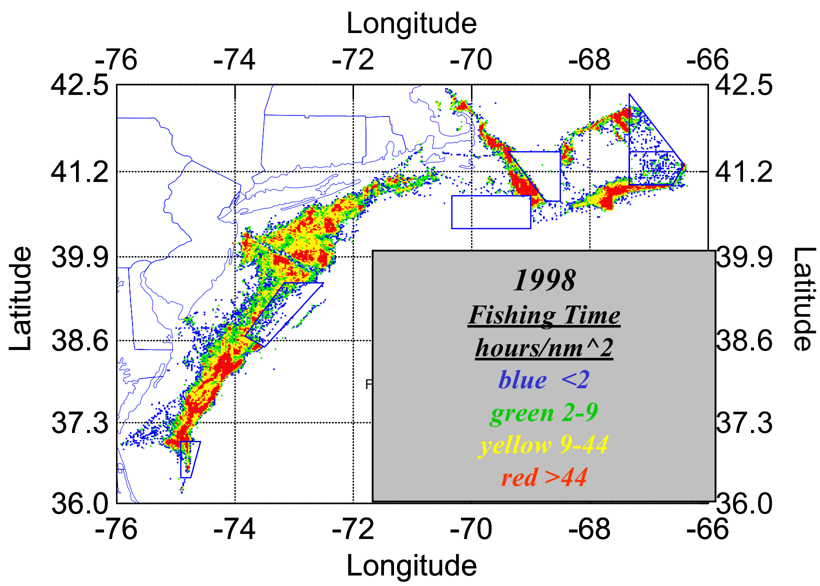
The real-time monitoring requirements for this management action were much greater than normal and would have been impossible to achieve without a vessel monitoring system (VMS). Beginning in May 1998, all full and part-time scallop vessels were required to have a VMS to track of days at sea usage. The VMS also allows the vessel to communicate via e-mail to a central site. Messages received at this site can then be routed to appropriate destinations. The vessel location is embedded in each transmission so it is possible to develop a general map of catch rates by location. Data forms were developed at the central site and distributed to all vessels; hence, the basic components of a real-time monitoring system were already in place. VMS position reports are logged and regularly loaded into a database— generating about 200,000 reports per month.

The limited fishery was closely monitored by observers and via electronic reporting of daily catches. Approximately 2,700 mt (meats) of scallops were landed from this area before closure based on attainment of the yellowtail bycatch limit. Approximately 23% of the vessel-days were covered by at-sea observers.

Table 1. Summary of hours of fishing activity and catches from Vessel Monitoring System data. Quartiles of fishing activity are based on distribution of total number of hours per 1 nm^3 grid for the 1998 and 1999 calendar years.

Year	Quartiles of Fishing Activity (hr) (Range) [mean]	Number of 1-nm sqr sub-areas in which fishing activity occurred	Total Effort—fishing activity (hr)	Total Catch (lb)**	Percent of Total Catch	Value of Catch ** (million $)
1998	(0.1-1.9) [1.0]	2,604	2,521	59,149	1	0.36
	(2-9.2) [4.4]	2,992	13,039	245,087	3	1.65
	(9.3 - 44) [23.9]	3,808	91,181	1,613,070	20	10.04
	(44.1-591) [103.3]	2,796	289,792	6,283,570	77	37.58
	Total	12,200	395,532	8,200,870	100	49.51
1999	(0.1-1.9) [1.0]	3,181	3,127	141,163	1	0.90
	(2-9.2) [4.1]	3,023	12,287	468,550	2	2.83
	(9.3 - 44) [22.5]	2,026	45,677	1,855,170	10	10.43
	(44.1-857.7) [119.4]	2,999	357,934	16,854,300	87	98.63
	Total	11,608	407,787	19,319,200	100	105.48
2000	(0.1-1.9) [0.9]	4,403	3,930	225,839	1	1.14
	(2-9.2) [4.2]	2,953	12,495	760,983	3	3.90
	(9.3 - 44) [23.6]	2,500	59,096	3,883,500	15	20.0
	(44.1-1,543) [104.9]	2,946	309,045	20,620,200	81	102.39
	Total	12,802	384,565	25,490,500	100	127.45

**total catch based on match of VMS data with landings records from commercial dealers. In 1999 the landings were about 91%. In 1998 the match was only 68% in part due to lack of VMS requirement until May 1998



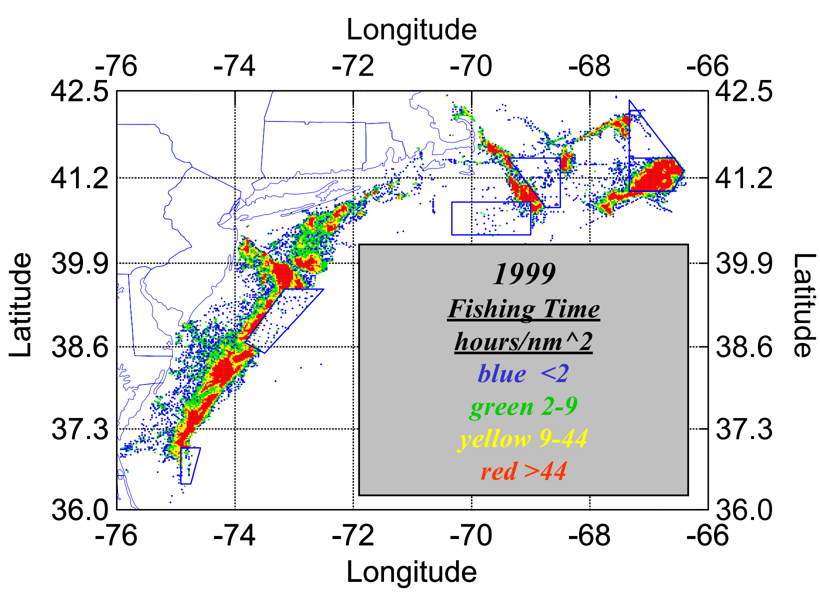


Fig. 1. Spatial distribution of fishing activity by sea scallop fleet in 1998 and 1999. Area II cooperative survey was conducted in 1998; Area I and Nantucket Lightship cooperative surveys were conducted in 1999. Area II was fished commercially in 1999.

Research Communications Unit
Northeast Fisheries Science Center
National Marine Fisheries Service, NOAA
166 Water St.
Woods Hole, MA 02543-1026

STANDARD
MAIL A

Publications and Reports of the Northeast Fisheries Science Center

The mission of NOAA's National Marine Fisheries Service (NMFS) is "stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and promotion of the health of their environment." As the research arm of the NMFS's Northeast Region, the Northeast Fisheries Science Center (NEFSC) supports the NMFS mission by "planning, developing, and managing multidisciplinary programs of basic and applied research to: 1) better understand the living marine resources (including marine mammals) of the Northwest Atlantic, and the environmental quality essential for their existence and continued productivity; and 2) describe and provide to management, industry, and the public, options for the utilization and conservation of living marine resources and maintenance of environmental quality which are consistent with national and regional goals and needs, and with international commitments." Results of NEFSC research are largely reported in primary scientific media (*e.g.*, anonymously-peer-reviewed scientific journals). However, to assist itself in providing data, information, and advice to its constituents, the NEFSC occasionally releases its results in its own media. Those media are in four categories:

NOAA Technical Memorandum NMFS-NE -- This series is issued irregularly. The series typically includes: data reports of long-term or large area studies; synthesis reports for major resources or habitats; annual reports of assessment or monitoring programs; documentary reports of oceanographic conditions or phenomena; manuals describing field and lab techniques; literature surveys of major resource or habitat topics; findings of task forces or working groups; summary reports of scientific or technical workshops; and indexed and/or annotated bibliographies. All issues receive internal scientific review and most issues receive technical and copy editing.

Northeast Fisheries Science Center Reference Document -- This series is issued irregularly. The series typically includes: data reports on field and lab observations or experiments; progress reports on continuing experiments, monitoring, and assessments; background papers for scientific or technical workshops; and simple bibliographies. Issues receive internal scientific review, but no technical or copy editing.

Fishermen's Report -- This information report is a quick-turnaround report on the distribution and relative abundance of commercial fisheries resources as derived from each of the NEFSC's periodic research vessel surveys of the Northeast's continental shelf. There is no scientific review, nor any technical or copy editing, of this report.

The Shark Tagger -- This newsletter is an annual summary of tagging and recapture data on large pelagic sharks as derived from the NMFS's Cooperative Shark Tagging Program; it also presents information on the biology (movement, growth, reproduction, etc.) of these sharks as subsequently derived from the tagging and recapture data. There is internal scientific review, but no technical or copy editing, of this newsletter.

OBTAINING A COPY: To obtain a copy of a *NOAA Technical Memorandum NMFS-NE* or a *Northeast Fisheries Science Center Reference Document*, or to subscribe to the *Fishermen's Report* or the *The Shark Tagger*, either contact the NEFSC Editorial Office (166 Water St., Woods Hole, MA 02543-1026; 508-495-2228) or consult the NEFSC webpage on "Reports and Publications" (*http://www.nefsc.nmfs.gov/nefsc/publications/*).

APPENDIX II

EFH Scoping Comments Summary and Response

Response to Comments

Public comments on the Amendment 13 Draft Supplemental Environmental Impact Statement (DSEIS) were accepted during a formal comment period, September 1 through October 15, 2003. Comments were accepted at public hearings or received at the Council offices by letter, email, or facsimile. The Council held a meeting October 21, 2003 to review the comments. The responses below are based on all comments received up to the date of that meeting. Comments, or revisions to comments, received after that date are not addressed. The Council, in consultation with NMFS, chose to provide to the public the analysis of the EFH alternatives for Amendment 13 as early as possible. The Council voted to submit the EFH DEIS (stand alone) for public comment at its March 2003 meeting. The Notice of Intent for the EFH EIS was published on April 4, 2003. The public comment period was ninety days from April 4 through July 2, 2003. The responses to those comments made earlier related to the EFH components of Amendment 13 are provided at the end of this document.

Numerous comments were received in support or opposition of various alternatives. Those comments are noted but are not addressed in the following discussion.

I. Purpose and need for action

1. The Council should not implement Amendment 13 because stocks are increasing under the current regulations.
Amendment 13 is required to bring the Northeast Multispecies FMP into compliance with the Magnuson-Stevens Act (M-S Act). While most (but not all) groundfish stocks are increasing in biomass, fishing mortality remains high and the rate of increase for many stocks does not comply with the rebuilding requirements of the M-S Act. Overfishing is occurring on eight groundfish stocks. Amendment 13 will reduce fishing mortality, end overfishing, and ensure that overfished stocks are rebuilt consistent with the requirements of the law.

2. The Amendment 13 process should be stopped for a variety of reasons - bad science, trawlgate, new biomass targets, no proven adverse impacts of fishing on essential fish habitat, etc.
The Council does not believe stopping the Amendment 13 process is a reasonable option. The Council is charged with developing a management plan that complies with applicable law. Under the terms of a court order in the matter of CLF v/ Evans et al., the NMFS must implement these regulations by May 1, 2004. In order to meet this date, the Council must submit the amendment in December, 2003.

Through the course of the development of this amendment, there has been considerable debate about the quality of the science uses as its foundation. As a result of this debate, an independent peer review was conducted in February, 2003. This review considered issues related to recent assessments, an error in the conduct of the trawl survey, and the new biomass targets. While the peer review provided numerous suggestions for improvement, the overall conclusion was that the scientific basis for the amendment was sound and should be used for management purposes.

Finally, any further delay in implementing rebuilding programs will not only delay benefits of rebuilding, but could result in the adoption of more severe restrictions in the future in order to accelerate the delayed rebuilding program

II. Proposed action

Status Determination Criteria

3. Language that establishes when overfishing is occurring should be revised to say that overfishing must be ended immediately.
The purpose of defining when overfishing occurs is to establish clear criteria for determining stock status. Action taken to end overfishing must be consistent with applicable law. There is no need to reiterate legal requirements in the status determination criteria.

4. The scientific basis for the newest biomass targets lacks factual basis grounded in observation and experience. The targets contradict the experience described by those fishing in the affected areas and the conclusions are extrapolated from data nearly three years old.
The basis for the new biomass targets is discussed in detail in NEFSC 2002a. Data used to develop the targets is from observations of stock size and recruitment over long time periods for most stocks. The experience of those fishing in the area is limited to observations of stock size during a period when it is known many stocks were subject to high fishing mortality rates. As a result, those observations may not accurately reflect the productive ability of the stocks.

5. Target fishing mortality rate for rebuilt stocks should be at a different level (other than 75 percent of F_{MSY}).
A 2002 review of reference points (NEFSC 2002a) did not include a review of appropriate target fishing mortality rates (as opposed to threshold fishing mortality rates). As a result, and in the absence of any detailed analysis, the Council relied on technical guidance (Restrepo et al 1999) to establish target fishing mortality rates. This issue will be reviewed in the future.

6. Review of Status Determination Criteria is planned too far into the future.
Status determination criteria will be reviewed in 2008. In order for any review to be useful, there must be sufficient time to collect additional information on stock dynamics at lower fishing mortality rates. Conducting a review prior to 2008 would mean that there would be little additional data that might influence the estimation of reference points. Without additional data, it is unlikely that a review would reach conclusions different than those in NEFSC 2002a.

Proposed Rebuilding Programs
In addition to the following, comments suggested combining the phased and adaptive rebuilding strategies. This approach was adopted by the Council and is discussed in the FSEIS.

7. The DSEIS needs a calculation of phased F approach for Amendment 9 targets.
The Council did not calculate rebuilding fishing mortality rates for any strategy designed to reach the Amendment 9 targets. In June 2002, the Regional Administrator advised the Council that those targets were no longer considered the best available science. As a result, the Council saw little utility in designing a rebuilding trajectory that could not be implemented.

8. The Council should adopt adopt mixed stock exception for GB cod, CC/GOM YTF, and SNE yellowtail flounder.
The "mixed stock exception" is a reference to the provisions of the National Standard guidelines that allow overfishing to continue on a stock if necessary to achieve optimum yield for other stocks in the fishery. Stringent conditions must be met in order to use this provision. The Council believes that the proposed management action meets the requirements of the M-S Act without using this mixed stock exception. As such, the proposed action is a preferred approach because it will rebuild all stock in a more rapid manner than would occur if overfishing were allowed to occur for an extended period on these other stocks.

II. Fishery Program Administration

Fishing Year

9. EPA favors a fishing year consistent with the calendar year, so as to be less confusing to fishermen and regulators, and minimize the lag time between collection and use of data.
The Council decided to maintain the current fishing year (beginning on May 1). Keeping the current fishing year simplifies implementation of the amendment since DAS do not have to be pro-rated. It is also familiar to both fishermen and regulators since it has been in place since 1994, matches the fishing year used in several other plans managed by the Council, and spreads the administrative burden of adjusting several management plans over a longer part of the year.

Periodic Adjustment Process

10. The MSMC should remain independent of the PDT.
As discussed in the amendment document, the MSMC is not currently independent of the PDT. Most members are identical. The idea that the MSMC is a wholly independent group is not supported by the actual membership or operation of the committee. It makes little sense to preserve this fiction in light of the reality that there are few analysts available with the tools, time, and knowledge of the fishery to perform the necessary work.

Special Access Programs

11. Expedited review of SAPs is likely to be unworkable.
Comment noted. Two procedures for implementing SAPs are included in the Amendment; one requires a framework while the other includes the expedited review. The Council believes an expedited process may facilitate targeting healthy stocks and achieving optimum yield from this fishery. If SAPs can only be approved through the framework adjustment process, it will likely cause delays in implementation.

12. US/CA SAP should not include access to the habitat area of particular concern (HAPC).
The US/CA SAP area has been revised and groundfishing will not be allowed in the cod HAPC.

Leasing of DAS

13. If DAS leasing is not allowed, it will help the recovery of groundfish because more DAS would be unused. Leasing should only be allowed to comparably sized vessels.
The proposed DAS leasing program places strict limits on leasing between vessels of different sizes. While it is true that the absence of a DAS leasing program may speed groundfish recovery because more DAS might be unused, it is also likely that the absence of such a program will increase the negative economic impacts on fishermen and communities. To not include a DAS leasing program may be contrary to M-S Act National Standards and the Regulatory Felxibility Act. The proposed action reduces the allocation of DAS, minimizing the likelihood that DAS leasing will result in the use of more DAS than the rebuilding programs can support.

VMS Requirements

14. EPA does not believe it is clear how vessels that are allowed to leave the fishery and stop submitting VMS reports will be monitored.
Vessels that wish to stop transmitting VMS reports will be required to obtain a letter of authorization from the NMFS Regional Administrator. This will identify those vessels that should not be fishing. This information will be provided to Coast Guard, NMFS, and state law enforcement agencies. These agencies routinely conduct at-sea patrols, monitor ports, and track landings received by dealers and will have a high probability of identifying vessels that are fishing illegally.

Reporting Requirements

15. Amendment 13 should improve data collection, monitoring, and enforcement systems. Improved data reporting is necessary; for example, it sill takes 18 months to obtain catch data after a fishing year is completed.

Amendment 13 includes improved dealer and vessel reporting measures, as well as a statement of intent for a desired level of observer coverage. It also includes additional monitoring requirements for several proposed special access programs. While the Council agrees that improved data reporting is important, and has adopted additional requirements to improve data collection, the claim that it takes 18 months to obtain catch data after a fishing year is not accurate. The lag between the end of the fishing year and the availability of catch data is typically about four months.

Hand Gear permits

16. The hand gear proposal should be a frameworkable item, and should be enlarged to include a "small gear" fishery.

The hand-gear permits are a "frameworkable" measure and the Council may consider changes to those permits in the future.

Miscellaneous Comments

17. Transit time should not be included as a DAS, unless it was included in the original DAS allocation.

For vessels with individual DAS permits, transit time was included in the original DAS allocations. For fleet DAS vessels, the original allocations were based on available time for fishing after mandatory blocks of time out of the fishery. In both instances, transit time was included in the calculation – DAS represent time away from port, not actual time spent fishing. At present, the only way to monitor fishing activity is by the time away from port. Actual time fishing cannot be monitored. DAS allocations continue to include transit time.

DAS Carryover

18. EPA does not support carrying over DAS from one fishing year to the next. Loss of such DAS would be useful as another method of DAS reduction.

The proposed action continues to allow carry-over of a limited number of DAS, though in the first year of the amendment all DAS carried over from fishing year 2003 become Category B DAS. Carry-over of DAS is viewed as a safety measure. Absent the allowance of a carry-over DAS, vessel owners are likely to rush to fish all their remaining DAS at the end of the fishing year, regardless of weather. This measures is required to comply with M-S Act National Standards.

III. Measures to Control Capacity

19. None of the capacity options will work, the Council should develop more options.

The Council selected two of the capacity alternatives considered (DAS transfer and the DAS reserve program). Should these measures prove ineffective, additional alternatives could be considered in the future.

20. There is no mention of credit for DAS for vessels that participated in experimental fisheries.

Amendment 13 includes a statement of Council intent that NMFS should consider adjusting DAS allocations for vessels that participated in experimental fisheries (section 3.5.1). This will need to be evaluated on an individual permit basis. Some vessels were required to use DAS in experimental fisheries; others may not have received reduced DAS because of participation in such fisheries.

21. The policy on cooperative research should be a qualification process, rather than a review process.
The policy has been revised so that it is not an appeal process. It was not possible to create a qualification process because many of the details of experimental fisheries are not included in available databases.

22. EPA does not believe the capacity alternatives will quickly reduce unused capacity. In addition, the FSEIS should consider other alternatives, such as a federal DAS buyout and the expiration of DAS allocations after a fixed time frame. It should also be emphasized that reduction of used DAS is more effective for recovery.
Many of the capacity alternatives were not designed to quickly reduce DAS. Reductions of DAS are disruptive to fishermen and communities, and some of the capacity alternatives were developed with the specific intent of gradually reducing the pool of DAS so that the negative impacts would be mitigated. The DAS reserve program, however, does rapidly reduce the number of allocated DAS. For example, the proposed action under this alternative immediately reduces allocated DAS from about 131,000 to about 68,000. By itself, however, this program is not intended to be a mortality control measure. It creates a pool of effective effort that can then be reduced as needed to control mortality without the complicating factor of a large number of unused DAS. The selected rebuilding alternative controls the use of these allocated DAS so that mortality will be reduced.

The Council is prohibited by law from lobbying Congress for funds, such as to support a proposal for a federal buyout of permits or DAS. Current regulations for buyout programs specify that the programs must be initiated by the industry, not the Council.

Establishing a future date when DAS expire would encourage the use of DAS at a time when rebuilding is necessary and is not considered a reasonable alternative for that reason.

IV. Measures to Achieve Rebuilding
Numerous comments supported various specific management measures. Those comments are noted, but are not addressed in this section. In addition, several comments suggested an alternative suite of management measures that was adopted by the Council. Those comments are addressed in the FSEIS.

Commercial Fishery
23. The Amendment 13 alternatives are drastic and out of proportion with the current stock condition.
The proposed actions, and alternatives not selected, are designed to meet the requirements of the M-S Act.

24. A multi-species approach must be used to recognize the dramatic rise in populations of some species.
Amendment 13 does use a multi-species approach for management measures. The measures apply across all species targeted in the groundfish fishery. Measures are also proposed that enable targeting of healthy stocks.

25. There are no measures included that will reduce discards.

There are numerous measures in the amendment that will reduce discards. These include gear changes (mesh size, number of gillnets, number of hooks, etc), reductions in fishing effort, incentives for developing fishing practices that target healthy stocks, seasonal closures that limit fishing on aggregations of fish, possession limits designed to minimize discards. These measures are described and analyzed in section 5.2.8.

26. The amendment should include incentives for using gear that minimize bycatch, and/or measures that reward responsible fishing practices.
The amendment does include measures that provide an incentive to use gear that minimizes bycatch:

- Special Access Programs (SAPs) can be authorized for to target healthy stocks using gear or techniques that minimize bycatch of stocks that need rebuilding programs.
- Category B DAS may be used to target healthy stocks, subject to strict limits on the catch of other stocks. While the details of these programs will be developed in a future action, they provide incentives to develop selective gear that will allow the use of these Category B DAS.
- Certified bycatch/exempted fisheries can be authorized to fish for non-groundfish species using selective gear that minimizes bycatch of groundfish species.

Recreational Fishery
27. EPA believes the landings of recreational fishers are incidental compared to commercial landings. Nevertheless, the proposed per person fish limit seems high, and limits for other species should be disclosed in the FSEIS.
Recreational landings are a significant part of total removals for some stocks, primarily GOM cod and SNE/MA winter flounder. In the case of GOM cod, recreational harvest has been as much as twenty percent of total removals. While the ten fish bag limit may seem high, in fact it is a significant reduction for party-charter vessels that did not have any bag limit prior to a court order in 2002. Per person limits are not specified for other species because the recreational landings are not considered significant. One exception in the future may be haddock, but current statistics do not support development of a possession limit for this species.

V. Measures to Minimize the Adverse Effects of Fishing on Essential Fish Habitat

28. Oppose all EFH measures until adverse impacts from fishing gear on EFH have been proven.
Adverse effects from fishing gear have been demonstrated in the Gear Effects Evaluation section and are documented in the Adverse Impacts Determination section. The following species (and life stages) have EFH that is moderately and or highly vulnerable to bottom-tending mobile gear:

Otter Trawls: American plaice (Juvenile (J), Adult (A)), Atlantic cod (J, A), Atlantic halibut (J, A), haddock (J, A), ocean pout (E, L, J, A), red hake (J, A), redfish (J, A), white hake (J), silver hake (J), winter flounder (A), witch flounder (J, A), yellowtail flounder (J, A), red crab (J, A), black sea bass (J, A), scup (J), tilefish (J, A), barndoor skate (J, A), clearnose skate (J, A), little skate (J, A), rosette skate (J, A), smooth skate (J, A), thorny skate (J, A), and winter skate (J, A).

Scallop Dredge (New Bedford style): American plaice (J, A), Atlantic cod (J, A), Atlantic halibut (J, A), haddock (J, A), ocean pout (E, L, J, A), red hake (J, A), redfish (J, A), white hake (J), silver hake (J), winter flounder (J, A), yellowtail flounder (J, A), black sea bass , (J, A), scup (J), barndoor skate (J, A), clearnose skate (J, A), little skate (J, A), rosette skate (J, A), smooth skate (J, A), thorny skate (J, A), and winter skate (J, A).

Hydraulic Clam Dredges: Atlantic cod (A), black sea bass (J, A), clearnose skate (J, A), little skate (J, A), ocean pout (E, L, J, A), red hake (J), rosette skate (J, A), scup (J), silver hake (J), winter flounder (A), winter skate (J, A), and yellowtail flounder (J, A).

According to 50 CFR 600.815, to the extent practicable, these adverse effects must be minimized. As such, the Council is proposing to implement Habitat Alternatives 2, 7 and 10b as described in the proposed measures section of the document.

29. DSEIS inadequate because of several reasons:

1. *Failure to include alternatives for the creation of habitat research areas and the designation of HAPC's (because the Omnibus Habitat Amendment is delayed)*
2. *Failure to include an area-based management system for the protection of sensitive habitats.*
3. *Failure to include an approach for focus protection on known sensitive groundfish EFH, with priority for overfished species.*
4. *Failure to include increased protections for Georges Bank juvenile cod EFH to improve recruitment success for the fishery.*
5. *Failure to avoid all known gravel or hard-bottom areas (a Habitat Technical Team scientific recommendation).*
6. *Failure to include alternatives designed specifically to protect deep-water corals.*
7. *Failure to avoid gravel or hard-bottom areas where biogenic structure is present or recovering (a Habitat Technical Team scientific recommendation).*

The consideration of HAPCs and DHRAs will be contained in the Omnibus Habitat Amendment (Amendment 14 to the Northeast Multispecies FMP). The notice of intent for the Amendment and the beginning of the scoping period for the Amendment will occur in January 2004.

A broad range of alternatives, largely based on suggestions generated during scoping for Amendment 13 in 2001, has been considered in Amendment 13. These include alternatives to protect vulnerable or sensitive EFH and EFH for species that are overfished or where overfishing is occurring. Alternatives considered contained up to approximately 15% and 35% of the known rocky bottom (bedrock and gravel) according to the low resolution, high spatial coverages in the Poppe et al. database. A goal of the upcoming Omnibus Amendment is to integrate and optimize the protection of EFH across all Council-managed species.

Within the 10 habitat alternatives that involve the use of closed areas to minimize adverse effects to EFH, all of these alternatives contain some EFH for juvenile cod. For example, total juvenile cod EFH protection ranges from 6.3% for Habitat Alternative 5a to 17.4% for Habitat Alternative 6 (see Table 143 in Section 5.3.8.3.1.3). The Council believes that this represents a wide range of closed area alternatives that would protect a sufficient amount of EFH for juvenile cod. The Council selected Habitat Alternative 10b, which will prohibit the use of mobile bottom tending gear in 2,811 square nautical miles, and contains 15.3% of the total juvenile cod EFH for the entire region. This amount of protection of juvenile cod EFH is on the higher end of the alternatives under consideration. It is important to note that the year-round groundfish mortality closed areas in FY2001 (the No Action habitat alternative) contain 22.9% of the juvenile cod EFH area, and these areas will continue to be closed as mortality closures, providing additional habitat benefits for EFH in those areas.

Because deep-water corals are not currently defined as EFH for any Council-managed species, the minimal overlap of the groundfish fishery with corals (which are predominantly found in deep water submarine canyons), and because this issue was not raised during scoping for Amendment

13, the Council did not consider alternatives to protect deep-water corals. However, the Council is currently considering alternatives to protect these corals under Amendment 2 to the Monkfish FMP as there is greater overlap with this fishery and the deep-water corals.

30. The FSEIS should explain why each habitat alternative was not selected.
The Council determined the practicability of each alternative under consideration in Amendment 13 and, as required by the SFA, has proposed to implement those that are practicable. Any alternative not selected for implementation has been deemed not practicable (see Practicability Analysis section).

31. The FSEIS should discuss why the extension of the WGOM was chosen for a habitat alternative. The advantages and disadvantages for habitat between 3a and 3b are not discussed.
The areas as proposed were intended to increase the amount of complex and, in most cases, gravel-cobble-boulder habitat included within the groundfish closed areas and protected from any adverse impacts associated with fishing activities. The original pros and cons list from the rationale behind Alternative 3 is provided below.

Pros: The alternative closed area boundaries would better protect certain types of habitat (gravel, cobble, boulder and other complex habitats) than the existing groundfish closed areas. Protection of these habitats could result in more overall fish production long-term due to protected healthy habitats. The proposed alternative closed area boundaries in Alternative 3 would result in smaller closed areas, increasing fishing opportunities near these areas.

Cons: If the current groundfish areas are retained and the habitat closed areas are layered on top and in addition to them, there will be a loss of fishing opportunities and resulting revenue over the short-term. As stand-alone closed areas, the habitat areas may not meet fishery management and conservation objectives (i.e., they would allow fishing to occur within the areas, albeit with reduced impact gears, thus the fishing mortality rate within the areas would not be zero).

The northern boundaries of Alternative 3a and 3b modified based on recommendations by the public and incorporates Jeffreys Ledge. The southern boundary of Alternative 3a include a shift of the WGOM closure boundary to the east to include a diversity of varied habitats while the southern boundaries of 3b were modified to include only the hard and rough bottom habitat Both of these modifications were based on high-resolution sediment mapping of the area.

32. For clarity, the titles of habitat alternative 3 and 4 should be different.
We will take this under advisement.

33. Suggestion that gear regulations are a better idea for habitat measures for this Amendment, and closed areas for habitat should be put off until the Omnibus.
The Council was required to look at a reasonable range of alternatives, which includes closed areas. It is not always practicable to modify gears used in the multispecies fishery so that their effect is more than minimal and less than temporary in nature as the fishery targets groundfish. As such, the Council is left with effort reductions and closed areas as tools for minimizing the potential adverse effects of fishing on EFH. The Council has chosen to implement measures that will reduce effort significantly and closed areas designed specifically to protect EFH in Amendment 13.

IV. Environmental Impacts of the Alternatives

<u>Biological Impacts</u>

34. Definition of recovery based on SSB is inappropriate.
For overfished stocks, the M-S Act defines recovery as achieving B_{MSY}. The amendment is consistent with the Act.

35. The draft FMP overemphasizes total biomass and ignores individual stock status.
This comment is unfounded. The amendment clearly identifies stock status for all individual stocks and estimates the impacts of the amendment on each individual stock.

36. The Council must end overfishing.
The proposed management plan will end overfishing on all stocks.

37. Do not believe that the conservation benefits from the interim measures have been accurately assessed and accounted.
Estimates of calendar year 2002 fishing mortality are included in the FSEIS and have been incorporated into the rebuilding strategy analysis for the proposed action.

38. There should be a more detailed explanation of why many stocks grow under the no-action fishing mortality rates.
Several comments questioned the stock increases projected to occur if the fishing mortality rates in 2001 are maintained. The amendment document is not the appropriate place for a review of the technical merits of the projection techniques. The projection methodology was peer-reviewed by Payne et al (2003) and found to be consistent with accepted practices. The methodology uses assumptions on recruitment that are consistent with those used to develop estimates of B_{MSY} and F_{MSY}. The methodology includes both deterministic and stochastic elements, reflecting variability in recruitment. For many groundfish stocks, fishing mortality rates have been reduced to levels low enough to allow the stocks to increase from current levels. These results should not be surprising when viewed in concert with recent trends in stock biomass – many of these same stocks have increased in size over the last few years at the observed fishing mortality rates. If these mortality rates are maintained, however, most stocks will not reach B_{MSY}. This is also reflected in the projections, which show the growth in most stocks leveling off well below the B_{MSY} level.

39. DSEIS does not adequately develop and analyze various rebuilding options: for example, it uses linear projections for index-based stocks.
The amendment document uses the best available science for developing and analyzing various rebuilding strategies. This includes the use of age-based projection models reviewed by Payne et al (2003) and found sufficient for use. The amendment includes a new projection methodology for stocks assessed using trawl survey indices. This approach was described in NEFSC 2002a and was also reviewed by Payne et al (2003). This is the only technique available for forecasting future stock size for index-based stocks. The limitations of this projection methodology are clearly described in the amendment.

40. White hake no action index projections appear to be in error.
The projections have been verified. The thrust of this comment is that the stock appears to be growing faster than the projections indicate will happen. This could be due to a number of reasons – for example, above average recruitment.

41. Hard TAC analysis is done incorrectly – made invalid assumptions on DAS use, does not reflect changes in fishing behavior that may occur.
The hard TAC measures were analyzed using two different analytic techniques: a closed area model and a trip limit model. The closed area model assumed DAS use consistent with a twenty

percent reduction in used DAS, which is consistent with the DAS use observed to date in fishing year 2003 and higher than DAS use observed in 2002 and is consistent with the DAS proposed under Alternatives 2, 3 and one version of Alternative 4. The trip limit model used various assumptions on DAS use, based on the different options for effort controls that were included in Alternative 3. These assumptions on DAS use were developed by the PDT and are believed appropriate. Additionally, the trip limit model attempts to estimate fisherman's behavioral changes in response to both the "derby" and discarding implications of hard TAC's. Fishermen are assumed to make decisions on when to end stop fishing for a species based on maximizing revenue. The behavioral response that is not captured is the potential for geographic fishing pattern changes in response to high discard rates.

42. FMP fails to account for decreasing fishing pressure on other stocks as stocks rebuild.
This comment is not clear. If the intent is that fishing pressure on some groundfish stocks will decrease as other stocks rebuild, this is an unsupported conclusion. Whether this will occur depends on the ability of fishermen to selectively target healthy stocks in a multispecies fishery. If the intent is that fishing pressure on other, non-groundfish stocks will decrease as vessels choose to target groundfish, this is also an unsupported conclusion. Given that fishing opportunities (DAS) will be lower under Amendment 13, the rebuilding of groundfish stocks may not attract effort away from less healthy fisheries. Indeed, some public comments expressed concern that the restrictions in this amendment will force effort into other fisheries.

43. Amendment 13 must adopt a requirement to minimize bycatch, including bycatch as a component of a hard TAC on total mortality.
The M-S Act requires that, to the extent practicable, bycatch be minimized. Amendment 13 includes management measures that comply with this requirement. Those measures are analyzed and described in section 5.2.8.

44. Gear use must be modified to minimize bycatch- number of gillnets, etc.
The proposed action includes changes to gear to minimize bycatch. There are reductions in the number of gillnets, controls on the number of hooks, and increases in mesh size.

45. Bycatch measures need to be analyzed and redone. Bycatch analysis is not sufficient. Bycatch analysis should use bycatch data from the 2002 fishing year, obtained through the observer program.
As discussed in section 5.2, the analysis of the impacts of measures on bycatch is hampered by a lack of data. Specific information is not available for determining the impact of each measure on bycatch, or for estimating the economic costs or benefits of measures selected to address bycatch. Measures are thus analyzed with respect to their relative impacts on bycatch compared to the No Action measures (measures in place in FY 2001).

The conversion of observer reports to estimates of total bycatch requires detailed analysis that is conducted as part of a formal assessment. For those stocks with formal assessments in 2003 (witch flounder, dogfish), recent observer reports were included in the assessment. For other stocks, this information will be incorporated during future assessments. Recent observer reports were used, however, to estimate bycatch resulting from special access programs.

Habitat Impacts
46. None of the habitat alternatives are relevant in light of new information from SMAST research. Furthermore, there is no big difference between the closed area habitat alternatives for any of the EFH metrics except sediment.

The SMAST data provide a snapshot of the bottom substrate types of a relatively small area on George's Bank and do not characterize the entire northeast shelf, which encompasses the spatial extent of the fishery. The data were considered and were determined not to impact the EFH vulnerability determinations for each species. Since several species were found to be vulnerable to bottom-tending mobile gear, habitat measures to minimize these potential adverse effects are necessary.

47. Commenter does not support EFH option 7 for herring gear. Furthermore, the document does not assess the impacts on the herring fishery if this measure was implemented. Another commented noted that it is unclear from the document why herring mid-water trawls and pots and traps were proposed for prohibition since they would have no or little effect on bottom habitat. The rational used to include these gears in this measure should be included in the FSEIS.
The prohibition of herring gear from the existing year-round groundfish closed areas was included for consideration by the Council because there is a large body of anecdotal evidence that midwater trawls can and are fished at times on the seafloor (bottom contact). Pots and traps were included to extend the list to all bottom-tending mobile AND static gear; in other words, any gear that contacts the bottom. The intent behind Alternative 7 was that, absent any specific habitat closures, the gears allowed in the groundfish closed areas (currently only limited by their ability to catch groundfish) would be reduced impact gears.

<u>Economic Impacts</u>
48. There must be a way to find more time to allow more in-depth and better-quality analysis of economic impacts.
Analysis in this amendment was constrained by the need to comply with a court-ordered deadline for implementing the amendment. Nevertheless, the economic impact analysis is far more detailed than that provided for other groundfish actions. The analysis includes both long-and short-term impacts, and analyzes impacts based on different groupings (vessels, ports, gears, etc.). It also includes input/output analyses of the impacts on coastal communities. (Sections 5.4)

49. The DSEIS fails to provide adequate discussion of benefits of ending overfishing.
The DSEIS clearly describes the biological (section 5.2) and economic (section 5.4) returns expected if target fishing mortality rates are achieved and overfishing is ended.

50. Economic impacts should consider displacement of effort into other fisheries.
The fishery impact statement includes a discussion of the impacts of displacement of groundfish vessels into other fisheries, and identifies those fisheries most likely to be affected. .

51. The DSEIS is flawed because it assumes the TAC for each species will be harvested each year.
There are two types of analyses in the DSEIS. When comparing rebuilding strategies (including the benefits of different rebuilding dates) over the long-term, the amendment assumes that each strategy is perfectly implemented and all fishing mortality rates are achieved – in essence, that the TAC (target or hard) is caught for every species. This approach is used to compare the potential benefits of alternative strategies. When estimating the short-term impacts on individual vessels and communities, however, no such assumption is made. The management measures are modeled to determine their impact on fishing mortality, and these realized estimates of mortality are used to estimate economic impacts. In many cases, the measures are predicted to reduce mortality below targeted levels; the TACs (hard or target) for each species are not likely to be harvested. These analyses reflect that difference.

52. The price model used in the amendment does not match the source paper; it should not be used because it is untested.
The primary purpose of the study summarized in the source paper was to develop recommendations on how to specify price models for groundfish. The price model used in the amendment follows these recommendations where they were definitive and used the findings as general guidance where recommendations were not definitive. The difficulties in predicting seafood prices is fully acknowledged in the DSEIS as are the potential limitations of the specific price models used in the economic analysis. Further, as noted in the DSEIS, the primary purpose of the long-term analysis was to compare rebuilding strategies over time. From this perspective, the price model was not used to accurately predict the price of cod or haddock in any given year. The price model was used to capture the price effects of different quantities supplied over time. As such, the fact that the predicted price of cod would be lower under one rebuilding alternative that produces higher cod landings as compared to a different rebuilding alternative means that an ordinal ranking between the two alternatives can be established.
There are questionable assumptions in the analysis of impacts on individual vessels.
The comment refers primarily to assumptions for vessel costs. Accurate cost data is difficult to obtain for the groundfish industry, and the available information typically lags real-world prices. The economic analyses in the document provide the ability to compare alternatives, not the ability to accurately forecast expected revenues. As long as the cost information is consistent across all alternatives, comparisons between the alternatives are still valid.

53. Analysis does not take into account skyrocketing costs of working waterfront.
The analysis focuses on the impacts of the proposed measures on harvester revenues. To the extent increased costs on the waterfront affect vessel profitability, they may be captured in the Regulatory Flexibility Analysis. With respect to comparing different alternatives, as long as consistent cost information is used, the relative benefits of the different alternatives can be compared.

54. The DSEIS does not account for vessel relocation.
The DSEIS did not account for vessel relocation. Groundfish permits/vessels frequently move from port to port, either because an owner sells the permit or relocates his business. There are no regulatory limits on this type of activity. Vessel relocations might affect the distributive economic impacts on states and ports. Additional analyses have been included in the FSEIS to characterize changes in homeports in recent years and the impacts of possible vessel relocations on Maine ports, since this comment was heard most often with respect to those vessels.

55. The DSEIS does not take into account the derby effects of fishing on prices.
The comment is accurate. There is no price model available that reflects or predicts changes in prices based on short-term variations in fishing. The price model is based on an annual average price. As such, it captures the impact on prices of an annual increase in landings, but does not capture seasonal variability that may result in part from regulatory actions.

56. There is no consideration of processing capacity in the economic analysis.
This comment is founded on an argument that the proposed measures will result in a drastic reduction in processing capacity in the industry due to reduced landings. As a result, the speculation is that as stocks rebuild, it will not be possible to process increased landings. This will reduce prices and lower the economic benefits of rebuilding. The comment is accurate in that the estimation of net benefits of the various rebuilding strategies does not explicitly account for changes in the numbers of harvestors or processors. It should be noted that landings are not expected to be less than those observed in the mid- to late- 1990's. Processing capacity, while reduced during this period, has been able to increase to handle the landings of more recent years.

The proposed rebuilding strategies should result in steadily increasing landings, at least until stocks are rebuilt to B_{MSY} levels. Once stocks are rebuilt, fishing mortality will be allowed to increase. This may result in catches that exceed available processing capacity in the short term. The price effects of this increase in landings are captured by the price model.

57. The FMP fails to account for lower fishing costs on rebuilt stocks.
This comment is not accurate. The long-term economic analysis explicitly accounts for the different costs between the different rebuilding alternatives. Some alternatives have lower costs (for example, due to the use of fewer DAS), which is reflected in their net benefit streams. In addition, the analysis explicitly assumes that catch rates will increase (further reducing fishing costs).

58. The short and long-term economic impacts analyses do not match.
The long-term economic impact analysis assumes that target fishing mortality rates are met for every stock, and the allowable catch from each stock is harvested. This approach was taken to facilitate the policy decision of what rebuilding strategy to follow. The short-term economic impacts analysis, however, does not make this same assumption. Impacts on vessel revenues are based on the mortality rates that are expected to be realized from the proposed measures. As a result of the different approach for the two analyses, they appear to conflict. Over the long-term, as the management measures are refined and ways are found to target healthy stocks, the realized economic impacts should more closely approach the long-term projections. The proposed action also has a closer link between the proposed measures and the designed strategy, so that these impacts are expected to more closely match realized impacts.

59. Dramatic distributional changes or infrastructure costs are not included in the figures for calculating net benefits.
The net benefit analysis does not attempt to identify distributional impacts. It is based on the aggregate impacts of the management plan. The calculation of net benefits takes a National accounting stance. Within this context the majority of distributive effects represent transfers of benefits and costs from one group to another and so have no effect on aggregate net benefit.

60. The No Action alternative analysis should include an increase in landings when stocks are rebuilt.
When comparing rebuilding strategies, the fishing mortality rates experienced in 2001 were used as the No Action fishing mortality rates. These rates were held constant through the rebuilding period to reflect that no changes were planned for the management plan under this alternative. It would hold landings of Georges Bank and Gulf of Maine haddock, and Georges Bank yellowtail and winter flounder – four stocks expected to rebuild under the No Action fishing mortality rates - lower than might be allowed in the future. By contrast, under all alternative rebuilding strategies, the fishing mortality rates were allowed to increase once a stock was rebuilt. The effect of this divergent treatment is that the economic returns of the No Action alternative may appear lower than would be realized if fishing mortality rates were allowed to increase on rebuilt stocks. However, note that the validity of the argument that stocks would rebuild under No Action hinges on the assumption that FY2001 fishing mortality rates (under FY2001 management measures and DAS allocations) would not increase. In fact, there were signs in FY2001 that effort was not stable, but was increasing. From 1997 to 1999 DAS use was relatively constant hovering around 50,000 DAS. DAS use increased in FY2000 to about 62,000 DAS and increased again in FY2001 to 64,000 DAS. FY2001 contained no provisions that would prevent DAS from continuing to climb as allocations exceeded 135,000 DAS. With few checks on effort, the assumption that FY2001 fishing mortality rates would remain constant is questionable. Under a scenario of increasing fishing mortality rates, the No Action landings and revenues would actually be higher

than predicted in the DSEIS in the short term but would be lower (perhaps much lower) over the longer term as biomass levels and the resulting landings would be lower.

61. The draft FMP overstates No Action and status quo economic impacts by failing to accurately reflect current biological status of the most depleted stocks and their response to likely fishing impacts under these alternatives. The DSEIS assumes average recruitment for al stocks, including Georges Bank cod, thus making the long-termeconomic benefits of doing nothing are more, and less risky, than will actually be the case.

First, as is clearly stated in the DSEIS, the economic analyses of all rebuilding strategies is intended to be used to compare strategies, not to precisely predict expected revenues. Second, economic benefits of all rebuilding strategies – including No Action and the status quo – are analyzed in the same manner. The first step is to estimate projected stock size and landing streams that will result from the specific fishing mortality rates selected for that strategy. For the stocks with age-based assessments, the landings streams are estimated using a projection model. This model was reviewed by Payne et al. (2003) and determined to be appropriately designed and structured for the purpose. The model does not, as is claimed, use average recruitment for all stocks. The projection model uses the appropriate recruitment assumptions for each stock consistent with NEFSC 2002a. In general, there are two broad forms of recruitment assumptions used in the projection model, though there are slight variations from stock to stock. These broad forms are an empirical distribution function and a stock-recruit relationship. The GB cod projection uses a stock-recruit function that estimates lower recruitment at low stock sizes. For both recruitment assumptions, the model includes both a deterministic and a stochastic element. Factors such as recruitment are varied during subsequent iterations of the model. The results provide a distribution of expected stock sizes and landing streams. For many stocks, the no action and status quo fishing mortality rates are low enough that some stock growth is expected to occur, though most stocks will not reach BMSY under these fishing mortality rates. This result should not be surprising, since many of these stocks – including GB cod – have shown some increase in stock size in recent years at current fishing mortality levels.

It is possible that realized stock growth may not match the projected stock growth for any number of reasons. Different levels of recruitment or changes in environmental conditions are just two of the factors that could slow or speed rebuilding. It should be noted that these variations could occur under any rebuilding strategy, not just the No Action and Status Quo alternatives. Nevertheless, the projection model represents the best available estimate of future stock growth under any rebuilding strategy. One way of comparing the risk between different approaches is by examining the uncertainty over the projected stock size in future years. These comparisons are included in section 5.2.1.8. Generally, they do show that there is increased uncertainty about future biomass levels under the No Action strategy.

The economic analysis uses the entire distribution of the landings streams to determine a likely economic return, capturing the differences in the uncertainty of the various rebuilding strategies. The analytic technique is explained in section 5.4.

62. DSEIS inappropriately analyzes hard TAC options. The detrimental economic impacts of hard TAC are overstated. The amendment does not analyze the Council's preferred alternative - prohibiting retention of a species once the TAC is caught. TAC analysis only looks at short-term impacts.

Both long term and short-term economic analyses are included in the FSEIS. The long-term impacts are based on successful implementation of a rebuilding strategy. Short-term impacts focus on changes in gross revenues and the impacts on coastal communities of those changes. All of the measures designed to achieve rebuilding (not just the hard TAC alternative) are analyzed for their short-term impacts. This is because it is difficult, if not impossible, to predict over the long-term how the changes in revenues will affect individual vessels.

With respect to economic analysis of the distributive impacts of the hard TAC option, no model exists that can simulate the impacts of allowing retention of one species after another has been caught. The amendment does analyze the biological and bycatch impacts of the retention prohibition option.

63. DSEIS used closed area model for hard TAC economic analysis.
Two tools were used to assess the economic impacts of hard TACs. The closed area model was used in an attempt to identify the distributive impacts of a hard TAC on fishing vessel gross revenues. The amendment clearly highlights the limitations of this approach. One of the most important limitations is that the model does not capture the interactions that may occur when two or more vessels fish on the same stock of fish. Any incentive to race for fish is lost in the closed area model. A second model was developed based on trip limit analysis that helps to capture these impacts.

64. DSEIS assumes that revenues from other species will not offset groundfish losses.
The purpose of the DSEIS is to analyze the impacts of the management measures on vessels fishing for groundfish. The DSEIS analyzes the impacts of the regulations of revenues obtained on trips that land groundfish, including revenues from other species. Because of reduced opportunities to fish for groundfish, these other revenues are also likely to decline. The impacts of the measures are also reported based on vessel dependency on groundfish. These analyses clearly show that those vessels that are dependent on groundfish for their revenues will suffer the largest losses, while those vessels that obtain revenue from other fisheries will not suffer as greatly. Finally, the amendment includes a fishery impact statement that describes the potential for vessels to enter other fisheries to supplement their income.

65. Given the uncertainty associated with forecasting economic impacts, according to the analysis it is difficult to conclude that any of the rebuilding alternatives generate significantly more economic benefits than the No Action.
Comment noted. The goal of the management plan, however, is not just the creation of economic benefits. Optimum yield, the stated goal of the M-S Act, is defined as that level of harvest that will return the greatest overall benefit to the nation. For overfished stocks, however, it is also defined as the level of yield consistent with rebuilding the stock.

66. Economic analysis does not account for behavioral or technological changes.
The closed area model attempts to capture some of the behavioral changes that will result from the imposition of new regulations. The model is limited, however, in that it relies heavily on past activity to forecast future responses. Technological changes are not incorporated into the model and are difficult to predict. Technological changes could impact the fishery in several possible ways. For example, increased efficiency could result in a need for fewer DAS to harvest the stocks, reducing the participation of many vessels. On the other hand, more selective gear might allow for targeting of healthy stocks that would allow more participation in the fishery. It is not possible to accurately forecast how these changes will impact future fishing activity.

67. Analysis should incorporate possibility that adaptive or phased approaches must account for the likelihood overfishing will occur if an alternative not adopting a hard TAC is selected.
This comment reflects an unsupported conclusion: that absent a hard TAC, any rebuilding strategy will not work.

68. The DSEIS assumptions on future changes to the lay system incorrect.
This comment refers to a discussion that notes that vessel owner may react to reduced revenues by changing the lay system used to pay crew. It is a reasonable expectation that business owners will attempt to reduce costs to remain profitable. The cost of labor is a significant part of any business activity. While it may be difficult to attract qualified labor at a lower crew share, this response is still a possible response of business owners.

69. Fixed cost numbers do not include depreciation, mortgage principal payments.
Depreciation is not an actual cost. Information is not available on mortgage principal payments. In order to characterize the impacts of different debt loads, the Regulatory Flexibility Analysis now includes estimates of profitability based on different levels of debt an inclusive proxy for mortgage payments (principal and interest) and depreciation.

70. Downeast Maine is omitted from regional impact analyses.
This comment is not accurate. Economic impacts on the downeast coastal communities are described in the input-output analysis of short-term coastal impacts. The comment may refer to the description of impacts on groundfish communities contained in the social impact analysis. Downeast Maine was not included because it is no longer has significant groundfish activity and the analysis focuses on groundfish ports that may be impacted most heavily by the proposed action.

71. The illegal and discriminatory impacts of Maine having a long steaming time is not documented in Amendment 13.
The physical distance of some ports from particular fishing grounds has always created a competitive disadvantage for vessels fishing from those ports, whether the vessel is homeported in Maine, New Jersey, or any other state. This amendment cannot change that simple geographic fact, though these problems have been exacerbated by the range of some stocks decreasing as stock size declined. Fishermen have reacted over the years by developing fisheries and markets that allow them to compete economically.

Steaming time was considered in initial allocation of DAS for vessels receiving an Individual Allocation, based originally on documented fishing time between 1988 and 1990. Vessels that spent more time at sea because they were farther from fishing grounds received a larger individual DAS allocation. Fleet DAS were based on the time allowed to fish after mandatory blocks out of the groundfish fishery were taken. All vessels could have chosen either DAS category; neither category has an illegal or discriminatory impact on any state or community.

<u>Social Impacts</u>
72. The cumulative impacts of all the regulations over time are not addressed in the analysis.
The cumulative impact analysis includes a qualitative review of the impacts of regulations over time. The AHE clearly discussed the cumulative impacts of the various management regulations and their influence fishermen and their communities.

73. SIA relies on economic data at too broad a scale to reveal impacts on most vulnerable communities.
The SIA uses available economic data aggregated at a level that provides meaningful information. In general, this information is only available down to the county level. At smaller organizational levels, much of the information is confidential and cannot be reported.

74. SIA emphasizes quantitative over qualitative analysis.

This complaint is unfounded. Many of the impacts discussed in the SIA are indeed qualititative in nature. For example, the impact of unrealistic trip limits on the attitudes of fishermen, the disruption caused by changes in DAS and seasonal closures – these are all discussed in a qualitative fashion.

75. Spatialized definitions of communities used in federal fisheries policy are vulnerable to critique in social science context.
Noted. The amendment complies with current guidance from the NMFS, which defines communities in a place-based context.

76. Amendment 13 does not emphasize the extent to which future small economic benefits accrue to small number of participants, as opposed to high costs to a large number of participants.
The amendment document clearly recognize that current participants in the fishery may not benefit from rebuilt stocks. It is not clear, however, how many participants will benefit from the rebuilding program.

77. Socio-economic impact of EFH portions of DSEIS are flawed – they do not recognize benefits of habitat protection.
The socio-economic impacts of the EFH portions of the DSEIS focused on the impacts of additional habitat closed areas. These areas were analyzed using a "no displacement" model – that is, effort is assumed not to be displaced into open areas. While this provides a means to compare different alternatives, it does not provide an absolute indication of the impacts that can be expected. The benefits of additional habitat protection have not been quantified and cannot be estimated.

Comments received on the DEIS for the Essential Fish Habitat Components of Amendment 13 to the Multispecies FMP (April 4 – July 2, 2003 Public Comment Period)

Process/Legal Comments

Comment: Having separate EFH DEIS is piecemeal and violated NEPA (1)
Response: This does not violate NEPA. NEPA allows for an iterative process of bringing information to the public, revising the information and then going back to the public. That's what was done in this situation. It is only piecemeal if separate decisions are being made. However, the selection of alternatives to minimize adverse effects of fishing on EFH will only be conducted once.

Comment: No EFH Assessment (1)
Response: The EFH Assessment is not required at the DEIS stage. It will be completed and included in the FEIS.

Comment: No public hearing on DEIS (1)
Response: The DEIS will receive public comment during the regular Amendment 13 public comment period currently scheduled for Fall 2003.

Comment: Not all alternatives provided during scoping are included in DEIS (3)
Response: The Council considered all alternatives provided during scoping and are included in the DEIS.

Comment: Range of alternatives is not sufficient (4)
Response: The EFH DEIS includes consideration of 22 distinct alternatives comprising 39 individual options. Following the guidance of the Gear Effects Workshop (NEREFHSC, 2002) and the NRC Report on the Effects of Trawling on Benthic Habitats (NRC, 2002), the alternatives include closed areas, gear modifications and effort controls. NMFS and the Council feel that this is more than a sufficient range of alternatives for minimizing adverse impacts of fishing on EFH.

Comment: There is a lack of alternatives beyond the closed area alternatives (2)
Response: The Council has considered 14 distinct alternatives comprising 18 different options that use tools other than closed areas to minimize adverse effects of fishing on EFH.

Comment: Need to continue the Joint Advisor process of identifying HAPCs (1)
Response: The process of identifying new HAPCs and considering fishing restrictions in new and existing HAPCs will occur during the upcoming EFH Omnibus Amendment scheduled to commence in the late Fall of 2003.

Comment: Council should abandon the DEIS and return to scoping (1)
Response: Due to the ongoing legal settlement agreements as a result of AOC v. Daley and CLF v. Daley, the timeline for implementation of Amendment 13 does not allow for the development of a new document. Further, the Council believes that the current Amendment 13 document comprises three years of ongoing public comment through which time the ideas, suggestions and reviews of goals, objectives and resulting management alternatives have been sufficiently vetted through the Council process.

Comment: Legal interpretation of the EFH/MSA requirements and EFH case law are provided (1)

Response: The Council believes that the guidance provided by NOAA GC on the Council's roles and responsibilities relative to the MSA and, specifically, the EFH Final Rule has been followed by the Council to the best of its ability. As such, the Council believes it has followed the guidance of legal counsel on developing and submitting a legally defensible DEIS.

Comment: Alternatives are overly broad (1)
Response: The Council feels that the breadth of alternatives is important in order to meet its NEPA requirements.

Comment: Include glossary and list of acronyms (1)
Response: The Council will take this suggestion under advisement and consider including a glossary and list of acronyms in subsequent documents.

Commenter's Positions
Three commenters said that Alternative 3A should be the preferred alternative. Additionally, one commenter suggested that Alternative 3A provides the greatest protection for SBNMS and that the overlap of Alt 3A with SBNMS as habitat research closed area. One commenter suggested that sunset provisions of habitat-closed areas should be no more than 5 years to study habitat values. Further, one commenter maintained that the Council should use closed areas to protect complex hard bottom (Response note: Several of the Habitat Closed Area Alternatives employ the protection of complex hard bottom as their primary design criteria). A mandatory Vessel Monitoring System was supported by one commenter. Rockhopper and roller gear restrictions in Alternative 8 were supported by one commenter. Additionally, a commenter supported expanding the list of gears prohibited in closed areas. Two commenters supported the selection of the No Action Alternative as preferred alternative (Response note: the No Action alternative does not meet the biological objectives of Amendment 13 and was only included in the analysis as a baseline with which to compare other alternatives). Two commenters suggested that area based management of the ocean must be addressed in an integrated manner (Response note: The Council agrees with the commenters on this topic but had to consider and implement alternatives to minimize adverse impacts to EFH as practicable to fulfill SFA requirements). One commenter suggested that measures to protect deep-water corals should be included in AM13.

Analysis Comments
A. EFH Analyses Comments

Comment: There are deficiencies in the alternatives analysis for environmental impacts (6)
Response: The Council believes that given the available information and resources the analysis of the alternatives is sufficient to meet the requirements of both NEPA and the SFA.

Comment: There are deficiencies in the alternatives analysis for socio-economic impacts (6)
Response: The Council believes that given the available information and resources the analysis of the alternatives is sufficient to meet the requirements of both NEPA and the SFA.

Comment: No discussion of the ramifications of a Alack of knowledge@ in decision-making (1)
Response: This topic will be better covered in the FEIS.

Comment: Should explain the rationale for preferring certain alternatives (1)
Response: This topic will be better covered in the FEIS.

Comment: Should provide a goal/purpose for each alternative (1)
Response: The goal/purpose of each alternative is clearly stated in the document and is covered in the Purpose and Need statement.

Comment: Should indicate amount of complex habitat protected by alternatives (1)
Response: This analysis is included in section 5.3.4.3.4 of the DSEIS.

Comment: Need a determination of what fishing is doing to the seabed and what it might do under various management alternatives (1)
Response: This analysis is included in the DSEIS in Sections 3.2 and 5.3 of the document.

Comment: Differences in closed area alternatives are indistinguishable when comparing amount of area closed (1)
Response: The habitat closed area alternatives under consideration range in area from 2,241 square nautical miles to 4, 038 square nautical miles. This information is included in Section 5.3.4.1.1 (table 68, column 1).

Comment: The sediment, guild, assemblage and species metrics should be discarded (4)
Response: The inclusion of these and other non-EFH metrics assist the Council in determining the indirect environmental effects of the alternatives as required in the EFH Final Rule and NEPA.

Comment: The only EFH-designated ten minute squares that are included in analyses are those based on survey data – thus, analyses exclude inshore areas.
Response: The Council determined after the DSEIS was submitted for public comment that this was a problem and resulted from the original conversion of the EFH database for use in a GIS. The Council is considering how best to rectify this problem. However, because it happened to the entire EFH database, the error is distributed throughout all the analyses of the closed areas and as such, because the inshore areas are not the focus of the closed area alternatives, it is still possible to understand the relative differences between alternatives.

Comment: None of the habitat closed area alternatives address impacts of non-groundfish gears on EFH of species that are not included in the Multi-Species FMP.
Response: Correct. This is not a requirement of the Multispecies FMP under the SFA.

Comment: Implications of proposed closures should be assessed across all mobile gears and all species and life stages whose EFH they affect.
Response: Implications of proposed closures are assessed across the gear types that have been determined to cause an adverse effect on species and life stage of EFH that are moderately or highly vulnerable to the effects of these gears. Adverse effect is defined in the EFH Final Rule as "…any impact that reduced the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of the actions."

Comment: Species and life stages identified as "adversely impacted" in Table 70 were used in analyses instead of those identified in vulnerability tables in Section 3.3.2.
Response: This is not true. The species and life stages listed in Table 70 are same ones identified in other tables.

Comment: Methods used to determine which species/life stages are adversely impacted by mobile gear are too subjective and results are not credible.
Response: These determinations are inferences based on available published information – evidence of a link between habitat alterations and resource productivity was not a criterion, only indications that habitat function or value (e.g., in providing shelter or food) would potentially be impaired by fishing effects.

Comment: Need to clarify that Table 70 only shows how much EFH occurs within the closed area alternatives, not the net change in gear impacts on EFH that would result from such closures.
Response: This will be clarified in the FEIS.

Comment: Need to total the EFH values for all species/life stages in each alternative in Table 70 since it is the aggregate value that is important.
Response: This has already been completed and will be included in the FEIS.

Comment: Sediment data are not sufficiently detailed (low spatial resolution) to support analyses of sediment composition within closed area alternatives.
Response: The data used from the Poppe et al. dataset are inaccurate at small scales, but represent best available information on sediments for whole region. Problems with data were recognized in analysis and conclusions drawn regarding the sediment composition of proposed closures.

Comment: Use of EFH – which already incorporates substrate – makes sediment analysis repetitive.
Response: Substrate features are not applied in EFH designations on a spatial basis.

Comment: Gravelly sand should not be included with gravel and bedrock as a component of hard bottom, i.e., as a substrate type that is vulnerable to mobile bottom-tending gear.
Response: This was determined by the EFH Technical Team as a substrate type of concern and is listed in the DEIS analyses as an important sediment type for comparative purposes.

Comment: Bedrock is the most important bottom type to protect, but none of the closed area options contain any significant amount of bedrock, except alternative 7.
Response: Bedrock is poorly represented in the sediment database because it is rare in offshore areas and poorly sampled.

Comment: More attention needs to be given to mud as a vulnerable bottom type.
Response: We agree that mud may be a habitat type that should be looked at in further depth. However, mud is not as vulnerable as gravel/rocky bottom. We will consider documenting the composition of the closed areas that are mud in the FEIS.

Comment: Gravel is also an important sediment type, but is defined in the DSEIS to include gravel (less important) and cobbles and boulders (more important). As such, the closed areas are not designed to protect most vulnerable substrates.
Response: This is an artifact of the Poppe et al. database, which constitutes the best scientific information available for the scale that the Council is developing closed area alternatives. Closed areas were not developed according to any systematic design criteria, but nevertheless can still meet habitat management objectives of A13.

Comment: Statement that Council adopts accepts and agrees with all conclusions reached by October 2001 workshop or with list of vulnerable species is incorrect.
Response: By approving the DEIS for submission to NMFS, the Council has agreed with the conclusions of the Workshop as outlined in the DEIS.

Comment: Analysis of biological and socio-economic impacts of non-closure alternatives (7-9) is incomplete and, in some cases (e.g., conclusions reached about where rock-hopper gear is used) is incorrect: much more effort was devoted to evaluating closed area alternatives.
Response: This will be improved for the FEIS.

B. Social and Economic Analyses Comments

Comment: Practicability analysis is deficient (6)
Response: The Council has received no official guidance from NMFS on implementing the practicability analysis requirement of the EFH Final Rule. This is the first document for which the Council has produced such an analysis. The practicability analysis has been drastically improved for the DSEIS related to the overall AM13 document.

Comment: Closed areas may displace effort into more sensitive areas so need better analysis of effort displacement (1)
Response: The current models available to predict effort shift by the fishery do not provide results on a high enough spatial resolution to be able to evaluate the net habitat impacts from habitats of low sensitivity to higher sensitivity and vice versa. Further, it is the hope of the Council that a comprehensive habitat sensitivity and recovery index can be developed in the Council's upcoming Omnibus Habitat Amendment.

Comment: Analyses are flawed (and useless) because they do not account for effort displacement and because they rely on a single year of data (2001) – a year when groundfish closed areas were in effect and revenue was low. Estimated costs of closing area are not reasonable.
Response: The analyses clearly state the limitations of using a no displacement model for effort. It is important to note that the no displacement model may over-estimate losses and does not account for revenue earned by the fishery from seeking product from other fisheries. Additionally, 2001 groundfishing revenues were the highest the fishery has posted in several years: 1999 - $70.0 million, 2000 – $85.9 million, 2001 - $102.2 million, 2002 - $92.8 million.

Comment: Community-based analysis is compromised by exclusion of ports in Mid-Atlantic region where scallop and clam dredge boats that would be shut out of proposed closed areas are based.
Response: The Mid-Atlantic communities were not excluded from the analyses. The analysis included all activity in all areas, including clam dredging.

Comment: Percent "groundfish" species in Table 119 that would be protected by each alternative are not defined and should only include species that are adversely affected by fishing (Table 70).
Response: This will be clarified for the FEIS.

Comment: Comparisons of habitat benefits (percent gains in EFH) are not equivalent to economic losses (percent loss in revenue compared to 2001): a 20% increase in EFH area is not balanced by a 20% loss in revenue.
Response: We agree and believe that the analyses do not equate these indicators directly (1:1).

Comment: What is the economic benefit of EFH protection?
Response: We do not have a quantitative method for estimating the economic benefit of EFH protection as we do not have a clear understanding of the link between EFH protection and resource productivity. We will be working on this issue in the upcoming Omnibus Amendment and hope to develop a deterministic model.

Comment: Level 3 analyses of revenue losses do not include lobster fishing trips made by boats that do not have federal permits.
Response: This is true for alternatives that have state-waters closures. Data on state-water lobster fishery activity on the fine scale used for analyses were not available.

Comment: Use of percent revenue losses obscures fact that absolute losses to overall fishery are greater than losses to groundfishery alone.
Response: The analysis was based on revenue changes for all fishery activity. Activity was not limited to groundfish.

C. Other Analyses Comments

Comment: Affected Environment section (Vol II) needs to include description of all affected fisheries in NE region, not just multi-species fishery.
Response: We will clarify this in the FEIS.

Comment: Some details in gear descriptions need to be corrected.
Response: As this is a draft document, all errors will be corrected for the FEIS where possible.

Comment: Summaries in gear effects tables (literature review) mis-represent conclusions of some studies.
Response: The EFH Technical Team reviewer was very careful to only report conclusions/methods of each study that were reported in the publication. However, the technical staff can check individual studies where there is a question.

Comment: Negative effects of fishing gears are qualitative and are not set in any quantitative context, without any mention of effects that were not seen.
Response: This is not true. Any effect that was tested for and found to be non-significant is reported in gear effects tables in the DSEIS.

Comment: Determinations of species and life stages with vulnerable EFH are not firmly grounded in scientific knowledge due to lack of evidence linking habitat alterations to changes in resource productivity.
Response: These determinations are inferences based on available published information – evidence of a link between habitat alterations and resource productivity was not a criterion, only indications that habitat function or value (e.g., in providing shelter or food) would potentially be impaired by fishing effects.

Comment: Identification of "potential" adverse effects in Section 3.3.2 are not relevant to EFH management objectives of MSA.
Response: We disagree. The EFH Final Rule makes it clear that EFH protection measures can be evaluated in terms of "potential" effects.

Comment: Discussion of same information (Section 3.3.2) in Amendment 10 makes it clear that ranks were assigned in a "risk-averse" manner (when uncertain, the higher rank was used): this approach is biased and produces misleading information.
Response: The Council believes that the use of a precautionary approach is justified in this situation

Comment: Some of the rationales cited in species vulnerability tables are flawed: some are not substantiated and others are based on incorrect assumptions or interpretations of published information.
Response: These were judgement calls by the EFH Technical Team given their areas of scientific expertise. Some of them may be incorrect and the conclusions are subject to further review.

Comment: Cumulative Impacts information presented is just summary and repetition of material presented elsewhere in the DEIS.
Response: The cumulative impact analysis is in its infancy. This is the first time the Council has prepared a cumulative impacts analysis. Absent any national guidelines for implementing this requirement under the SFA, the Council has developed an analysis that will meet the requirements and provide the Council with a tool for decision-making. It should be noted that this analysis has been drastically improved for the overall Amendment 13 document that is slated for public hear in September 2003.

Comment: Cumulative Impacts - Some issues that should be included are not, e.g., establishment of large habitat closures would make it less likely that other areas would be closed for groundfish or scallop management purposes or for closing inshore areas to protect EFH.
Response: We will be clarifying and improving the cumulative impacts section for the FEIS.

Scientific Comments

Comment: Closed areas were not designed properly (1)
Response: Specific design criteria (e.g., size, shape) were not used, but some closed areas were designed to maximize protection of EFH for a large number of species and others to protect more sensitive hard-bottom areas.

Comment: Need to better define the first pass hypothesis for fishing gear (1)
Response: This "hypothesis" was not applied to analyses or selection of closed areas. The assumption is that the level of disturbance diminishes by about 50% with each tow, but only in undisturbed areas and in a specific tow path. The guiding principle applied was that habitat function and value are reduced as fishing intensity throughout an area increases.

Comment: There is no scientific proof that young-of-year cod survival is improved with epibenthic growth on gravel substrate (1)
Response: It is unclear whether this is true, but there is enough evidence from research studies to infer that survival is potentially enhanced in gravel habitats with emergent epifauna.

Comment: Need to better define the term gravel and distinguish between pebbles and cobble/boulder (1)
Response: An improved description of sediment types will be included in the Amendment 13 DSEIS. However, the term gravel, as used in the USGS sediment database, includes cobble and boulder. They cannot be distinguished in the sediment maps/analysis.

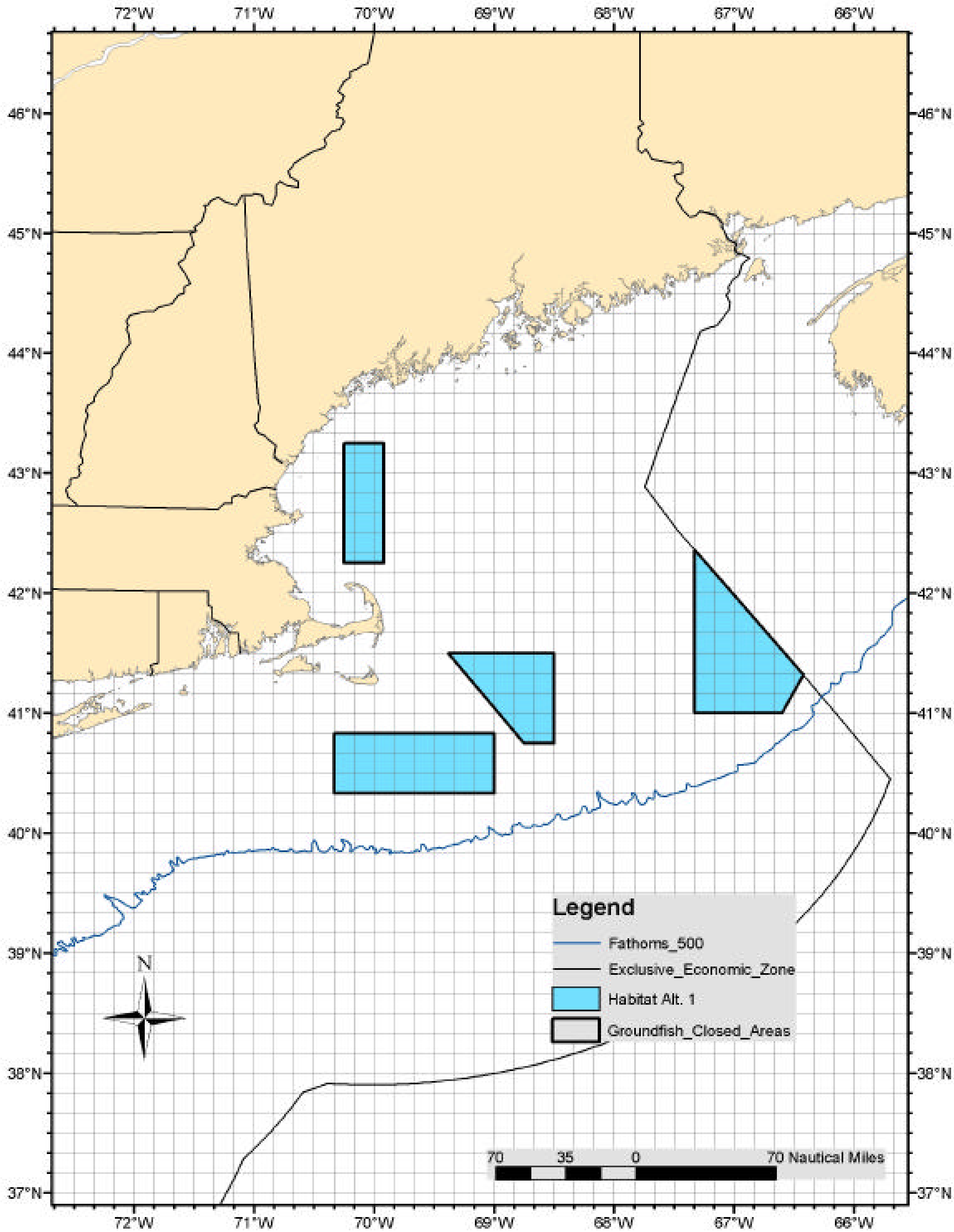
Comment: Discussion of closed area benefits is not based upon best scientific information available (1)
Response: The analysis of closed area benefits incorporated the best available scientific information available. However, a more thorough discussion of this scientific information will be included in the Amendment 13 DSEIS.

Comment: Concept of recovery is invoked without sufficient explanation of what it means.
Response: We agree that the definition of what is meant by habitat recovery should be explained more fully. This will be improved for the FEIS.

APPENDIX III

Maps And Coordinates For The Habitat Closed Area Alternatives

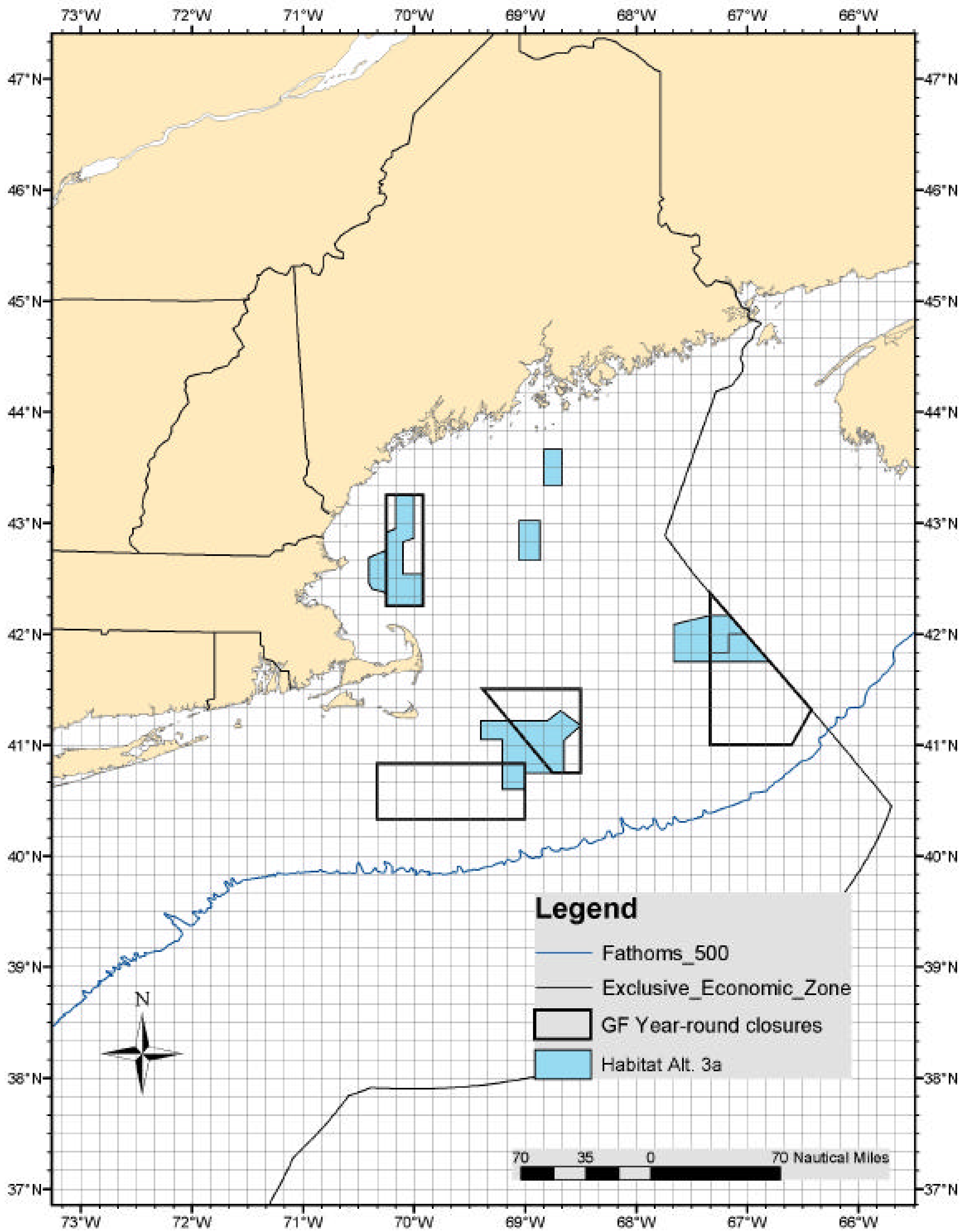
Shaded areas represent Habitat Alternative 1



Coordinates for Habitat Alternative 1

	LONGITUDE		LATITUDE	
	deg	**min**	**deg**	**min**
Closed Area I	69	22.8	41	30
	68	30	41	30
	68	30	40	45
	68	45	40	45
Closed Area II	67	19.5	42	21.7
	66	25.5	41	19.2
	66	36	41	0
	67	20	41	0
Nantucket Lightship	70	20	40	50
	69	0	40	50
	69	0	40	20
	70	20	40	20
WGOM	70	15	43	15
	69	55	43	15
	69	55	42	15
	70	15	42	15

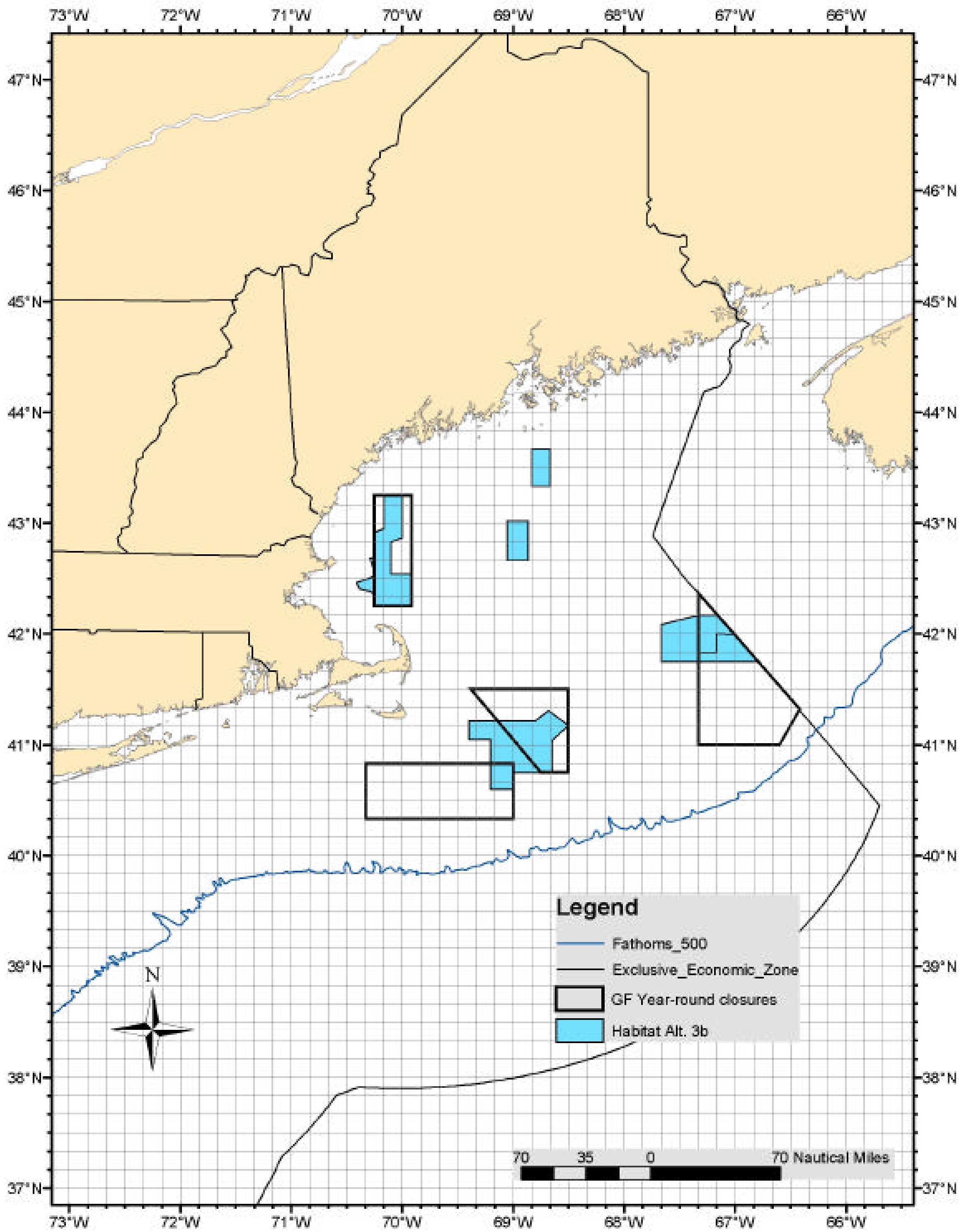
Shaded areas represent Habitat Alternative 3a. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 3a

	LONGITUDE			LATITUDE		
	deg	min	sec	deg	min	sec
Habitat Area I	69	24	0	41	13	0
	68	48	0	41	13	0
	68	41	0	41	18	30
	68	30	0	41	10	30
	68	39	0	41	2	30
	68	39	0	40	45	0
	69	0	0	40	36	0
	69	0	0	40	36	0
	69	12	30	40	36	0
	69	12	30	41	3	0
	69	24	0	41	3	0
Habitat Area II	67	40	0	42	5	0
	67	20	0	42	10	0
	67	9	35	42	10	0
	66	47	48	41	45	0
	67	40	0	41	45	0
Cashes Habitat	69	3	22	43	1	14
	68	51	56	43	1	14
	68	51	56	42	39	46
	69	3	22	42	39	46
Jeffrey's Habitat	68	50	0	43	40	0
	68	40	0	43	40	0
	68	40	0	43	20	0
	68	50	0	43	20	0
WGOM Alt. 1	70	10	0	43	15	0
	70	0	0	43	15	0
	70	0	0	42	52	0
	70	6	4	42	49	33
	70	6	4	42	32	30
	69	55	0	42	32	30
	69	55	0	42	15	0
	70	15	0	42	15	0
	70	15	0	42	20	27
	70	17	0	42	23	0
	70	23	0	42	24	18
	70	24	42	42	27	44
	70	24	42	42	41	18
	70	15	0	42	45	14
	70	15	0	42	55	0
	70	10	0	42	57	0

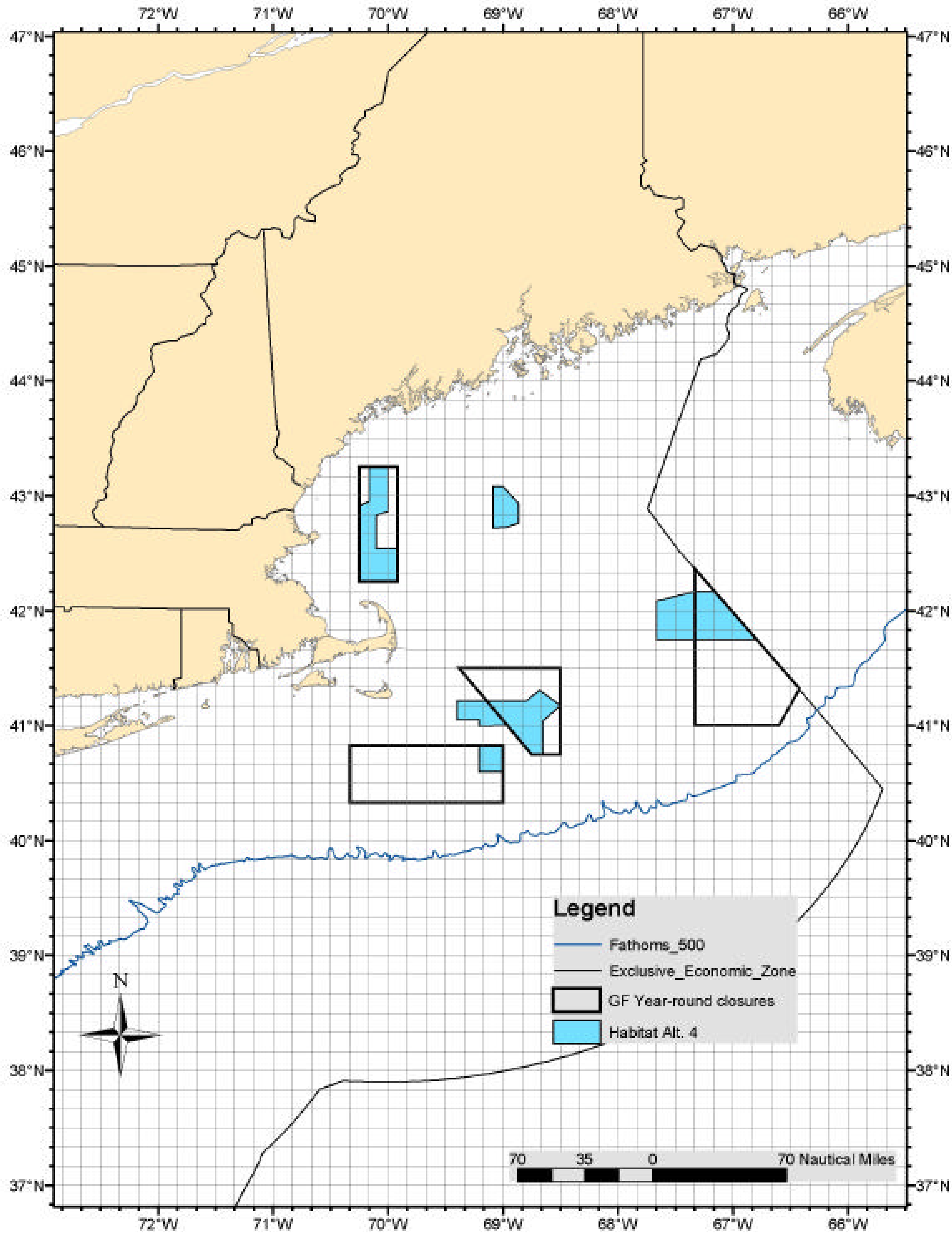
Shaded areas represent Habitat Alternative 3b. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 3b

	LONGITUDE			LATITUDE		
	deg	min	sec	deg	min	sec
Habitat Area I	69	24	0	41	13	0
	68	48	0	41	13	0
	68	41	0	41	18	30
	68	30	0	41	10	30
	68	39	0	41	2	30
	68	39	0	40	45	0
	69	0	0	40	36	0
	69	0	0	40	36	0
	69	12	30	40	36	0
	69	12	30	41	3	0
	69	24	0	41	3	0
Habitat Area II	67	40	0	42	5	0
	67	20	0	42	10	0
	67	9	35	42	10	0
	66	47	48	41	45	0
	67	40	0	41	45	0
Cashes Habitat	69	3	22	43	1	14
	68	51	56	43	1	14
	68	51	56	42	39	46
	69	3	22	42	39	46
Jeffrey's Habitat	68	50	0	43	40	0
	68	40	0	43	40	0
	68	40	0	43	20	0
	68	50	0	43	20	0
WGOM Alt. 2	70	0	0	43	15	0
	70	0	0	42	52	0
	70	6	4	42	49	33
	70	6	4	42	32	30
	69	55	0	42	32	30
	69	55	0	42	15	0
	70	15	0	42	15	0
	70	15	0	42	20	27
	70	17	0	42	23	0
	70	23	0	42	24	18
	70	24	42	42	27	44
	70	15	0	42	31	27
	70	15	0	42	33	50
	70	17	35	42	41	0
	70	15	0	42	41	35
	70	15	0	42	55	0
	70	10	0	42	57	0
	70	10	0	43	15	0

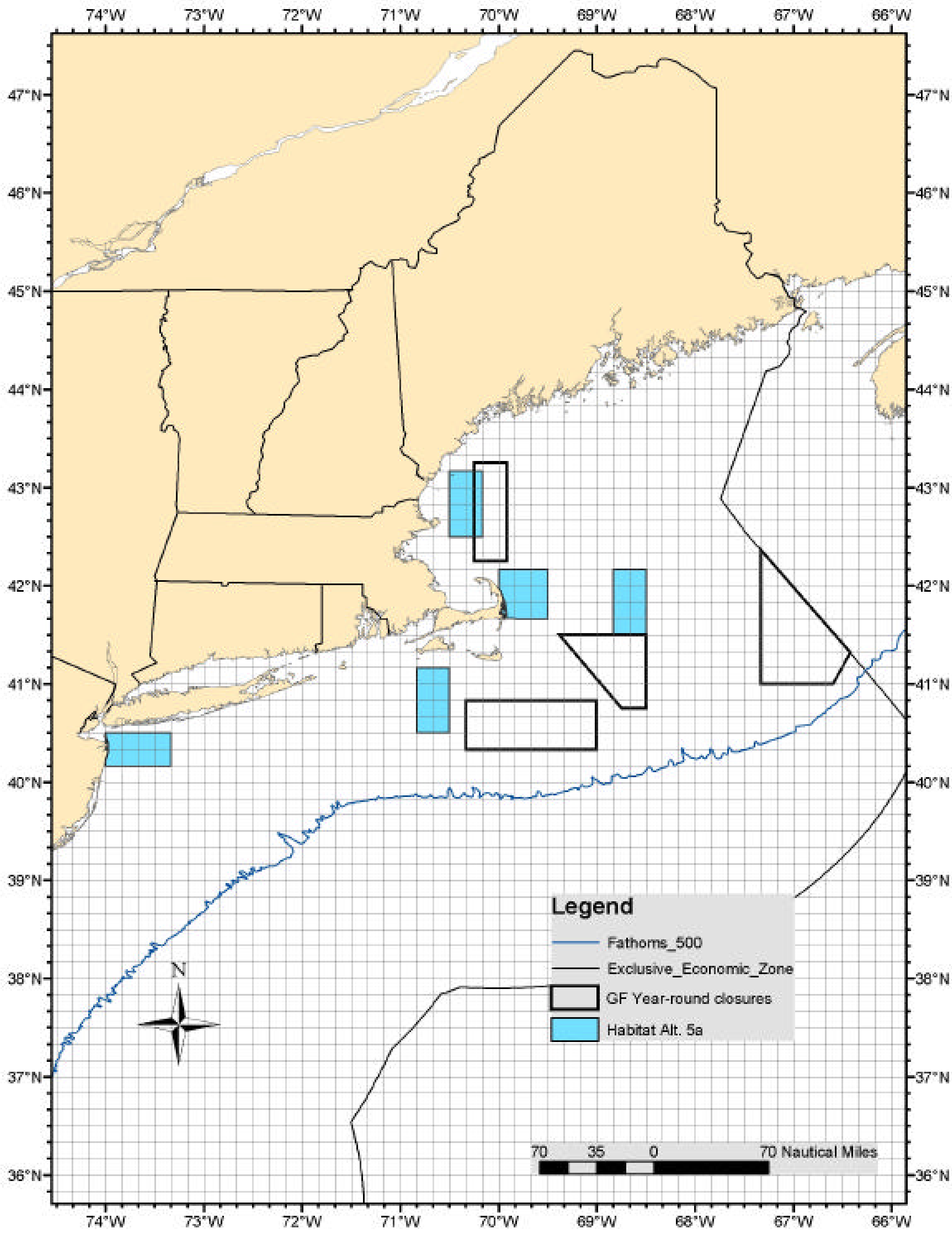
Shaded areas represent Habitat Alternative 4. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 4

	LONGITUDE		LATITUDE	
	deg	min	deg	min
GOM	70	9	43	15
	70	0	43	15
	70	0	42	51
	70	6	42	49
	70	6	42	32
	69	54	42	32
	69	54	42	15
	70	15	42	15
	70	15	42	20
	70	15	42	54
	70	10	42	57
CAI	69	24	41	13
	68	47	41	13
	68	40	41	18
	68	30	41	10
	68	39	41	2
	68	39	40	45
	68	45	40	45
	68	57	41	0
	69	12	41	0
	69	12	41	2
	69	24	41	2
CAII	67	40	42	4
	67	20	42	10
	67	9	42	10
	66	47	41	45
	67	40	41	45
Nantucket	69	0	40	50
	69	0	40	36
	69	12	40	36
	69	12	40	50
Cashes	69	5.8	43	4.4
	68	59.5	43	4.4
	68	51.5	42	55.6
	68	51.5	42	45.6
	68	58.3	42	43.3
	69	5.8	42	43.1

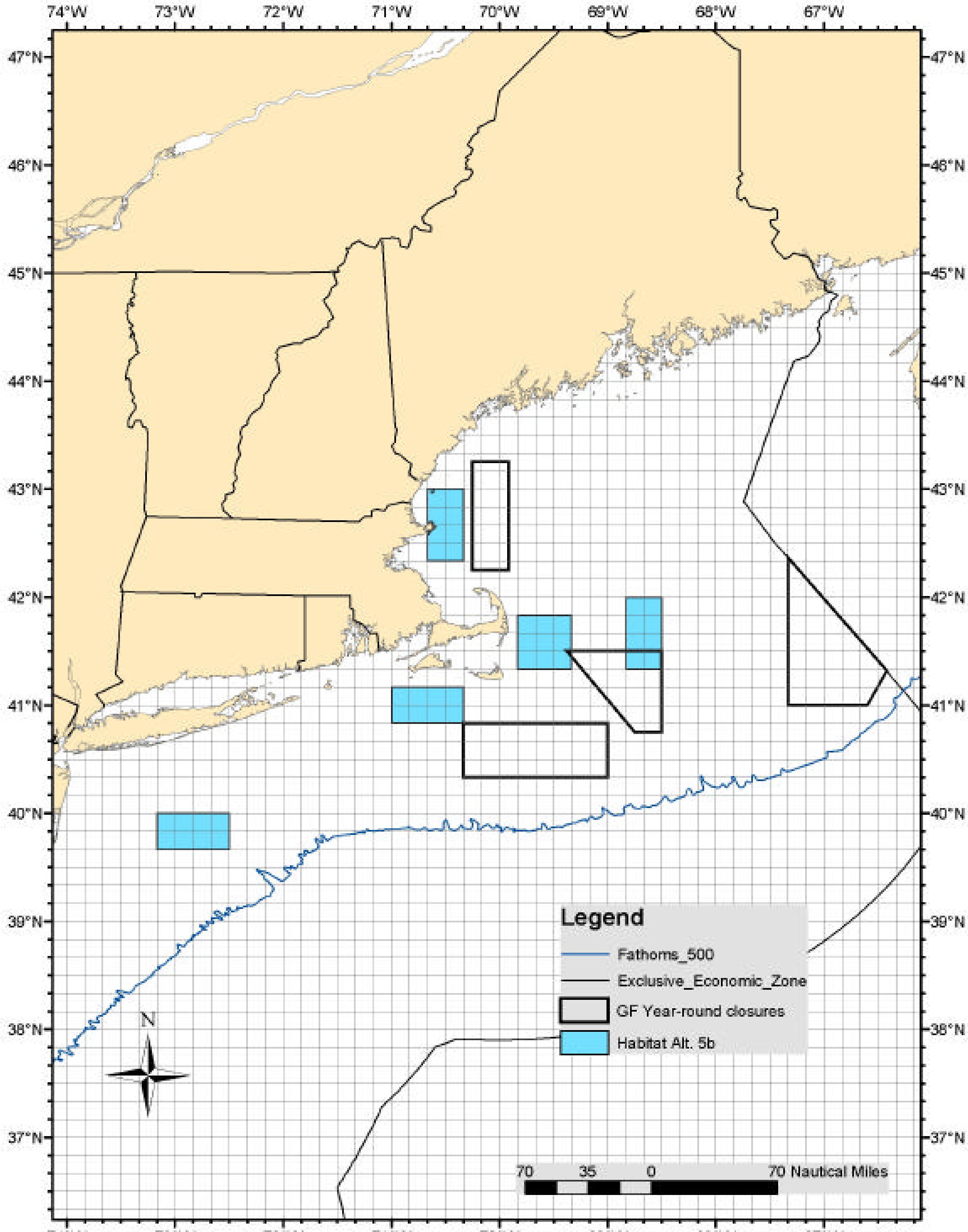
Shaded areas represent Habitat Alternative 5a. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 5a

		LATITUDE		LONGITUDE	
		deg	min	deg	min
GB					
	NW	42	10	-68	50
	NE	42	10	-68	30
	SE	41	30	-68	30
	SW	41	30	-68	50
GOM					
	NW	43	10	-70	30
	NE	43	10	-70	10
	SE	42	30	-70	10
	SW	42	30	-70	30
GSC					
	NW	42	10	-70	0
	NE	42	10	-69	30
	SE	41	40	-69	30
	SW	41	40	-70	0
MA					
	NW	40	30	-74	0
	NE	40	30	-73	20
	SE	40	10	-73	20
	SW	40	10	-74	0
SNE					
	NW	41	10	-70	50
	NE	41	10	-70	30
	SE	40	30	-70	30
	SW	40	30	-70	50

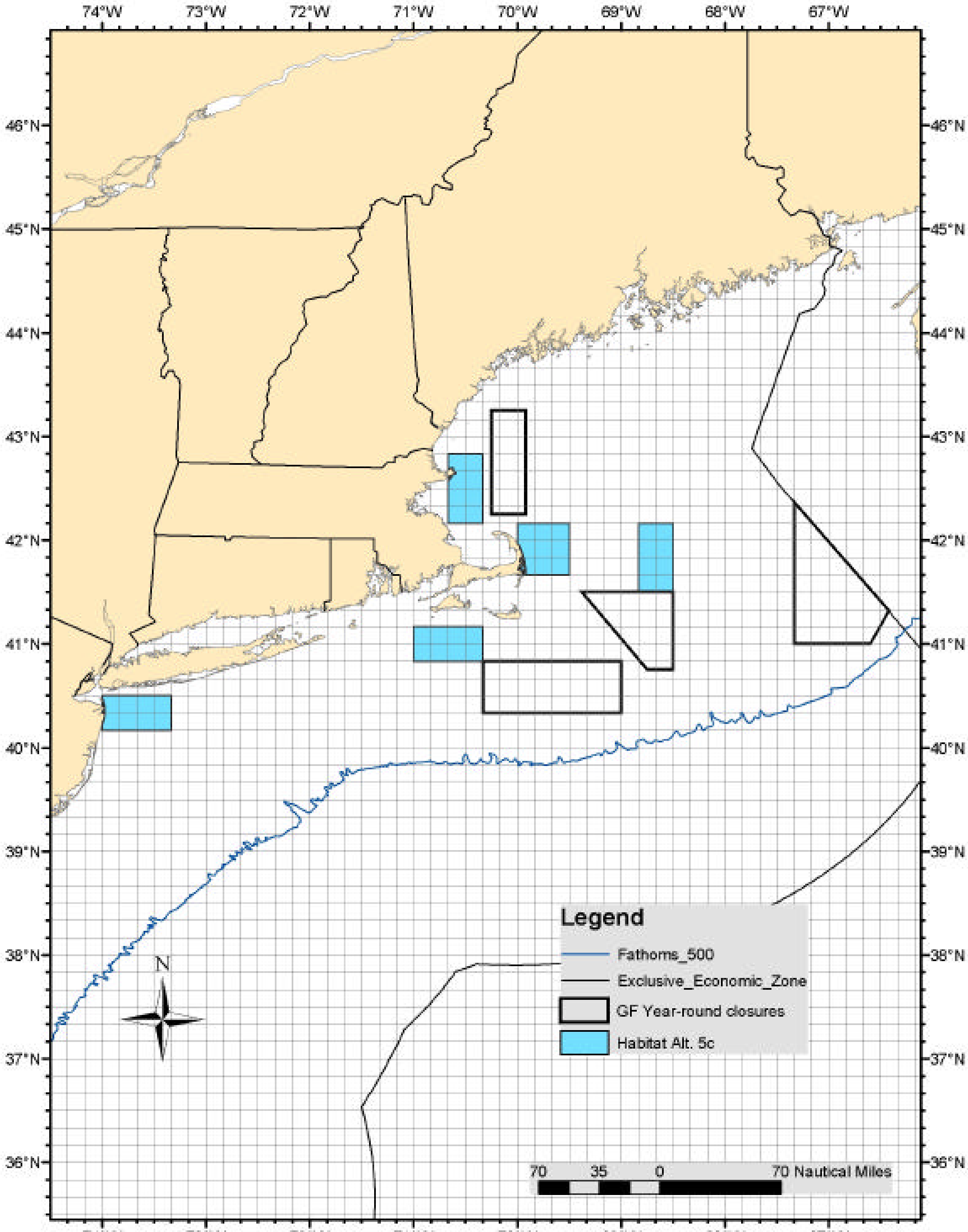
Shaded areas represent Habitat Alternative 5b. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 5b

		LATITUDE		LONGITUDE	
		deg	min	deg	min
GB					
	NW	42	0	-68	50
	NE	42	0	-68	30
	SE	41	20	-68	30
	SW	41	20	-68	50
GOM					
	NW	43	0	-70	40
	NE	43	0	-70	20
	SE	42	20	-70	20
	SW	42	20	-70	40
GSC					
	NW	41	50	-69	50
	NE	41	50	-69	20
	SE	41	20	-69	20
	SW	41	20	-69	50
MA					
	NW	40	0	-73	10
	NE	40	0	-72	30
	SE	39	40	-72	30
	SW	39	40	-73	10
SNE					
	NW	41	10	-71	0
	NE	41	10	-70	20
	SE	40	50	-70	20
	SW	40	50	-71	0

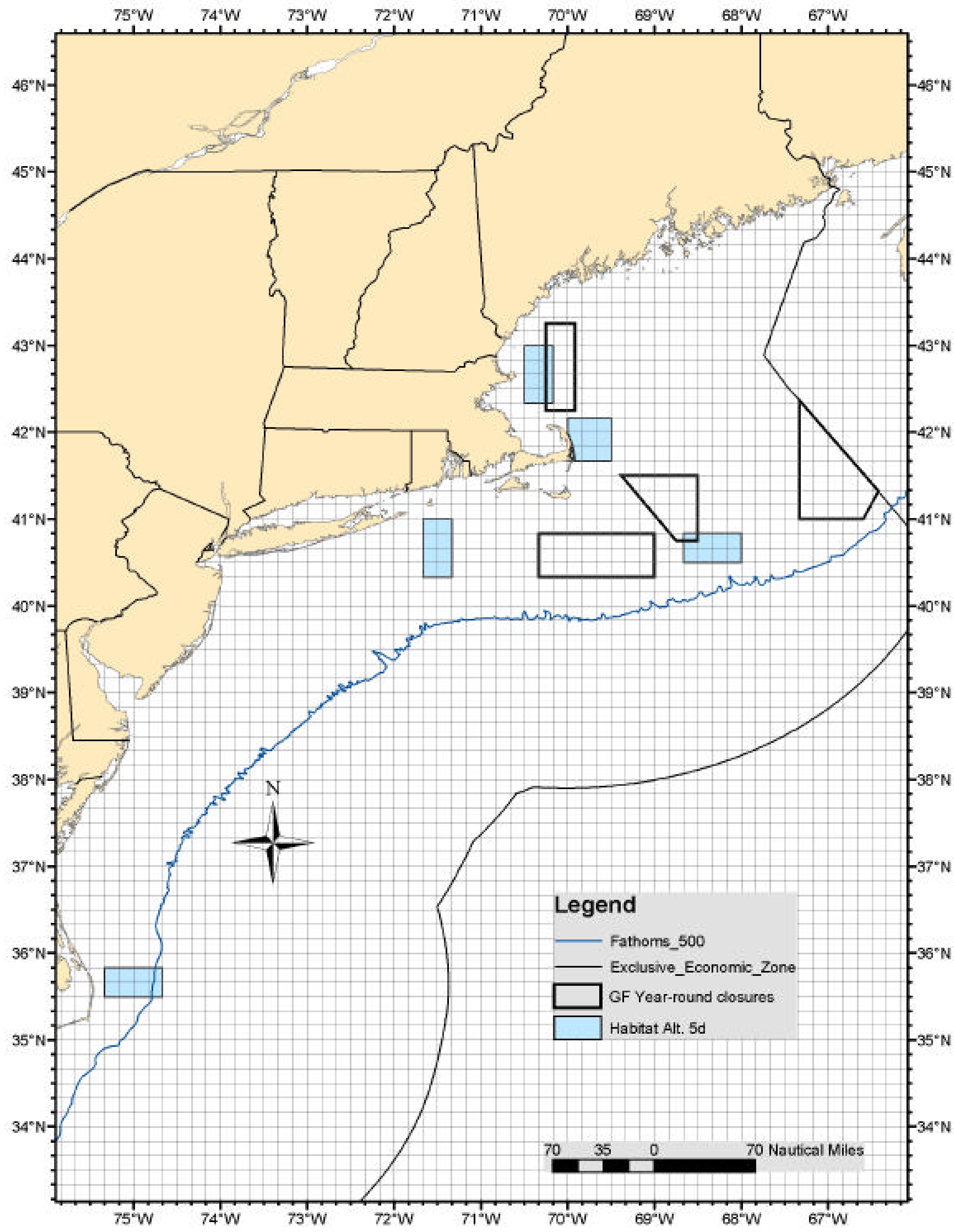
Shaded areas represent Habitat Alternative 5c. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 5c

		LATITUDE		LONGITUDE	
		deg	min	deg	min
GB					
	NW	42	10	-68	50
	NE	42	10	-68	30
	SE	41	30	-68	30
	SW	41	30	-68	50
GOM					
	NW	42	50	-70	40
	NE	42	50	-70	20
	SE	42	10	-70	20
	SW	42	10	-70	40
GSC					
	NW	42	10	-70	0
	NE	42	10	-69	30
	SE	41	40	-69	30
	SW	41	40	-70	0
MA					
	NW	40	30	-74	0
	NE	40	30	-73	20
	SE	40	10	-73	20
	SW	40	10	-74	0
SNE					
	NW	41	10	-71	0
	NE	41	10	-70	20
	SE	40	50	-70	20
	SW	40	50	-71	0

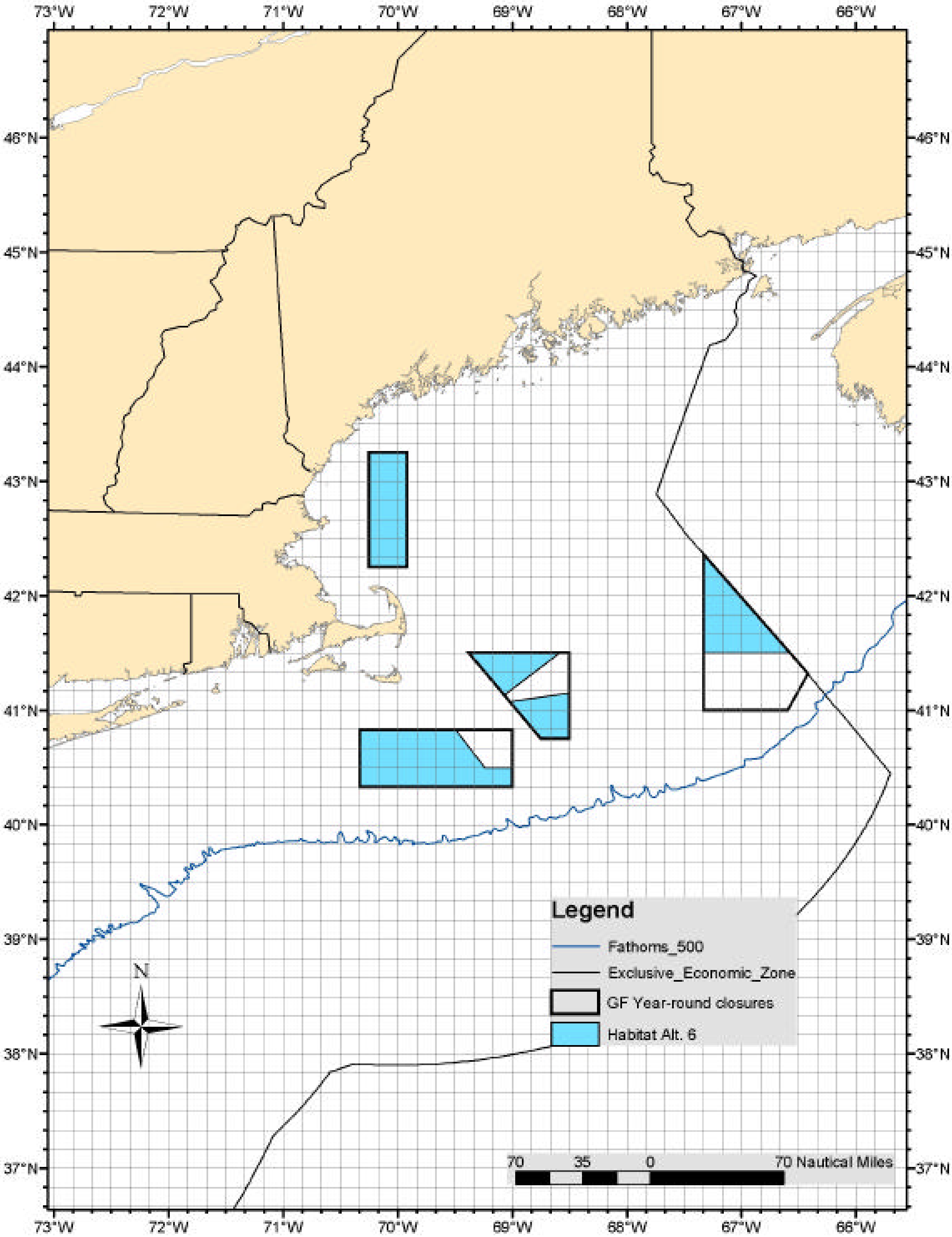
Shaded areas represent Habitat Alternative 5d. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 5d

		LATITUDE		LONGITUDE	
		deg	min	deg	min
GB					
	NW	40	50	-68	40
	NE	40	50	-68	0
	SE	40	30	-68	0
	SW	40	30	-69	40
GOM					
	NW	43	0	-70	30
	NE	43	0	-70	10
	SE	42	20	-70	10
	SW	42	20	-70	30
GSC					
	NW	42	10	-70	0
	NE	42	10	-69	30
	SE	41	40	-69	30
	SW	41	40	-70	0
MA					
	NW	35	50	-75	20
	NE	35	50	-74	40
	SE	35	30	-74	40
	SW	35	30	-75	20
SNE					
	NW	41	0	-71	40
	NE	41	0	-71	20
	SE	40	20	-71	20
	SW	40	20	-71	40

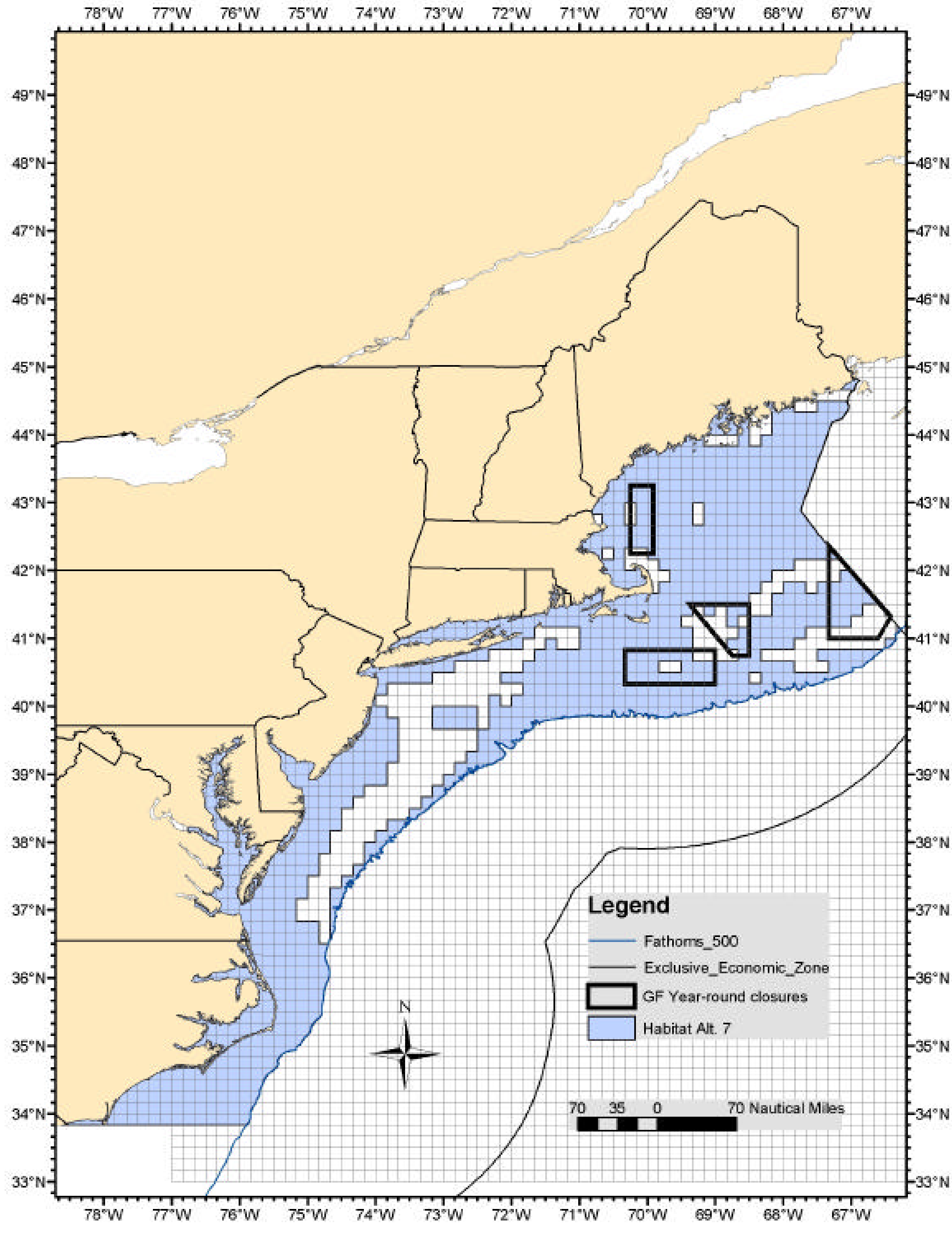
Shaded areas represent Habitat Alternative 6. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 6

	LONGITUDE		LATITUDE	
	deg	min	deg	min
CAI	69	1.2	41	4.5
	68	30	41	9
	68	30	40	45
	68	45	40	45
	69	23	41	30
	68	35	41	30
	69	4.3	41	8
CAII	67	20	42	22
	66	34.8	41	30
	67	20	41	30
Nantucket Lightship	69	0	40	20
	69	0	40	30
	69	14.5	40	30
	69	29.5	40	50
	70	20	40	20
	72	20	40	50
WGOM	69	55	42	15
	69	55	43	15
	70	15	43	15
	70	15	42	15

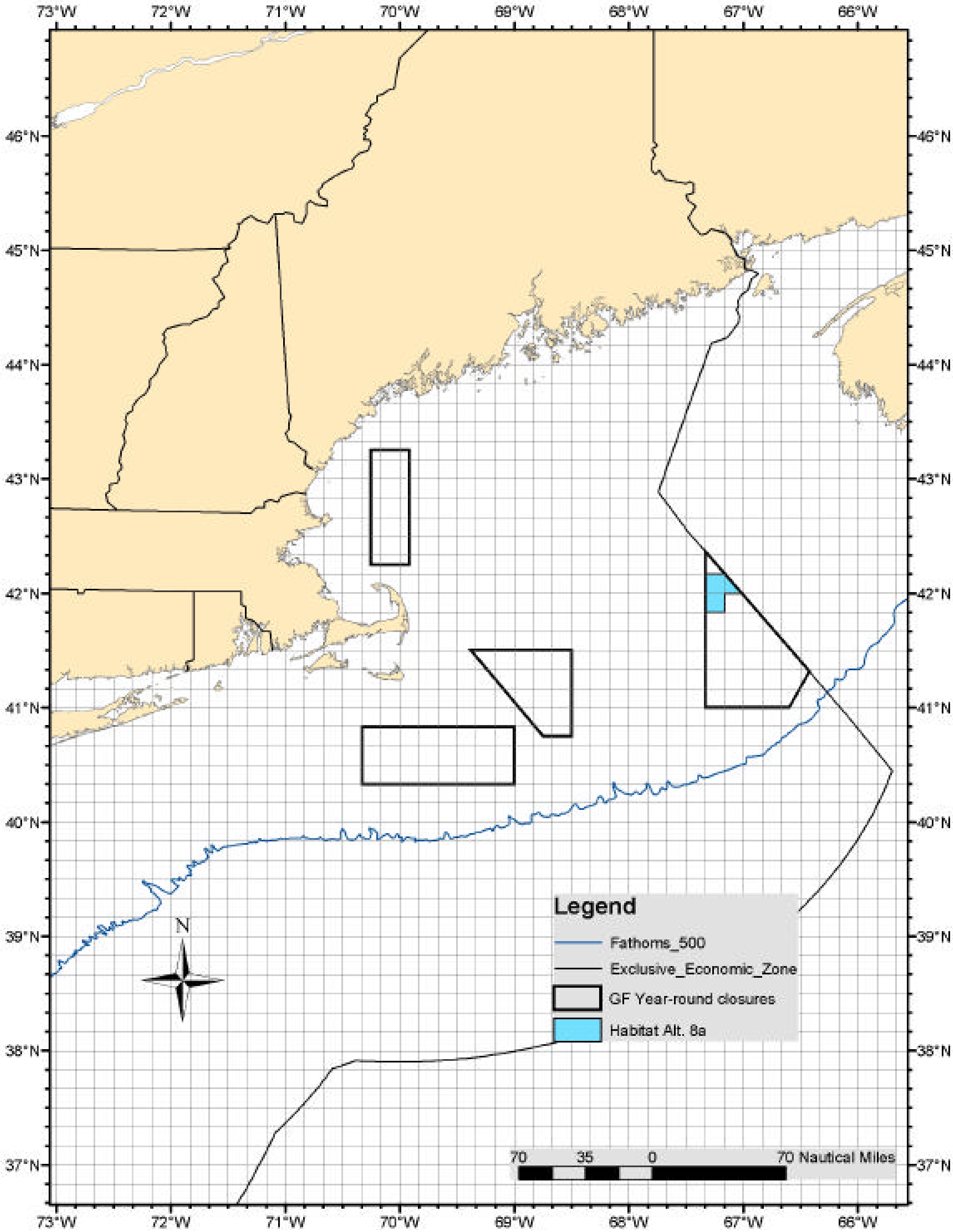
Shaded areas represent Habitat Alternative 7. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 7

"Not Applicable"

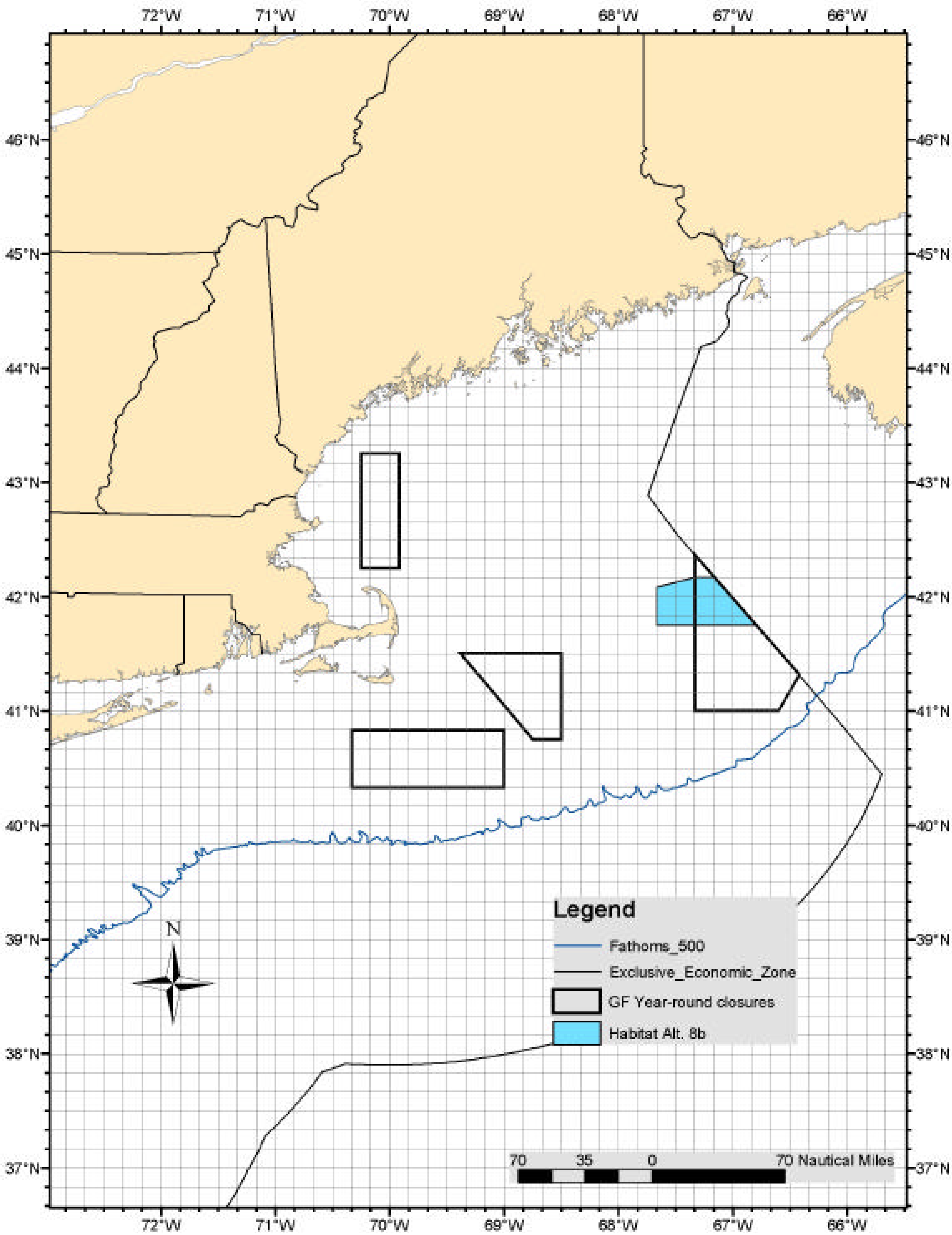
Shaded areas represent Habitat Alternative 8a. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 8a

LONGITUDE		LATITUDE	
deg	min	deg	min
67	20	42	10
67	9.3	42	10
67	0.5	42	0
67	10	42	0
67	10	41	50
67	20	41	50

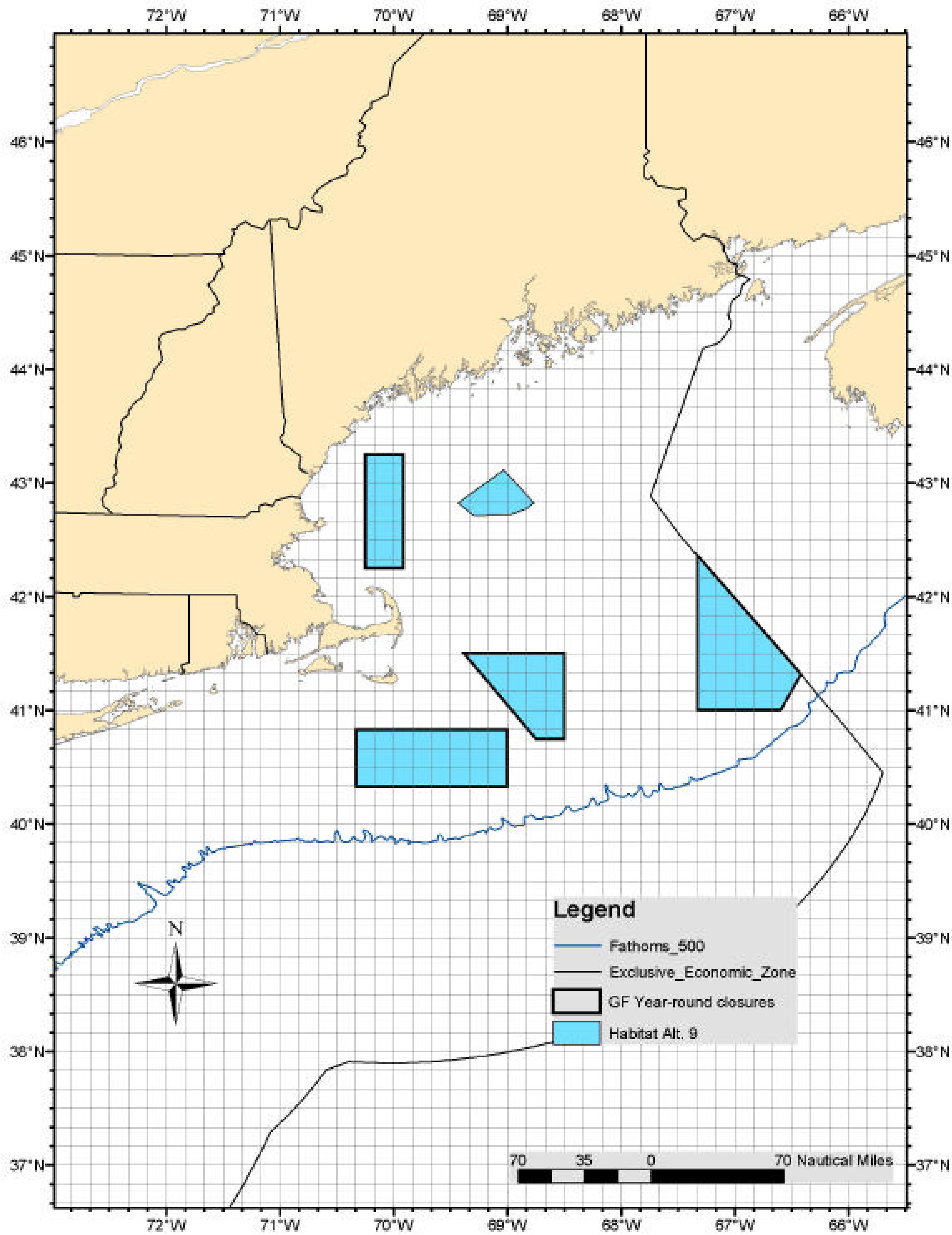
Shaded areas represent Habitat Alternative 8b. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 8b

LONGITUDE		LATITUDE	
deg	min	deg	min
67	40	42	5
67	20	42	10
67	10	42	10
66	48	41	45
67	40	41	45

Shaded areas represent Habitat Alternative 9. Note No Action Groundfish Closed areas are included for reference.



Coordinates for Habitat Alternative 9

	LONGITUDE		LATITUDE	
	deg	min	deg	min
Closed Area I	69	22.8	41	30
	68	30	41	30
	68	30	40	45
	68	45	40	45
Closed Area II	67	19.5	42	21.7
	66	25.5	41	19.2
	66	36	41	0
	67	20	41	0
Nantucket Lightship	70	20	40	50
	69	0	40	50
	69	0	40	20
	70	20	40	20
WGOM	70	15	43	15
	69	55	43	15
	69	55	42	15
	70	15	42	15
Cashes	69	26	42	49.5
	69	2	43	7
	68	46	42	49.5
	68	50.5	42	46.5
	68	58.5	42	43.5
	69	17.5	42	42.5

APPENDIX IV

METHODS OF ANALYSIS FOR ASSESSMENT OF ENVIRONMENTAL CONSEQUENCES

Table of Contents:

1.0 Biological Projection Methods

The model follows, for each area i and time t, population vectors p(i,t) = (p1, p2,..., pn), where pj represents the density of scallops in the jth size class in area i at time t. The model uses a difference equation approach, where time is partitioned into discrete time steps t1, t2,…, with a time step of length ?t = tk+1 - tk. The landings vector h(i,tk) represents the catch at each size class in the *i*th region and *k*th time step. It is calculated as:

$$h(i,t_k) = [I - \exp(\Delta t H(i,t_k))]\, p(i,t_k),$$

$$h_{jj} = \begin{cases} 0 & if \quad s(j) \le s_d \\ -F_c(i,t_k)[s(j) - s_{\min}]/(s_{full} - s_{\min}) & if \; s_d < s(j) < s_{full} \\ -F_c(i,t_k) & if \quad s(j) \ge s_{full} \end{cases}$$

where *I* is the identity matrix and *H* is a diagonal matrix whose *j*th diagonal entry h_{jj} is given by:

Here, s_{min} is the minimum size at which a scallop is vulnerable to the gear, s_{full} is the size at which a scallop is fully vulnerable to the gear, s_d is the cull size (=s_{min}) below which scallops are discarded, and $F_c(i,t_k)$ represents the capture fishing mortality rate suffered by a full recruit in area *i* at time t_k.

To model the effect of four inch rings, a more complex selectivity pattern was used, based on the data of W. DuPaul. Selectivity of scallops less than 99mm was reduced 41% compared to 3.5" rings described above, 23% for scallops between 99 and 104 mm, 15% for scallops between 104 and 109 mm, and 10% for scallops between 109 and 124 mm. Consistent with the observed data, total contact time and area swept per unit fully recruited fishing mortality (>88mm for 3.5" rings, >125mm for 4" rings) using four inch rings was reduced by 15%.

The landings $L(i,t_k)$ for the *i*th region and *k*th time step are calculated using the dot product of landings vector $\mathbf{h}(i,t_k)$ with the vector $\mathbf{m}(i)$ representing the vector of meat weights at shell height for the *i*th region:

$$L(i,t_k) = A_i\, \mathbf{h}(i,t_k) \bullet \mathbf{m}(i)/(w\, e_i)$$

where e_i represents the dredge efficiency in the *i*th region, and *w* is the tow path area of the survey dredge (estimated as 8/6080 nm^2).

Even in the areas not under special area management, fishing mortalities tend to not be spatially uniform for poorly mobile stocks such as sea scallops (Caddy 1975, Hart 2001). Fishing mortalities in 2001-2003 were specified, based on observed distributions of fishing effort (from VMS and VTR information), so that total fishing effort for each of these two years corresponds to about 26000 actual DAS (see LPUE/DAS submodel, described below). Fishing mortalities in open areas beyond 2003 (except for Alternative 1e and in the mechanical rotation options) are determined by a "fleet dynamics model", similar to that of Caddy (1975). This model estimates fishing mortalities in open areas based on (i) area-specific exploitable biomasses, (ii) observed area-specific preferences (at similar biomasses, higher fishing mortalities are observed in the Mid-Atlantic, especially in Delmarva), and (iii) so that the overall DAS or open-area F matches the target. Based on these ideas, the fishing mortality F_i in the ith region is modeled as:

$$F_i = k*f_i*B_i$$

where B_i is the exploitable biomass in the ith region, f_i is an area-specific adjustment factor to take into account preferences for certain fishing grounds (due to lower costs, shorter steam times, ease of fishing, habitual preferences, etc.), and k is a constant adjusted so that the total DAS or fishing mortality meets its target. For these simulations, f_i = 1 for all Georges Bank areas, f_i = 1.5 for New York Bight areas (Mid-Atlantic subareas 6-9), and
f_i= 3 for the southern Mid-Atlantic areas (1-5). These weightings were chosen to correspond with the much higher fishing mortalities at a given biomass observed in the Mid-Atlantic, especially in the south.

In alternative 1e (area management without rotation), fishing mortality was set at the target (0.2) in all areas open to fishing, corresponding to area-specific DAS or quotas that would occur under this proposed plan. In the mechanical rotation plans, areas are either (M-1) closed for three years and then fished at 0.32, 0.4, and 0.48, or (M-2) closed for five years and then opened for one year at F = 1.2.

Scallops of shell height less than a minimum size s_d are assumed to be discarded, and suffer a discard mortality rate of d. Discard mortality was estimated in NEFSC (2001) to be 20%. There is also evidence that some scallops not actually landed may suffer mortality due to incidental damage from the dredge. The level at which this occurs was assessed in NEFSC (2001). It depends on the dredge efficiency e and also probably bottom type. If a fraction c of the scallops remaining on the bottom suffer incidental mortality, then the incidental fishing mortality F_I can be calculated as:

$$F_I = F_L c(1-e)/e,$$

where F_L is capture fishing mortality.

Caddy (1973) estimated that c was about 0.15 to 0.2 in a relatively hard-bottom area in Canadian waters, while Murawski and Serchuk (1989) estimated that $c < 0.05$ in a sandy bottom area off of New Jersey. For Georges Bank, we used c = 0.175 from Caddy together with a dredge efficiency estimate of e = 0.5 (NEFSC 2001) to obtain an estimate of $F_I = 0.175F_L$. For the Mid-Atlantic, we used c = 0.05 (the maximum possible value from Murawski and Serchuk) together with an efficiency of e = 0.7 (NEFSC 2001) to estimate $F_I = 0.03F_L$.

The scallops grow according to a von Bertalanffy equation, so that their shell height $s(t)$ at age t (in years) is given by:

$$s(t) = L_\infty[1-\exp(-k[t-t_0])].$$

The growth equation is used to construct a matrix *G*, which specifies the fractions of each size class that remains in that size class, or grows to other size classes, in a time ? t.

Recruitment was modeled stochastically, and was assumed to be log-normal in each subarea. The mean, variance and covariance of the recruitment in a subarea was set to be equal to that observed in the historical time-series between 1982-2001. The same random number seed was used in all simulations, so that differences among simulation runs cannot be ascribed to different recruitment streams. New recruits enter the smallest size class (40-45 mm in these simulations) at a rate r_i depending on the subarea *i*, and stochastically on the year. Area-specific recruitment rates are given in Table 2.

These simulations assume that recruitment is a stationary process, i.e., no stock-recruitment relationship is assumed. The increased recruitment that have occurred in the past few years as biomass has increased suggests the possibility that recruitment overfishing may have been occurring in the years prior to 1996 (though it is also possible that oceanographic conditions could be responsible for the high recent recruitment; see NEFSC 2001). If recruitment overfishing was occurring historically, then the model projections will underestimate future recruitment, biomass, and landings. However, given that scallop egg production is currently and is projected to remain an order of magnitude higher than the levels in the 1980s and early 1990s, and that the landings under the current model assumptions are higher than those reported historically, it is likely that any stock-recruitment relationship will be saturated at these high levels of egg production. Hence, it is probable that future recruitment will not depend on the exact level of biomass (provided that the biomass remains high), and the mean future recruitment will be near its asymptotic value. This means that the *relative* yields and biomasses from the various scenarios will not be affected by the particular assumptions about recruitment made here. So while there may be some uncertainty as to the absolute levels of future recruitment, yields, and biomasses, model projections should give accurate comparisons of the relative advantages and disadvantages of different management strategies.

The population dynamics of the scallops in the present model can be summarized in the equation:

$$p(i,t_{k+1}) = r_i + G\exp(-M\Delta tH)p(i,t_k),$$

where $?_i = (r_i ? t,0,0,\ldots)$. The population and harvest vectors are converted into biomass by using the shell-height meat-weight relationship:

$$W = \exp[a + b\ \ln(s)],$$

where *W* is the meat weight of a scallop of shell height *s*. For calculating biomass, the shell height of a size class was taken as its midpoint. The model also keeps track of egg production, based on the fecundity - shell-height relationship of MacDonald and Thompson (1985). A summary of model parameters is given in Table 1.

Initial conditions for the population vector **p** *(i,t)* were estimated using the 2001 NMFS research vessel sea scallop survey. Catches in the survey were adjusted for catchability of a lined dredge, as described in NEFSC (2001). The initial conditions from the 2001 survey were bootstrapped using the bootstrap model of Smith (1997), so that each simulation run had both its own stochastically determined bootstrapped initial conditions, as well as stochastic recruitment stream.

Commercial landing rates (LPUE) were estimated using an empirical function based on the observed relationship between annual landing rates, expressed as number caught per day (NLPUE) and survey exploitable numbers per tow. At low biomass levels, NLPUE increases roughly linearly with survey abundance (see Fig 1). However, at high abundance levels, the catch rate of the gear will exceed that which can be shucked by a seven-man crew. The is similar to the situation in predator/prey theory, where a predator's consumption rate is limited by the time required to handle and consume its prey (Holling 1959). The original Holling Type-II predator-prey model assumes that handling and foraging occur sequentially. It predicts that the per-capita predation rate R will be a function of prey biomass B according to a Monod functional response:

$$R = \frac{aB}{b + B},$$

where a and ß are constants. In the scallop fishery, however, some handling (shucking) can occur while foraging (fishing), though at a reduced rate because the captain and one or two crew members need to break off shucking to steer the vessel during towing and to handle the gear during haul back. The fact that a considerable amount of handling can occur at the same time as foraging means that the functional response of a scallop vessel will saturate quicker than that predicted by the above equation. To account for this, a modified Holling Type-II model was used, so that the landings per unit effort (DAS) L (the predation rate) will depend on scallop (prey) exploitable biomass B according to the formula:

$$L = \frac{aB}{\sqrt{b^2 + B^2}}. \qquad (*)$$

The parameters a and ß to this model were fit to the observed fleet-wide LPUE vs. exploitable biomass relationship during the years 1982-2000 (Figure 1). The number of scallops that can be shucked should be nearly independent of size provided that the scallops being shucked are smaller than about a 20 count. The time to shuck a large scallop will go up modestly with size. To model this, if the mean meat weight of the scallops caught, g, in an area is more than 20 g, the parameters a and ß in (*) are reduced by a factor $\sqrt{20/g}$. This means, for example, that a crew could shuck fewer 10 count scallops per hour than 20 count scallops in terms of numbers, but more in terms of weight.

An estimate of the fishing mortality imposed in an area by a single DAS of fishing in that area can be obtained from the formula $F_{\text{DAS}} = L_a/B_a$, where L_a is the LPUE in that area obtained by the above formula, and B_a is the exploitable biomass (in absolute units) in that area. This allows for conversion between units of DAS and fishing mortality.

The LPUE/biomass functional relationship can also be used to estimate dredge contact time and total area swept. Even when shucking time is not limited, the dredge will not be on the bottom all the time that a vessel's DAS clock is ticking. A vessel typically steams a little less than 10% of the time. The dredge can be on the bottom for nearly 90% of the remaining time; the rest of the time is needed for dredge set-out, haul-back, and dumping on deck. This implies that at low densities, when shucking is not limiting, that dredge contact time is about 19.5*D hours, where D is the number of DAS charged.

The catch rate per hour contact time should be directly proportional to biomass regardless of biomass levels. Since at low biomass, the relationship (*) reduces to $L = (a/ß)B$ (Figure 1), the predicted (numerical) landings L_0 per 19.5 hours contact time is:

$$L_0 = (a/ß)B. \qquad (**)$$

Thus, the actual bottom contact time C (in hours) per DAS charged is:

$$C = 19.5\frac{L}{L_0} = \frac{19.5b}{\sqrt{b^2 + B^2}}.$$

Since a typical vessel fishes at about 4.5 knots, and employs two 15 foot dredges, the area swept in an hour of bottom contact time is about: 4.5*2*15/6080 nm^2 = 0.0222 nm^2. Hence, the area swept, A, per DAS charged is:

$$A = \frac{19.5 * 0.0222b}{\sqrt{b^2 + B^2}}.$$

Rotational closures and openings occur according to a specified rule involving growth rates etc., as specified below. Reopened areas are specially controlled for a three-year period following reopening, with fishing mortalities usually fixed at 0.32, 0.4, 0.48 for the three years. Hudson Canyon considered harvest area for the 2003-2006 period.

Simulations were run 400 times for 30 years each. “Long-term” results are the means (and standard deviations) of the last 10 years of the 400 simulations.

Table 1. **Model parameters**

Parameter	Description	Value
Δt	Simulation time step	0.1 y
L_∞	Maximum shell height	152.46 mm (GB), 151.84 mm (MA)
K	Growth parameter	0.3374 y^{-1} (GB), 0.2997 y^{-1} (MA)
M	Natural mortality rate	0.1 y^{-1}
a	Shell height/meat wt parameter	-11.6038 (GB), -12.2484 (MA)
b	Shell height/meat wt parameter	3.1221 (GB), 3.2641 (MA)
s_0	Initial shell height of recruit	40 mm
s_{min}	Minimum size retained by gear	65 mm
s_{full}	Size for full retention by gear	88 mm
s_d	Maximum size discarded	80 mm
d	Mortality of discards	0.2
	Non-catch scallop mortality for scallops in the dredge path1	17.5% (GB)2, 3% (MA)3
e	Dredge efficiency	50% (GB), 70% (MA)
a	LPUE/biomass relationship	49056
ß	LPUE/biomass relationship	102.8

1 Hart, D.R. In press.
2 Based on observations from Caddy 1973.
3 Based on observations from Murawski and Serchuk 1989.

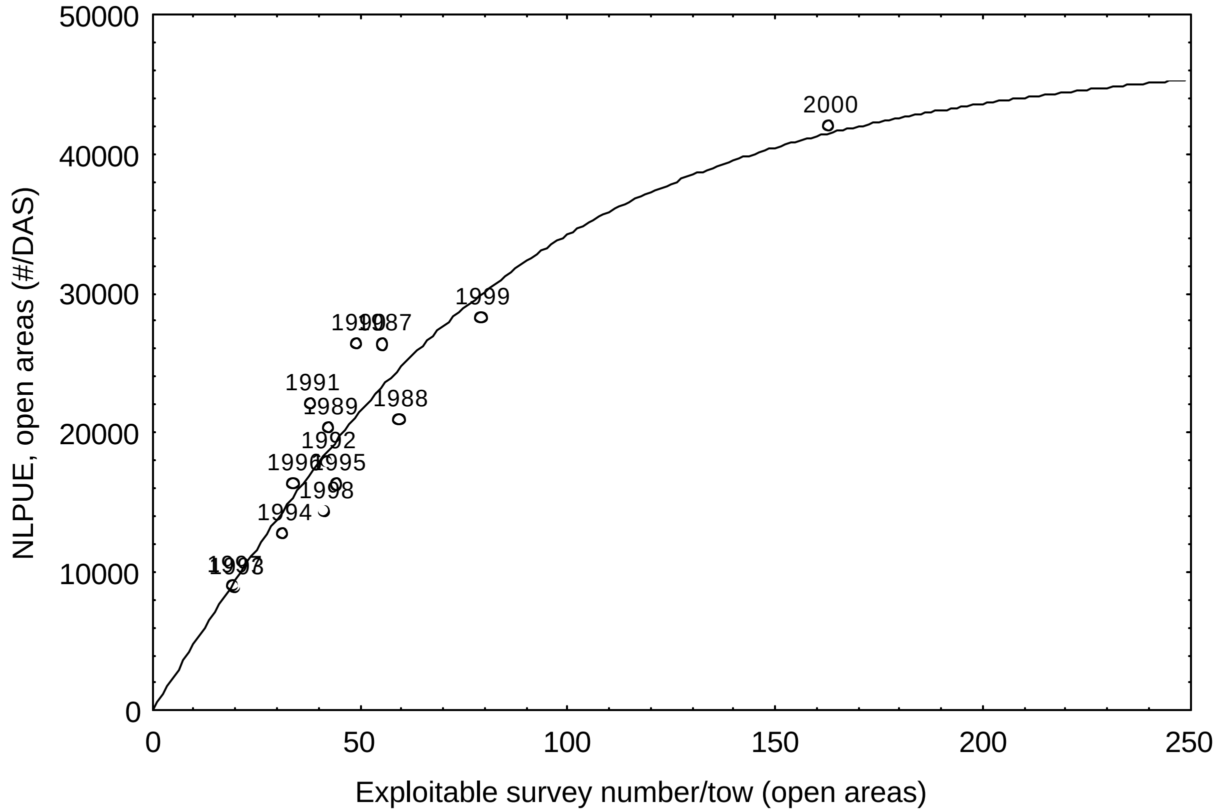


Figure 1. LPUE/biomass relationship

Table 2. **Mean and covariance of area specific log-transformed recruitment**

Mid-Atlantic

Subarea	mean	cov(1)	cov(2)	cov(3)	cov(4)	cov(5)	cov(6)	cov(7)	cov(8)	cov(9)
1	4.05	1.3	0.95	0.46	0.43	0.39	0.13	-0.02	0.08	-0.39
2	4.32	0.95	1.2	0.63	0.57	0.53	0.35	0.25	0.26	-0.21
3	4.22	0.46	0.63	0.50	0.40	0.40	0.19	0.11	0.17	0.03
4	4.05	0.43	0.57	0.40	0.83	0.52	0.32	0.35	0.37	0.19
5	4.19	0.39	0.53	0.40	0.52	0.70	0.45	0.35	0.32	0.24
6	4.36	0.13	0.35	0.19	0.32	0.45	0.52	0.38	0.30	0.17
7	4.03	-0.02	0.25	0.11	0.35	0.35	0.38	0.43	0.33	0.24
8	3.43	0.08	0.26	0.17	0.37	0.32	0.30	0.33	0.36	0.25
9	2.65	-0.39	-0.21	0.03	0.19	0.24	0.17	0.24	0.25	0.93

Georges Bank

	mean	cov(1)	cov(2)	cov(3)	cov(4)	cov(5)	cov(6)	cov(7)	cov(8)	cov(9)	cov(10)	cov(11)	cov(12)	cov(13)	cov(14)
1	2.35	2.7	0.50	0.54	0.20	-0.04	-0.18	-0.24	0.12	0.13	0.53	0.03	0.06	1.8	-0.03
2	5.48	0.50	1.0	0.15	0.03	-0.12	-0.07	-0.16	-0.19	0.36	0.10	0.10	0.01	0.26	-0.20
3	3.94	0.54	0.15	0.57	0.24	0.37	0.01	0.37	0.11	-0.01	0.13	-0.09	0.24	0.34	0.13
4	3.21	0.20	0.03	0.24	0.42	0.42	0.02	0.46	0.21	0.28	-0.11	0.26	0.05	0.19	0.39
5	2.39	-0.04	-0.12	0.37	0.42	0.97	0.18	0.95	0.06	0.39	-0.09	-0.22	0.24	0.02	0.45
6	3.34	-0.18	-0.07	0.01	0.02	0.18	0.89	0.09	0.06	0.83	0.12	-0.11	0.37	-0.11	0.23
7	3.42	-0.24	-0.16	0.37	0.46	0.95	0.09	1.3	-0.01	0.11	-0.14	-0.19	0.19	-0.09	0.45
8	2.41	0.12	-0.19	0.11	0.21	0.06	0.06	-0.01	1.5	0.06	-0.16	-0.17	0.09	0.12	1.49
9 (CAII-acc)	4.38	0.13	0.36	-0.01	0.28	0.39	0.83	0.11	0.06	2.0	-0.03	-0.02	-0.09	-0.04	0.33
10 (CAII-na)	3.66	0.53	0.10	0.13	-0.11	-0.09	0.12	-0.14	-0.16	-0.03	0.53	-0.12	0.19	0.32	-0.21
11 (CAI-acc)	3.06	0.03	0.10	-0.09	0.26	-0.22	-0.11	-0.19	-0.17	-0.02	-0.12	2.0	0.07	0.41	-0.19
12 (CA1-na)	4.94	0.06	0.01	0.24	0.05	0.24	0.37	0.19	0.09	-0.09	0.19	0.07	1.0	0.20	0.43
12 (NLS-acc)	4.03	1.8	0.26	0.34	0.19	0.02	-0.11	-0.09	0.12	-0.04	0.32	0.41	0.20	1.3	0.10
14 (NLS-na)	2.56	-0.03	-0.20	0.13	0.39	0.45	0.23	0.45	1.5	0.33	-0.21	-0.19	0.43	0.10	1.9

2.0 Essential Fish Habitat Analysis Methods

2.1 Introduction

The EFH analysis first evaluated the gears used in the scallop fishery, and determined which species had EFH that was adversely impacted by scallop fishing. The adverse impacts determination was based on a review of fishing gear effects literature relevant to the U.S. Northeast region, and the vulnerability of each species EFH to bottom tending gears. In order to evaluate the vulnerability of benthic EFH to bottom tending gear, a matrix was developed that qualitatively assessed six criteria such as the dependence of a particular species on bottom habitat for reproduction, shelter, food, and spawning behavior. Once the list of species with vulnerable EFH was identified, the various alternatives developed to minimize the impacts of scallop fishing on EFH of adversely impacted species were assessed. Many of the alternatives designed to minimize the adverse impacts of fishing on EFH include closed areas for EFH protection. Section ???, details the methods used in comparing the closed area alternatives, while Sections 2.1.1 through 2.1.5 describe the overall approach used in the EFH analyses within Amendment 10.

2.1.1 Gear Descriptions

Specifically, to describe gears, information from the NMFS VTR database and an ASMFC gear report was used. The primary source of information for gear descriptions was the EFH Omnibus Amendment (1998). Additionally, gear descriptions are provided using the Northeast Regional EFH Steering Committee's 2002 report from the Gear Effects Workshop in addition to several articles published in peer reviewed journals. See Appendix VI for a detailed description of all the fishing gears used in the Northeast region.

2.1.2 Distribution of Fishing Activity by Gear

The data used to perform this analysis were extracted from vessel trip report and clam logbook databases maintained at the U.S. National Marine Fisheries Service (NMFS) Northeast (NE) Regional Office in Gloucester, MA. Days absent calculations for trawl and dredge vessels are clearly preferable to simply summing the number of trips, but over-estimate actual fishing time since they include travel time and any other non-fishing-related activity while vessels are away from port. Thus, the GIS plots and analyses presented here do not represent fishing effort. They were only used to indicate the relative, not the absolute, distribution of fishing activity by geographical area and sediment type. Toward this end, all GIS input data were compiled and sorted into three categories: low, medium, and high degrees of activity that corresponded to cumulative percentages of 90, 75, and 50% of the total number of days at sea, or days spent fishing for each gear type during the seven-year time period. Data reported from ten minute squares (TMS) south of Cape Hatteras, North Carolina (35° N) and north of 45° N latitude in the Gulf of Maine were excluded from analysis, as were TMS-binned data from the low end (cumulative percentages >90%) of the frequency distribution. Exclusion of "low end" data (TMS with only a few trips or days) eliminated a large number of spatially misreported trips from analysis. Also included in this section are GIS plots of fishing activity for scallop dredge vessels operating in the limited access fishery during 1998, 1999, and 2000 which were derived from vessel monitoring systems (VMS) placed aboard each vessel. These plots provide a much more detailed depiction of fishing activity for dredge vessels during these three years than VTR data since they are collected at much higher spatial and temporal resolutions. Data were collected at 20-minute intervals during the time when vessel speed was less than 5 knots in order to differentiate between fishing activity and steaming time and then binned into one nautical mile squares. It is recognized that fishing activity includes other activities besides dredging, e.g., shucking time.

2.1.3 Types of Gear Effects

A number of authors have reviewed, to varying extents, existing scientific literature on the effects of fishing on habitat (e.g., Auster et al. 1996, Cappo et al. 1998, Collie 1998, Jennings and Kaiser 1998, Rogers et al. 1998, Auster and Langton 1999, Hall 1999, Collie et al. 2000, Lindeboom and de Groot 2000, Barnette 2001, National Research Council 2002). The conclusions reached by these authors is extracted from a recent NOAA report (Johnson 2002). A number of review papers have focused specifically on the physical effects of bottom trawls (e.g. ICES 1973). A working committee of the International Council for the Exploration of the Seas (ICES) issued, in November 2000, a report on the "Effects of Different Types of Fisheries on North Sea and Irish Sea Benthic Ecosystems." This report (ICES 2000) was a summary of findings based on a comprehensive report of the same title edited by Lindeboom and de Groot (1998). Alteration of physical structure, sediment suspension, changes in chemistry, and changes to benthic community are documented and described in the FEIS using peer reviewed literature and two reports (NRC and Gear Effects Workshop).

A Review of Fishing Gear Effects Literature Relevant to the U.S. Northeast Region was conducted and included in the FEIS that included the review of forty-four publications. They included all known studies (written in English) that examined the effects of the three principal mobile, bottom-tending fishing gears used in the Northeast U.S. on benthic marine habitats. Only publications that evaluated the direct habitat effects of fishing by these gears were reviewed (i.e., modifications to the physical structure of the seafloor or effects on benthic organisms that live in or on the seafloor). Effects of fishing on resource populations were not included, nor were studies that evaluated the indirect effects of fishing on marine ecosystems caused by the selective removal of species targeted by the gear or which are caught incidentally (as by-catch) during fishing. Both peer-reviewed and non-peer-reviewed publications were included, but most were peer-reviewed. To be included, accounts of research projects had to be complete and describe methods and results. Abstracts and poster presentations were not included. The summaries in this document are, in all cases, based on primary source documents. Two bottom-tending mobile gear types that are widely used in other parts of the world, but not in the Northeast U.S. – beam trawls and toothed scallop dredges – were not included even though considerable research has been conducted on their habitat effects. Also excluded were studies done on the effects of other gear types used strictly in inshore state waters in habitats where sea scallops are not found (e.g., escalator dredges in submerged aquatic vegetation) and any research relating to fixed and pelagic gear effects.

2.1.4 Vulnerability of Benthic EFH to Bottom-Tending Fishing Gears and Adverse Impacts Determinations

To evaluate the vulnerability of benthic EFH to bottom-tending fishing gears, information used included: 1) the EFH designations adopted by the NEFMC and MAFMC; 2) the results of a fishing gear effects workshop convened in Fall 2001 (NEREFHSC 2002); 3) an evaluation of the information provided in this gear effects evaluation section of this document, including the effects of fishing gear on habitat from existing scientific studies, and the geographic distribution of fishing gear use in the Northeast Region; and 4) the habitats utilized by each species and life stage as indicated in their EFH designation and supplemented by other references. A matrix (was developed for each benthic life stage for each species to determine the vulnerability of its EFH to effects from bottom tending mobile gear. Six criteria were qualitatively evaluated for each life stage based upon existing information. Each evaluation consisted of a score based upon a predefined threshold. The methods that were used to rank vulnerability were subject to a peer review by the NMFS Northeast Fisheries Science Center's review process for publications. The thresholds for adverse impact determinations were developed and reviewed by the Council's Essential Fish Habitat Technical Team. The adverse impact determinations are based on conclusions in the Gear Effects Evaluation in Section **Error! Reference source not found.**??? and is substantiated by two recent reports. The first of these (NREFHSC 2002) is the report of a workshop held in October 2001 that examined the habitat effects of gears used in the Northeast region on three substrate types (gravel, sand, and mud). The second report (Morgan and Chuenpagdee 2003) evaluated the effects of ten different commercial fishing gears on marine ecosystems in U.S. waters.

2.1.5 Minimizing Adverse Effects of Fishing on EFH

From the vulnerability analysis, it was determined that the EFH of some species in the region may be adversely impacted from scallop fishing. Thus, alternatives were developed in Amendment 10 to minimize, to the extent practicable, the adverse impacts of scallop fishing on EFH. Many of the alternatives designed to minimize the adverse impacts of fishing on EFH include closed areas for EFH protection. These alternatives were evaluated using a strategy developed by the Habitat Technical Team of the New England Fishery Management Council. Using the best available science for the entire region, the habitats within the management area were described. More specifically, the amount of various sediment types, the aerial extent of EFH designations, and biomass indices for various species were analyzed using several sources of data and methods (See Appendix IV for a detailed description of the methods used in the habitat evaluation). All of the data were analyzed using GIS, a mapping program that enables data to be analyzed geographically.

The sediments inside each alternative were evaluated based on a digitized US Geological Survey map (Poppe et al, published in 1986 and 1989), which is the only source of sediment data available that includes the entire management area. The amount and percent coverage of bedrock, gravel, gravelly sand, sand, muddy sand, and mud bottoms in each area was described. The amount and percent coverage of EFH area in square nautical miles was calculated for species with EFH vulnerable to bottom tending gear. EFH area was calculated as the number of square nautical miles included in designated ten-minute squares of longitude and latitude, as defined in the EFH Omnibus Amendment (1998) and other sources. Lastly, the Habitat Technical Team identified several trophic guilds, species assemblages, and individual benthic species that are indicators of the ecosystem characteristics of each proposed habitat closed area. Biomass data were obtained from the 1995-2001 NMFS bottom trawl survey data. As illustrated in the document, there are limitations to each of these data sets and methods, however the Council has used the best available science to describe the affected environment and evaluate the potential habitat impacts from the various alternatives under consideration.

2.2 Analytical Methods Used to Compare Closed Area Options

The NEFMC Habitat Technical Team has identified five metrics that describe habitat attributes of the closed area alternatives. These are:

1) substrate composition for six sediment types,
2) Essential Fish Habitat (EFH) for 23 species that are vulnerable to habitat disturbance by bottom-tending fishing gear,
3) biomass of five trophic guilds (species with similar diets),
4) biomass of five species aggregations,
5) biomass of six species that are closely associated with benthic environments.

All five habitat metrics were analyzed in terms of percentage composition within each proposed closed area and within the entire Northeast region (North Carolina to Maine). In addition, EFH area values were scaled for differences in area between alternatives.

In order to determine the percent of sediment, EFH, or biomass contained within each closed area alternative, a denominator had to be identified. For this analysis, the Northwest Atlantic Analysis Area (NAAA) was defined as the area within the 500 fathom line to the east, the coastline (including state waters) to the west, the Hague line to the north, and the North Carolina/ South Carolina border to the south (Figure 1). Although federal fishery management plans cannot close areas in state waters, it is important to include the area and habitat characteristics of the nearshore coastal waters in the calculations in order to more accurately evaluate the proposed area closures. The total area of the NAAA was determined to be 83,550 nmi^2.

Figure 2. Map of the Northwest Atlantic Analysis Area with sediment data (Poppe et al., 1989 and 1994).

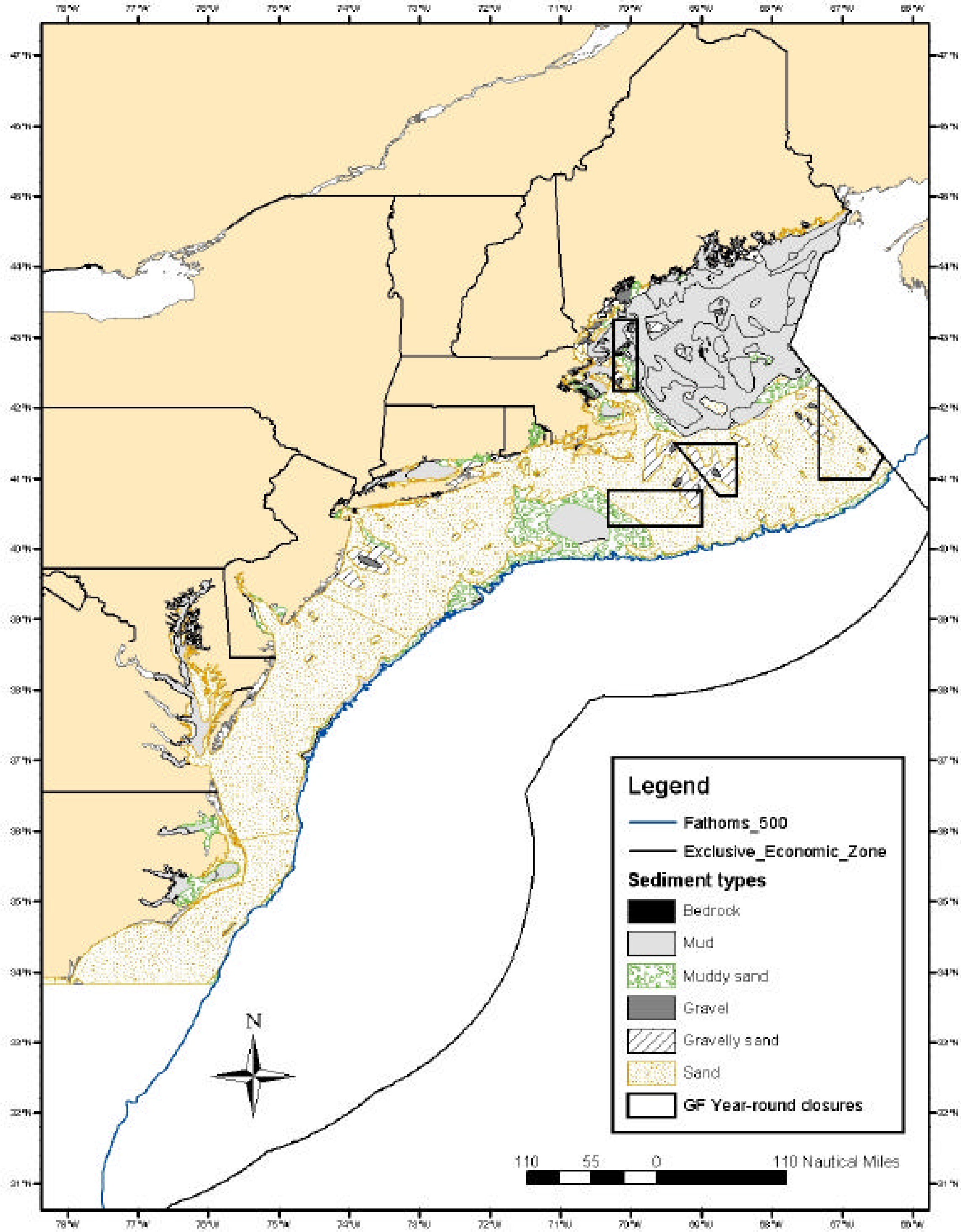
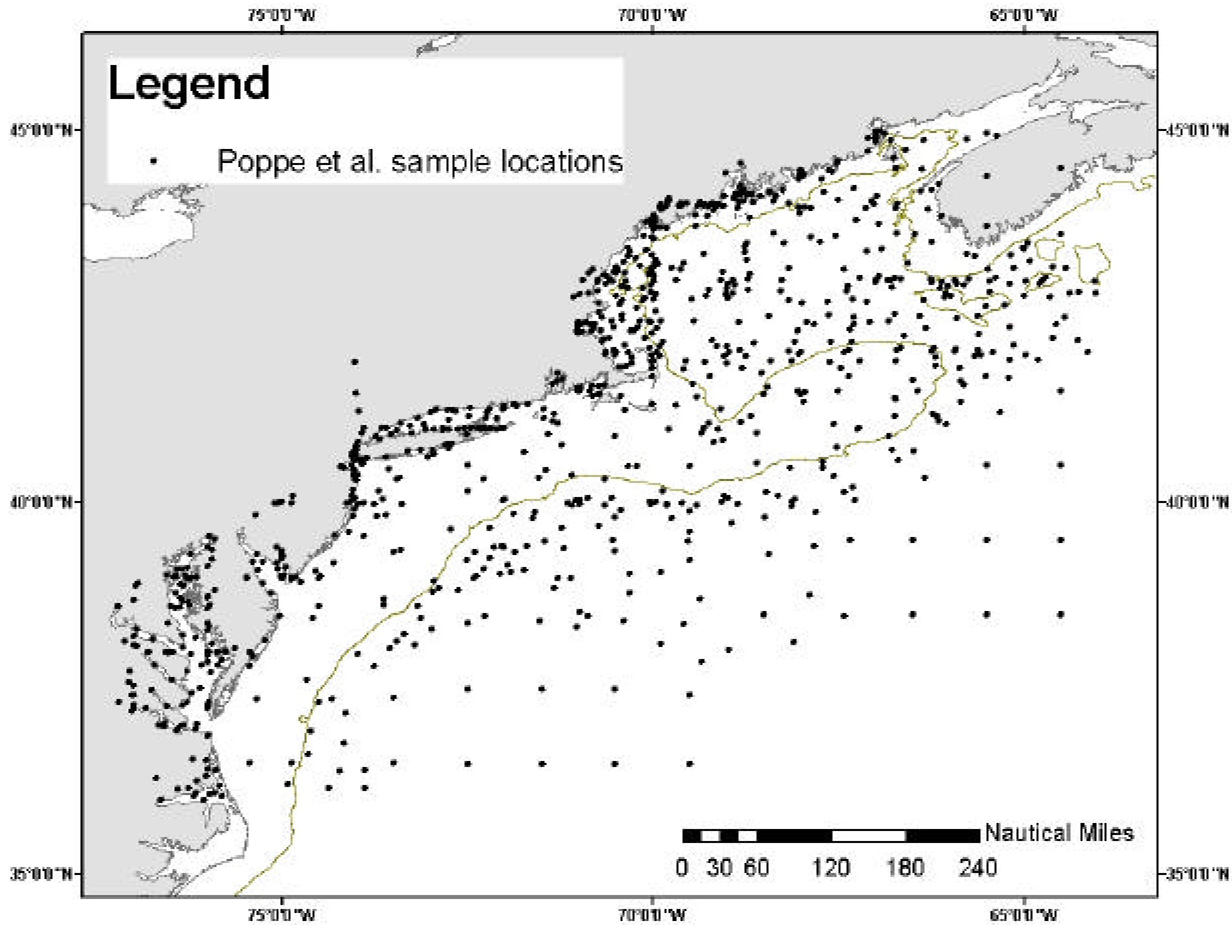


Figure 2. Sample locations used to generate Poppe et al. sediment map.



2.2.1 Sediments

Sediment data were analyzed in two different ways. First, the distribution of sediment types contained within each alternative was calculated. This analysis depicts the percent sediment composition of each closed area alternative. The second component of the sediment analysis determined the percent of each sediment type within each proposed closed area compared to the total amount of each sediment type in the Northwest Atlantic Analysis Area (see Figure 1).

Sediment data (in nmi^2) were derived from digitized maps of sediment coverage originally developed by Poppe et al. (1989, 1994) and made available by the U.S. Geological Survey (Figure 1). Sediment types were originally classified into nine distinct grain size categories ranging from clay to bedrock. For simplicity, these nine sediment categories were condensed into six (based on a recommendation from the Habitat Technical Team). The six categories used for analysis are: bedrock, gravel, gravelly sand, sand, muddy sand, and mud. Note that the geographic coordinates and areas (latitude, longitude or square decimal degrees) were based on the World Geodetic System of 1984 (WGS84), and the projected coordinates and areas (meters or nmi^2) were derived from the Universal Transverse Mercator, Zone 19 North Projection (UTM, Zone 19N). Areas covered by each sediment type within the NWA Analysis Area and within each proposed closed area were calculated using ArcView 8.1 GIS software (ESRI).

The digitized map is based on a limited number (975) of sample points, especially in offshore areas (see Figure 2) and does not accurately depict small-scale sediment distributions. The following explanation of how the maps were originally developed and their limitations was provided by the USGS:

"Bathymetry is used as a guide in placing some of the contacts between different sediment types. However, because the true boundaries between sediment types are probably highly irregular or gradational, because the extreme textural variability that characterizes some areas does not appear at this scale, and because the accuracy of the navigational systems used during the earlier studies is limited, all contacts should be considered to be inferred. In summary, the CONMAP series is old and does not accurately depict small-scale sediment distributions. This data layer is supplied primarily as a gross overview and to show general textural trends."

Additional sediment data are available in an up-dated and enlarged USGS database and have been "mapped" as point data, but they have not yet been combined with the older CONMAP data to produce a new contoured map of sediment distribution.

2.2.2 Essential Fish Habitat

Essential Fish Habitat (EFH) has been designated for life stages of 39 species in the NAAA by the New England and Mid-Atlantic Fishery Management Councils (Table 1). (Note that Atlantic salmon has been left out of the table because there are no abundance data available for this species). Each species and life stage has a written, legally-binding definition of EFH and the EFH area of most species has been delineated based on their abundance from annual stock assessment surveys in the region.

Table 1 - Species with EFH designations in the region

Species	Council	Species	Council
Atlantic cod	NE	Barndoor skate	NE
Haddock	NE	Clearnose skate	NE
Atlantic herring	NE	Little skate	NE
Monkfish	NE	Rosette skate	NE
Ocean pout	NE	Smooth skate	NE

American plaice	NE	Thorny skate	NE
Pollock	NE	Winter skate	NE
Red hake	NE	Tilefish	MA
Redfish	NE	Black sea bass	MA
Sea scallop	NE	Scup	MA
White hake	NE	Summer flounder	MA
Whiting (Silver Hake)	NE	Quahogs	MA
Windowpane flounder	NE	Surf clams	MA
Winter flounder	NE	Dogfish	MA
Witch flounder	NE	Bluefish	MA
Yellowtail flounder	NE	Butterfish	MA
Atlantic halibut	NE	Illex squid	MA
Red crab	NE	Loligo squid	MA
Offshore hake	NE	Mackerel	MA

For most species in New England and the Mid-Atlantic, EFH has been mapped for each species and life stage by individual ten-minute squares (TMS) of latitude and longitude. The amount (or percent) of EFH area occupied by EFH-designated TMS (or portions thereof) provides a useful tool for comparing the EFH value of closed area alternatives. Although EFH data for all managed species in the NAAA was calculated, the EFH component of the habitat metric analysis only includes 23 species with at least one life history stage that has been identified as having EFH that is vulnerable to bottom tending gear(Table 2). The rationale for the individual vulnerability determinations can be found in the Gear Effects Evaluation section of this document. If a species was determined to be "highly" or "moderately" vulnerable to bottom tending gears (otter trawls, scallop dredges, or clam dredges) then it was included in the EFH component of the habitat analysis. EFH area values for each vulnerable species and life stage were adjusted to account for differences in the size of the closed area alternatives by dividing EFH area in square nautical miles by the area of each proposed closed area (nmi^2). It is important to note that the legal EFH designation for many species is slightly larger than the EFH area used in this analysis. This analysis used the total EFH area within the NAAA, so it does not include the area of EFH within inshore bays and rivers. The inshore boundary of the EFH analysis, as well as the sediment and biomass analysis, is the coastline from Maine to North Carolina, thus inshore waters are not included.

Table 2 - List of species and life stages with EFH defined as "vulnerable" to bottom tending fishing gear (see Gear Effects Evaluation)

American Plaice (A)	Red Hake (A)
American Plaice (J)	Red Hake (J)
Atlantic Cod (A)	Redfish (A)
Atlantic Cod (J)	Redfish (J)
Atlantic Halibut (A)	Rosette Skate (A)
Atlantic Halibut (J)	Rosette Skate (J)
Barndoor Skate (A)	Scup (J)
Barndoor Skate (J)	Silver Hake (J)
Black Sea Bass (A)	Smooth Skate (A)
Black Sea Bass (J)	Smooth Skate (J)
Clearnose Skate (A)	Thorny Skate (A)
Clearnose Skate (J)	Thorny Skate (J)
Haddock (A)	Tilefish (A)
Haddock (J)	Tilefish (J)
Little Skate (A)	White Hake (J)
Little Skate (J)	Winter Flounder (A)
Ocean Pout (A)	Winter Skate (J)
Ocean Pout (E)	Winter Skate(A)

Ocean Pout (J)	Witch Flounder (A)
Pollock (A)	Witch Flounder (J)
	Yellowtail Flounder (A)
	Yellowtail Flounder (J)

2.2.3 Trophic Guilds

A guild is defined by Root (1967) as 'a group of species that exploit the same class of environmental resources in a similar way' and explicitly focuses on classifying species based upon their functional role in a community without regard to taxonomy. The guild is used to simplify the structure and dynamics of complex ecosystems regardless of the mechanism generating resource partitioning. Guild members play similar functional roles within ecosystems. In other words, a species guild is a group of species defined by their role within the ecosystem. In our analysis, we focused on guilds as determined by dietary similarity (determined from the stomach contents of species brought up in the trawl surveys).
Cluster analysis (based on Garrison 2000) was used to define trophic guilds found in the Northwest Atlantic Analysis Area (NAAA). The general guild structure and levels of dietary overlap are consistent across both temporal and spatial scales. Complementary analyses to the current study within the Georges Bank region identified similar trophic guilds and general stability in the trophic guild structure over the last three decades. Despite the notable changes in species composition in the Northeast shelf fish community, the patterns of trophic resource use and guild structure have remained remarkably consistent.

Five trophic guilds were identified for this analysis: benthivores, amphipod eaters, planktivores, piscivores, and shrimp and fish eaters (Table 3 – Table 7). The species and size ranges used for these guilds are delineated in the tables below.

Table 3 – List of species and species' sizes in the benthivore guild.

Benthivores	Size
HADDOCK	All
THORNY SKATE	S,M
YELLOWTAIL FLOUNDER	M,L
WINTER FLOUNDER	All
GULF STREAM FLOUNDER	All
WITCH FLOUNDER	All
SCUP	All
AMERICAN PLAICE	All
ATLANTIC CROAKER	All
OCEAN POUT	All

Table 4– List of species and species' sizes in the amphipod eater's guild.

Amphipod eaters	Size
FAWN CUSK-EEL	All
LONGHORN SCULPIN	All
WINDOWPANE	All
ATLANTIC COD	S,M
WINTER SKATE	S,M
LITTLE SKATE	S,M
RED HAKE	S,M
SPOTTED HAKE	S
WHITE HAKE	S
FOURSPOT FLOUNDER	S

YELLOWTAIL FLOUNDER	S

Table5– List of species and species' sizes in the planktivore guild.

Planktivores	**Size**
NORTHERN SAND LANCE	All
ATLANTIC HERRING	All
BUTTERFISH	All
ATLANTIC MACKEREL	All
ALEWIFE	All
SPINY DOGFISH	S,M
NORTHERN SHORTFIN SQUID	L
LONGFIN SQUID	All

Table 6 – List of species and species' sizes in the Piscivore guild.

Piscivores	**Size**
SPINY DOGFISH	L
SEA RAVEN	All
GOOSEFISH	All
BLUEFISH	All
WEAKFISH	All
SUMMER FLOUNDER	All
SPOTTED HAKE	M
ATLANTIC COD	L,XL
FOURSPOT FLOUNDER	M
SILVER HAKE	L
WHITE HAKE	L
THORNY SKATE	L,XL
WINTER SKATE	L,XL

Table 7 – List of species and species' sizes in the shrimp and fish eater's guild.

Shrimp and Fish Eaters	**Size**
POLLOCK	All
SILVER HAKE	S,M
ACADIAN REDFISH	All
WHITE HAKE	M
RED HAKE	L
SMOOTH SKATE	All

All biomass data were compiled as summed mean weights per tow (in kg) from all the tows made in each ten minute square (or portion of a square) in each proposed closed area during all NEFSC bottom trawl surveys during 1995-2001. Percentage biomass data were calculated as the ratio of the summed mean weight per tow in each proposed closed area over the total mean weight per tow for each guild in the entire NAAA.

2.2.4 Species Assemblages

Assemblages are groups of species that co-occur spatially and vary by season and by area. Certain species co-occur with others in certain areas, but do not in other areas; the same can be said for seasons/time. Each assemblage was based on co-occurrence without regard for season or time.

Cluster analysis (based on Garrison and Link 2000, Gabriel 1992) was used to define spatial-temporal assemblages (*i.e.*, principal groundfish, principal pelagics, demersals, pelagics and elasmobranchs) found in the NAAA. Species that are included in each of these assemblages are delineated in the table below. With one exception (Atlantic mackerel), all the species in the first four assemblages are unique to those groups; nineteen of the 71 species included in the demersal assemblage also occur in one of the other groups. Biomass data were compiled for each of these assemblages in the same manner as for the other biomass metrics.

Table 8 – List of species belonging to each of the spacio-temporal assemblages.

Elasmobranchs	Principle Groundfish	Pelagic Species	Principle Pelagics
SPINY DOGFISH	ATLANTIC COD	ROUND HERRING	ATLANTIC HERRING
BARNDOOR SKATE	HADDOCK	CAPELIN	ATLANTIC MACKEREL
WINTER SKATE	ACADIAN REDFISH	ATLANTIC SILVERSIDE	
CLEARNOSE SKATE	SILVER HAKE	ATLANTIC MACKEREL	
ROSETTE SKATE	RED HAKE	BUTTERFISH	
LITTLE SKATE	POLLOCK	BLUEFISH	
SMOOTH SKATE	YELLOWTAIL FLOUNDER	WEAKFISH	
THORNY SKATE	SUMMER FLOUNDER	NORTHERN SHORTFIN SQUID	
	WINTER FLOUNDER	LONGFIN SQUID	
	WINDOWPANE	BAY ANCHOVY	
	AMERICAN PLAICE	LANTERNFISH UNCL	

Demersal Species			
SMOOTH DOGFISH	BLUE HAKE	SEA RAVEN	SILVERSTRIPE HALFBEAK
SPINY DOGFISH	METALLIC CODLING	BLACK SEA BASS	SLENDER SNIPE EEL
BARNDOOR SKATE	FOURBEARD ROCKLING	ACADIAN REDFISH	FLAT NEEDLEFISH
WINTER SKATE	CUSK	TILEFISH	OFFSHORE HAKE
CLEARNOSE SKATE	ATLANTIC HALIBUT	NORTHERN SAND LANCE	ATLANTIC CROAKER
ROSETTE SKATE	AMERICAN PLAICE	STRIPED CUSK-EEL	SCUP
LITTLE SKATE	SUMMER FLOUNDER	ARCTIC EELPOUT	SPOT
SMOOTH SKATE	FOURSPOT FLOUNDER	WOLF EELPOUT	ATLANTIC SEASNAIL
THORNY SKATE	YELLOWTAIL FLOUNDER	WRYMOUTH	NORTHERN SEAROBIN
SILVER HAKE	WINTER FLOUNDER	ATLANTIC WOLFFISH	STRIPED SEAROBIN
ATLANTIC COD	WITCH FLOUNDER	OCEAN POUT	ARMORED SEAROBIN
HADDOCK	WINDOWPANE	FAWN CUSK-EEL	SEAROBIN UNCL
POLLOCK	GULF STREAM FLOUNDER	GOOSEFISH	FLYING GURNARD
WHITE HAKE	HOOKEAR SCULPIN	EEL UNCL	CUNNER

	UNCL		
RED HAKE	SCULPIN UNCL	HEADLIGHTFISH UNCL	TAUTOG
SPOTTED HAKE	MOUSTACHE SCULPIN	CONGER EEL	NORTHERN STARGAZER
LONGFIN HAKE	SHORTHORN SCULPIN	SNUBNOSE EEL	ROCK GUNNEL
HAKE UNCL	LONGHORN SCULPIN	MARGINED SNAKE EEL	

2.2.5 Individual Benthic Species

Six species (longhorn sculpin, sea raven, redfish, ocean pout, jonah crab and American lobster) were chosen by the Habitat Technical Team to use in the species component of the habitat metric analysis. These species were chosen for their close association with benthic habitats for both feeding and protection from predators. Just like the previous two biomass metrics, this analysis compared the percent of each species biomass inside the closed areas vs. the total biomass for that species in the entire Northwest Atlantic Analysis Area.

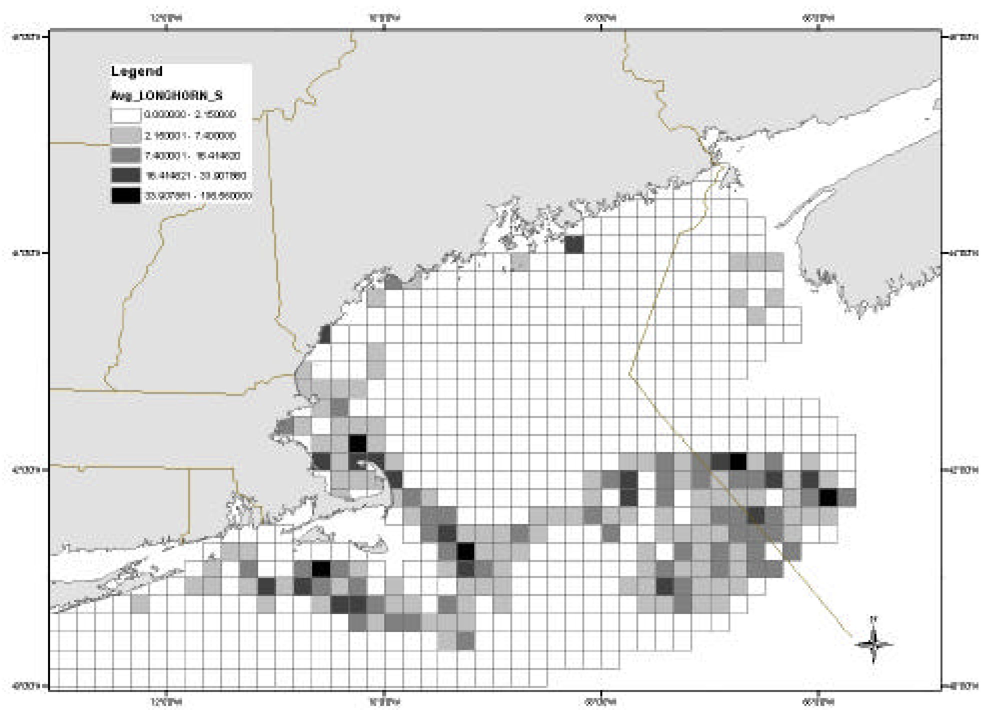


Figure 3 – Longhorn Sculpin mean wt (kg) per tow, 1995-2001 trawl surveys.

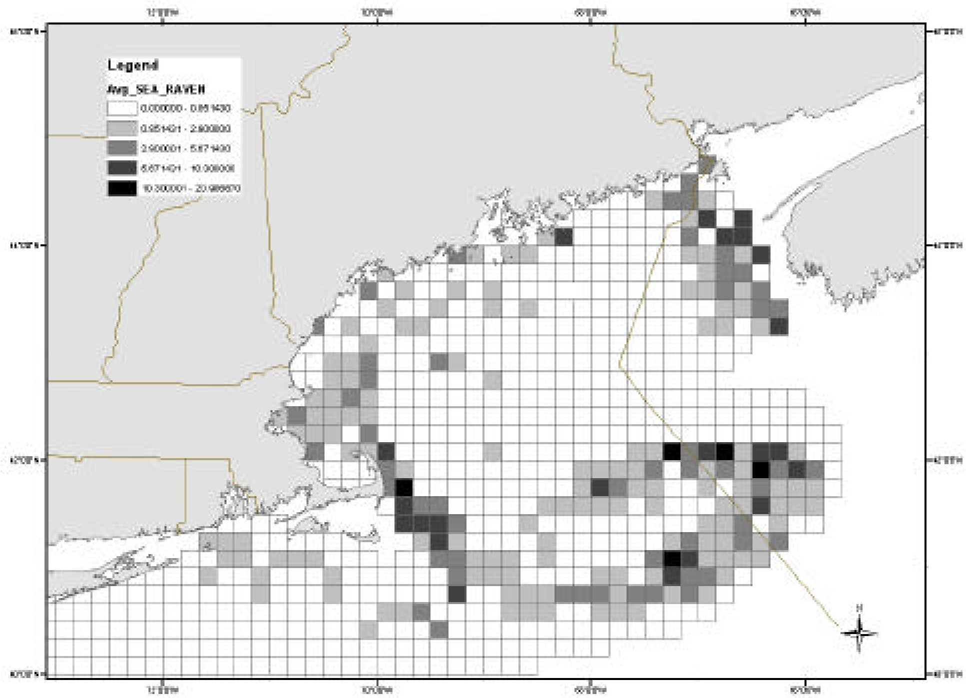


Figure 4 – Sea Raven mean wt (kg) per tow, 1995-2001 trawl surveys.

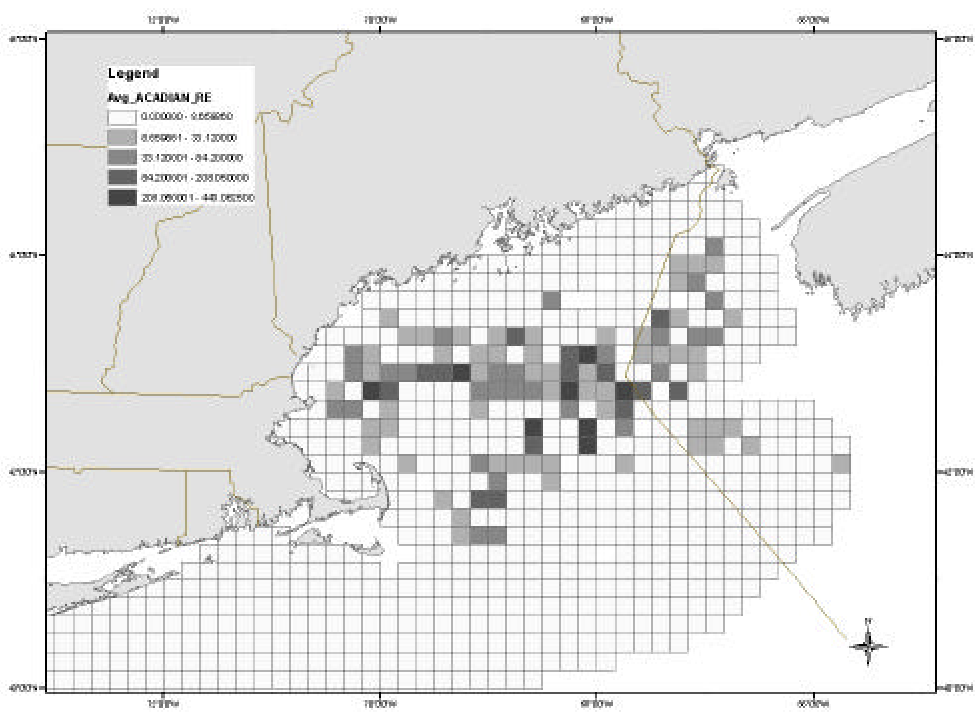


Figure 5 – Redfish mean wt (kg) per tow, 1995-2001 trawl surveys.

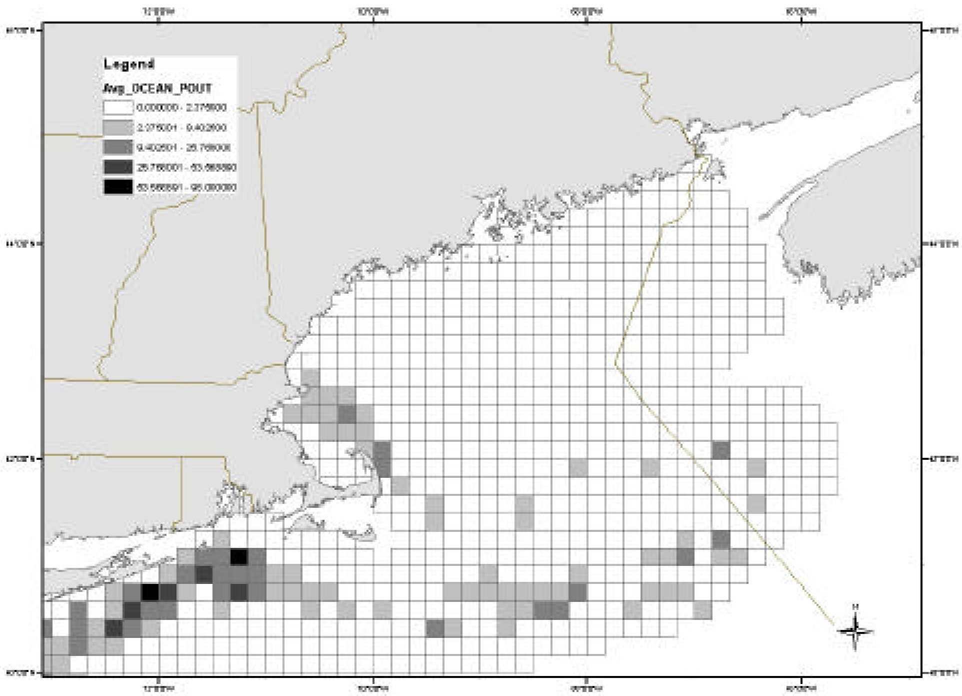


Figure 6 – Ocean Pout mean wt (kg) per tow, 1995-2001 trawl surveys.

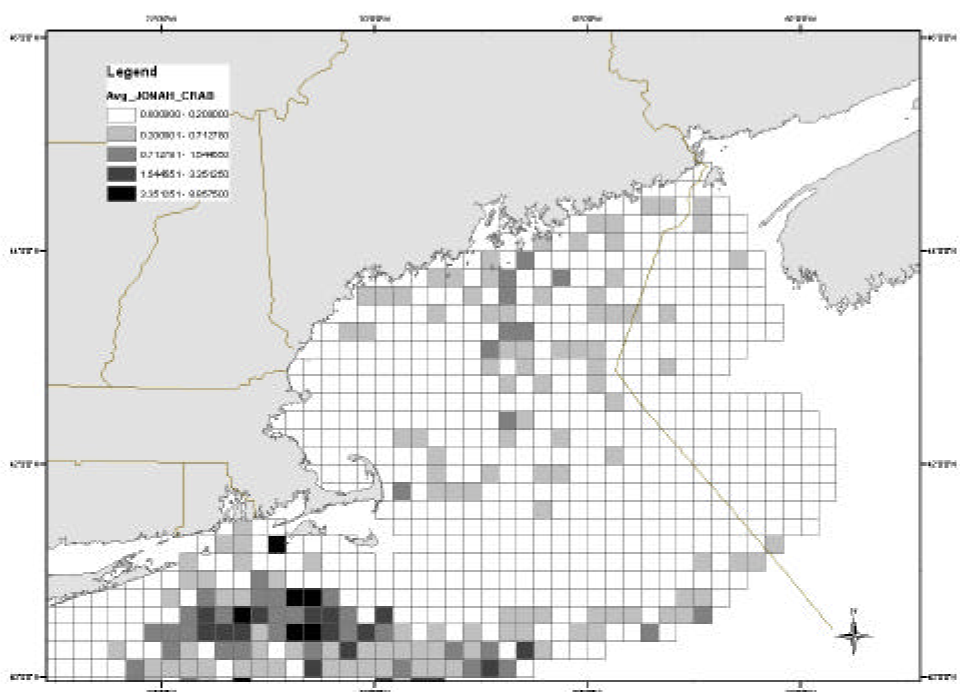


Figure 7 – Jonah Crab mean wt (kg) per tow, 1995-2001 trawl surveys.

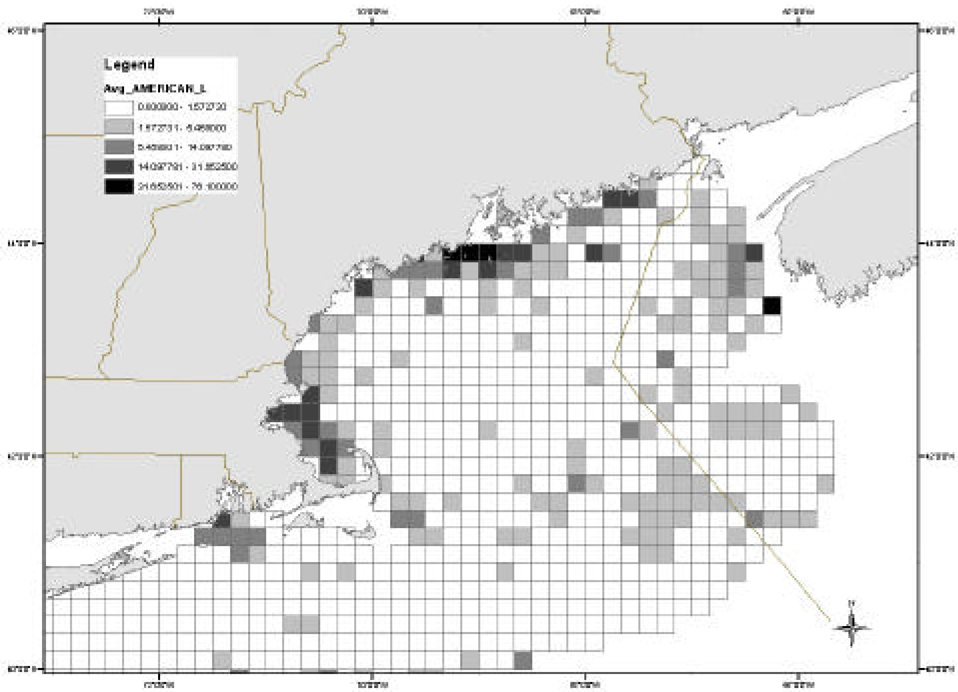


Figure 8 – American Lobster mean wt (kg) per tow, 1995-2001 trawl surveys.

ANALYTICAL METHODS USED TO IDENTIFY SOME OF THE HABITAT CLOSED AREA ALTERNATIVES (5A-D)

2.3 Description of Working Group EFH Model to identify important habitat areas and consider productivity tradeoffs

2.3.1 Theoretical Background and Methods

MacCall (1990) developed mathematical treatment of spatial population dynamics for marine fish populations. While doing so, he utilized and extended the population theory of density-dependent habitat selection which says that the marginal value of an animal's habitat is dictated not only by the physical and chemical characteristics of its environment, but also dictated by the competition for resources (food, refugia, etc.) with other individuals in the population. The realized habitat suitability of the individual is therefore affected by competition, predation, territoriality, and oceanographic/substrate conditions. MacCall (1990) postulates that individuals occupy habitats with the highest suitability to their survival and growth. It requires an assumption of an ideal free distribution where animals move, recruit to, or survive in response to marginal differences in their habitat and at higher population levels, occupy areas that would be less suitable at lower population size.

Extending the concept of density-dependent habitat suitability, originally developed by Fretwell and Lucas (1970), MacCall (1990) proposed a "Basin Model", relating habitat suitability to the intrinsic rate of population growth (r) and to population size as a function of the local carrying capacity (K) of the habitat (Figure 9). When at the carrying capacity (K) or high population size (Figure 9), the abundance distribution is affected by the fitness of the underlying habitat, but the population occurs at some level thorough its range. In an ideal free state, individuals are re-distributed such that the marginal habitat suitability due to competition is equal for all and all individuals contribute equally to the intrinsic rate of population growth (r). At lower population size, marginal habitats (outside the domain of B in Figure 9) become unoccupied. Thus at mean or low population size, the abundance distribution is proportional to the habitat value of an area to a population and to its intrinsic rate of growth (i.e. habitat is more valuable and productive to the species at location A than at locations B or other locations throughout the range). Thus, over a long time series, the mean abundance at any location is suitable as a proxy for the value of the habitat to a population.

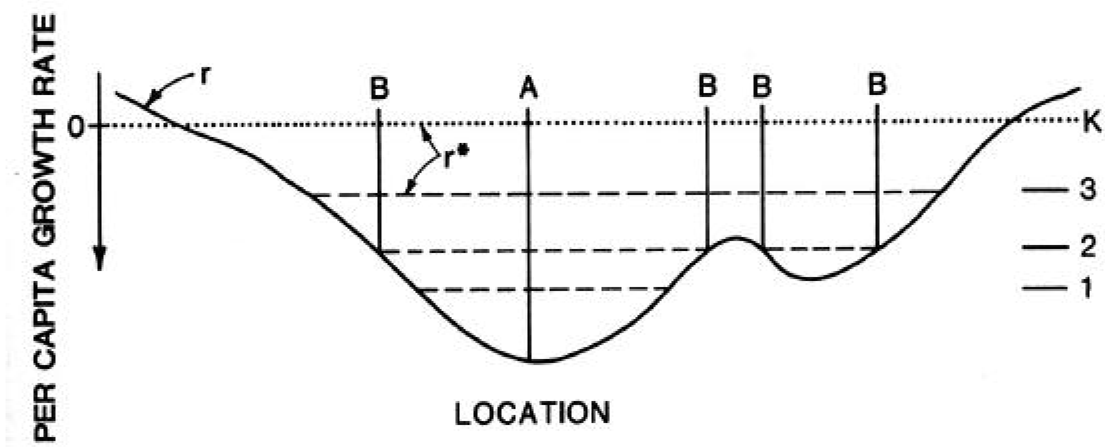


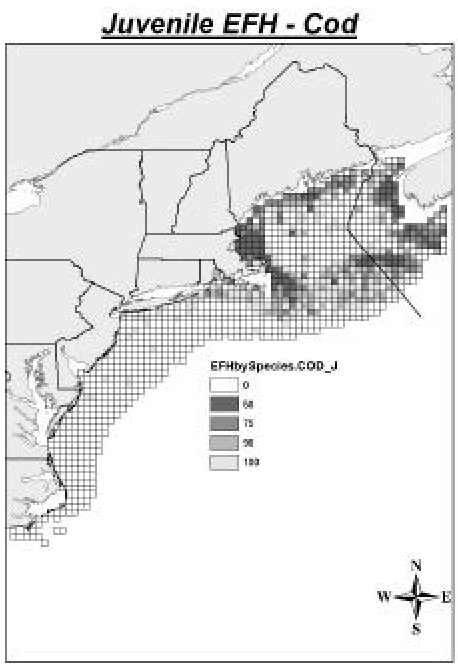
Figure 9. **Diagram of the "Basin Model", proposed by MacCall (1990), relating habitat suitability to the intrinsic rate of population growth (r) and to stock size as a proportion of carrying capacity (K).**

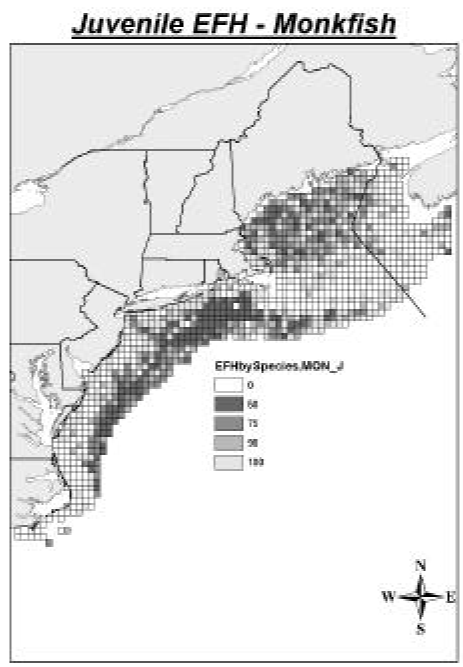
Garrison (2001) examined the spatial patterns of 27 finfish sampled by the bottom trawl survey on the NE US continental shelf (Azarovitz 1981). Although there were temporal changes in abundance and distributions, there was a strong fidelity to relatively stable faunal regions. Spatial ranges for many species however contracted at low population size (Atkinson *et al.* 1997, Wigley *et al.* 1996), often concentrating in areas having higher CPUE at high abundance (e.g. haddock in Garrison 2001).

The EFH designations in the Essential Fish Habitat amendments used median abundance data from 1963 to 1997 and were normalized with respect to differences in catchability between species (see explanation below). For each species, the abundance data was categorized by life stage (eggs, larvae, juvenile, adult) and binned by ten-minute square throughout the extensive range of the bottom trawl survey. This treatment made the data ideally suited for identifying candidate habitat closures by applying MacCall's (1990) Basin Model to the standardized abundance data in a GIS format (ArcView 8.1 for display and analysis; Minami 2000).

In preparation for the 1998 EFH amendment, the survey abundance data were post-stratified by ten-minute square and their geometric means were ranked for all ten-minute squares by species and life stage (eggs, larvae, juvenile, and adult). All ten-minute squares were assumed to be of equal size with a homogenous distribution of catches within a ten-minute square. Ranked from highest to lowest, a ten-minute square was designated as a '25th percentile' if the cumulative sum was less than 25% of the total summed catch, i.e. 25 percent of the total swept-area abundance for a species and life stage. By design, the squares with the highest catches therefore were often represented by much less than 25 percent of the area where a species occurred[4]. Ten-minute squares with the next 25 percent of the cumulative abundance were designated as the 50th percentile category, followed by 75th and 90th percentile categories. Finally, the EFH designations included a 100th percentile category that included all ten-minute squares where there was one or more observations during the 37 year time series, but did not contribute to more than 10 percent of the total swept area abundance.

This analysis produced maps of EFH designations by species (37) and life stage (4), producing 148 maps or data layers, with varying distributions that relate to the preferred habitats for each species. Some examples for four groundfish species [cod (Gadus morhua), monkfish (Lophius americanus), white hake (Urophycis tenuis), and yellowtail flounder (Limanda ferruginea)] are shown in Figure 10. These data, categorized by species, life stage, and EFH designation were assigned weights to account for the relative EFH value between ten-minute squares and for the association with sensitive, complex habitat for a given species and life stage.





4 A species with a uniform distribution would have 25 percent of the ten-minute squares designated as the 25th percentile, for example.

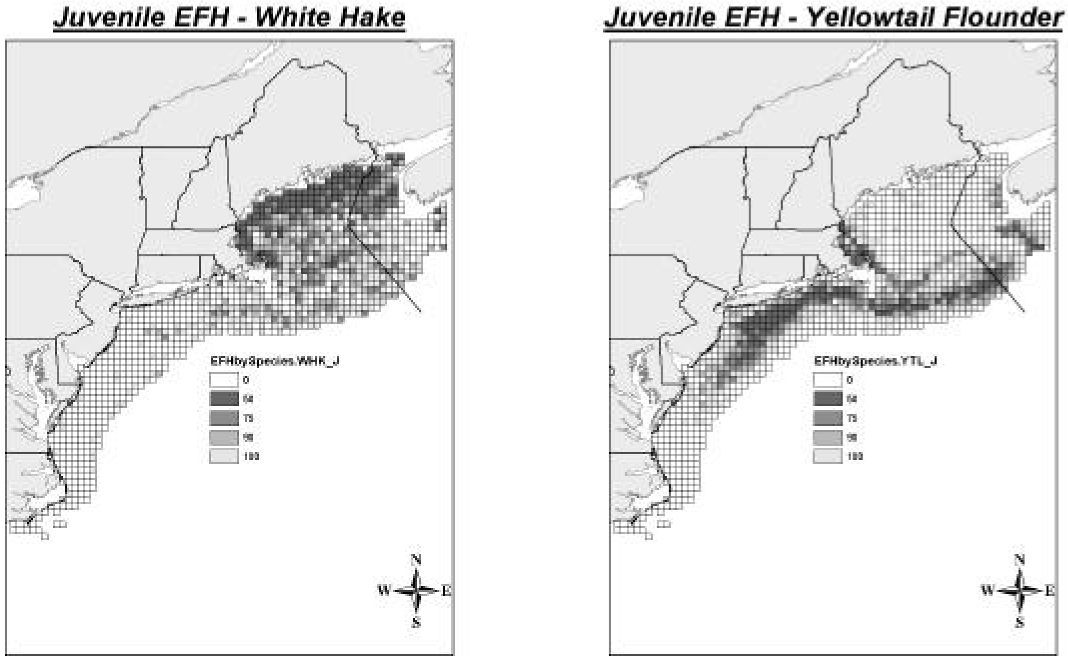


Figure 10. **Ten-minute square distributions of mean survey abundance (1963-1998) using juvenile cod, monkfish, white hake, and yellowtail flounder as examples.**

2.3.2 Enumerating EFH classifications as a proxy for habitat value

Utilizing the above percentile ranks as a starting point, ten-minute squares received an initial value based on Equation 1, where p = 50, 75, 90, and 100. This results a corresponding values of 25, 5, 1.9, and 1, respectively, reflecting a relative species/life-stage EFH index based on the abundance distributions. For this analysis, the 25th and 50th percentiles were combined into one category with an index value of 25. A subsequent sensitivity analysis was conducted, giving the 25th percentile an EFH index value of 125, but it did not materially change the eventual identification of the habitat closure areas. EFH index values using the 25th percentile were not used in the final analysis, because these rankings were unavailable for some species in the model.

Equation 1

$$5^{(100-p)/25}$$

EFH values by life stage were given unequal weight in the GIS framework to account for the stage's relationship with the bottom habitat that may be altered by fishing. Except for herring (Clupea harengus), eggs and larvae were given a zero weight and not included in the aggregate EFH value because these life stages for oceanic species are mostly pelagic and would be unaffected by bottom conditions. The EFH values for the juvenile life stage were given a weight of 4:1 relative to the adult life stage because:

- Juvenile life stage is generally more vulnerable to changes in bottom habitat
- Juvenile stage is the best metric of resource potential
- Juvenile stage generally favors an invertebrate diet, whereas adult stage tends to be piscivorous

- Adult distributions can vary due to fishing and management effects

The EFH values described above were furthermore given unequal weight in the GIS framework to account for the species association to habitat thought to be vulnerable to fishing effects and for the species management status. A working group of habitat experts and plan development team members determined which of the criteria were met by a species. This weighting factor ranged from zero to four, depending on how many of the following criteria were satisfied by the species included in the GIS framework.

- Association with bottom habitat that might be affected by fishing activities
    - i.e. does the species rely on bottom habitat for food, refuge, or another important ecological function?
- Vulnerability of bottom habitat to fishing activities
    - i.e. is there a potential conservation benefit for the habitat that is associated with the species?
- Stock status
    - i.e. is the species or stocks for that species depleted and considered overfished?
- Relative value to the fisheries
    - i.e. would there be a potential direct economic or social benefit to conserving EFH for the species?

These weights for each species in the analytic framework are shown in Table 3 under the "EFH factor weight" heading. Species with a weight of zero were not considered further in the analysis and did not contribute to the ten-minute square EFH value. These species with zero EFH value for the purposes of this analysis were either pelagic, ubiquitous over varied habitats, or both.

Table 3. **EFH and productivity data weights by species.**

Family	Species	Scientific name	EFH factor weight	EFH factor weight wo relative value	Fishery productivity weight
Clupeidae	Herring (eggs)	Clupea harengus	3	3	0
Gadidae	Cod	Gadus morhua	4	3	1
	Haddock	Melanogrammus aeglefinus	4	3	1
	Pollock	Pollachius virens	1	1	0
	Red hake	Urophycis chuss	2	2	0
	White Hake	Urophycis tenuis	3	2	0
Lophiidae	Monkfish (Goosefish)	Lophius americanus	4	3	1
Malacanthidae	Tilefish	Lopholatilus chamaeleonticeps	4	3	0
Mrrlucciidae	Whiting (Silver hake)	Merluccius bilinearis	2	1	2
Paralichthyidae	Summer flounder	Paralichthys dentatus	3	2	2
Pleuronectidae	American plaice	Hippoglossoides platessoides	4	3	3
	Halibut*	Hippoglossus hippoglossus	4	3	1
	Winter flounder	Pseudopleuronectes americanus	2	2	3
	Witch flounder	Glyptocephalus cynoglossus	3	3	3
	Yellowtail flounder	Limanda ferruginea	3	3	3
Pomatomidae	Bluefish	Pomatomus saltatrix	0	0	0
Rajidae	Skate, barndoor	Dipterus laevis	2	2	0
	Skate, clearnose	Raja eglanteria	0	0	0
	Skate, little	Leucoraja erinacea	0	0	0
	Skate, rosette	Leucoraja garmani virginica	1	1	0
	Skate, smooth	Malacoraja senta	1	1	0
	Skate, thorny	Amblyraja radiata	1	1	0
	Skate, winter	Leucoraja ocellata	0	0	0
Scombridae	Atlantic mackerel	Scomber scombrus	0	0	0
Scophthalmidae	Windowpane flounder	Scophthalmus aquosus	2	2	0
Scorpaenidae	Acadian redfish	Sebastes faciatus	4	3	1
Serranidae	Black sea bass	Centropristis striata	4	3	1
Sparidae	Scup	Stenotomus chrysops	2	2	2
Squalidae	Dogfish	Squalus acanthus	2	2	1
Stromateidae	Butterfish	Peprilus triacanthus	0	0	0
Zoarcidae	Ocean pout	Zoarces americanus	2	2	0
Loliginidae	Longfin squid	Loligo pealeii	0	0	2
Arcticidae	Ocean quahog	Arctica islandica	2	1	2
Geryonidae	Red crab	Chaceon quinquedens	0	0	0
Pectinidae	Scallops*	Placopecten magellanicus	2	1	0
Ommastrephida	Shortfin squid	Illex illecebrosus	0	0	0
Mactridae	Surf Clam	Spisula solidissima	2	1	3

Managers expressed concern that the EFH values for certain species were inappropriate because it included a weight for "Relative value to the fisheries". Although possible, no species received a weight of one solely due to this consideration and a sensitivity analysis was conducted with the weights listed in the next column of Table 3. These results did not make an appreciable difference in the distribution of aggregate EFH values for all species and life-stages.

The aggregate EFH value was calculated according to Equation 2 as the sum of the above weights multiplied by the EFH classification values for each species (37) and life-stage (juvenile and adult). These aggregate EFH values were plotted in ArcMap to allow visual inspection of the patterns to identify areas where closures might be most effective for protecting the habitat of a variety of species meeting the above criteria. Because these values were weighted, the distribution favors the highest abundance of juveniles for overfished species that are associated with vulnerable bottom habitats.

Equation 2

$$EFH_{TMS} = \sum_{p=50,75,90,100} g_p \left[\sum_{s=1}^{37} w_s \left(j * EFH_{j,s} + a * EFH_{a,s} \right) \right]$$

where: $EFH_{j,s}$; $EFH_{a,s}$ = Essential fish habitat values by ten-minute square, species, and life stage; averaged survey abundance over the 37-year time series for juveniles or adults

g_p = EFH value determined from Equation 1

w_s = EFH species weights given in Table 3

j, a = Life stage weight: 4 for juvenile data, 1 for adult data

EFH_{TMS} values were plotted using ArcMap to examine the distribution of the high valued ten-minute square and possibly identify areas that would efficiently conserve EFH for a variety of species. This distribution favors the juveniles of overfished species that are associated with vulnerable bottom habitats. Generally, the pattern shows the highest values along the inshore portions of the Gulf of Maine, along the South Channel region east of MA, in Southern New England south of RI, along the Hudson Canyon east of NJ, and along the outer shelf margin of the Mid-Atlantic region.

2.3.3 Productivity tradeoffs to account for practicality

The productivity by ten-minute square was calculated to estimate the relative cost of closing areas to protect habitat. Although individuals of some species will contribute to an export of recruits or adults from closed areas, closures potentially limit access to adult, harvestable portions of the resource. Areas with high productivity, or abundance of adult species, will tend to cost more to close than other areas given equal migratory, fishing cost, and other effects. The aggregate adult abundance data, classified into percentiles as for the EFH data above, were deemed an acceptable proxy for a more direct measure of geographic productivity. Except for sea scallops, a more direct measure of productivity was unavailable. Adult biomass, on the other hand, could be a better measure of the yield that might be harvestable from various areas, but the survey biomass data are biased by overfishing and historic exploitation patterns.

Even though the distribution of adult abundance might estimate the potential productivity of an area and its potential cost, various factors unique to each species influence whether the cost due to closure would be high or low. Similar to the criteria for EFH value, three criteria were developed to weight the influence of a species adult abundance on the overall distribution of 'productivity'. This weighting factor ranged from zero to three, depending on how many of the following criteria were satisfied by the species included in the GIS framework. Some species (e.g. whiting and longfin squid) had higher weights for productivity than for the EFH value (see "Fishery Productivity Weight" in Table 3).

- Whether the species can be caught by gear that would not be excluded by a habitat closure
  - i.e.. passive, fixed gears could substitute for a mobile, bottom tending gear that would be excluded
- Mobility of adults
  - i.e. would the individuals later become available to the fishery
- Relative value to the fisheries
  - i.e. prohibiting access to more valuable species would have a higher cost

Direct estimates of the distribution of sea scallop productivity were available by rotational management area, under consideration by managers. The long-term maximum yield had been estimated for rotation management based on estimated local recruitment, growth and realized size selection from area rotation and gear management (Hart 2003). These area estimates were distributed over the ten-minute squares within them according to Equation 3.

Equation 3. Ten-minute square sea scallop productivity.

$$P_{TMS} = \left(\frac{LTPY_{RMA} * \frac{i_{40-72,TMS}}{i_{40-72,RMA}}}{A_{TMS}} \right)$$

where: $LTPY_{RMA}$ = long-term potential yield for a rotation management area

i_{40-72} = post-stratified index of abundance for 40 – 72 mm scallops
A_{TMS} = Area of ten-minute square (UTM projection)

Various combinations of productivity tradeoffs against aggregate EFH value were considered. The total productivity estimates, summed across species, were standardized by dividing their mean values into the mean aggregate EFH value (994.6 with four criteria weights; 799.8 with three criteria weights; see Table 4) for the 1104 ten-minute squares in the GIS framework, resulting in a set of productivity weight factors (Table 4). When subtracted from the aggregate EFH value from Equation 1, the net conservation value mean for all ten-minute squares was zero. Positive values meant that the closure of a ten-minute square would favor more EFH protection than it might cost by limiting access to adult finfish and shellfish. Negative values generally meant that a closure would protect fewer species' EFH and/or have a potentially high cost.

Equation 4

$$Q = \sum EFH_{TMS} - w_s P_s - w_g \sum_s EFH_{a,s}$$

Where: EFH_{TMS} = aggregate EFH species-weighted value for ten-minute square
P_s = long-term potential yield for sea scallops, when fished at Fmax
$EFH_{a,s}$ = aggregate, species-weighted EFH value for adult life stage
w_s = normalizing weight for sea scallop productivity
w_g = normalizing weight for standardized adult EFH distributions for groundfish and monkfish

Table 4. **Mean aggregate EFH and productivity values and productivity tradeoff weights used in** Equation 4**.**

Net conservation value (Q)	EFH value (4 factors; $\sum EFH_{TMS}$)	EFH value (3 factors; $\sum EFH_{TMS}$)	Groundfish productivity (w_1)	Groundfish productivity incl. scallops (w_s)	Sea scallop productivity (w_3; mt/nm^2)	Monkfish productivity (w_4)
Mean value in all ten-minute squares	994.6	799.8	120.2	128.5	3.325	6.137
Groundfish & Scallop (1:1)	1	0	4.137	0	149.6	0
Groundfish & Scallop (2:1)	1	0	5.516	0	99.71	0
Groundfish, scallop, & monkfish (1:1:1)	1	0	2.758	0	99.71	54.02
Groundfish & Scallop (1:1)	0	1	3.327	0	120.3	0
Groundfish incl. Scallop	0	1	6.624	0	0	0

3.0 Economic Model: Assumptions, Methodology, and Uncertainty

The economic model includes an ex-vessel price equation, a cost function and a set of equations describing the consumer and producer surpluses. The ex-vessel price equation is used in the simulation of the ex-vessel prices, revenues and consumer surplus along with the landings and average meat count from biological projections. The cost function is used for projecting harvest costs and thereby for estimating the producer benefits as measured by the producer surplus. The set of equations also include the definition of the consumer surplus, producer surplus, rent to vessels and total economic benefits.

Next section provides a historical review of the factors that affect the price of the domestic sea scallops during the last two decades along with a description of the total supply including the imports. In the following sections, the equations of the economic model are described.

3.1 Historical Background: Scallop landings and prices, meat count, and imports

Table 5**.** Landings, Imports, Prices and Meat Count

Period	Domestic Landings (million lbs)	Imports (million lbs)	Total Supply (landings+ imports)	Ex-vessel Price ($/lb)	Import Price ($/lb)	Meat Count (meats per pound)
1. 1982-1986	18	34	52	7.35	5.96	28
2. 1987-1992	34	37	71	5.06	4.48	37
3. 1993-1998	16	55	70	5.86	3.91	36
4. 1999-2001	33	46	79	4.34	3.52	27*

* Years 1999 and 2000 only.

Table 5 summarizes scallop landings, imports, meat count, ex-vessel and import price for four different periods corresponding to periods of low and high level of US sea scallop landings. Both Periods 1 (1982-1986) and 3 (1993-1998) include the years during which landings of sea scallops in the Northeast were below 20 million pounds. Periods 2 (1987-1992) and 4 (1999-2001) correspond, however, to years of high landings mostly exceeding 30 million pounds. Comparison of these periods provide some insights about the change in ex-vessel prices, quantity of imports, import prices and total supply of scallops as follows:

- Ex-vessel prices move in opposite direction to the domestic landings of sea scallops. Specifically, they were higher in periods (periods 1 and 3) of lower landings and lower in periods of high (periods 2 and 4) landings.

- In general, however, both ex-vessel and import prices of scallops exhibited a declining trend in the last two decades, especially since 1983. Figure 11 shows that average annual domestic price of scallops corrected for inflation at the 1996 cost of living (i.e., expressed in terms of 1996 constant prices) declined from over $7.35 per pound in early 1980's (period 1) to less than $5 per pound since year 2000. Similarly, the import prices per pound of scallops declined from over $6 per in the early 1980's to less than $4 since year 2000.

- Total supply, as measured by the sum total of landings and imports, has been increasing since 1982. Average annual supply increased 79 million pounds during the period 1999 to 2001 from an average of 52 million pounds during 1982-1986. The increase in the overall seafood consumption as the consumers became aware of the beneficial health impacts of fish, the decrease in the price of scallops both domestic and foreign and the increase in the disposable income of consumers were the main factors that contributed to the increase in demand for scallops.

- Imports increased substantially after 1982, from 20 million pounds to more than 40 million pounds after 1984. It is also evident from Figure 12 that imports as a substitute for domestic scallops fluctuated to fill the gap between domestic landings and the total demand for scallops, especially after 1990. Quantity of imports of scallops increased significantly during the period 1993-1998 (Period 3) in response to the rapid decline in domestic landings of scallops to less than 20 million. This trend seems to be reversed in the recent years, however, due to the recovery of the scallop resource. For example, level of imports declined to 40 million pounds in 2001 as domestic landings reached 44 million pounds in the same year.

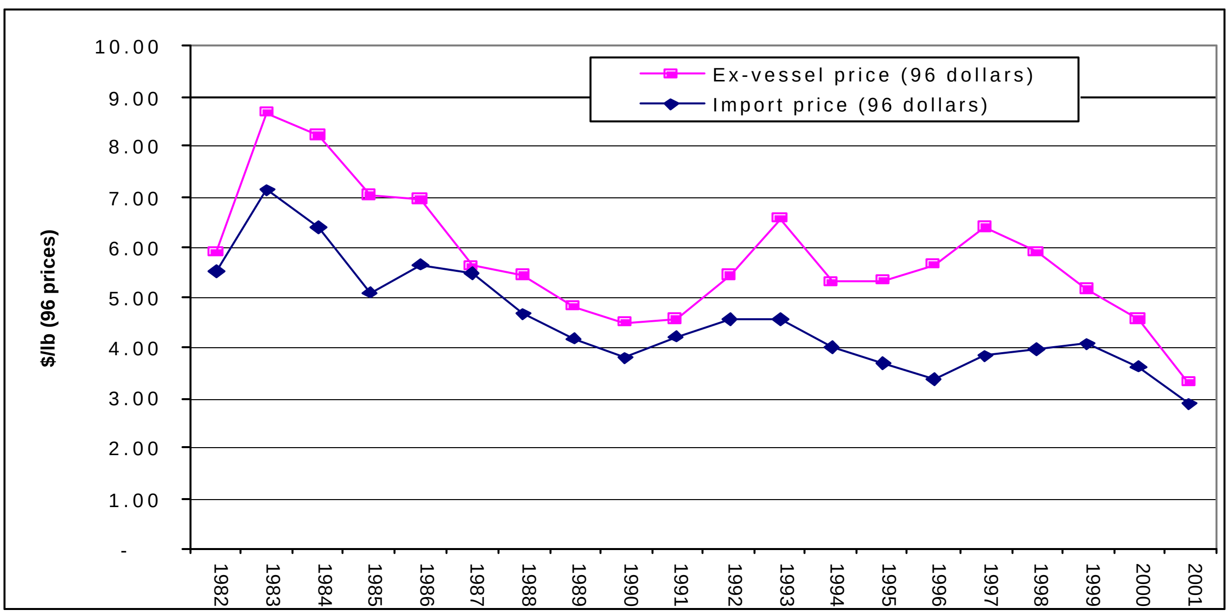


Figure 11. Ex-vessel and average price of scallops (in 1996 constant dollars)

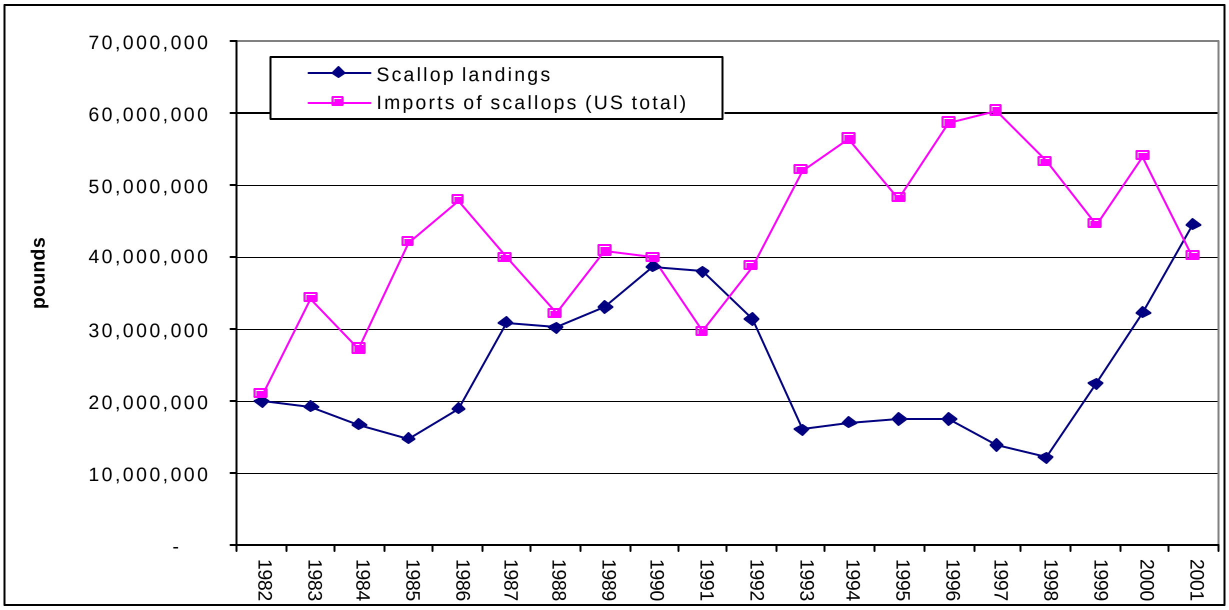


Figure 12**.** Sea scallop landings and imports (pounds)

- Table 5 shows meat count of the scallop resource available to fishing during the first two decades since 1982. Average meat count per year increased from 28 meats per pound during 1982-1986 (Period 1) to over 35 meats per pound during the next two periods ending with year 1998. The size of landed scallops were restricted by a meat count standard that first went into effect in 1982 with the implementation of the first FMP to Atlantic sea scallops. The meat count was restricted at 30 meats per pound. In June 1983, the Regional Director set the meat count at 35 meats per pound. Meat count standard was eliminated in 1994 with the implementation of Amendment 4 to the Sea Scallop FMP. With the recovery of the scallop resource in the recent years, the meat count declined to 27 meats per pound during the period 1998 to 2000, indicating that the size of the exploitable scallops available for fishing increased.

- The monthly price data collected from dealers database from January 1998 to December 2001 indicated the presence of price premium for larger scallops (Figure 13). Although price differentials between meat count categories fluctuated from month to month, In general U-10 (under 10 count) scallops earned the highest price premium. The differences in price were larger between the 30/40 count scallops and the 20/30 count scallops until the last quarter of 2000. It seems, however, that the price premium for relatively larger scallops except U-10's almost disappeared after October 2000.

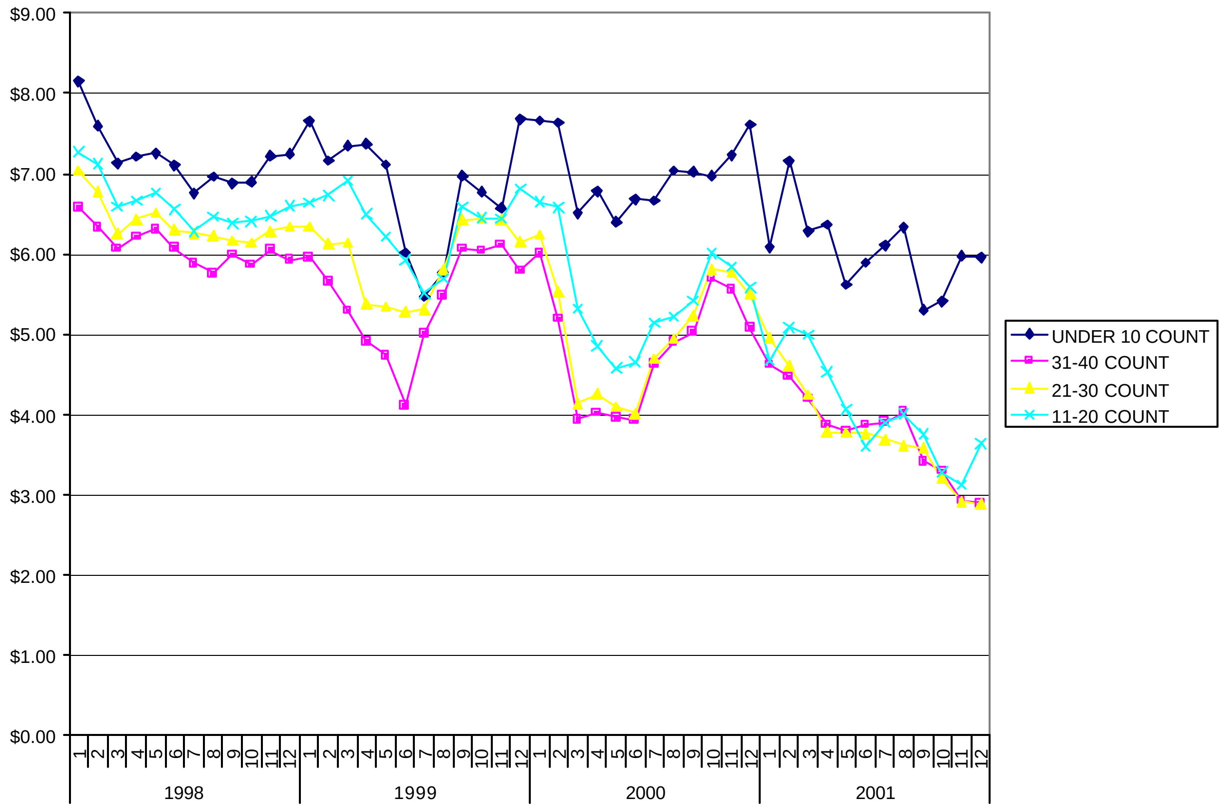


Figure 13. Price premium: Average monthly price of scallops by count .

- This is because composition of landings has changed dramatically since year 2000. The share of 11-20 count scallops in total landings increased to almost 25% and the share 21-30 scallops increased to almost 50% in year 2001 from around an average 15% and 25% respectively from 1998 and 1999 (Table 6). As the supply of 21-30 count scallops increased, their prices came closer in value to the prices of 31-40 count scallops. It seems that the price of 11-20 count scallops is following the same trend as their supply keeps increasing because of the recovery of the scallop resource and availability of larger scallops especially in the formerly closed areas.

- The U-10 scallops commanded a large price differential ranging from $1 to $2 per pound in year 2001. The percentage share of U-10's in total landings was still small, however, about 7.3% in 2000 and 3.2% in 2001 (Table 6). The continuity of the price premium for U-10's in the future is uncertain because of the expected increase in the average size of the landed scallops. In fact, analyses based on a regression of the price for U-10's and their relative supply indicated strongly that such price differentials would decrease in the future as more U-10 scallops are landed in the future years.

Table 6. Composition of sea scallop landings by count category

Count/Year	1998	1999	2000	2001
11-20 COUNT	17.34%	11.74%	18.42%	24.61%
21-30 COUNT	22.06%	25.23%	43.70%	49.82%
31-40 COUNT	13.34%	20.37%	18.31%	11.15%
41-50 COUNT	9.16%	12.58%	1.71%	0.18%
51-60 COUNT	7.44%	1.60%	0.07%	0.00%
61+ COUNT	2.60%	0.14%	0.01%	0.00%
UNDER 10 COUNT	1.66%	16.57%	7.32%	3.20%
Unclassified	26.39%	11.77%	10.48%	11.05%

3.2 Ex-vessel price equation

Ex-vessel price of sea scallops (PEXVES) is postulated to be a function of:

- domestic landings (DOMLAN, million pounds),
- disposable income per capita (PCDPI),
- average price of all scallop imports to the Northeast region (PIMPAL),
- average meat count (MCOUNT). It is estimated as the weighted average of meat count by area, weighted by the numbers and size of the areas open to fishing.
- A dummy variable, D94, as a proxy of management changes, such as the abolition of the meat count standard, since 1994.

Other things being equal, higher landings would lead to a lower price for scallops. Higher income would result in a higher price because sea scallop is considered a normal good. Higher price of scallop imports as a substitute would lead to a higher price for domestic scallops as well. Normally, larger scallops command a higher price because they are preferred in restaurant markets. Since the size of scallops is measured in meat counts per pound, smaller meat count implies that the scallops are larger compared to a pound of scallops with a higher meat count. Therefore, smaller meat count representing larger scallops would be associated with a higher ex-vessel price, implying an inverse relation between average meat count (MCOUNT) and the ex-vessel price (PEXVES).

All the price variables are corrected for inflation and expressed in 1996 prices by deflating current levels by consumer price index (CPI) for food. Per capita disposable income is also expressed in 1996 dollars by deflating nominal values with the GDP implicit deflator. The semi-log form was chosen to restrict estimated price to positive values only. The empirical estimation is shown in Equation 5.. As Figure 14 shows, this equation provides a good fit to the actual values of annual ex-vessel price.

Equation 5.

$$\text{Log(PEXVES)} = \underset{(2.42)}{1.1606} - \underset{(-6.49)}{0.0146} * \text{DOMLAN} + \underset{(1.30)}{0.00002} * \text{PCDPI} + \underset{(3.94)}{0.1228} * \text{PIMPAL} - \underset{(-0.46)}{0.0013} * \text{MCOUNT} - \underset{(-1.73)}{0.1458} * \text{D94}$$

n=18, from 1982 to 2000, adj R-sq = 0.90, D-W = 1.67, t-value in parentheses.

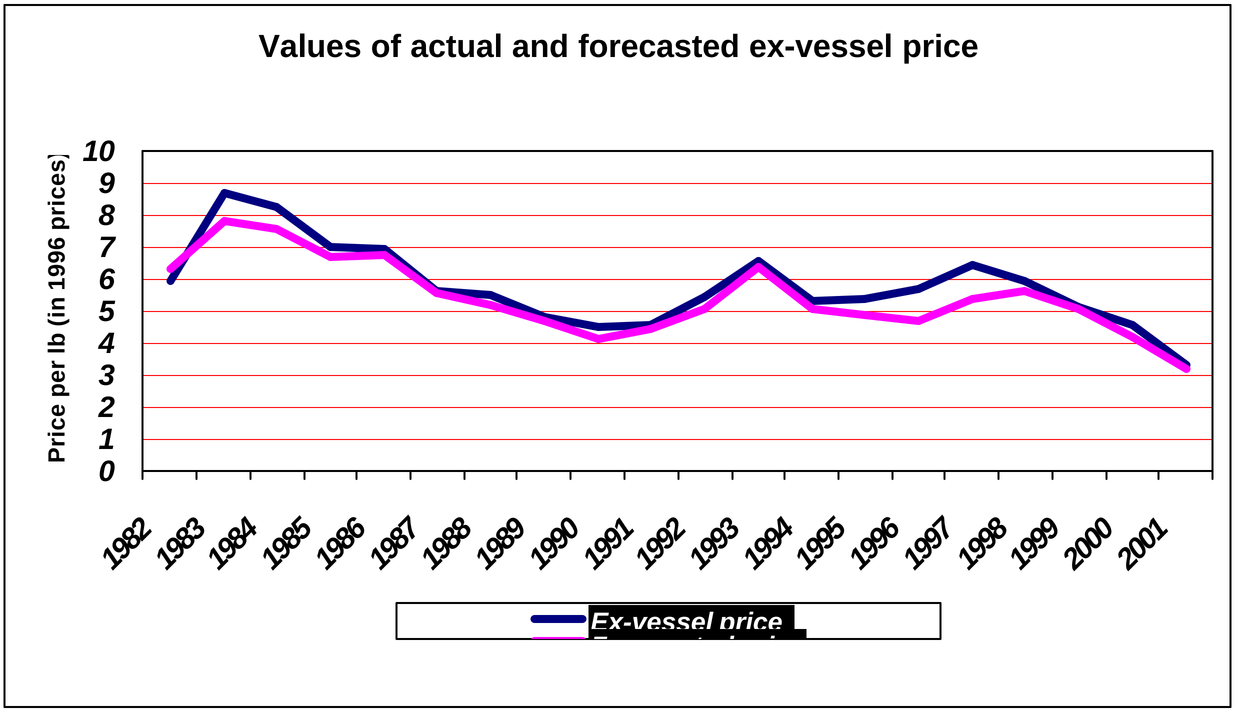


Figure 14. The actual and predicted values of ex-vessel price

3.3 Operating cost equation

Fishery management measures not only affect the level of landings and prices of scallops, but also have an impact on the trip and operating cost of vessels. Since cost data are needed for estimating producer surplus and thus net national benefits (consumer and producer surpluses), specification and estimation of cost equations are necessary for analyzing policy options. The operating cost of scallop fishing (OPC) is postulated to be a function of vessel crew size (CREW), vessel size in gross tons (GRT) and vessel days at sea (DAS).

The operational costs are assumed to change with a vessel's effort, and therefore, were assumed to decline as DAS decreased. Operating costs consist of trip costs, such as food, fuel, oil and ice, which vary with DAS, as well as half of repairs, assuming that more vessel activity will increase repair costs

This cost equation was assumed to take a double-logarithm form and estimated with data collected by the Economic and Social Science Branch of Northeast Fisheries Science Center. The detailed information on the cost/earnings data are available in two studies: Gautam and Kitts (1996) and Edwards (1997). The empirical equation presented below verifies the postulated hypothesis and has proper statistical properties.

Equation 6.

$$\underset{}{Log(OPC)} = \underset{(6.31)}{4.6130} + \underset{(3.34)}{0.2531} * Log(CREW) + \underset{(3.46)}{0.2743} * Log(GRT) + \underset{(8.79)}{1.1134} * Log(DAS)$$

n=69, adj R-sq = 0.58, D-W = 1.97, t-value in parentheses.

The operating costs were estimated in 1996 prices. The latest statistics (for July 2002) indicated that fuel costs were 9 percent higher compared to year 1996. If the recent changes in fuel prices were taken into account, the estimated operational expenses would go up by less than 9% since variable costs also include non-fuel costs such as water, ice, oil, food, and half-of repair expenses. Because the fuel prices could not be predicted for the coming years at this time, no adjustments were made to the estimated costs and gross profits in this section.

3.4 Fixed Cost Equation

The fixed costs include insurance, license, half of repairs, office expenses, professional fees (for accounting etc.,), dues, utilities, interest, dock expenses, rent, employee benefits and bank, store, auto, travel expenses.

Insurance comprised a significant proportion of the fixed costs, and amounted to over $78,790, followed by interest payments, amounting to over $40,000 in 1996 dollars and as an average of the vessels included in the cost data. Interest payments could be close to the total payments on mortgage for some vessels. Inclusion of interest payments probably overestimates fixed costs for some vessels that are already paid off.

Overall, estimated repairs averaged $69,900 a year in 1996 constant dollars and half of this, $34,965 was included in fixed costs. The other half of repairs was included in the operational costs because some part of repair expenses is related to the level of fishing activity. For example, a vessel that fishes full-time will likely need more repairs than a vessel that fishes only part-time.

Other than these costs, the vessels will incur dockside expenses and overhead no matter how many days they fish. These expenses were included in the fixed costs for all options. Section ??? in the FSEIS shows the average fixed costs by DAS-use groups for a sample of vessels included in the Gautam and Kitts (1996) cost data. Since these costs seems to be higher for vessels with a higher DAS-use, there is no evidence that that the average fixed costs per vessel increase as a vessel stay longer at the dock.[5]

---

5 Some industry members reported that some repairs that are done by crew when they are on board catching scallops will not be finished if the DAS allocations are reduced and the vessel owners will need to pay for these repairs when the boat is at the dock.

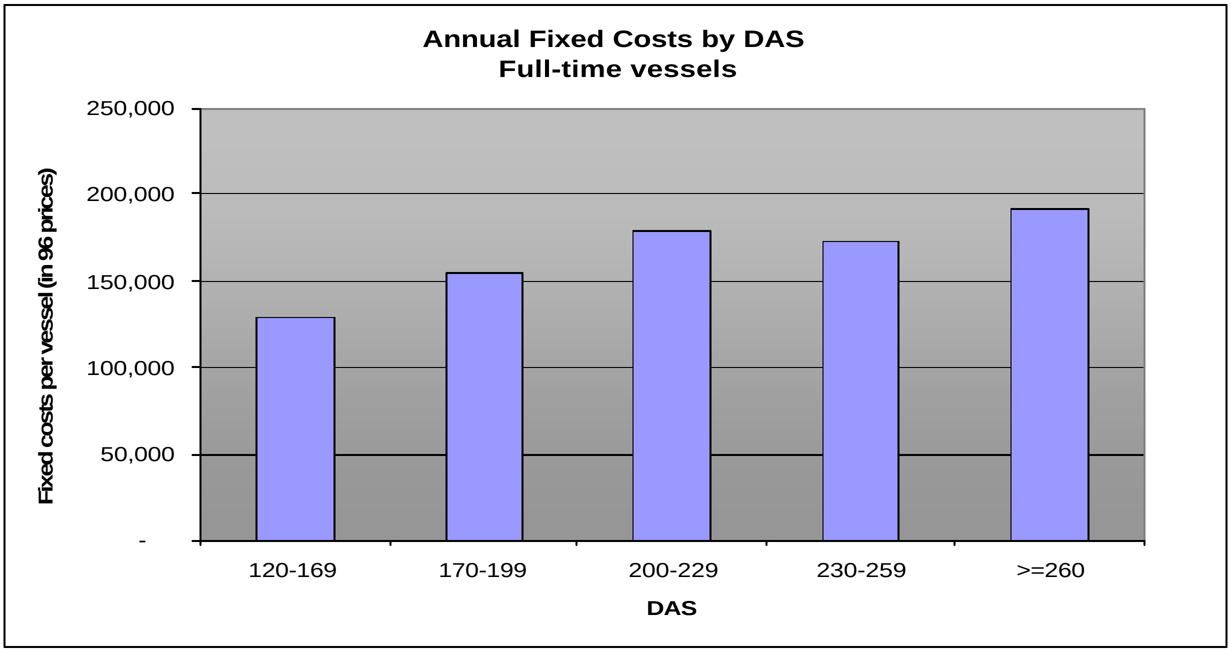


Figure 15. Annual fixed costs by DAS-use category for a sample of full-time vessels

It was estimated that the fixed costs for an average scallop vessel amounted to $163,400 in 1996 constant dollars. This estimate is based on the fixed cost regression (Equation 3) shown below, which estimates the fixed costs as a function of vessel characteristics. 6

Equation 3.

$$FC = \underset{(1.46)}{480160.22} + \underset{(1.61)}{266.54 * (GRT)} + \underset{(3.22)}{88.05 * HP}$$

n=75, adj R-sq = 0.16, t-value in parentheses.

3.5 Gross profits

As it is well known, the net income and profits could be calculated in various ways depending on the accounting conventions applied to gross receipts and costs. The gross profit estimates used in the economic analyses in the FSEIS rather than corresponding to a specific accounting procedure, simply show the difference of gross revenue over variable (including the

6 The cost data collected by Daniel Georgianna et.al (1999) has similar results for the fixed costs. When half of the repairs were added to the overhead costs for the consistency of the fixed costs definition, the fixed costs for the large New Bedford and New England scallop boats amounted to $172,113 in 1997. This amount included, however, taxes, and the principal and interest payments on loans, whereas the fixed cost estimates used in the vessel impact analysis above did not include taxes and the principal payments. For the boats in Mid-Atlantic this amount was much less, around $115,000. Therefore, the estimates for fixed costs in these section are close to the amount of fixed costs ($163,403) estimated for the large vessels in New England.

crew shares) and fixed expenses. It is in some ways similar to the net income estimated from cash-flow statements since depreciation charges are not subtracted from income because they are not out-of-pocket expenses.

3.6 Consumer surplus

Consumer surplus measures the area below the demand curve and above the equilibrium price. For simplicity, consumer surplus is estimated here by approximating the demand curve between the intercept and the estimated price with a linear line as follows:

CS=(PINT*DLNP-EXPP*DLNP)/2
EXPP= Ex-vessel price corresponding to landings for each policy option.
PINT=Price intercept i.e., estimated price when domestic landings are zero

DLNP= Sea scallop landings for each policy option.

Although this method may overestimate consumer surplus slightly, it does not affect the ranking of alternatives in terms of highest consumer benefits or net economic benefits.

3.7 Producer surplus

The producer surplus (PS) is defined as the area above the supply curve and the below the price line of the corresponding firm and industry (Just, Hueth & Schmitz (JHS)-1982). The supply curve in the short-run coincides with the short-run MC above the minimum average variable cost (for a competitive industry). This area between price and the supply curve can then be approximated by various methods depending on the shapes of the MC and AVC cost curves. The economic analysis presented in this section used the most straightforward approximation and estimated PS as the excess of total revenue (TR) over the total variable costs (TVC). It was assumed that the number of vessels and the fixed inputs would stay constant over the time period of analysis. In other words, the fixed costs were not deducted from the producer surplus since the producer surplus is equal to profits plus the rent to the fixed inputs. Here fixed costs include various costs associated with a vessel such as depreciation, interest, insurance, half of the repairs (other half was included in the variable costs), office expenses and so on. It is assumed that these costs will not change from one scenario to another.

PS=EXP*DLN- ΣOPC
ΣOPC = Sum of operating costs for the fleet.

Producer Surplus also equals to sum of rent to vessels and rent to labor. Therefore, rent to vessels can be estimated as:

RENTVES=PS – CREWSH7

Rentves= Quasi rent to vessels

7 CREWSH is estimated as follows: CREWSH=.60*gross revenues -trip costs. With this definition, crew shares are equivalent to crew income, i.e., their revenue net of trip expenses.

Crewsh= Crew Shares

3.8 Total economic benefits

Total economic benefits (TOTBEN) is estimated as a sum of producer and consumer surpluses and its value net of status quo is employed to measure the impact of the management alternatives on the national economy.

TOTBEN=PS+CS

3.9 Other assumptions

- The vessel costs are estimated for an average scallop vessel that has a GRT, HP, and crew size equivalent to the fleet average. All the costs are estimated in 1996 constant prices.
- The scallop revenues are estimated from projected landings and the annual price model in 1996 real prices.
- Import prices, and the disposable income are held constant at the 2001 level, but in 1996 constant prices when estimating ex-vessel prices.
- The maximum crew size is restricted at seven men.
- Crew shares are estimated using a 40/60 lay-system according to which crew receives 60% of the gross stock and pays for the trip expenses.
- A discount rate of 7% is applied to annual values in deriving present cumulative value of the revenues, costs, producer and consumer surpluses and total economic benefits.
- The results are based on the assumption that there will be sufficient effort to land the scallops predicted by the biological model and there would be no reduction in total effort. This implies that even if there were some business failures DAS would be redistributed among the remaining vessels either with regulation and/or some consolidation.

3.10 Risk and Uncertainty and Sensitivity Analyses

The sensitivity analysis presented in this section applies both to the long-term impacts of the rotational and non-rotational alternatives and to the short-term effects of the rotational management, area access and habitat closures.

The numerical estimates of the revenues, costs and benefits should be used in comparing one option with another rather than is predicting the future values of the economic variables. The absolute values of the net economic benefits and its components would change if a different discount rate was applied and/or different assumptions were used regarding the trends in disposable income, import prices and costs. Also, the estimates for landings and prices are subject to statistical errors and variability. If the standard deviations in various variables and coefficients are taken into account, the range of values for revenues, consumer and producer surpluses and net economic benefits will fall within a confidence interval around the mean values. The ranking of the options in terms of their net economic benefits relative to each other are likely to stay the same, however, as discussed below.

Sensitivity of the results to the assumptions about area access:

The economic benefits and costs were estimated assuming that the total landings from the controlled access areas will be equivalent to the estimated TACs. If, however, the vessels prefer to fish in the open areas rather than in the restricted access areas at the selected days-at-sea trade-offs and trip limits, thus landing less in these areas than the corresponding TAC levels, the results will be different than shown. If for example, LPUEs in Georges Bank closed areas fall short of the estimated LPUEs from the biological model, some scallop fishermen may choose not to fish in those areas. In that case, the actual landings may fall short of the TACs for the access, and the total landings, revenues and economic benefits for all options with area access would be less than predicted.

Sensitivity of results to the value of the discount rate:

If a lower discount rate was used for estimating the cumulative present value of the benefits, the economic benefits of options with lower fishing mortality and lower DAS allocations will increase relative to the options with higher DAS allocations. For example, if a discount rate of 3% percent was applied in estimating the present value of the net benefits, the economic benefits associated with no action would increase relative to the rotational management with access. This is because the benefits on scallop stock biomass and yield from lower fishing mortalities will be realized later in the future years and the future years would be discounted less with a 3 percent discount rate compared to a 7 percent rate.[8]

Sensitivity of the results to future values of disposable income and import prices:

The long-term impacts of all options were analyzed by asking the following question: What would be the impact of changing the proposed measures on long-term economic benefits and its components holding other variables, such as disposable income and import prices constant. For this reason, the ex-vessel price was estimated for the future years assuming the disposable income and import prices will stay constant at their 2001 value. The absolute value of the net benefits would change if a different set of assumptions were used. The ranking of the alternatives in terms of their economic benefits would still stay the same, however, for the following reasons:

- If it was assumed, as an example, the disposable income per capita (DPIPC) will increase at an average of 3% rate per year as it did in the last 10 years, the ex-vessel prices would increase under all options, increasing the value of the scallop resource and therefore total net benefits. Because those options with lower fishing mortality, i.e., lower DAS allocations and larger closures result in higher yield compared to others, the economic benefits associated with no action and the alternatives with no access to the Georges

8 An alternative discount rate that is often used in cost benefit analyses is social discount rate. OMB circular defines this rate as follows: "The social rate of time preference reflects the discount rate at which society is indifferent between a payment now and a correspondingly larger payment in a future year. It may be lower than the average real return on investment because, as a result of taxes and other distortions, individuals do not receive the full return on their investments. Most analysts use the average real rate on long-term Treasury bonds to represent the social rate of time preference. For the last 15 years, this rate has been in the range of 3 to 5 percent (http://www.whitehouse.gov/OMB/memoranda/m00-06.html)."

Bank closed areas would increase slightly relative the options with smaller closures and area access. The reverse would happen if there was a change in historical trends and disposable income declined by 3% over the same period. Even under this unlikely scenario, however, more conservative options would result in larger net economic benefits compared to the other alternatives. In general, however, the differences in net benefits one option versus another is not very sensitive to changes in disposable income within the range of its historical trend.9

- The average import price of scallops from all countries declined at an average annual rate of 3 percent during the last 10 years from 1991 to 2001, although in some years there was an increase in import prices. The continuation of a declining trend in import prices would accelerate (dampen) the decline (increase) in domestic scallop prices as the landings increase (decline) in response to changes in stock biomass. If the cost/benefit analysis was conducted assuming import prices will decline by 3 percent in the next 10 years, results would be similar to that of a declining disposable income per capita (DPIPC). Specifically, the difference in the net benefits of the more conservative options relative to the others would slightly decrease although their net benefits would still exceed the benefits of the later options.

- An increasing trend in import prices would have the reverse effect, increasing the net benefits of the more conservative options relative to the others slightly. As with the changes in the disposable income, however, the sensitivity of the relative differences in net benefits (of one option versus another) to changes in import prices are small within the range of historical trends.

Sensitivity of the results to variances in landings and price estimates:

The landings and price estimates and their variability determine to a large extent the absolute values and variability of the revenue, producer and consumer surplus, and net benefit estimates for each option. The ranking of the options in terms of their economic benefits are not expected to change, however, when the variability and the standard errors in the estimates are taken into account:

The prices were estimated using the price model (**Equation 5.**) discussed in Section 3.2. If the elasticity (i.e., responsiveness) of prices to change in landings is lower than the mean values, the absolute values of economic benefits would be less for each option. The differences in net economic benefits of one option versus another would change slightly and the relative benefits of the more conservative options would still exceed the benefits of the other options.

The landings from the biological model estimates have variability due to the possible changes in recruitment over the next 10 years and long-term. The long-term cost/benefit analysis of the rotational and the non-rotational analysis takes into account this variability in the discussion of results as presented in Section ??? in the FSEIS. If variability is taken as a measure

9 In general, the results are not very sensitive to the changes in the disposable income (DPI) as could be inferred from the coefficient of this variable in the price equation.

of risk, the risk of landings falling below the mean values is higher for the rotational options that increase closure duration or maximum biomass closed. The adaptive rotations with variable closure durations improve landings slightly compared to other rotational options. But the same alternatives also result in higher variability from one year to the next.

APPENDIX V

DETAILED DATA OF HABITAT METRIC ANALYSIS FOR THE HABITAT CLOSED AREA ALTERNATIVES *COMBINED WITH* THE NO ACTION ALTERNATIVE

Appendix V was part of the DSEIS analysis of the combined effect of the proposed habitat alternatives and no action groundfish mortality closures in Multispecies Amendment 13. This analysis was unable to illustrate the independent effects of the habitat closure alternatives and the groundfish mortality alternatives. While the combined effects analysis could be appropriate under Multispecies Amendment 13 that regulates all gear capable of having adverse impacts on groundfish EFH, the analysis was not appropriate for Amendment 10 which regulates only scallop dredges, trawls, and all gear capable of having adverse impacts on scallop EFH. Copies of Appendix V in the DSEIS are available from the Council Office.

APPENDIX VI

Essential Fish Habitat Section:

Gear Descriptions of Gears Used in Northeast U.S.

Gear Descriptions of Gears Used in Northeast U.S.

1 Introduction

Descriptions are included in this appendix for the following general gear categories used in state and federal waters of the Northeast region of the U.S: Bottom tending mobile gear, bottom tending static gear, pelagic gear, and other gears. The Northeast region falls within the jurisdiction of the NEFMC and MAFMC as well as the individual states from Maine to North Carolina which are represented by the Atlantic States Marine Fisheries Commission (ASMFC). These jurisdictions are responsible for the management of many different fisheries extending from the upper reaches of the rivers and estuaries out to 200 miles offshore at the limit of the Exclusive Economic Zone (EEZ).

2 Fisheries Landing Data and Gear Usage Information

Sixty categories of fishing gear were identified as having been associated with landings of federal or state managed species based on a review of the National Marine Fisheries Service commercial fisheries landings data for 1999 and an ASMFC report on gear impacts to submerged aquatic vegetation (Stephan *et al.* 2000).

Fishing gears considered in this report are those used to land any amount of any species managed by either the NEFMC or MAFMC (**Error! Reference source not found.**) as well as gears that contributed 1% or more of any individual state's total landings for all species (Table 2). Although certain gear types are not managed under the auspices of the MSA, this methodology recognizes that certain gear utilized in state waters may have adverse impacts to EFH that is designated in nearshore, estuarine and riverine areas. Table 3 provides the list of all 60 gears considered and indicates whether the gear is utilized in estuaries, coastal waters (0-3 miles), or offshore waters (3-200 miles). Since the seabed is the location of the habitat types most susceptible to gear disturbances, Table 3 also indicates whether the gear contacts the bottom and if the use of the gear is regulated under a federal FMP. This report considers gear to be regulated under a federal FMP if it is typically utilized to harvest fish under a federal vessel or operators permit.

	NORTHEAST SPECIES																														
GEAR	DOGFISH	BLUEFISH	BUTTERFISH	SURFCLAM	OCEAN QUAHOG	COD, ATLANTIC	RED CRAB	SUMMER FLNDR	WINDOWPANE FLNDR	WINTER FLNDR	WITCH FLNDR	YELLOWTAIL FLNDR	MONKFISH	HADDOCK	HAKE, RED	HAKE, SILVER	HAKE, WHITE	HALIBUT, ATLANTIC	HERRING, ATLANTIC	MACKEREL, ATLANT	PLAICE, AMERICAN	POLLOCK	OCEAN POUT	REDFISH	SCALLOP, SEA	SCUP	BLACK SEA BASS	SKATES	SQUID, LOLIGO	SQUID, ILLEX	TILEFISH
Bag Nets			-																											-	
Beam Trawls. Other		-	-		-					-	-	-	-		-	-									-	-			-		
Cast Nets		-						-																		-					
Combined Gears		-																									-				-
Diving Outfits. Other																									-	-					
Dredge Clam				92	100			-		-			-												-	-					
Dredge Conch								-																				-			
Dredge Scallop. Bay										-	-		-												-						
Dredge Scallop. Sea		-	-			-		2	-	-	-	1	16			-	-				-	-			90	-	-	-	-	-	-
Floating Traps (Shallow)		1	-			-		-		-			-			-			-	2		-				9	-	-	-		
Fyke And Hoop Nets.		-	-					-	-	-	-	-	-															-			
Gill Nets. Drift. Other	-	9	-					-		-		-	-		-	-			-	-			-			-	-	-	-		
Gill Nets. Drift.		5	-																												
Gill Nets. Other		5	-					-					-							-							-	-			
Gill Nets. Sink/Anchor.	60	16	-			20		-	-	4	2	6	29	7	-	-	35	8	-	1	2	55	3	16	-	-	-	12	-	-	-
Gill Nets. Stake	-	-	-					-					-						-	-											
Haul Seines. Beach	-	1	-					-		-					-	-			-	-								-			
Haul Seines. Long		-	-																												
Haul Seines.						-				-	-	-	-	-		-	-				-	-		-				-			
Lines Hand. Other	-	5	-			5		2	-	-	-	-	-	-	-	-	-		-	-	-	-	4	-		12	14	-	-		2
Lines Long Set With	-	-	-			17		-		-	-	-	-	2	-	-	5	-		-	-	2	7	-	-	-	-	-	-		61
Lines Long. Reef Fish																															32
Lines Troll. Other		-	-					-																			-				-
Lines Troll With Baits								-																							
Otter Trawl Bottom. Fish	38	20	93			57		92	98	95	97	92	53	91	98	99	58	89	2	93	97	42	77	83	-	66	25	86	99	100	4
Otter Trawl Bottom.		-				-		-		-	-	-	-	-							-	-			9		-	-	-		
Otter Trawl Midwater																			53	-											
Pots And Traps. Conch		-	-			-																	-				-				
Pots And Traps. Crab.		-	-					-																			-				
Pots and Traps. Crab.		-																													
Pots And Traps. Crab.		-					60	-																							
Pots And Traps. Fish		-	-			-		-		-			-		-	-	-		-	-		-	7	-		5	53	-	-		-
Pots And Traps. Lobster		-	-			-		-		-			-	-	-	-	-			-		-	-	-	-	-	-	-	-		
Pots And Traps. Lobster		-	-			-	40	-		-			-		-		-						-	-		-	-		-		-
Pots And Traps. Other		-						-																		-	3				
Pound Nets. Crab		-						-																							
Pound Nets. Fish		5	3			-		2	-	-		-	-		-	-			-	-						-	-	-	-		
Pound Nets. Other		-	-					-		-										2						2	-		-		
Purse Seines. Herring																			31												
Purse Seines. Other		3																													
Reel. Electric or																											-				
Rod and Reel																											-				
Scottish Seine		-	-			-		-	-	-	-	-	-	-	-	-	-			-	-	-	-			-	-	-	-		
Scrapes								-																							
Spears		-																									-				
Stop Seines																			-												
Trawl Midwater. Paired																			14												
Weirs																			-												

"-" Indicates there was less than 1% landings associated with this gear type for this species

"Blank" Indicates there were no landings recorded for this gear type for this species

Table 1 - Percentage of Landings for Federally Managed Species by Fishing Gear Type Used in Northeast Region in 1999

	Percent of Landings (1% or more) for All Species by State											
Gear	**CT**	**DE**	**MA**	**MD**	**ME**	**NC**	**NH**	**NJ**	**NY**	**RI**	**VA**	**% Landings All States Combined**
By Hand, Other		18										
Diving Outfits, Other					5							1
Dredge Clam			9	10				39	1	1		6
Dredge Crab		11									1	
Dredge Mussel					1							
Dredge Other					3							
Dredge Scallop, Sea	7		10		1		1	2			1	2
Dredge Urchin, Sea					1							
Floating Traps (Shallow)										1		
Fyke And Hoop Nets, Fish				2								
Gill Nets, Drift, Other		4		3				2				1
Gill Nets, Drift, Runaround						1						
Gill Nets, Other						14						1
Gill Nets, Sink/Anchor,			12	5	1		42	5	5	4	3	4
Gill Nets, Stake		7										
Haul Seines, Beach				2							1	
Haul Seines, Long						1						
Hoes					1							
Lines Hand, Other		1	2	1		1	1		1			1
Lines Long Set With Hooks			4			1		1	4			1
Lines Long, Shark						1						
Lines Troll, Other						1						
Lines Trot With Baits				17								1
Not Coded	16				1			1	30			2
Otter Trawl Bottom, Shrimp					1	6	3					1
Otter Trawl Midwater			11		21		8			18		6
Pots And Traps, Conch		2										
Pots And Traps, Crab, Blue		51		36		36		3			6	8
Pots And Traps, Crab, Other			2							1		
Pots And Traps, Eel		2		1								
Pots And Traps, Fish		1		3								
Pots And Traps, Lobster Inshore	13		5		25		9			4		5
Pots And Traps, Lobster Offshore	2		4				9	1		2		1
Pots And Traps, Other			1		1							
Pound Nets, Crab				1								
Otter Trawl Bottom, Crab						1						
Otter Trawl Bottom, Fish	61		38	3	9	7	26	26	58	56	2	18
Pound Nets, Fish				14		1			1		4	2
Purse Seines, Herring			1		23							4
Purse Seines, Menhaden						27		18			74	28
Purse Seines, Other											7	2

Table 2 - Principal Fishing Gears Used in Each State in the Northeast Region in 1999

GEAR	Estuary or Bay	Coastal 0-3 Miles	Offshore 3-200 Miles	Contacts Bottom	Federally Regulated
Bag Nets	X	X	X		X

Beam Trawls	X	X	X	X	X
By Hand	X	X			X
Cast Nets	X	X	X		
Clam Kicking	X			X	
Diving Outfits	X	X	X		
Dredge Clam	X	X	X	X	X
Dredge Conch	X			X	
Dredge Crab	X	X		X	
Dredge Mussel	X	X		X	
Dredge Oyster, Common	X			X	
Dredge Scallop, Bay	X			X	
Dredge Scallop, Sea		X	X	X	X
Dredge Urchin, Sea		X	X	X	
Floating Traps (Shallow)	X	X		X	X
Fyke And Hoop Nets, Fish	X	X		X	
Gill Nets, Drift, Other			X		X
Gill Nets, Drift, Runaround			X		X
Gill Nets, Sink/Anchor, Other	X	X	X	X	X
Gill Nets, Stake	X	X	X	X	X
Haul Seines, Beach	X	X		X	
Haul Seines, Long	X	X		X	
Haul Seines, Long(Danish)		X	X	X	X
Hoes	X			X	
Lines Hand, Other	X	X	X		X
Lines Long Set With Hooks		X	X	X	X
Lines Long, Reef Fish		X	X	X	X
Lines Long, Shark		X	X		X
Lines Troll, Other		X	X		X
Lines Trot With Baits		X	X		X
Otter Trawl Bottom, Crab	X	X	X	X	
Otter Trawl Bottom, Fish	X	X	X	X	X
Otter Trawl Bottom, Scallop		X	X	X	X
Otter Trawl Bottom, Shrimp	X	X	X	X	X
Otter Trawl Midwater		X	X		X
Pots And Traps, Conch	X	X		X	
Pots and Traps, Crab, Blue Peeler	X	X		X	
Pots And Traps, Crab, Blue	X	X		X	
Pots And Traps, Crab, Other	X	X	X	X	X
Pots And Traps, Eel	X	X		X	
Pots and Traps, Lobster Inshore	X	X		X	
Pots and Traps, Lobster Offshore			X	X	X
Pots and Traps, Fish	X	X	X	X	X
Pound Nets, Crab	X	X		X	
Pound Nets, Fish	X	X		X	
Purse Seines, Herring		X	X		X
Purse Seines, Menhaden		X	X		
Purse Seines, Tuna		X	X		X
Rakes	X			X	
Reel, Electric or Hydraulic		X	X		X
Rod and Reel	X	X	X		X
Scottish Seine		X	X	X	X
Scrapes	X			X	
Spears	X	X	X		
Stop Seines	X			X	
Tongs and Grabs, Oyster	X			X	
Tongs Patent, Clam Other	X			X	
Tongs Patent, Oyster	X			X	
Trawl Midwater, Paired		X	X		X
Weirs	X			X	

Includes all gears that accounted for 1% or more of any state's total landings and all gears that harvested any amount of any federally managed species, based upon 1999 NMFS landings data and ASMFC Gear Report (ASMFC 2000). Shaded rows represent gears that are federally managed and contact the bottom.

Table 3 - Fishing Gears Used in Estuaries and Bays, Coastal Waters, and Offshore Waters of the EEZ, from Maine to North Carolina.

3 Description of Gear Types

3.1 BOTTOM-TENDING MOBILE GEAR

3.1.1 Otter Trawls

Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function may be defined by the part of the water column where the trawl operates (e.g., bottom) or by the species that it targets (Hayes 1983). There is a wide range of otter trawl types used in the Northeast as a result of the diversity of fisheries prosecuted and bottom types encountered in the region (NREFHSC 2002). The specific gear design used is often a result of the target species (whether they are found on or off the bottom) as well as the composition of the bottom (smooth versus rough and soft versus hard). There are two three components of the otter trawl that come in contact with the sea bottom: the doors, the ground cables and bridles which attach the doors to the wings of the net, and the sweep (or foot-rope) which runs along the bottom of the net mouth. Bottom trawls are towed at a variety of speeds, but average about 5.5 km/hr (3 knots or nmi/hr).

3.1.1.1 Doors

The traditional otter board is a flat, rectangular wood structure with steel fittings and a stell "shoe" along the bottom that prevents the bottom of the door from damage and wear as it drags over the bottom. Other types include the V-type (steel), polyvalent (steel), oval (wood), and slotted spherical otter board (steel) (Sainsbury 1996). It is the spreading action of the doors resulting from the angle at which they are mounted that creates the hydrodynamic forces needed to push them apart. These forces also push them down towards the sea floor. On fine-grained sediments, the doors also function to create a silt cloud that aids in herding fish into the mouth of the net (Carr and Milliken 1998). In shallow waters, light-weight doors are typically used to ensure that the doors and the net spread fully. In these cases, light, foam filled doors can be used (Sainsbury 1996). Vessels fishing large nets in deeper water require very large spreading forces from the doors. In these cases, a 15 m^2 (49 ft^2) V-door weighing 640 kg (1480 lbs) can provide 9 metric tons of spreading force (Sainsbury 1996).

3.1.1.2 Ground Cables and Bridles

Steel cables are used to attach the doors to the wings of the net. The ground cables run along the bottom from each door to two cables (the "bridle") that diverge to attach to the top and bottom of the net wing. The bottom portion of the bridle also contacts the bottom. In New England, fixed rubber discs ("cookies") or rollers are attached to the ground cables and lower bridle. In general, bridles vary in length from 9 m to 73 m (30 - 200 ft) while ground cables can be from 0 to 73 m (200 ft) depending upon bottom conditions and towing speed (Sainsbury 1996). The length of these cables can therefore increase the area swept by the trawl by as much as three fold.

3.1.1.3 Sweeps

On smooth bottoms, the sweep may be a steel cable weighted with chain, or may be merely rope wrapped with wire. On rougher bottoms, rubber discs ("cookies") or rollers are attached to the sweep to assist the trawl's passage over the bottom (Sainsbury 1996). There are two main types of sweep used in smooth bottom in New England (Mirarchi 1998). In the traditional chain sweep, loops of chain are suspended from a steel cable, with only 2-3 links of the chain touching bottom. Contact of the chain with the bottom reduces the buoyancy of the trawl – which would otherwise be negatively buoyant – to the point where it skims along just a few inches above the bottom to catch species like squid and scup that swim slightly above the bottom. The other type of sweep is heavier and is used on smooth bottom to catch flounder. Instead of a cable, rubber cookies stamped from automobile tires are attached to a heavy chain. This type of sweep is always in contact with the bottom. Cookies vary in diameter from 1.5 to 6.5 cm (4 to 16 inches) and do not rotate (Carr and Milliken 1998).

An important consideration in understanding the relative effects of different otter trawl configurations is their weight in water relative to their weight in air. Rockhopper gear is not the heaviest type of ground gear used in this region since it loses 80% of its weight in water (i.e., a rockhopper sweep that weighs 1000 pounds on land may only weigh 200 pounds in water) (NREFHSC 2002). Streetsweeper gear is much heavier in the water due to the use of steel cores in the brush components. Plastic-based gear has the smallest weight in water to weight in air ratio (approximately 5%) (NREFHSC 2002). For the same reasons, steel doors are much heavier in water than wooden doors (Mirarchi 1998).

Roller sweeps and rockhoppers are used on irregular bottom (Carr and Milliken 1998). Vertical rubber rollers rotate freely and are as large as 14.5 cm (36 inches) in diameter. In New England, the rollers have been largely replaced with "rockhopper" gear that uses larger fixed rollers and are designed to "hop" over rocks as large as 1 meter in diameter. Small rubber "spacer" discs are placed in between the larger rubber discs in both types of sweep. Rockhopper gear is no longer used exclusively on hard bottom habitats, but is actually quite versatile and used in a variety of habitat types (NREFHSC 2002). "Street-sweepers" were first used in Massachusetts in 1995, replacing heavier rockhopper gear, and consist of circular brushes up to 12.5 cm (31 inches) in diameter. They are lighter than rubber rockhopper gear and can probably fish much rougher bottom than other sweep designs (Carr and Milliken 1998).

Flatfish are primarily targeted with a mid-range mesh flat net that has more ground rigging and is designed to get the fish up off the bottom. A high rise or fly net with larger mesh is used to catch demersal fish that rise higher off the bottom than flatfish (NREFHSC 2002). Crabs, scallops, and lobsters are also harvested in large mesh bottom trawls.

Small mesh bottom trawls are used to capture northern and southern shrimp, whiting, butterfish and squid and usually employ a light chain sweep. Small-mesh trawls are designed, rigged, and used differently than large-mesh fish trawls. Bottom trawls used to catch northern shrimp in the Gulf of Maine, for example, are smaller than most fish trawls and are towed at slower speeds (<2 knots versus 4 knots or so for a fish trawl). Footropes range in length from 12 m to over 30 m (40 - 100 ft), but most are 15 to 27 m (50 - 90 ft). Because shrimp inhabit flatter bottom than many fish do, roller gear tend to be smaller in diameter on shrimp nets because they are not towed over rough bottom (Dan Schick, Maine Dept. of Marine Resources, personal communication). Because shrimp can not be herded in the same manner as fish, footropes on shrimp trawls are bare (no cookies) and are limited to 27 m (90 ft) in length (D. Schick, personal communication). Northern shrimp trawls are also equipped with Nordmore grates in the funnel of the net to reduce the by-catch of groundfish. Southern shrimp trawlers that catch brown and white shrimp typically tow 2-4 small trawls from large booms extended from each side of the vessel (DeAlteris 1998). Northern shrimp trawlers tow a single net astern.

The raised-footrope trawl was designed especially for fishing for whiting, red hake, and dogfish. It was designed to provide vessels with a means of continuing to fish for small mesh species without catching groundfish. In this type of trawl, 1 m (42 inches) long chains connect the sweep to the footrope, which results in the trawl fishing about 0.45 to 0.6 m (1.5-2 ft) above the bottom (Carr and Milliken 1998). The raised footrope and net allows complete flatfish escapement, and theoretically travels over codfish and other roundfish (whiting and red hake tend to swim slightly above the other groundfish). Although the doors of the trawl still ride on the bottom, Carr and Milliken (1998) report that studies have confirmed that the raised footrope sweep has much less contact with the sea floor than does the traditional cookie sweep that it replaces.

3.1.2 Beam Trawls

The beam trawl is much like an otter trawl except the net is spread horizontally by a steel beam that runs the horizontal width of the net rather than with otter boards. The net is spread vertically by heavy steel trawl heads that generally have skid-type devices with a heavy shoe attached (Sainsbury 1996). Beam trawls currently in use in Europe are up to 12 m (40 ft) in width and very heavy, increasing in weight from 3.5 mt (7,700 lbs) in the 1960s to as much as 10 mt (22,000 lbs) in the 1980s (Rogers *et al*. 1998). Despite the weight of the gear, increased towing power and size of trawlers have allowed towing speeds to reach 14.8 km/hr (8 knots or nmi/hr).

It is believed that beam trawls are not currently used in the Northeast U.S. (NREFHSC 2002). A few beam trawls were used in the 1970s to catch monkfish, but the fishery was unsuccessful. In the mid 1990s, a number of boats off New Bedford, MA used what were referred to as beam trawls, but the gear more closely resembled a scallop dredge rather than the traditional, European beam trawls. There are a few boats that are currently recorded as using beam trawls in the NMFS fishery landings database, but it is believed these were most likely mis-characterized and are actually otter trawls being deployed from the side of the vessels (NREFHSC 2002).

It is unlikely that fishermen would begin using beam trawls in the Northeast U.S. Beam trawls are prevalent in the North Sea where the water is dark and murky and the fisheries target flatfishes, which sit slightly under the sediments. In these fisheries, the beam trawl acts to sieve the fish up off the seafloor. The lack of conventional herding effect and small mouth opening of the beam trawl would not be effective for harvesting U.S. target species. Furthermore, most vessels being used in the Northeastern U.S. do not have the size or power required to handle a beam trawl (NREFHSC 2002). Therefore, beam trawls will not be considered further in this report as a gear type potentially impacting marine habitats off the Northeastern U.S.

3.1.3 Clam Dredges

3.1.4 Hydraulic Clam Dredge

Hydraulic clam dredges have been used in the surfclam (*Spisula solidissima*) fishery for over five decades and in the ocean quahog (*Arctica islandica*) fishery since its inception in the early 1970s. These dredges are highly sophisticated and are designed to: 1) be extremely efficient (80 to 95% capture rate); 2) produce a very low bycatch of other species; and 3) retain very few undersized clams (NREFHSC 2002).

The typical dredge is 3.7 m (12 feet) wide and about 6.7 m (22 feet) long and uses pressurized water jets to wash clams out of the seafloor. Towing speed at the start of the tow is about 4.5 km/hr (2.5 knots or nmi/hr) and declines as the dredge accumulates clams. The dredge is retrieved once the vessel speed drops below about 3 km/hr (1.5 knots), which can be only a few minutes in very dense beds. However, a typical tow lasts about 15 minutes. The water jets penetrate the sediment in front of the dredge to a depth of about 20 - 25 cm (8 - 10 inches), depending on the type of sediment and the water pressure. The water pressure that is required to fluidize the sediment varies from 50 pounds per square inch (psi) in coarse sand to 110 psi in finer sediments. The objective is to use as little water as possible since too much pressure will blow sediment into the clams and reduce product quality. The "knife" (or "cutting bar") on the leading bottom edge of the dredge opening is 14 cm (5.5 inches) deep for surfclams and 8.9 cm (3.5 inches) for ocean quahogs. The knife "picks up" clams that have been separated from the sediment and guides them into the body of the dredge ("the cage"). If the knife size is not appropriate, clams can be cut and broken, resulting in significant mortality of clams left on the bottom. The downward pressure created by the runners on the dredge is about 1 psi (NREFHSC 2002).

The high water pressure associated with the hydraulic dredge can cause damage to the flora and fauna associated with bottom habitats. However, water pressure greater than that required for harvesting will reduce the quality of the clams by loading them with sand and increase the rate of clam breakage. Therefore higher, more damaging water pressures are usually not used.

Before 1990, two types of hydraulic dredges were common in the fishery, stern rig dredges and side rig dredges. A side rig dredge has a chain bag that drags behind the dredge and smooths out the trench created by the dredge. The chain bag results in significantly more damage to small clams and other bycatch than occurs with the stern rig dredge. Currently, most of the dredges in the fishery are stern rig dredges, which are basically giant sieves. Small clams and bycatch fall through the bottom of the cage into the trench and damage or injury to benthic organisms is minimal. Improvements in gear efficiency have reduced bottom time and helped to confine the harvest of surfclams to a relatively small area in the mid-Atlantic Bight (NREFHSC 2002).

Hydraulic clam dredges can be operated in areas of large grain sand, fine sand, sand and small grain gravel, sand and small amounts of mud, and sand and very small amounts of clay. Most tows are made in large grain sand. Dredges are not fished in clay, mud, pebbles, rocks, coral, large gravel greater than one half inch, or seagrass beds (NREFHSC 2002).

In the soft-clam (*Mya arenaria*) fishery, the dredge manifold and blade are located just forward of an escalator, or conveyor belt, that carries the clams to the deck of the vessel. These vessels are restricted to water depths less than one-half the length of the escalator and are typically operated from 15 m (49ft) vessels in water depths of 2-6 m (6.6 - 20 ft) (DeAlteris, 1998). The escalator dredge is not managed under federal fishery management plans. A variation of this type of dredge, the suction dredge, is used in Europe to harvest several bivalve species. Sediment and clams that are dislodged by water pressure are sucked through a hose to the vessel. These dredges are also restricted to shallow water.

3.1.4.1 Quahog Dredge

Ocean quahogs are also harvested in eastern Maine coastal waters using a non-hydraulic dredge that is essentially a large metal cage on skis with 15 cm (6 inch) long teeth projecting at an angle off the leading bottom edge (Pete Thayer, Maine Dept. of Marine Resources, personal communication). Maine state regulations limit the length of the cutter bar to 91 cm (36 inches). The teeth rake the bottom and lift the quahogs into the cage. This fishery takes place in small areas of sand and sandy mud found among bedrock outcroppings in depths of 9 to > 76 m (30 - 250 ft) in state and federal coastal waters north of 43°20' N latitude. These dredges are used on smaller boats, about 9 - 12 m long (30 to 40 ft) and are pulled through the seabed using the boat's engine (NREFHSC 2002). This fishery is managed under the MAFMC Surf Clam and Ocean Quahog FMP (MAFMC).

3.1.5 Sea Scallop Dredges

3.1.5.1 New Bedford Scallop Dredge

The New Bedford (or "chain sweep") dredge is the primary gear used in the Northeast U.S. sea scallop (*Placopecten magellanicus*) fishery and is very different than scallop dredges utilized in Europe and the Pacific because it is a toothless dredge.

The forward edge of the New Bedford dredge includes the cutting bar, which rides above the surface of the substrate, creating turbulence that stirs up the substrate and kicks objects (including scallops) up from the surface of the substrate into the bag. Shoes on the cutting bar are in contact with and ride along the substrate surface (NREFHSC 2002). A sweep chain is attached to each shoe and to the bottom of the ring bag (Smolowitz 1998). The bag is made up of metal rings with chafing gear on the bottom and twine mesh on the top, and drags on the substrate when fished. Tickler chains run from side to side between the frame and the ring bag and, in hard bottom, a series of rock chains run from front to back to prevent large rocks from getting into the bag (Smolowitz 1998). New Bedford dredges are typically 4.3 m (14 feet) wide; two of them are towed by a single vessel at speeds of 4 to 5 knots. Chain sweep dredges used along the Maine coast are smaller.

In the Northeast region, scallop dredges are used in high and low energy sand environments, and high energy gravel environments. Although gravel exists in low energy environments of deepwater banks and ridges in the Gulf of Maine, the fishery is not prosecuted there (NREFHSC 2002).

3.1.5.2 Toothed Scallop Dredges

The leading edge of scallop dredges used in Europe, Australia, and New Zealand to catch other species of scallop that "dig" into the bottom have teeth which dig into the substrate. This type of dredge is used by smaller vessels that are not able to tow a non-toothed dredge fast enough (4-5 knots) to fish effectively (NREFHSC 2002). Some of the European scallop dredges are spring-loaded so that the cutting bar flexes backward when it contacts a hard object on the bottom, then springs back when the dredge passes over the obstacle. These dredges are approximately 0.75 m (2.5 ft) wide and may be fished in gangs of 3-9 dredges on either side of the vessel (Kaiser *et al.* 1996a). A typical tooth bar bears 9 teeth, 11 cm (4.3 inches) long, spaced about 8 cm (3 inches) apart. French dredges, 2 m (6.6 ft) wide, are not spring-loaded and generally are fished on cleaner ground. They are fitted with a diving vane to improve penetration of the bottom. Scallop dredges used in Australia and New Zealand are heavy, rigid, wire mesh "boxes" that do not have a chain bag (McLoughlin *et al.* 1991).

3.1.6 Other Non-Hydraulic Dredges

3.1.6.1 Oyster or Crab Dredge/Scrape/Mussel Dredge

The oyster dredge is a toothed dredge consisting of a steel frame 0.5-2.0 m (1.6 -6.6 ft.) in width, a tow chain or wire attached to the frame, and a bag to collect the catch. The bag is constructed of rings and chain-links on the bottom to reduce the abrasive effects of the seabed, and twine or webbing on top. The dredge is towed slowly (<1 m/sec) in circles, from vessels 7 to 30 m (23 - 98 ft.) in length (DeAlteris 1998). Crabs are harvested with dredges similar to oyster dredges. Stern-rig dredge boats (approximately 15 m (49') in length) tow two dredges in tandem from a single chain warp. The dredges are equipped with 10 cm (4 inch) long teeth that rake the crabs out of the bottom. (DeAlteris 1998). The toothed dredge is also used for harvesting mussels (Hayes 1983). These dredging activities are not managed under federal fishery management plans

3.1.6.2 Bay Scallop Dredge

Bay scallops usually reside on the bottom. The bay scallop dredge may be 1 to 1.5 m (3.3 - 4.9 ft.) wide and about twice as long. The simplest bay scallop dredge can be just a mesh bag attached to a metal frame that is pulled along the bottom. For bay scallops that are located on sand and pebble bottom, a small set of raking teeth are set on a steel frame, and skids are used to align the teeth and the bag (Sainsbury 1996). This dredging activity is not managed under federal fishery management plans.

3.1.6.3 Sea Urchin Dredge

Similar to a simple bay scallop dredge, the sea urchin dredge is designed to avoid damaging the catch. It has an up-turned sled-like shape at the front that includes several leaf springs tied together with a steel bar. A tow bail is welded to one of the springs and a chain mat is rigged behind the mouth box frame. The frame is fitted with skids or wheels. The springs act as runners, enabling the sled to move over rocks without hanging up. The chain mat scrapes up the urchins. The bag is fitted with a codend for ease of emptying. This gear is generally only used in waters up to 100 m (330 ft.) deep (Sainsbury 1996). This dredging activity is not managed under federal fishery management plans.

3.1.6.4 Clam "Kicking"

Clam kicking is a mechanical form of hard clam harvest practiced in North Carolina which involves the modification of boat engines so that the propeller is directed downwards instead of backwards (Guthrie and Lewis 1982). In shallow water the propeller wash is powerful enough to suspend bottom sediments and clams into a plume in the water column, which allows them to be collected in a trawl net towed behind the boat (Stephan *et al*. 2000). This activity is not managed under federal fishery management plans.

3.1.7 Seines

3.1.7.1 Haul Seines

Haul seining is a general term describing operations where a net is set out between the surface and sea bed to encircle fish. It may be undertaken from the shore (beach seining), or away from shore in the shallows of rivers, estuaries or lakes (Sainsbury 1996). Seines typically contact the sea bottom along the lead line. Additionally the net itself may scrape along the bottom as it is dragged to shore or the recovery vessel. This activity is not managed under federal fishery management plans.

3.1.7.2 Beach Haul Seines

The beach seine resembles a wall of netting of sufficient depth to fish from the sea surface to the sea bed, with mesh small enough that the fish do not become gilled. A floatline runs along the top to provide floatation and a leadline with a large number of weights attached ensures that the net maintains good contact with the bottom. Tow lines are fitted to both ends. The use of a beach seine generally starts with the net on the beach. One end is pulled away from the beach, usually with a small skiff or dory, and is taken out and around and finally back in to shore. Each end of the net is then pulled in towards the beach, concentrating the fish in the middle of the net. This is eventually brought onshore as well and the fish removed. This gear is generally used in relatively shallow inshore areas. (Sainsbury 1996). This activity is not managed under federal fishery management plans

3.1.7.3 Long Haul Seines

The long haul seine is set and hauled in shallow estuarine and coastal areas from a boat typically 15 m (49 ft.) long. The net is a single wall of small mesh webbing less than 5 cm (2 inches), and is usually greater than 400 m (1440 ft.) in length and about 3 m (9.8 ft.) in depth. The end of the net is attached to a pole driven into the bottom, and the net is set in a circle so as to surround fish feeding on the tidal flat. After closing the circle, the net is hauled into the boat, reducing the size of the circle, and concentrating the fish. Finally, the live fish are brailed or dip-netted out of the net. (DeAlteris 1998). This activity is not managed under federal fishery management plans

3.1.7.4 Stop Seines

These are seines that are used in coastal embayments to close off the opening to a small cove or bight. This method is used in Maine to harvest schools of juvenile herring (Everhart and Youngs 1981). This activity is not managed under federal fishery management plans

3.1.7.5 Danish and Scottish Seines

Danish or Long seining or anchor dragging was developed in the 1850s prior to the advent of otter trawling. The Danish seine is a bag net with long wings, that includes long warps set out on the seabed enclosing a defined area. As the warps are retrieved, the enclosed area (a triangle) reduces in size. The warps dragging along the bottom herd the fish into a smaller area, and eventually into the net mouth. The gear is deployed by setting out one warp, the net, then the other warp. On retrieval of the gear, the vessel is anchored. This technique of fishing is aimed at specific schools of fish located on smooth bottom. In contrast to Danish seining, if the vessel tows ahead while retrieving the gear, then this is referred to as Scottish seining or fly-dragging. This method of fishing is considered more appropriate for working small areas of smooth bottom, surrounded by rough bottom. Scottish and Danish seines have been used experimentally in U.S. demersal fisheries. Space conflicts with other mobile and fixed gears, have precluded the further development of this gear in the U.S., as compared to Northern Europe (DeAlteris 1998). This activity is managed under federal fishery management plans.

3.2 Bottom-Tending Static Gear

3.2.1 **Pots**

Pots are portable, rigid devices that fish and shellfish enter through small openings, with or without enticement by bait (Everhart and Youngs 1981; Hubert 1983). They are used to capture lobsters, crabs, black sea bass, eels and other bottom dwelling species seeking food or shelter (Everhart and Youngs 1981; Hubert 1983). Pot fishing can be divided into two general classifications: 1) inshore potting in estuaries, lagoons, inlets and bays in depths up to about 75 m (250 ft.) and; 2) Offshore pottting using larger and heavier vessels and gear in depths up to 730 m (2400 ft.) or more (Sainsbury 1996).

3.2.1.1 Lobster Pots

Lobster pots are typically rectangular and are divided into two sections, the chamber and the parlor. The chamber has an entrance on both sides of the pot and is usually baited. Lobsters then move to the parlor via a tunnel (Everhart and Youngs 1981). Escape vents are installed in both areas of the pot to minimize the retention of sub-legal sized lobsters (DeAlteris 1998).

Lobster pots are fished as either 1) a single pot per buoy (although two pots per buoy are used in Cape Cod Bay, and three pots per buoy in Maine waters), or 2) a "trawl" or line with up to 100 pots. According to NREFHSC (2002) important features of lobster pots and their use are the following:

- About 95% of lobster pots are made of plastic-coated wire.
- Floating mainlines may be up to 7.6 m (25 ft.) off bottom.
- Sinklines are sometimes used where marine mammals are a concern – neutrally buoyant lines may soon be required in Cape Cod Bay.
- Soak time depends on season and location - usually 1-3 days in inshore waters in warm weather, to weeks in colder waters.
- Offshore pots are larger (more than 1 m (4 ft) long) and heavier (~ 100 lb or 45 kg), with an average of ~ 40 pots/trawl and 44 trawls/vessel. They have a floating mainline and are usually deployed for a week at a time.
- There has been a three-fold increase in lobster pots fished since the 1960s, with more than four million pots now in use.

Although the offshore component of the fishery is regulated under federal rules, American lobster is not managed under a federal fishery management plan.

3.2.1.2 Fish Pots

Black sea bass pots are similar in design to lobster pots. They are usually fished singly or in trawls of up to 25 pots, in shallower waters than the offshore lobster pots or red crab pots. Pots may be set and retrieved 3-4 times/day when fishing for scup (NREFHSC 2002). This activity is managed under a federal fishery management plan. Hagfish pots (40 plastic gallon barrels) are fished in deep waters, on mud bottoms. Cylindrical pots are typically used for capturing eels in Chesapeake Bay, however, half-round and rectangular pots are also used and all are fished in a manner similar to that of lobster pots (Everhart and Youngs 1981). Hagfish and eel activities are not managed under a federal fishery management plan.

3.2.1.3 Crab Pots

Crabs are often fished with pots consisting of a wire mesh. A horizontal wire partition divides the pot into an upper and lower chamber. The lower chamber is entered from all four sides through small wire tunnels. The partition bulges upward in a fold about 20 cm (8 inches) high for about one third of its width. In the top of the fold are two small openings that give access to the upper chamber (Everhart and Youngs 1981).

Crab pots are always fished as singles and are hauled by hand from small boats, or with a pot hauler in larger vessels. Crab pots are generally fished after an overnight soak, except early and late in the season (DeAlteris 1998). These pots are also effective for eels (Everhart and Youngs 1981). This activity is not managed under a federal fishery management plan.

Deep sea red crab pots are typically wood and wire traps 1.2 m by 0.75 m (48 by 30 inches) with top entry. Pots are baited and soak for about 22 hours before being hauled. Currently, vessels are using an average of 560 pots in trawls of 75- 180 pots per trawl along the continental slope at depths from 400 to 800 m (1300 - 2600 ft). These vessels are typically 25 - 41 m (90 - 150 ft) in length. Currently there are about 6 vessels engaged in this fishery (NEFMC 2002). This activity is managed under a federal fishery management plan.

3.2.2 Traps

A trap is generally a large scale device that uses the seabed and sea surface as boundaries for the vertical dimension. The gear is installed at a fixed location for a season, and is passive, as the animals voluntarily enter the gear. Traps are made of a leader or fence, that interrupts the coast parallel migratory pattern of the target prey, a heart or parlor that leads fish via a funnel into the bay or trap section that serves to hold the catch for harvest by the fishermen. The non-return device is the funnel linking the heart and bay sections (DeAlteris 1998). This activity is not managed under a federal fishery management plan.

3.2.2.1 Fish Pound Nets

Pound nets are constructed of netting staked into the sea bed by driven piles (Sainsbury 1996). Pound nets have three sections: the leader, the heart, and the pound. The leader (there may be more than one) may be as long as 400 m (1300 ft) and is used to direct fish into the heart(s). One or more hearts are used to further funnel fish into the pound and prevent escapement. The pound may be 15 m (49 ft) square and holds the fish until the net is emptied. These nets are generally fished in waters less than 50 m (160 ft) deep. Pound nets are also used to catch crabs. This activity is not managed under a federal fishery management plan.

3.2.2.2 Fyke and Hoop Nets

Constructed of wood or metal hoops covered with netting, hoop nets are 2.5 to 5 m (8.2 - 16 ft) long, "Y-shaped" nets, with wings at the entrance and one or more internal funnels to direct fish inside, where they become trapped. Occasionally, a long leader is used to direct fish to the entrance. Fish are removed by lifting the rear end out of the water and loosening a rope securing the closed end. These nets are generally fished to about 50 m (160 ft) deep (Sainsbury 1996). A common fyke net is a long bag mounted on one or several hoops which keep the net from collapsing as well as provide an attachment for the base of the net funnels to prevent the fish from escaping. This gear is used in shallow water and extensively in river fisheries. (Everhart and Youngs 1981). This activity is not managed under a federal fishery management plan.

3.2.2.3 Weirs

A weir is a simple maze that intercepts species that migrate along the shoreline. Brush weirs are used in the Maine sardine/herring fishery. These are built of wooden stakes and saplings driven into the bottom in shallow waters. The young herring encounter the lead which they follow to deeper water, finally passing into an enclosure of brush or netting. The concentrated fish are then removed with a small seine (Everhart and Youngs 1981). This activity is not managed under a federal fishery management plan.

3.2.2.4 Shallow Floating Traps

In New England, much of the shoreline and shallow subtidal environment is rocky and stakes can not be driven into the bottom. Therefore, the webbing of these traps is supported by floats at the sea surface, and held in place with large anchors. These traps are locally referred to as “floating traps.” The catch, design elements and scale of these floating traps is similar to pound nets (DeAlteris 1998).

The floating trap is designed to fish from top to bottom, and is built especially to suit its location. The trap is held in position by a series of anchors and buoys. The net is usually somewhat “T-shaped,” with the long portion of the net (the leader net) designed to funnel fish into a box of net at the top of the T. The leader net is often made fast to a ring bolt ashore (Sainsbury 1996). This activity is not managed under a federal fishery management plan.

3.2.3 Sink Gill Nets and Bottom Longlines

3.2.3.1 Sink/Anchor Gill Nets

Individual gill nets are typically 91 m (300 feet) long, and are usually fished as a series of 5-15 nets attached end-to-end. Gill nets have three components: leadline, webline and floatline. Fishermen are now experimenting with two leadlines. Leadlines used in New England are ~65 lb (30 kg.)/net; in the Middle Atlantic leadlines may be heavier. Weblines are monofilament, with the mesh size depending on the target species. Nets are anchored at each end, using materials such as pieces of railroad track, sash weights, or Danforth anchors, depending on currents. Anchors and leadlines have the most contact with the bottom. Some nets may be tended several times/day, (e.g., when fishing for bluefish in the Middle Atlantic). For New England groundfish, frequency of tending ranges from daily to biweekly (NREFHSC 2002). These activities are managed under federal fishery management plans.

3.2.3.2 Stake Gill Nets

Generally a small boat is used inshore so that a gill net is set across a tidal flow and is lifted at slack tide to remove fish. Wooden or metal stakes run from the surface of the water into the sediment and are placed every few meters along the net to hold it in place. When the net is lifted, the stakes remain in place. These nets are generally fished from the surface to about 50 meters deep (Sainsbury 1996). These activities are not managed under federal fishery management plans.

3.2.3.3 Bottom Longlines

Longlining for bottom species on continental shelf areas and offshore banks is undertaken for a wide range of species including cod, haddock, dogfish, skates, and variuos flatfishes (Sainsbury 1996). A 9.5 m (31 ft) vessel can fish up to 2500 hooks a day with a crew of one and double that with 2 crew members. Mechanized longlining systems fishing off larger vessels up to 60 m (195 ft) can fish up to 40,000 hooks per day (Sainsbury 1996).

In the Northeast up to six individual longlines are strung together, for a total length of about 460 m (1500 ft), and are deployed with 20-24 lb (9 - 11 kg) anchors. The mainline is parachute cord or sometimes stainless steel wire. Gangions (lines from mainline to hooks) are 38 cm (15 inches) long and 1-2 m (3-6 ft) apart. The mainline, hooks, and gangions all come in contact with the bottom. Circle hooks are potentially less damaging to habitat features than other hook shapes. These longlines are usually set for only a few hours at a time (NREFHSC 2002). Longlines used for tilefish are deployed in deep water, may be up to 40 km (25 miles) long, are stainless steel or galvanized wire, and are set in a zig-zag fashion (NREFHSC 2002). These activities are managed under federal fishery management plans.

3.3 PELAGIC GEAR

3.3.1 Mid-Water Otter Trawl

The mid-water trawl is used to capture pelagic species that school between the surface and the sea bed throughout the water column. The mouth of the net can range from 110 m to 170 m (360 - 560 ft.) and requires the use of large vessels (Sainsbury 1996). Successful mid-water trawling requires the effective use of various electronic aids to find the fish and maneuver the vessel while catching them (Sainsbury 1996). This activity is managed under federal fishery management plans. This gear is not expected to have contact with or impacts upon bottom habitats.

3.3.2 Paired Mid-Water Trawl

Pair-trawling is used by smaller vessels which herd small pelagics such as herring and mackerel into the net (Sainsbury 1996). Large pelagic species are also harvested with a huge pelagic pair trawl towed at high speed near the surface. The nets have meshes exceeding 10 m (33 ft.) in length in the jibs and first belly sections, and reduce to cod-end mesh sizes of 20 cm (8 inches) (DeAlteris 1998). This activity is managed under federal fishery management plans. This gear is not expected to have contact with or impacts upon bottom habitats.

3.3.3 Purse Seines

Purse seines are very efficient for taking pelagic schooling species. The purse seine is a continuous deep ribbon of web with corks on one side and leads on the other. Rings are fastened at intervals to the lead line and a purse line runs completely around the net through the rings (Everhart and Youngs 1981). One end of the net is fastened to the vessel and the other end to a skiff. The vessel then encircles a school of fish with the net, the net pursed and hauled back to the vessel. Purse seines vary in size according to the vessel size, the size of the mesh, the species sought and the depth to be fished. Tuna seines are nearly one kilometer (0.6 miles) long and fish from 55 - 640 m (180 - 2100 ft.) (Everhart and Youngs 1981) . Due to the large depth of the net for tuna purse seines, they have been shown to contact and interact with the sea bottom when fishing in some shallow water locations such as Massachusetts Bay and vicinity (NMFS 2001). However, these interactions are unintended and rare. This activity is managed under federal fishery management plans.

3.3.4 Drift Gill Nets

Gillnets operate principally by wedging and gilling fish, and secondarily by entangling (DeAlteris 1998). The nets are a single wall of webbing, with float and lead lines. Drift gillnets are designed so as to float from the sea surface and extend downward into the water column and are used to catch pelagic fish. In this case the buoyancy of the floatline exceeds the weight of the leadline. Drift gillnets may be anchored at one end or set-out to drift, usually with the fishing vessel attached at one end (DeAlteris 1998). This activity is managed under federal fishery management plans. This gear is not expected to have contact with or impacts upon bottom habitats.

3.3.5 Pelagic Longline Gear

The pelagic or subsurface longline is a technique directed mostly towards tunas, swordfish, sailfish, dolphin (dorado), and sharks. The gear is typically set at depths from the surface to around 330 m (1100 ft.). The gear can also be set with a main line hanging in acrs below the bouy droplines to fish a band of depths (Sainsbury 1996). The gear is set across an area of known fish concentration or movement, and may be fished by day or night depending upon the species being sought (Sainsbury 1996). The length of the mainline can vary up to108 km (67 miles) depending on the size of the vessel. If the mainline is set level at a fixed depth, then the leader or gangion lengths vary from 2-40 m (6.6 - 130 ft.), so as to ensure the hooks are distributed over a range of depths (DeAlteris 1998). If a line-shooter is used to set the mainline in a catenary shape with regard to depth, then the gangions are usually a single minimal length, but are still distributed by depth (DeAlteris 1998). Each gangion typically contains a baited hook and chemical night stick to attract the fish. Traditional or circle hooks may be used. Swordfish vessels typically fish 20 to 30 hooks per 1.6 km (1 mile) of mainline between 5 and 54 km (3 - 34 miles) in length (Sainsbury 1996). This activity is managed under federal fishery management plans. This gear is not expected to have contact with or impacts upon bottom habitats.

3.3.6 Troll Lines

Trolling involves the use of a baited hook or lure maintained at a desired speed and depth in the water (Sainsbury 1996). Usually, two to four or more lines are spread to varying widths by the use of outrigger poles connected to the deck by hinged plates. Line retrieval is often accomplished by means of a mechanized spool. Each line is weighted to reach the desired depth and may have any number of leaders attached, each with a hook and bait or appropriate lure. This gear is generally fished from the surface to about 20 meters (Sainsbury 1996). This activity is managed under federal fishery management plans. This gear is not expected to have contact with or impacts upon bottom habitats.

3.4 OTHER GEAR

3.4.1 Rakes

A bull rake is manually operated to harvest hard clams and consists of a long shaft with a rake and basket attached. The length of the shaft can be variable but usually does not exceed three times the water depth. The length and spacing of the teeth as well as the openings of the basket are regulated to protect juvenile clams from harvest (DeAlteris 1998). Rakes are typically fished off the side of a small boat. This activity is not managed under federal fishery management plans

3.4.2 Tongs

Tongs are a more efficient device than rakes for harvesting shellfish. Shaft-tongs are a scissor-like device with a rake and basket at the end of each shaft. The fisherman stands on the edge of the boat and progressively opens and closes the baskets on the bottom gathering the shellfish into a mound. The tongs are closed a final time, brought to the surface, and the catch emptied on the culling board for sorting. The length of the shaft must be adjusted for water depth. Oysters are traditionally harvested with shaft tongs in water depths up to 6 m (21 ft.), with shaft tongs 8 m (29 ft.) in length (DeAlteris 1998). Patent tongs are used to harvest clams and oysters and are opened and closed with a drop latch or with a hydraulic ram and require a mechanized vessel with a mast or boom and a winch (DeAlteris 1998). Patent tongs are regulated by weight, length of teeth, and bar spacing in the basket. This activity is not managed under federal fishery management plans

3.4.3 Line Fishing

3.4.3.1 Hand Lines

The simplest form of hook and line fishing is the hand line. It consists of a line, sinker, leader and at least one hook. The line is usually stored on a small spool and rack and can vary in length. The line varies in material from a natural fiber to synthetic nylon. The sinkers vary from stones to cast lead. The hooks are single to multiple arrangements in umbrella rigs. An attraction device must be incorporated into the hook, usually a natural bait and artificial lure (DeAlteris 1998). Although not typically associated with bottom impacts, this gear can be fished in such as manner so as to hit bottom and bounce or be carried by currents until retrieved. This activity is managed under federal fishery management plans.

3.4.3.2 Mechanized Line Fishing

Mechanized line hauling systems have been developed to allow more lines to be worked by smaller crews and use electrical or hydraulic power to work th elines on the spools or jigging machines (Sainsbury 1996). These reels, often termed bandits, are mounted on the vessel bulwarks and have a spool around which the mainline is wound (Sainsbury 1996). Each line may have a number of branches and baited hooks, and the line is taken from the spool over a block at the end of a flexible arm. This gear is used to target several species of groundfish, especially cod and pollock and it has the advantage of being effective in areas where other gears cannot be used. Jigging machine lines are generally fished in waters up to 600 m (2000 ft) deep (Sainsbury 1996). This gear may also have the ability to contact the bottom depending upon the method selected to fish. This activity is managed under federal fishery management plans.

3.4.4 Hand Hoes

Intertidal flats are frequently harvested for clams and baitworms using hand-held hoes. These are short handled rake-like devices, which are often modified gardening tools (Creaser et. al. 1983). Baitworm hoes have 5 to 7 tines, 21 to 22 cm (8.3 - 8.7 ft) in length for bloodworms and 34 to 39 cm (13 - 15 inches) for sandworms. Clam hoes in Maine typically have 4 to 5 tines, 15 cm (6 inches) long (Wallace 1997). This activity is not managed under federal fishery management plans.

3.4.5 Diving

By either free diving or using SCUBA, divers collect crustaceans, mollusks and some reef fish in shallow water. Most often a support vessel is used to transport the diver(s) to the fishing site and carry the landings to port. In deeper waters, helmet diving systems are used and the diver is tethered to the vessel with air pumped from the surface. This method is most often used by sea urchin divers and some lobster divers. Divers normally use small rakes or hoes to scrape creatures off rocks or dig them out of the seabed. Generally, the catch is placed in bags which are either towed to the surface by the boat or floated to the surface using an air source and a lift bag. Divers rarely work deeper than about 20 m (66 ft) (Sainsbury 1996). This activity is not managed under federal fishery management plans.

3.4.6 Spears

Spears came into use when it was found that a pole or shaft with a point on it could be used by a fisherman operating from shore, floating raft, or boat to capture animals previously out-of-reach (DeAlteris 1998). However, the single prong spear required an accurate aim, and fish easily escaped. With the addition of a barb, fish retention was improved; and spears with multi-prong heads increased the likelihood of hitting the target. Spears were initially hand-held, then thrown, then placed in launching devices including cross-bows, spear guns for divers, etc. Spears with long shafts (gigs) are used by fishermen in small boats at night in the Carolina sounds for flounder, through the ice for eels in New England bays, and by divers for fish in coastal waters (DeAlteris 1998). This activity is not managed under federal fishery management plans.

APPENDIX VII

Summary of Amendment 10 Scoping Comments

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
Thomas R. Hill, *Chairman* | Paul J. Howard, *Executive Director*

Scallop Fishery Management Plan

Amendment 10

Scoping hearing summary – Fairhaven MA
February 15, 2000

Mr. Williamson and Mr. Applegate read an introduction to explain some of the problems, issues and potential management measures that could be considered in Amendment 10. Mr. Williamson pointed out that a comprehensive program for area management could ease the difficulty in developing Frameworks 11 and 13 to allow access to the groundfish closed areas. He explained that Amendment 10 could be either a very comprehensive amendment or it could be something very streamlined to specifically address area based management.

Mrs. Ellen Skaar, a fishing boat owner, said that with the a current limit seven man limit, there is no incentive to have shackers, i.e. less experience crew. Her youngest brother died at sea in Greenland this summer, she said. He was working with beginners – there was no reason for him to drown if there were capable seamen working with him. She wanted a training program for seamen, a training program for shackers.

Mr. Ron Smolowitz, Connamessett Farms, and a technical advisor to the Fisheries Survival Fund: Amendment 10 should not be viewed as the be all end all to scallop management, he advised. The scoping document indicates a broad purview, but he thought that Amendment 10 should focus on growing more scallops, rather than on allocation issues. The Council and the industry need better data and dockside compliance, he said. A framework that would allow us to enhance scallop populations and have predator control would be the most beneficial effort.

Mr. Richard Taylor, a part-time scallop vessel owner from Gloucester, MA thought that the document runs the gamut from A to Z. The real reason that any change is needed, he said, is to increase the yield from the fishery, that is the catch based on SFA requirements for how many scallops can be caught. To increase yield, we need to increase biomass by targeting larger scallops he asserted, one allowing the industry to plant scallops and protect them until they reach a harvestable size. He'd rather increase the size of the pie, rather than cut the pie thinner. How to decide what to close and protect what is out there until it should be harvested should be the main focus of Amendment 10.

Roy Starvish, Jr., a son of a scallop fisherman with several vessels, said that he is100 percent in favor of transferable IFQs. Capacity reduction would be simplified through market forces. Gainful employment would be enhanced by allowing the fishery to provide predictable landings. Vessel safety could be improved. Older vessels require maintenance and predictable landings would provide revenues needed to maintain vessels at highest standards. He said that an IFQ system would guarantee compliance with the

SFA. Transferable IFQ is a free market system, enhancing capitalism, using the same market forces that are evident in the majority of other US industries. It would allow a fishermen to manage his vessel in ways that are in the best interest of his family, he concluded.

Mr. Ronald Enockson, a scallop boat owner, was concerned about the time that area rotation would take to implement. At present, the day-at-sea tradeoff is not enough incentive to fish in the closed area he thought, possibly backfiring due to the high number of scallops in the open area. He recommended changing the day-at-sea tradeoff or changing the trip limits to induce a shift of fishing into the closed areas. It takes too long to implement new rules, and by the time it is implemented, things change. The long time frame also makes it difficult for the industry to plan the upcoming season. He said he was unsure what will happen if there is 100 percent area rotation, and fishermen loose the opportunity to fish in open areas. He thought that such a system would create tremendous derby-style fishing behavior. He was also concerned about what happens if a vessel has to compromise safety to use its automatic loss of 10 days-at-sea. He explained that the current access program in the groundfish closed areas force vessels to fish in compromising situations, which are made worse by the short season to access each area. He recommended finding ways to extend the season or allow them to occur to more favorable seasons.

Mr. Hans Davidson, a vessel owner and member of the FSF, agreed with Mr. Smolowitz that Amendment 10 should focus ways to grow scallop biomass, avoiding contentious issues such as ITQs, capacity, and allocating days-at-sea to gear sectors. These other issue would just bog down the process, when they may not be needed if we can increase productivity. He is fearful that the fleet will have a few owners and skippers will receive minimum pay under a system that allowed transferability.

Mr. Marty Manley, a New Bedford boat owner, feels that the Council is on the right track to focus on research and growing more scallops.

Mr. James Sicora, a mate of a fishing vessel Jupiter, was concerned that the effort in the closed areas need to be spread out, including the areas in the southern resource. There were many almost mishaps in the closed areas this year, he reported, giving him concern about safety of fishermen. Three more trips were given out during the biggest spawn in history. There was a lack of communications between vessels, he reported. Amendment 10 should take into account safety and that the closed areas are in a hurricane's path and the access to the areas should not occur during the hurricane season. He reported that some boats stayed out there in the hurricane to avoid the cost of loosing days, when they should be coming in due to weather.

Mr. Malvin Kvilhaug, a fisherman from New Bedford, asked if the 120 days would last for 18 months when the fishing year changes to a new date, or whether there would be an allowance to bridge the period between the current fishing year and the new one. Mr. Williamson answered that the timing would change, but the allocation process would remain the same with an interim adjustment to account for the transition. Mr. Kvilhaug repeated his concern that the vessels would receive no more days during the transition.

Mr. Sicora thought that the year should start on January 1, so that vessels had fewer days in the hurricane season and the small scallops that are abundant in fall would not be vulnerable to fishing effort. He said the current fishing year made tax-planning harder.

Mr. Hans Davidson had no preference for when the fishing year starts, but it should minimize regulatory complexity and cost. It should be thought through and stay that way in the future, he advised.

Mrs. Deb Shrader, director of Shore Support, was glad that Amendment 10 might re-evaluating the overfishing definition reference points. She also noted the lack of socio-economic information in the

Environmental Impact Statements for previous amendments She recommended that the Council conduct a study to determine the current effects and develop ways to measure socio-economic changes. There needs to be sufficient time for gear manufacturers and suppliers to obtain new gear and use up the old, she added.

Mrs. Skaar said that the fleet has a quota, based on days-at-sea. She asked if a quota would layer on top of or replace the current system. She said the current system seems to be working. Please focus on area management to boost yield and leave the current system in place, but improved by area management, she implored.

Mrs. Shrader added that the closed area management is working to take pressure off the open areas. She said that enforcement was concerned about simultaneous access to more than one area, but the stock is being lost while the fleet is waiting for the access to the closed areas. She thought that the Coast Guard should deploy more resources if needed. It is the government's responsibility to ensure there are sufficient funds for adequate enforcement, she maintained. Mr. Williamson replied that one of the important considerations in Amendment 10 will be developing methods to simplify enforcement.

Mrs. Harriet Didrickson, a boat owner and a ship chandler, said that the Council should allow at least 30 days after the last scoping hearing to comment. She said the document is hard to understand. She sees a lot of double talk, many things that have been considered in the past, many broad statements. She thought it was hard to comment on that basis.

Mrs. Didrickson added that there were no people interviewed in New Bedford for the Monkfish FMP. She wants to see it fulfilled that there are interviews in the ports for the amendments and FMPs. She would like the Council to hold meetings closer to the ports, rather than in Boston and Warwick. Warwick is a lot more convenient for the fleet than Boston, however.

She doesn't know how small scallops are defined. The concentrated fishing in the open areas, which nature is providing very well now. Scalloping is now good, so there is a limited amount that management can do, she thought. The catch in New Bedford no longer sets the marketplace, she reported, since the determinant is an international market with imports from China, Canada, and other places. She recommended against consideration of consolidation, under any name or device. She doesn't know how much more needs to be done to the gear. More changes would reduce scallop catch.

On the fishing year, she thought that scientists were never on time with results. The vessels need to know where they will be able to fish and how many days they have, but the information is not available early enough. The government needs to be more timely. She said that the notification of the additional trip allocations for Closed Area II was back-dated and early information was not available. She wanted more research and try to get everyone fishing with as much product as possible. The MSY value was chosen, based on assumptions and uncertain numbers – these can be changed. Fishermen should have access to the raw data, she said. She added that the social data was lacking and needs to be improved.

Mrs. Shrader added that the social economic impact estimates were not provided in previous documents. Now the draggers and scallopers are carrying much fewer men now than in the past. No one has looked at what impact that has had on the community. New Bedford was not considered as important in the process. Many others are now no longer in the fishery, but this was not accounted for in the FMP.

Mr. Sicora added that scallops should not be loaded on deck and then picked through – the little ones should be discarded as soon as possible. Fishermen should not be allowed to dump tows on top of each other before picking through the pile. He recommended that the only thing that should remain on deck is product that will be landed, not later discarded after it is long dead. The area access forces too many vessels in one spot, compromising safety, he repeated. He added that the Council should focus on the environmental cycles that control recruitment.

Mr. Enockson liked the day-at-sea system because there is no limit on what a vessel can land. He thought that a 100 percent area management system would effectively become a quota, because access would be based on the type a gear a vessels uses and other factors that determine how much it can land. He cannot see how everyone would have the exact same quota.

Mr. Mark Bruce, a vessel owner, said that the Council should focus on the optimism of the scallops showing up. The scoping document seems to have just more restrictions. The focus of Amendment 10 should be on what we are going to do with all of these scallops, he advised. He thought that measures would be obsolete next year, because the vessels would be making a killing in the open areas. The fishing effects on the bottom are much less than they used to be. He wanted to see fewer changes to rules, because they are not being given time to work. He doesn't want to fish in November and December in Closed Area I, but he is being forced to fish in that season to be able to fish in the channel.

Mr. Williamson said that the Council hopes to develop a more comprehensive scallop management program, where access dates are set to enhance scallop yield, instead of other considerations.

Mr. Erik Hansen, owner and operator of the FV Endeavor, reported that there is no impact on small scallops with the current dredges and a six or seven man crews. He didn't see why there was a focus on reducing mortality on small scallops; unless it was due to catches by trawl vessels. He added that the survey data should be analyzed in four or five months, there should not be more time for scientists to drag their feet.

Mr. Frank Weckessen, a boat owner from Fairhaven, the Council should eliminate consideration of meat count, the vessels should be able to bring in whatever they catch to provide the best available information. Trip reporting needs no changes, because the vessels are already reporting a lot.

Mr. Davidson added his hope that Amendment 10 will concentrate on increasing the biomass. There is enough scallops to maintain all the jobs and vessel owners that have permits. He concluded that it is crazy to be considering ITQs and consolidation. He said that the survey indicated a much higher biomass, yet the FMP was on schedule to go to 51 days. He likes the way things are going and the ongoing dialogue with the scientists is healthy. He said it was a complicated system to fish in the groundfish closed areas, but there should be more research about closed areas. The industry will have confidence in the findings if they are part of the research, he advised. The fisheries should support as many people as it can at a reasonable, human wage.

Mr. Kvilhaug added that Amendment 10 should promote the fleet to fish in areas where scallops are big. One such area is closed because there is habitat. He favored more dialogue to better define where the sensitive areas really are in the HAPC. He thought it was absurd that one claim and a small group are saying that it is environmentally sensitive, for such a valuable resource area and to take the entire amount of that area away from the fishery.

Mr. Sicora added another point that the closed areas in the southern portion should be opened. He said that all scallops don't get big, so the area closures may not help in those cases. He said that there was incredible variation in meat yield for the same size scallop, depending on where the scallop came from. There would be a lot less damage to the bottom if the fishing effort were spread out. The larger rings are doing a fabulous job of letting the small scallops escape. The fleet should catch as many scallops as possible in a short as tow as possible to do the least amount of damage to the bottom. He did not favor a larger ring in the closed areas, because it would increase the length of the tow.

Mrs. Didrickson also would not like to see any more gear changes – the current gear regulations are working well. Mrs. Skaar advised against consideration IFQs in Amendment 10, because it could concentrate the industry into few hands.

Mr. Williamson closed the meeting at 9:05, as there were no more comments from the audience.

Scallop Fishery Management Plan

Amendment 10

Scoping hearing summary – Virginia Beach, VA
February 16, 2000

Mr. Wells gave an informal introduction, saying that the resource seems to be doing well and the management plan is on-track to reduce mortality and rebuild biomass. He explained that there many possible issues for Amendment 10 and asked for comments.

Mrs. Kathleen O'Neil, owns eight full-time scallop vessels, said that the vessels were not allowed to bring scallops back to home port from the closed areas on Georges Bank. NMFS know whether we were steaming or fishing from the hourly VMS reports, she said. The Mid-Atlantic vessels need to bring product back to home ports to keep processors and support system working. The steam time should not be counted, if dredges are properly stored on the vessels. She believes that the vessels should not be penalized for bringing product back to home ports.

She thought that it is extremely essential and important to develop a plan to avoid catching small scallops. This would allow more days-at-sea and increase landings. She said that Amendment 10 should address the scallop size selectivity with nets. Dredges do the same when they get full, but not as much as nets do, she explained. The FMP must reduce the catch of 50-60 and 60-70 scallops. Spawning happens when scallops reach 30-40 count, she explained, and spawning is needed to ensure a good resource.

She favors allowing more crew on scallop vessels. The seven-man crew is a safety problem. Vessels have to make an economic decision to carry six men when price is low, but generally the vessels cannot continue with seven men, she explained. With the current scallop abundance, fishing is turning into a derby fishery. She recommended that the FMP change to allow vessels to carry at least eight to nine men.

On area management or rotation, she said that the plan needs to allow fishermen to work at all times, not just 120 days per year. Management does not need more restrictions, so the industry is cautious about the new ideas, since it cannot be changed very easily once something is implemented. The resource is very variable, Mrs. O'Neil pointed out. She is interested about transferable quotas and curious about how it would work when there is a bumper crop. An ITQ system might allow the industry more flexibility to adapt to changing conditions, without waiting for the government to change the rules. She also thought that a transferable effort system could work well.

Dr. Trevor Ketchington, Gadus Associates and a consultant to the Fisheries Survival Fund, said he would comment on Amendment 10, but the tonight's remarks have not been approved, so what he offered isn't an official position of the Fund. The time frame for Amendment 10 is very fast, he said, so Amendment 10 should be used to grow more scallops, not to allocate the scallops to different people. Amendment 10 would get bogged down if allocations are reconsidered, he predicted. Regarding the change in the fishing year, it is a matter for the management process to decide, since it depends on the length of the framework process and the timing of surveys. But he asked that management consider that the end user is the fishing industry, who must plan for and adapt to changing management.

Dr. Ketchington predicted that the scoping document issue on essential scallop habitat would leads rapidly to consideration of HAPCs. This raises red flags with him, since the public is seeing HAPCs as a measure of ecologically sensitive areas, which translates into no fish areas. This can be acceptable for finfish fisheries, because they move, but he predicted that an HAPC for scallops wouldn't be helpful because the scallops do not move and later become available to the fishery.

A recent development is the Magnuson Stevens Act now requires rebuilding within a fixed period of time, Dr. Ketchington explained. There are now eight years left in the scallop-rebuilding program. If an area is permanently blocked off – it reduces the yield and a smaller open area is now required to rebuild. This is a serious risk since it increases management's target. Closures such as this could end up with a beautiful area management system, but it cannot be done because the conservation bar moves up under such a system. A rotating system of closures will increase the catch and increase the biomass of scallops – this is great. However the target to be reached is linked to the long-term biomass, which can be pushed up out of reach without closing all areas to fishing. The PDT should find some solution for manages to keep the targets at an achievable level.

The preliminary fisheries service calculation shows that closures can only substantially increase landings by only two ways. If overfished, the are rotation will increase yield. The only two choices for area rotation the could give a serious increase is to close most of the grounds for a long time with a short open period in a small part of the resource to wipe them out from the open area when they reach optimum size. This gives a 15 to 22 percent increase in catch, Dr. Ketchington predicted, but it would not be acceptable to industry. The environmental group and the public would also hate such a system. The only other way to substantially improve yield is to identify closures in very small areas where surveys and fishery data show there is seed, with a one to three year closure, and fish the open areas at a moderate rate. This also will give a 25 percent increase in catch. The problem with the second strategy is that the system will look complicated, since the areas would be small and the data needs will be high. Coast Guard will be very upset by the idea of having very small closed areas to protect seed piles, he said.

Dr. Ketchington explained that people are already concerned about enforceability of a rotational area management strategy. Some views are that small closures cannot be enforced and they will only work through compliance. There are two types of compliance: willing compliance and enforced compliance. The only one that will work is education and information to induce willing compliance. Either a strategy will fail, because Coast Guard will enforce it, or a strategy that can be enforced, but such a system of large closed areas will do little for the resource and the fishery.

Mr. William Mullis, a boat owner from Gloucester County, VA who also buys scallops for Atlantic Gem Seafoods: He wants the 20 percent back from Amendment 7 that was taken away due to uncertainty. He thinks that Amendment 4 has been tremendously successful. Amendment 4 caused many boats to leave the fishery and there is a tremendous amount of seed out there now. The additional 20 percent in Amendment 7 may have been in error and should be re-considered. This is a significant cut to the businesses. There is more scallop seed than people know about. He reported having a net recently blocked by a very large pile of scallops.

Mr. Mullis would like Amendment 10 to implement a more stable management strategy. Amendment 7 is a death warrant for the industry, he felt. He sees the framework process as giving the industry a reprieve, one year at a time. The Council was faulty in approving Amendment 7, he said. There was contradictory information in the Amendment 7 document. He felt the industry lost control over management in Amendment 7 and the Council was going to do what it wanted to. He hopes that Amendment 10 can improve the predictability of future management, so the industry knows where we are going. The industry needs different sizes scallops to sell, not just U10's or 10-20's. There is a huge processor demand for smaller scallops, he said.

Mr. Mullis didn't believe that the net boats are that big of a threat. There are few of these permits with full-time allocations and trawl allowances. Many trips were landing 30-40 and 40-50 count scallops. The Council does not need to take action to address the differences between dredge and trawl scallopers. The discard mortality on some net scallopers is more hurtful than what the net actually catches, he said. If the vessels deckload, it increases mortality and that is what the Council should address, he recommended. The Council should do something about the number of general category permits, because many of these boats will begin targeting scallops with a 400 pound trip limit. When the Virginia Beach area opens up, there will be many general category targeting scallops, he predicted. The only ones that should be able to fish day trips on 400 lbs are the ones that also have the limited access permits.

Mr. Mullis recommended that the Council should make allowances for steam time, without counting the days-at-sea while traveling to Georges Bank. There is not enough suppliers and processors if all the New Bedford boats are able to fish in the Mid-Atlantic closed areas. He would prefer that many of the New Bedford boats will able to land the scallops in New Bedford. His boats are catching more than 1,000 pounds per day-at-sea now in the open areas – so the access to the closed areas must be competitive to attract fishing effort, he advised. An allowance for steaming time would reduce the cost for fishing in a closed area that is far from port. Not everyone is able to land scallops in New Bedford, so the system is not fair to all the fishing fleet.

Habitat issues are a concern to Mr. Mullis, and he is fearful of the outcome. A permanent closure may be counterproductive if good sets occur more often in fished areas that may contribute to better scallop productivity. He said that the gravel bottom on Georges Bank might get sanded over in the absence of fishing when the area is closed to fishing.

He is a little bit ambivalent about managing by quotas. Mr. Mullis thought that quotas might improve predictability, but with the day-at-sea system, some boats can do better than other boats, which is a preferable outcome.

He favors moving into something else and replace the death warrant caused by Amendment 7. Given Amendment 7, Mr. Mullis said he is very reluctant to trust the management of the resource to the Council. He is supportive of a buyback program for the scallop industry. Everyone else is getting help, why not the scallopers, he asked? The benefit will be in this country and is 110% behind a buyback program. If latent effort is a problem, it should be addressed in by a buyback program. He pointed out that the Council promised that the limited access permits would be good when the resource rebounds, but now there has been a warning (via a control date notice) that the history permits may be treated differently than active permits.

Mr. Mullis said he is supportive of anything that will give us better data. There is a tremendous amount of scallops out there and this speaks well for Amendment 4, he concluded.

Mr. Jim Fletcher, United National Fishermen's Association, said that there is another group that has been managing scallops since 1987 – the Japanese. They have been very successful in increasing scallop production. There is a potential to harvest 125 to 200 million pounds of scallops per year from our waters, he claimed.

He recognized that there is a problem with bycatch and habitat. It should be called regulatory discards. He recommended taking one half of the money of the bycatch and give half to the crew for processing and the other half should go to research. This would eliminate regulatory discards. There area other types of science that affect the availability of scallops, cyclical events that control scallop abundance.

The current science is not incorporating all the known science, such as sunspots and El Nino. The cyclicity should be taken into account by the management program.

Mr. Fletcher said that area based management to protect small scallops has merit, but it could give that market to the foreign import suppliers, reducing the benefits to the industry. He asked why we need a change in the fishing year? The Council could address this problem by getting better information more quickly, rather than changing the fishing year. Taking the cyclical events, like sunspots, would improve management, he said. The science needs to work outside the box.

Regarding gear restrictions, further tightening would stop the landings of smaller scallops that are valuable to the markets, Mr. Fletcher warned. The net scallop boats represent a small part of the scallop fleet. The problem comes from just a few vessels, their behavior increases discard mortality. The problem is not caused by different gear selectivity, he claimed.

Regarding size limits, it is an interesting question to consider when the Mid-Atlantic areas reopen to scallop fishing. Will the access program allow for shell stocking, he asked? Some consideration should be given to use latent effort, allow them to combine and use the permits. Mr. Fletcher recommended using the moratorium dates to the benefit of the resource. Most of the general category permit vessels are less than 50'.

Regarding possession limits, they would take away the incentive for fishermen to work harder, so Mr. Fletcher thought a scallop possession limit would be a bad idea. Regarding the amount of crew, a nine-man crew is safe, but a seven man crew is unsafe. Higher landings would mean that vessels will need more men on board to maintain safety, Mr. Fletcher advised. The industry doesn't need bag tags, because it will reduce product quality, because the fishermen will stuff the bags to avoid the regulations anyway.

If all the catch is landed, observers are not needed, because much of the information can be collected at the dock. There should be at least two vendors of the VMS systems to provide competition and better prices. The industry has problems with having a single vendor and prices are going up.

Mr. Fletcher said that there is science showing that one major storm will redistribute the bottom sediment in less than 100 fathoms more than that caused by a year's worth of fishing. Amendment 10 should allow 142 days in 2000, because the science that shows the rebound came from 142 days. The credibility of science should be reviewed in this regard. The assumption of the models is that the scallop gear removes all scallops from the area and it would take 3-4 years to recover. But. he said, this is not realistic, because the larger rings leave many scallops behind where it takes only 6-12 months to recover. Mr. Fletcher advised that Amendment 10 should address the ways that others use to improve the resource productivity, much more than 20-30 million pounds.

Mr. Dinny O'Neil, a boat owner from Seafood VA, said that the plan should first consider the safety of the crew and vessels. A seven-man crew is dangerous. The age at entry should be managed through larger ring and mesh size. Smaller nets to be equivalent to 30 foot dredge, such as a 45-foot net with a 30-foot spread. There should be closed areas, but no bottom should be closed permanently, he recommended. The current areas discriminate against the Mid-Atlantic boats. There should be some allowance for this to not count steam time against the day-at-sea clock. Some form of transferable effort should also be considered and he fully supports a buyback program.

Mr. Wells said that the top priorities identified by the committee in September were area management, reducing mortality on small scallops, and the open access general category permits. He thought people said that if areas close, they should be assured that the area would later reopen.

Mr. Tim Daniels, Old Point Packing, thought that habitat impacts with a dredge are much greater than the habitat impacts with a trawl. It is not an issue that the Council should consider right now, however. He thought that Amendment 10 effort should focus on ways to return the small scallops back to the bottom so they survive, possibly with sorting machines. This would help the resource much more than any other strategy. It would reduce mortality and save more scallops and increase landings while reducing mortality.

Mr. Wells asked about the effect of relaxing the crew size restriction. Mr. Applegate replied that it has an effect of limiting the number of scallops that can be harvested in both closed and open areas, so other restrictions would have to replace the effect of the crew size to meet the plan's mortality targets.

Mr. Greg Fulcher said that the Council needs to improve efficiency, by allowing sorting machines or other mechanization. There should be and individual quota, based on the amount of scallops that are in the ocean, he recommended. An individual quota would stop the incentive to take more men and work them as hard as a seven-man crew would work. He doesn't want his boats cutting 40-50 scallops. A 20-30 scallop can be caught and be less costly to fish, working his crew easier. General category permits should be discontinued, because 400 pounds per day could be very profitable, at $5-6 per pound. When the VA/NC area opens, there will be many general category vessels fishing there. Some of his boats cannot pull 15-foot dredges; so larger rings would not be viable for his boats that use smaller dredges. He also recommended that the Council consider developing a buyback, and the net boats should be the first industry targeted.

Mr. Wells asked why net boats have not been required to increase the mesh size, when other industry sectors have been using larger rings. This would improve escapement. He also pointed out that a vessel upgrade could allow a permit that is allowed to use a net, could possibly pull a dredge. Mr. Fulcher thought that it was a non-issue. Dr. William DuPaul replied that a trawl boat would catch more small scallops than a dredge boat. Mr. Oswald Willaims thought that one change might be to increase the mesh size only in the top of the net to reduce bycatch.

Mr. Fulcher said that his boats didn't fish in the Georges Bank closed areas, because it was unfair to force his boats to use dredges. Mr. Tim Daniels asked if it wasn't fair that trawl boats could increase the horsepower by 20 percent, so that they can begin using dredges He thought it would be fair to give a trawl vessel a greater day-at-sea allocation to compensate for forcing it to use a dredge, if the Council wants to ban scallop trawls.

Mr. Bill Mullis added that the trawl vessels had far less bycatch than a dredge boat. Most of the trawl vessels catch few monkfish. A trawl boat will lay up and stop towing, while a dredge vessel is working 24 hours a day.

Mr. Wells closed the hearing 9:30 pm., as there were no more comments from the audience.

Scallop Fishery Management Plan

Amendment 10

Scoping hearing summary – Cape May, NJ
February 17, 2000

Mr. Daniel Cohen, representing Atlantic Cape Fisheries, said that he wanted the Council to consider an aggressive program of stock assessment with the help of industry to provide the basis for a quota-based system linked with a strong level of enforcement. This added research would identify areas with a quota and those quota would be divided among the fleet each year. If quotas are not possible in Amendment 10, however, it should include area management to improve yield per recruit, Mr. Cohen advised. He was also in favor of balancing fishing mortality created by different types of gears.

Mr. Cohen spoke in favor of a call in system, with a standardized bag or box, with a government tag to enforce the quota. Amendment 10 should also address the amount of scallops that can be landed with a general category permit, he said, since the current permit allowances promote targeting by part time vessels.

Dr. Trevor Ketchington, with the Fisheries Survival Fund (FSF), noted on behalf of the fund that members have turned out for all three meetings. The FSF has held its own meeting before the hearing and their intention was to have a prepared statement, but the ideas are still being gathered. The FSF will therefore have a formal and detailed proposal developed by the March 6 deadline, especially on the area management proposal.

Mr. Nils Stolpe, representing the FSF and Garden State Seafood Association, pointed out that the scallop fleet at Barnegat Light are all part of the FSF. One of his concerns is the concept of area licensing in the area allowances section. A critical part of a successful FMP is flexibility to fish, for resource, size and safety reasons. The fleet must be given the flexibility to fish in the maximum amount of area that is open to fishing, he advised. He is committed to working on a rotational management system, that will work for industry to provide an ongoing crop of scallops into the future.

Mr. Keith Laudeman from Cold Spring Fishermen Supply, asked why the Council is trying to change the system? Mr. Applegate replied that is was needed to rebalance the high mortality in the open areas and the low mortality in the closed areas where scallops are larger.

Mr. Cohen recommended doing a second survey in January and February to identify areas of small scallops before they become vulnerable to fishing. This would enable a different fishing year and collect data about recruitment before the scallops are caught by commercial vessels.

Mr. Nick English, who owns two scallop boats in Barnegat Light, offered his opinion of rotational area fishing: With half of the areas open, give those days to fish in the closed areas from June to October. The rest of the days can be used in the open areas. There are more scallops out there than have ever been observed, he said, due to days, gear, and the crew limit. He wants to allow small boats fish in the Mid-Atlantic in the fall, as opposed to go all the way to Georges Bank to fish.

Mr. English asked about the rational behind the access to the groundfish closed areas. Rick Savage replied that there are many interests, not just for scallop fishing, which required the Council to prevent scallop fishing in more than one area at a time. His main fear is that the plan will put the vessels in only a small part of the resource and all the remaining areas are closed.

Mr. Greg Fulcher, a manager of four net boats in NC, said that Amendment 4 has been very successful in reducing effort and it reduced crew from nine to seven men. It is going in the right direction, he thought, why are changes needed now? Amendment 10 should address a buyback to reduce effort and help the resource to achieve MSY, fairly compensating the industry that would leave, either through a government or industry supported buyback program.

There is a 20 percent error in Amendment 7 that was taken away from industry, he argued. This should be given back. He advised that the FMP cannot close an area for a long period of time, because scallops are non-mobile, so these areas must become available, not protected for very long periods of time to protect habitat. No more than one to three year closures on juvenile scallops is adequate, he said. Mr. Fulcher is opposed to a nine man crew, because it would increase fishing effort and that only benefits the boat owner, not benefiting the industry. There should be a per boat quota, to allow the industry to modernize and allow them to return the seed to the water and decrease discard mortality. A quota will allow those improvements, he said, a quota for limited access scallop vessels. The industry is in desperate need for upgrading and replacing vessels. Need to address the general category permit and the 400 pound limit. There are fast vessels that will target scallops with general category permits. There should be a fixed time to open the areas in the Mid-Atlantic. The net boats were unable to fish in New England because the boats were unable to pull dredges, which are much harder on the bottom.

There is a belief in the industry that net vessels target small scallops, but this is not true. The net boats target the largest scallops that they are able, because they can land more pounds at lower cost. Last year his oats caught 20-40 count scallops. Net boats area at a disadvantage, because the net boats cannot work in all bottom types, unlike dredges.

There are 250 boats in the industry, and only 30 are trawl vessels. The 40-60 count scallops are caught by both types of gear. Vessel owners cannot build an expensive boat if they cannot predict future landings or access to areas, Mr. Fulcher replied to a question from Mr. Savage.

Mr. Cohen said the purpose of Amendment 10 is to try to maximize the potential of the scallop fishery from 18-20 million to well beyond that, using a scheme to focus effort on large scallops. He thought that the Council could choose one of three methods to increase the size of scallops caught by the fleet: a size restriction, i.e. a minimum size, identify areas quickly enough and close them, or to modify gear to make it more size selective. If we focus on how to maximize yield, it could range from 20-40 million pounds. He recommended that the Council look at other ways to enhance the resource, possibly through predator control. Automatic sorters to separate small scallops and starfish from the large scallops might be a good choice, he said, possibly allowing the selective mortality on scallop predators, like starfish.

Mr. Cohen thought that allowing shucking machines on scallop vessels would by its nature produce a cooked rather than fresh product, so it wouldn't work for the current markets. A sorting machine could reduce discard mortality by reducing the time that small scallops are on deck. Quota management would allow vessels more time to do things that might in the end be more valuable to the resource. Right now, it is very costly to have the crew working in non-productive ways, because of the limits on days, he said.

Mr. Lauderman, pointed out that all 250 permits are not being used, so some inactive boats could get part of a quota, diluting the amount that would go to active vessels. He said that his vessel had a good year last year, but only because of access to the closed areas. Mr. Lauderman believes a buyback program is needed, but it doesn't now appear to be likely given the improvement in the resource.

Mr. Fulcher echoed this comment that the industry is still in critical need of a buyback program.

Regarding the issue of more crewmen, it seems to be an issue if the management is controlling effort or catch added Mr. Cohen. If the management focuses on the latter, then the crew size does not matter. If we have better estimates of the stock, then it would allow more flexibility for industry.

Mr. Savage closed the meeting at 8:35 p.m. as there were no more comments from the audience.

Scallop Fishery Management Plan

Amendment 10

Scoping hearing synopsis
February 15-17, 2000

Fairhaven, MA – February 15, 2000

1. Broad support for using rotational area management to boost yield, i.e. increase the size of the pie.
2. Support for increasing research to improve scallop productivity.
3. Broad support for increasing crew size to improve safety, possibly through a training program for the extra crewmember.
4. Support for reducing discard mortality by prohibiting deck-loading.
5. Majority opposed to new measure that would allocate the resource, since this would bog down Amendment 10 and possibly give fishermen a smaller piece of the pie.
6. All but one were opposed to developing an ITQ system for scallop management.

Virginia Beach, VA – February 16, 2000

1. Support for area-based management to keep the industry from harvesting the seed piles, when and where they occur.
2. Some expressed concern that an area would not reopen to fishing once it was closed to rebuild scallop biomass or allow habitat to recover.
3. Strong support for a change allowing vessels to transit to fishing areas without counting days-at-sea, provided that fishing gear is properly stored.
4. Some spoke in favor of an ITQ system.
5. Support given for a buyback program.
6. 50/50 split about balancing mortality in for a day-at-sea used by a vessel using trawls vs. vessels using dredges. Some thought that bycatch amounts and habitat impacts were less for vessels using trawls, although the trawls caught small scallops better than dredges when the small scallops are abundant.

Cape May, NJ – February 17, 2000

1. Amendment 4 is working, so large changes are unnecessary.
2. Should have access to the Mid-Atlantic closed areas when the scallops are at marketable size.
3. Support given for quota management, with additional research and improved enforcement and monitoring.
4. A buyback program is needed to remove inactive vessel capacity.
5. Support for sorting machines or other methods that would increase survival of discarded scallops.

Appendix VIII

A Proposal for Harvest Cooperatives in the Sea Scallop Fishery
by
Dr. Steve Correia and Dr. Steve Edwards
Scallop PDT member

Harvest Cooperatives in the Atlantic Sea Scallop Fishery:
Amendment 10 Management Alternative

Steve Correia (Massachusetts DMF) and Steve Edwards (NMFS)
Scallop Plan Development Team

May 29, 2001 (DRAFT)

Introduction

Amendment 10 alternatives thus far prepared by the Fishery Survival Fund (FSF) and the Council's Sea Scallop Plan Development Team (PDT) propose either rotational closures of dense seed beds or separate management of historical scallop beds. Both strategies promise to limit localized overfishing and increase economic benefits. However, they also require industry to comply with some control over its traditional freedom to chose fishing locations. For example, small New England vessels might not traditionally fish eastern Georges Bank due to weather or the Mid-Atlantic due to distance. Some scallopers from VA or NC might prefer the Mid-Atlantic because it is familiar. Scallopers who do not traditionally harvest sea scallops throughout their range could find it difficult to use all of their area-specific allocations of DAS, TACs, or combinations of trips and trip limits. Recognizing this drawback, the FSF's and PDT's rotational management proposals constrain the number and locations of closures and re-opened areas so as to spread impacts among ports. These constraints do not ensure that all scallopers have the means to completely use their area-specific allocations, however. Furthermore, the constraints could require premature openings that compromise potential benefits.

The Proposal

This harvest cooperative proposal is offered as an independent component to any of the Amendment 10 area management alternatives. In a sense it substitutes for the tradable or transferable mechanisms that reportedly are opposed by the Council and much of industry. Thus, it is a different way to make area management policy flexible for industry. Permission to form voluntary harvest cooperatives could allow industry to adapt to area management controls by **pooling** their effort or harvest allocations and, at the same time, reduce operating costs, including fuel expenses. If widespread, harvest cooperatives would make constraints on the location of closures unnecessary.

At the onset, annual harvest cooperatives formed by scallopers would be partnerships for collective decision-making about input use, including allocation of area-specific DAS/TAC/trips among member vessels. Cooperatives may form after the annual specifications of the fishing year are approved and before the fishing year begins. Permit owners who want to work together would negotiate a harvest contract and submit a fishing plan to NMFS. Among other things, the cooperative's contract will stipulate where specific vessels will fish and how it plans to divide shares of the total harvest among permit owners and, conceivably, captains and crew. Fishing plans will include descriptions of how the cooperative will comply with Amendment 10 objectives, the annual specifications, and any rules or controls that the Council establishes for cooperatives. Once approved, cooperatives receive the combined, or pooled, area-specific allocations of its members. Permit owners not in a cooperative would be regulated by their individual annual allocations.

Special Considerations

There are several considerations that need to be highlighted given the concerns of the Council.

Membership constraints: If permit stacking among fleet owners remains forbidden in Amendment 10, then the Council would need to establish rules that control its occurrence in harvest cooperatives. The rules could include a lower bound on the number of full-time (and full-time-equivalent for part-time and occasional scallopers) permit owners (e.g., 5), a lower bound on the percentage of owners with only one full-time permit (e.g., 80%), and possibly an upper bound on the total number of full-time permits (e.g., 20). To use the ***arbitrary*** numbers in parentheses, a 12-member cooperative would include at least 10 members who own only 1 full-time permit and no more than 2 members who together own 8 permits. Actual rules could be derived from information on permit ownership once the Council defines its social/economic objectives for harvest cooperatives.

Recent experience with harvest cooperatives in Alaska is germane to the stacking issue. In each of the three cooperatives – i.e., the Pacific whiting and Bering Sea Pollock cooperatives (Sullivan 2000) and the weathervane scallop cooperative (Joe Terry, NMFS, personal communication) – owners of more than one vessel agreed to harvest quotas that were less than equal vessel shares.

Activation of latent effort: We should expect more complete use of effort or harvest allocations by cooperatives, including those allocated to confirmation history permits. This possibility can be accounted for, though, when deciding individual shares from a TAC or industry's aggregate DAS.

DAS accounting: Unlike landings quotas or shares, the DAS allocated in a pool to a cooperative could be distributed among vessels in a way that increases overall fishing power. If DAS is the medium for allocation, then the Council and NMFS needs a way to technically evaluate a cooperative's fishing plan to see if it would likely contribute more to fishing mortality than planned. One option is to calibrate DAS using the standardized vessel production functions that were previously developed by the PDT. Note, however, that calibration cannot control for the skills of captain and crew.

Bycatch: Cooperatives provide an opportunity to reduce groundfish bycatch. Each cooperative could be allocated its share of area-specific bycatch TACs. This would create strong incentives within the cooperative to reduce its bycatch so as not to risk being closed for the season. This mechanism worked well during the first year of the weathervane scallop cooperative in AK (2000) where crab bycatch had previously closed the scallop TAC fishery.

Hypothetical examples

Three purely hypothetical examples are provided to illustrate how harvest cooperatives might work in the Atlantic sea scallop fishery depending on the harvest controls that the Council chooses. In each case we adopt the FSF proposal of up to 5 closed areas inside 5 regions plus 1 open area throughout the shelf. As mentioned above, however, harvest cooperatives are compatible with all of the proposed area management policies.

Example 1 - DAS controls: A cooperative with 12 members and 20 full-time permits receives a total of 2400 DAS (20x120) which are allocated as follows to the general open area and to 5 "closed" areas: 1200 to the general open area, 200 to the re-opened area in the Gulf of Maine (GOM), 600 to the re-opened area on Georges Bank (GB), 0 to the South Channel (SCh) closed area, 400 to the re-opened area in Hudson Canyon (HC), and 0 to the Southern (So) closed area. The cooperative has 2 vessels from Maine and MA use the GOM days, 2 vessels from MA and one from NJ use the GB days, 2 vessels from NJ and VA use the HC days, and 5 additional vessels from MA, NJ, VA, and NC use the general open area DAS allocation. The initial DAS allocation might be adjusted depending on the fishing power of the selected vessels. Presumably the power-adjusted DAS will be less than the initial allocation assuming that the most technically productive vessels (and captains and crew) are selected. At least 8 vessels are not used this year (more, depending on the DAS adjustment) which saves on some fixed costs, but the vessel owners, captains, and crew of these vessels share in the net operating profit nonetheless as stipulated in the cooperative's contract.

Example 2 - IQ controls: The same cooperative is allocated a pool of 4.8 million pounds of scallop meats from the general open area and the above re-opened areas. Area- and cooperative-specific bag tags are also issued. The 7-man crew limit is lifted, so vessels can economize on the number of trips and trip expenses required to land the area quotas. Given high biomass inside the re-opened areas, total effort by the cooperative is expected to be 1920 DAS (assuming an average CPUE of 2500 pounds by the selected vessels). Only about 9 out of the 20 vessels are used during the year.

Example 3 - Trip and trip limit controls: Although more complicated than the IQ control and even the DAS control, the number of area-specific trips and trip limits could be allocated to the harvest cooperative as well. If Frameworks 11, 13, and 14 are any indication, these measures and possibly an automatic DAS charge per trip would apply to the 3 re-opened areas in the GOM, GB, and HC in the example (not the general open area). As above, the cooperative would decide which vessels use each area's trips.

A variation on this theme is to make the trips and trip limits fungible. For example, suppose the cooperative is allocated a pool of 600 DAS to the GB re-opened area, and that its initial trip controls are 60 trips and a 2000 pound trip limit. The cooperative might have 3 vessels with captains and crew that could average 2500 pounds-per-day in this area. It therefore decides to take 48 10-day trips with these vessels.

References

Sullivan, J.M. 2001. Harvesting cooperatives and U.S. anti-trust law: recent developments and implications. Proceedings of IIFET2000 (International Institute of Fisheries Economics and Trade), Corvallis, OR, July, 2000. In press.

APPENDIX IX

Controlled Access Area Bycatch Estimates

And Scallop And Finfish Bycatch Estimates
From Vessel Trip Reports
By Quarter And Rotation Management Area, Pooled Over Years

Table of Contents

Tables

1.0 Assessment of Bycatch in the U.S. Atlantic Sea Scallop Fishery

Dr. Dvora Hart

1.1 Introduction

This document estimates, to the extent feasible, bycatch of commercially exploited finfish species in the sea scallop fishery, and their impact on the bycatch stocks. For certain species (goosefish, yellowtail and summer flounder), bycatch can be estimated using the discard ratio method. This computes total catch by expanding reported landings by the ratio R of discards to landings on observed trips. That is,

$$\text{Total catch} = (1 + R) \text{ landings.}$$

For other species, a rough estimate of bycatch can be obtained by comparing the comparing the bycatch of the species in observed trips with that of goosefish, and using the discard ratio estimate for goosefish as above. Goosefish is the best choice for this estimate because it is relatively ubiquitous. Moreover, its discard ratio estimate should be reliable because a majority of the goosefish are landed, so that R is fairly small.

For the potential bycatch species, landings, total fishing mortality, biomass and stock status were obtained from SARC and other NEFSC documents, dealer records, vessel log books and observer data. Various NEFSC scientists provided updates on the assessments and gave useful comments on their respective stock(s): A. Richards (goosefish), S. Cadrin (yellowtail), L. Hendrickson and P. Nitschke (winter flounder), M. Terceiro (summer flounder), L. Brodziak (Atlantic halibut), and K. Sosebee (skates).

The high observer coverage rate in the 2000-1 groundfish closed area fishery and in the 2001 Mid-Atlantic access areas allowed for highly accurate estimates of bycatch in these areas. Table 1 gives bycatch in the 2000-1 groundfish closed areas; Table 1a is in absolute numbers, while Table 1b gives the bycatch rate per pound of scallop meat landed. In Closed Area I and Nantucket Light Ship Closed Area, scallop biomass is projected to rise only modestly between 2000 and 2003. Since the finfish bycatch biomass would also be likely to rise modestly during this time, the bycatch rate observed in 2000-1 in these areas is likely to be representative of that in 2003-4 if these areas are reopened, provided that scallops are not significantly depleted. If fishing mortality on scallops in these areas were sufficiently high, the bycatch rate would be expected to increase, as was observed in the 1999 Closed Area II fishery. The high bycatch rate observed in the 2000 Closed Area II fishery was in large part due to this depletion effect. Since that time, a very large year class centered in this area has recruited into the fishery, and will be five years old in 2003. As a result, the scallop catch rate per hour bottom time in the southern portion of Closed Area II is projected to increase by as much as a factor of ten. This means that the bycatch rate in 2003-4 in this area would be expected to be much lower than it was in 2000, again provided that scallop fishing mortality is modest.

Table 2 gives estimates for the bycatch in the Mid-Atlantic access areas. The major bycatch species were little skate and goosefish. The bycatch rate (i.e., weight of bycatch per pound of scallop meats) of these species in these areas was at or below these respective rates in the open areas. Thus, continued access to these areas would not be expected to increase the bycatch of these species.

One of the best ways of reducing bycatch is to decrease mortality and therefore increase abundance on the target species, so that less fishing time is required to obtain the desired landings of the target. Sea scallops give a good example of this mechanism. In 1996, the area swept by the scallop fishery was about 14,900 nm2. By 2001, the area swept was less than one-third this figure. Such a reduction not only reduced habitat impacts, but also should reduce the mortality from scallop gear on bycatch species by about a factor of three (probably about a factor of four for flatfish, due to increases in the twine-top mesh). Most of the Amendment 10 alternatives will reduce area swept from 2001 levels by about a factor of two, thus further reducing bycatch. Gear modifications, such as increases in twine-top mesh and/or 4" rings, have the potential to reduce bycatch by a moderate amount.

1.2 Goosefish (Monkfish)

Goosefish was assessed in SARC-34. Total catch (landings and discards from all gear) in 2000 was 24,500 MT, and the biomass (North and South combined) was estimated at being between 97,600 and 134,900 MT. While stock biomass has increased, and fishing mortality has decreased, goosefish is classified as overfished, and overfishing is occurring.

Scallop dredges landed 2290.5 MT of goosefish in 2000, a little less than 10% of total landings. Using the discard ratio method, discards were estimated at 567.8 MT, giving a total catch of goosefish in scallop dredges as 2858.3 MT. If scallop trawls are included, the total goosefish catch from the scallop fishery was about 3000 MT. Assuming that no discarded goosefish survive, the fishing mortality of scallop dredges on goosefish was about 0.02 to 0.03 (compared to FMAX = FTHRESHOLD = 0.2). Thus, scallop dredges cause a small but not totally insignificant mortality on goosefish. The reduction of effort and area swept by scallop gear that would occur under most of the proposed measures will reduce goosefish bycatch, but gear modifications such as increases in twine tops are unlikely to have any effect.

1.3 Yellowtail Flounder

Four stocks of yellowtail flounder are recognized, Georges Bank, Cape Cod, Southern New England, and Mid-Atlantic, though the latter two may be one stock (with Mid-Atlantic being the minor component), and only the first three are listed in management plans. The Georges Bank yellowtail assessment (including Canada) was updated in Stone et al. (2001). Abundance of Georges Bank yellowtail increased tenfold from 1995 to 2000, and its biomass in 2000 (50,629 MT) was approaching its BMSY biomass target. Fishing mortality in 2000 (about 0.14) was below its target. Georges Bank yellowtail was not overfished, nor is overfishing occurring. US landings in 2000 were 3,678 MT, with discards of 358 MT. Canadian landings were 2,859 MT. Survey indices for the Cape Cod yellowtail have been improving in recent years, and the stock is not considered overfished, since its biomass is just over its threshold. Overfishing is occurring, however. Stock biomass in 1999 was estimated at 3,900 MT. Southern New England yellowtail was reduced to very low levels in the mid-nineties, and its biomass remains low, though it has improved somewhat in the last few years. It is overfished, and overfishing is occurring. Biomass in 1999 was estimated at 6,400 MT.

Because its substrate and depth preferences coincide fairly closely with that of sea scallops, yellowtail flounder is the flatfish most likely to be taken in the scallop fishery. Yellowtail catch in the scallop fishery in 2000 was estimated using the discard ratio method as 301 MT; most of this occurred in Closed Area II. In the 2000 groundfish closed area fishery, yellowtail catch was 243 MT, of which 88% was in Closed Area II. Catch of Southern New England yellowtail from the Nantucket Closed Area was very low (about 6 MT). The 58 MT yellowtail caught in the open areas were mostly from Cape Cod yellowtail stock (from the South Channel area), and the Georges Bank stock (northern edge and southeast parts).

Even though most of the yellowtail catch in the scallop fishery in 2000 was from the Georges Bank stock, it imposed a low mortality because of the large Georges Bank yellowtail biomass. Mortality on Georges Bank yellowtail from the scallop fishery was below 0.01 in 2000. Mortality from scallop gear on the Cape Cod yellowtail in 2000 was about 0.01, a low, but not totally insignificant figure. Mortality of southern New England yellowtail from scallop gear in 2000 was well below 0.01 (probably about 10 MT was taken).

A controlled access program to the closed areas, similar to that of Framework 13, is unlikely to have a significant impact on Georges Bank yellowtail flounder. The high bycatch rate in Closed Area II in 2000 would be expected to be much lower if this area was opened in 2003 or 2004, due to the higher projected scallop catch rate there. A portion of Closed Area I lies within the stock boundary of Cape Cod yellowtail, but the bycatch rate for this area in 2000 was low (24 MT). Thus, a closed area access program into Closed Area I is unlikely to have a significant impact on Cape Cod yellowtail, provided that significant depletion does not occur. Similarly, experience from the 2000 fishery indicates that scallop access to the northeast portion of the Nantucket Light Ship Closed Area would be unlikely to cause serious mortality on Southern New England yellowtail, provided that scallop biomass and catch rates remain high. However, given the seriously depleted state of this stock, a yellowtail bycatch TAC for this area would be important to prevent any possibility of serious impact.

Bycatch of yellowtail flounder could be reduced by effort reduction and gear modifications (e.g., an increase in the twine-top mesh size). Rotational or permanent closures of portions of the South Channel could have benefits to the Cape Cod yellowtail stock.

1.4 Summer Flounder (Fluke)

Summer flounder was last assessed in SARC-31, and is on the agenda for SARC-35 in June, 2002. Total biomass was estimated to be about 41,400 MT in 1999 and 46,400 MT in 2000. Though there have been considerable declines in fishing mortality and increases in biomass, summer flounder was classified by SARC-31 as overfished, and overfishing was occurring.

Total commercial landings were 4826 MT in 1999 and 5093 MT in 2000. Recreational landings were 4,115 MT in 1999 and 7,900 MT in 2000. Recreational discards are very high; 8550 MT were discarded in 2000 in the recreational fishery, and 740 in the trawl fishery.

Summer flounder are caught by scallop gear primarily in the Mid-Atlantic during the winter. Landings by scallop gear in 2000 were 23 MT, and 167 MT were estimated to be discarded by the discard ratio method. Therefore, the impact of scallop gear on the summer flounder stock is negligible, as bycatch from the scallop fishery represents less than 1% of the summer flounder biomass and catch. Summer flounder bycatch in the 2000-1 groundfish closed area fishery was very low (see Table 1). Besides a general reduction of effort, summer flounder bycatch could be reduced by increasing the twine top mesh to 10" and/or by seasonal closures in the Mid-Atlantic during the winter.

1.5 Winter Flounder (Blackback, Lemon Sole)

Georges Bank winter flounder was assessed in SARC-34. Biomass in 2000 was estimated at 8,800 MT and total commercial landings (including Canada) was 1,800 MT. Fishing mortality in 2000 was below the target rate, and the stock continues to rebuild.

The stock biomass in 2000 was 92% of the estimated BMSY target. Georges Bank winter flounder is not overfished, and overfishing is not occurring.

Southern New England/Mid Atlantic winter flounder was last assessed in SARC-28. Biomass was estimated to be at 64% of BMSY, above the biomass threshold. This stock was not classified as overfished, and overfishing was not occurring. The biomass was estimated to be 25,300 MT in 1999, and total landings in 2000 were 3,760 MT.

Winter flounder is commonly caught in scallop gear, especially in near-shore areas of the New York Bight and the South Channel. Observer data from 1991-2000 indicates that winter flounder bycatch was about 5% that of goosefish. Using the above estimate of 3000 MT for the goosefish catch in scallop gear suggests that the winter flounder catch in scallop gear was about 150 MT in 2000. Of this, approximately 70 MT was caught in the 2000-1 groundfish closed area fishery. About 40 MT of winter flounder was landed in scallop gear in 2000 (including bycatch in the bay scallop fishery). The above figures suggest that the scallop fishery exerts a fishing mortality of 0.01 or less on winter flounder. Thus, the impact of the scallop fishery on this species is small.

Bycatch of winter flounder could be reduced by effort reduction, increases in the twine-top mesh, and by seasonal or rotational closures of areas where this species occurs in high densities.

1.6 Atlantic Halibut

Atlantic halibut stocks have been at low levels for over a century due to overfishing, originally primarily from hook gear. This stock is classified as overfished. Most of the remnant population is located in the Gulf of Maine or in deeper waters than that used by the scallop fishery; thus the scallop fishery is unlikely to have a significant negative impact on Atlantic halibut. This is evidenced by the low catch rate in observed trips. In open area observed trips between 1991-2000, a total of 50 lbs of Atlantic halibut was caught, giving a bycatch ratio of 136,472 lbs of scallop meats per lb halibut bycatch. The ratio in the 2000-1 closed area fishery was somewhat higher (primarily because many of the above open area observed trips were in the Mid-Atlantic, where halibut is not found), though still very low in absolute terms. About 276 lbs of Atlantic halibut were caught in the 2000-1 closed area fishery, giving a ratio of about 19,000 lbs of scallop meats per lb of halibut bycatch.

Besides reduction of effort, larger twine top mesh is likely to reduce bycatch of juvenile Atlantic halibut. As halibut may have a chance of survival after discarding, a ban on possession of Atlantic halibut may also be beneficial.

1.7 Other flatfish

Other commercially exploited flatfish, such as American plaice (dab), witch flounder (gray sole), and windowpane flounder (sand dab) are susceptible to capture in scallop dredges. However, the distributions of these species have only a small overlap with that of sea scallops, so that bycatch of these flounders is low. This is evidenced by low bycatch rates in observed open area trips and in the 2000-1 closed area fishery. Thus, the scallop fishery does not have a significant negative impact on these stocks. Like other flatfish, bycatch of these species could be reduced by effort reduction and an increase in twine-top mesh.

1.8 Gadids

The bycatch of gadids such as red hake, silver hake (whiting), haddock, and Atlantic cod in the scallop fishery is low. As evidence of this, the estimated bycatch of these species in the 2000-1 closed area fishery is about what can be taken by one trawl vessel in a single trip. Thus, the scallop fishery does not have a significant negative impact on these species. There is evidence that 4" rings can reduce bycatch of juvenile gadids.

1.9 Barndoor Skate

The entire skate complex was last assessed in SARC-30. The barndoor skate population was reduced to very low levels by the early seventies, probably because of high mortality imposed by large foreign trawlers. Since the late eighties, the NMFS bottom trawl surveys have shown substantial increases in abundance, and current bottom trawl survey indices are the highest in thirty years. The first barndoor caught on NMFS scallop survey was recorded in 1990, and the barndoor catch on the scallop survey has increased since then in parallel to the trawl surveys; 26 barndoors were caught on valid survey tows in the 2001 survey (stratified mean of 0.134/tow in Georges Bank). In response to a petition to list barndoor as an endangered species, SARC-30 concluded that "…there was no evidence that they were in danger of extinction or likely to become endangered within the foreseeable future throughout all or a significant portion of its range." However, the SARC did find that barndoor was overfished.

SARC-30 did not give an estimate for barndoor biomass or fishing mortality, but a swept area estimate can be obtained from the 2001 scallop survey. The area swept by a tow is about 8' by 1nm = 8/6080 sqnm, and the total area surveyed on Georges Bank was 6788 sqnm. Therefore, the minimum swept area estimate (in numbers) for barndoor is

$$0.134*6788*6080/8 = 693,611.$$

The catchability of barndoors in the small NMFS survey scallop dredge, towed at 3.8 knots, is likely low. As evidence of this, in 1999, the F/V Tradition towed the NMFS scallop survey dredge at 5 knots for 10 minutes; the observed catch rate for barndoors was over 4 times that which has been observed on the R/V Albatross IV. A reasonable estimate for catchability of barndoors on the research vessel scallop survey is about 10% (and almost surely less than 20%); this would give an estimate of 6.9 million in the surveyed areas. Taking an average weight of about 3.4 kg gives a swept area biomass of 23,680 MT in the surveyed areas (see Table 3). These estimates do not include individuals in unsurveyed areas, including Gulf of Maine, portions of southern New England or areas around Georges Bank that are too deep or shallow to be included in the scallop survey. It also does not include barndoors in Canadian waters.

Barndoors are susceptible to capture by scallop dredges. However, the fact that the barndoor population was increasing in the early 1990s, when scallop fishing was extremely intense, suggests that the mortality exerted by the scallop fishery on barndoors is low. Additionally, scallop fishing during 1945-1964 had occurred in Georges Bank at about the level that would occur under this amendment. During the end of this time, the bottom trawl survey indicated that barndoors were at high abundance. Thus, it does not appear that the projected levels of scallop fishing would have a serious impact on barndoor skates.

A little over 30 MT of barndoor skate were caught in the 2000-1 groundfish closed area fishery, less than 0.2% of the estimated biomass in the scallop surveyed area. Moreover, survivability of discarded barndoors may be high. It can be concluded that limited fishing in the groundfish closed areas, such as was done in 2000-1, is unlikely to have a substantial negative impact on barndoor skates. Decreases in effort would reduce bycatch of barndoors, but twine-top modifications are unlikely to affect barndoor or other skate bycatch.

1.10 Thorny skates

Thorny skates are at a low level of abundance (SARC-30), and are classified as being overfished. Thorny skates occur mostly in the Gulf of Maine, and have only a small overlap with the scallop fishery. This is evidenced by the low level of bycatch observed in the 2000-1 closed area fishery. For this reason, the scallop fishery is unlikely to have a substantial negative impact on the thorny skate population.

1.11 Other skates

The two types of skates most commonly caught in the scallop fishery are little and winter skate. Little skate is at a high level of abundance, and SARC-30 classified it as not overfished, and overfishing was not occurring. Winter skate is at a moderate level of abundance, and was classified by SARC-30 as overfished, and overfishing was occurring.

Smaller amounts of clearnose, smooth and rosette skates are also caught in the scallop fishery. Clearnose was not classified as overfished by SARC-30, but smooth skate was overfished, as the biomass was slightly below its overfished threshold. Like thorny skate, smooth skate is found mostly in the Gulf of Maine, so that its distribution has only a small overlap with the scallop fishery. Rosette skates are generally found in deeper waters than sea scallops, so that bycatch in the scallop fishery is not a serious issue.

SARC-30 did not give biomass estimates for skates, but swept area estimates for winter and little skate, the two main types of skates caught in the scallop fishery, in the areas surveyed by the 2001 scallop survey can be obtained in a like manner as barndoor skates. These swept area estimates are given in Table 3.

Skates are the most common finfish caught in scallop gear. Data from open area observed trips (1991-2000) suggests that the bycatch of skates is about 2.6 times that of goosefish (this ratio from the 2000-1 closed area fishery was 2.7). Using the above catch estimate of goosefish of 3000 MT in 2000 suggests that total bycatch of skates in that year was a little less than 8000 MT. Based on open area observed trips, about 82% of this was little skate, 9% winter skate, 3% each clearnose and smooth skate, 2% thorny skate, and <1% barndoor (this probably overestimates the percentage of thorny skates in 2000, because these skates are at lower levels than they were historically, and the 2000 fishery was concentrated in the Mid-Atlantic). These numbers suggest that bycatch for little skate was about 6,400 MT and winter skate was about 700 MT. Combining these figures with the biomass estimates from Table 3 suggests that the scallop fishery catches each year about 3% of the little skate, and 1% of the winter skate, of the biomass in the scallop surveyed areas. Discard mortality on skates may be modest. Because the little skate populations were growing when the scallop fishery was much more intense than it is at present, it is probable that the scallop fishery at present does not have a significant negative impact on little skates. Fishing morality on winter skates was estimated in SARC-30 to be 0.39; clearly most of this mortality is due to other sources than the scallop fishery. It is thus also unlikely that scallop fishing has a serious negative impact on winter skates.

1.12 Conclusions

The impact of the scallop fishery on bycatch species in 2000 was generally low. The bycatch species that is most seriously impacted is goosefish, and that only represents less than 10% of the total mortality on the stock, and less than 15% of the target mortality. Other stocks that may be marginally affected include Cape Cod yellowtail, and little and winter skates. Much of the reason for the low impact on bycatch species is the considerable reduction in bottom contact time that has occurred over the last five years. Amendment 10 will likely further reduce bottom contact time by a factor of about two, thus further reducing bycatch and its impact on bycatch species.

Table 1a. 2000-1 Groundfish Closed Area Fishery Bycatch summary (catch in lbs live wt.)

Species	CL1	CL2	NLS	TOTAL
Goosefish	380,263	385,277	35,545	801,086
Yellowtail Flounder	52,478	469,523	12,705	534,705
Winter Flounder	142,609	6,807	4,855	154,271
Summer Flounder	3,363	3,223	347	6,933
Atlantic Halibut	125	143	9	276
American Plaice	11,249	15,936	426	27,611
Witch Flounder	9,453	24,943	91	34,488
Windowpane Flounder	20,574	6,004	1,384	27,962
Red Hake	2,170	7,268	2,087	11,525
Silver Hake	1,382	9,743	628	11,753
Haddock	142	14	0	156
Atlantic Cod	2,244	350	85	2,679
Barndoor Skate	1,353	51,215	15,648	68,216
Thorny Skate	3,727	7,615	957	12,299
Other Skates	598,204	1,005,689	123,912	1,727,806
Sea Scallops caught (live wt)	27,670,000	14,000,000	10,720,000	52,400,000
Sea Scallops caught (meats)	3,322,000	1,681,605	1,286,864	6,290,469
% Scallops discarded	14	24	10	16
# Trips		164	136	
% Observed	28.9	51.2	35.2	36

Table 1b. 2000-1 groundfish closed area fishery – bycatch ratio (live weight / scallops landed [meat weight])

Species	Closed Area I	Closed Area II	Nantucket Lightship Area	TOTAL
Goosefish	0.1145	0.2291	0.0276	0.1273
Yellowtail Flounder	0.0158	0.2792	0.0099	0.0850
Winter Flounder	0.0429	0.0040	0.0038	0.0245
Summer Flounder	0.0010	0.0019	0.0003	0.0011
Atlantic Halibut	0.00004	0.00008	0.00001	0.00004
American Plaice	0.0034	0.0095	0.0003	0.0044
Witch Flounder	0.0028	0.0148	0.0001	0.0055
Windowpane Flounder	0.0062	0.0036	0.0011	0.0044
Red Hake	0.0007	0.0043	0.0016	0.0018
Silver Hake	0.0004	0.0058	0.0005	0.0019
Haddock	0.00004	0.00001	0.00000	0.00002
Atlantic Cod	0.0007	0.0002	0.0001	0.0004
Barndoor Skate	0.0004	0.0305	0.0122	0.0108
Thorny Skate	0.0011	0.0045	0.0007	0.0020
Other Skates	0.1801	0.5981	0.0963	0.2747

Table 2. 2001 Mid-Atlantic Access Area Bycatch Estimates. Catch in pounds live weight (except sea scallops)

Hudson Canyon South			Virginia Beach		
Species	Catch	%Land	Species	Catch	%land
SCALLOP, SEA (meats)	15,522,478	88	SCALLOP, SEA (meats)	440,475	70
SKATE, LITTLE	1,851,612	0	SKATE, LITTLE	7,877	0
MONKFISH (GOOSEFISH)	1,130,326	26	CRAB, JONAH	7,530	0
SKATE, NK	655,989	0	MONKFISH (GOOSEFISH)	7,068	52
SAND DOLLAR	481,756	0	SEA ROBIN, NORTHERN	4,031	0
SKATE, WINTER (BIG)	92,729	0	CRAB, HORSESHOE	2,309	0
FLOUNDER, SUMMER	83,266	8	HAKE, SPOTTED	1,968	0
FLOUNDER, FOURSPOT	73,343	1	CRAB, ROCK	1,934	0
SEA ROBIN, NORTHERN	42,967	0	CRAB, TRUE, NK	1,918	0
CRAB, ROCK	42,808	0	SKATE, ROSETTTE	1,622	0
SKATE, CLEARNOSE	35,401	0	SQUID, ATL LONG-FIN	1,238	0
DOGFISH, SPINY	17,940	1	FLOUNDER, FOURSPOT	1,188	0
HAKE, SPOTTED	15,626	0	CRAB, SPECKLED, NK	767	0
HAKE, RED (LING)	12,554	0	SEA BASS, BLACK	763	0
CRAB, JONAH	10,741	0	SKATE, CLEARNOSE	750	0
STARFISH, SEASTAR	10,453	0	DOGFISH, CHAIN	270	0
SEA ROBIN, STRIPED	8,952	0	EEL, SAND LANCE, NK	249	0
CRAB, CANCER, NK	7,705	0	WINDOWPANE FLDR	201	0
FLOUNDER, WITCH	6,041	3	OCTOPUS, NK	144	0
HAKE, SILVER (WHITING)	4,638	1	LOBSTER, AMERICAN	122	57
SEA BASS, BLACK	4,492	9	SKATE, NK	113	0
CRAB, TRUE, NK	3,103	0	EEL, AMERICAN	96	0
SEA ROBIN, NK	2,485	0	SKATE, WINTER (BIG)	87	0
LOBSTER, AMERICAN	2,427	22	HAKE, SILVER (WHITING)	81	0
SQUID, ATL LONG-FIN	2,111	5	SQUID, NK	65	0
FLOUNDER, WINDOWPANE	1,834	4	DOGFISH, SPINY	35	0
HAKE, WHITE	1,757	5	EEL, NK	27	0
SQUID, NK	1,594	18	EEL, CONGER	26	0
CRAB, HERMIT, NK	1,461	0	SEA BASS, NK	26	0
SNAPPER, NK	1,304	0	HAKE, RED (LING)	19	0
CRAB, HORSESHOE	1,141	4	FLOUNDER, SUMMER	17	0
SILVERSIDE, ATLANTIC	1,120	0	TRIGGERFISH, NK	17	0
CRAB, NORTHERN STONE	1,080	0	FILEFISH, NK	17	0
SCUP	898	24	SQUID, SHORT-FIN	17	0
SPONGE, NK	878	0	CRAB, SPIDER, NK	17	0
FLOUNDER, YELLOWTAIL	534	7	BUTTERFISH	9	0
CORAL, STONY, NK	395	0	HAKE, WHITE	9	0
FLOUNDER, WINTER	385	13	SCUP	9	0
SKATE, BARNDOOR	369	0	PORGY, NK	9	0
HAKE, NK	240	0	DOGFISH, NK	9	0
BUTTERFISH	208	1	FLOUNDER, WITCH	3	0
SQUID, SHORT-FIN	167	8			
SKATE, ROSETTTE	116	0			
OCEAN POUT	112	0			
WEAKFISH	106	0			
PORGY, NK	90	0			
AMERICAN PLAICE	69	100			
COD, ATLANTIC	26	0			
SPOT	21	0			
CUNNER (YELLOW PERCH)	17	0			
SKATE, SMOOTH	17	0			

Table 3. Skate Biomass Estimates. Only includes that portion in the areas surveyed by the NMFS scallop survey.

Species	Region	1.12.1.1.1.1.1 Num/tow	Min swpt number (thousands)	Number @q=0.2 (thousands)	Number @q=0.1 (thousands)	Mean wt (kg)	Biomass @q=0.2 MT	Biomass @q=0.1 MT
Barndoor	GB	0.13	691	3,456	6,913	3.43	11,840	23,680
Little	GB	8.70	44,903	224,512	449,025	0.23	51,189	102,378
Little	MA	15.50	98,464	492,318	984,636	0.37	184,373	368,746
Winter	GB	1.35	6,940	34,699	69,397	1.46	50,660	101,320
Winter	MA	0.69	4,352	21,758	43,516	0.19	4,025	8,050

2.0 Scallop And Finfish Bycatch Estimates From Vessel Trip Reports By Quarter And Rotation Management Area, Pooled Over Years

This is a distinct, separate analysis than the one above of scallop bycatch over a much larger area and pooled over 1991 to 2000 using Sea Sampling Observer Program data. The estimated bycatch rates for each species were adjusted for annual changes in that species' biomass indices on the NMFS fall finfish survey, then classified into rotation management areas and calendar quarter. Areas and quarters in the top 90th percentile are highlighted as areas and times where finfish bycatch was high. Due to low sample sizes, these estimates are much less precise than the estimates in the analysis above for controlled access areas during the 2000 and 2001 fishing years, when the Sea Sampling Observer Program sampled considerably more trips.

Table 4. **Scallop discards and landings per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	34	7	7	1	49	89	102	175	191	557
	Total trip catch, biomass adjusted (lbs)	517	657	13	10	1,198	29,450	23,888	34,570	25,818	113,727
	Total tow time (hours) on observed trips	18.80	12.70	5.70	0.80	38.00	38.60	94.40	106.60	161.50	401.10
	Catch per scallop pounds landed	0.03	0.16	0.00	0.01	0.04	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	41.72	367.28	1.33	13.60	47.89	1178.84	965.23	978.91	498.45	831.07
	Catch per DF (lbs.)	60.25	368.24	1.57	20.10	61.75	1566.89	1034.56	1299.38	596.78	1,017.66
MA8	Number of observed tows	197	131	12	41	381	779	444	296	478	1,997
	Total trip catch, biomass adjusted (lbs)	4,049	8,732	856	1,870	15,508	228,186	163,498	67,060	99,372	558,116
	Total tow time (hours) on observed trips	163.90	129.70	11.20	37.60	342.40	629.40	414.90	262.20	397.10	1703.60
	Catch per scallop pounds landed	0.03	0.07	0.10	0.05	0.05	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	34.26	89.22	77.84	44.01	57.53	978.69	1168.65	792.14	711.76	934.35
	Catch per DF (lbs.)	38.21	97.03	88.45	46.83	63.15	1100.07	1261.21	879.97	789.06	1,035.07
MA7	Number of observed tows	73	171	23	13	280	698	702	404	103	1,907
	Total trip catch, biomass adjusted (lbs)	1,739	16,666	1,546	29	19,980	226,049	242,536	98,360	25,675	592,619
	Total tow time (hours) on observed trips	68.60	200.90	21.50	8.50	299.50	622.20	556.50	328.50	43.30	1550.50
	Catch per scallop pounds landed	0.02	0.14	0.04	0.01	0.08	1.00	1.00	1.00	1.00	1.00

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per DA (lbs.)	29.86	298.11	32.23	7.98	120.58	1106.46	1119.77	868.04	1029.53	1,059.87
	Catch per DF (lbs.)	34.39	303.76	39.16	8.63	134.79	1238.88	1214.92	978.72	1350.47	1,181.45
MA6	Number of observed tows	269	193	79	100	641	866	835	917	618	3,236
	Total trip catch, biomass adjusted (lbs)	26,507	3,779	8,052	13,972	52,309	342,742	278,979	211,049	205,021	1,037,791
	Total tow time (hours) on observed trips	257.60	207.70	59.50	83.50	608.30	642.20	685.70	701.50	399.30	2428.70
	Catch per scallop pounds landed	0.11	0.04	0.08	0.12	0.09	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	172.27	47.58	77.42	195.18	127.94	1263.74	1226.83	915.43	1219.54	1,156.61
	Catch per DF (lbs.)	198.88	50.27	95.16	243.25	149.24	1611.43	1377.44	1064.94	1432.54	1,371.79
MA5	Number of observed tows	23	117	103	70	313	96	400	193	201	890
	Total trip catch, biomass adjusted (lbs)	286	5,807	6,954	355	13,402	19,323	119,034	52,261	40,924	231,542
	Total tow time (hours) on observed trips	25.20	104.60	106.80	58.00	294.60	65.50	322.60	194.80	185.60	768.50
	Catch per scallop pounds landed	0.02	0.07	0.17	0.02	0.09	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	29.93	85.08	152.77	15.28	91.44	690.46	1014.88	834.62	605.91	840.65
	Catch per DF (lbs.)	33.47	94.05	168.17	15.98	100.12	787.27	1122.72	911.63	649.27	922.75
MA4	Number of observed tows	98	318	150	100	666	459	924	391	201	1,975
	Total trip catch, biomass adjusted (lbs)	30,075	41,525	7,117	267	78,984	111,114	326,019	101,043	31,724	569,898
	Total tow time (hours) on observed trips	95.80	269.70	114.60	75.50	555.60	481.30	707.00	294.40	167.80	1650.50
	Catch per scallop pounds landed	0.42	0.16	0.09	0.01	0.18	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	415.16	235.16	93.53	6.15	214.37	694.23	1254.84	1006.61	636.07	999.62
	Catch per DF (lbs.)	526.18	272.20	102.94	6.47	246.77	826.66	1475.32	1105.89	669.89	1,153.36
MA3	Number of observed tows	24	7	127	14	172	112	205	211	57	585
	Total trip catch, biomass adjusted (lbs)	31,715	820	18,983	16	51,533	66,150	155,582	99,766	11,183	332,681
	Total tow time (hours) on observed trips	31.50	5.70	160.10	9.80	207.10	-7.70	150.80	246.90	39.70	429.70
	Catch per scallop pounds landed	1.18	0.06	0.22	0.01	0.40	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	2793.55	53.43	346.55	4.31	605.72	1507.72	2447.75	1399.84	796.69	1,726.04
	Catch per DF (lbs.)	4469.68	60.60	388.70	4.57	707.36	2061.35	3485.64	1563.88	837.37	2,162.03
MA2	Number of observed tows	17	15	14	27	73	118	95	115	30	358

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total trip catch, biomass adjusted (lbs)	9,979	544	837	37	11,397	72,360	39,824	107,575	4,892	224,651
	Total tow time (hours) on observed trips	14.90	14.30	14.90	19.20	63.30	63.30	87.20	139.60	21.30	311.40
	Catch per scallop pounds landed	0.15	0.05	0.07	0.01	0.12	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	335.24	64.28	80.85	5.47	205.92	2041.45	1717.17	2983.85	715.65	2,212.77
	Catch per DF (lbs.)	567.79	67.60	93.93	5.81	278.63	3246.44	1939.52	3367.76	759.98	2,766.60
MA1	Number of observed tows	31	3	7	1	42	70	11	127	84	292
	Total trip catch, biomass adjusted (lbs)	16,330	55	9	210	16,603	76,651	2,834	27,758	23,275	130,518
	Total tow time (hours) on observed trips	26.80	2.60	7.40	1.00	37.80	41.10	9.30	134.30	63.20	247.90
	Catch per scallop pounds landed	0.48	0.04	0.01	0.01	0.32	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	1063.35	40.80	3.63	12.34	460.36	1924.21	1023.76	747.58	870.53	1,225.87
	Catch per DF (lbs.)	1677.25	44.32	3.80	12.97	564.59	2909.17	1116.09	798.97	914.75	1,465.28
GB9	Number of observed tows						55		14	49	118
	Total trip catch, biomass adjusted (lbs)						10,115		1,987	5,687	17,789
	Total tow time (hours) on observed trips						44.80		13.60	37.50	95.90
	Catch per scallop pounds landed						1.00		1.00	1.00	1.00
	Catch per DA (lbs.)						609.87		637.57	508.58	575.99
	Catch per DF (lbs.)						647.79		701.74	594.83	635.17
GB8	Number of observed tows		4		70	74	23	302	99	229	653
	Total trip catch, biomass adjusted (lbs)		45		5,169	5,214	2,695	90,800	9,869	54,027	157,390
	Total tow time (hours) on observed trips		2.70		39.80	42.50	16.80	180.90	76.20	155.70	429.60
	Catch per scallop pounds landed		0.00		0.14	0.07	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		1.73		121.48	75.74	385.49	1277.13	395.93	818.17	931.04
	Catch per DF (lbs.)		2.07		194.28	107.36	412.24	1540.71	438.01	1121.28	1,155.70
GB7	Number of observed tows		11	7	14	32	14	48	121	53	236
	Total trip catch, biomass adjusted (lbs)		123	3	196	321	5,677	13,256	19,633	19,801	58,367
	Total tow time (hours) on observed trips		8.50	6.00	15.20	29.70	9.20	25.10	91.80	31.90	158.00
	Catch per scallop pounds landed		0.01	0.00	0.03	0.02	1.00	1.00	1.00	1.00	1.00

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per DA (lbs.)		12.19	1.31	20.63	14.82	652.58	1194.04	737.33	1060.29	896.53
	Catch per DF (lbs.)		27.85	1.51	25.77	23.19	2869.28	2486.13	852.89	1424.47	1,319.61
GB6	Number of observed tows		30	3	16	49	2	56	5	19	82
	Total trip catch, biomass adjusted (lbs)		7,762	3	7	7,772	364	44,349	757	5,492	50,962
	Total tow time (hours) on observed trips		27.60	2.30	19.90	49.80	1.40	53.00	4.00	23.20	81.60
	Catch per scallop pounds landed		0.22	0.01	0.00	0.19	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		420.23	5.53	0.80	279.65	988.80	1740.36	1063.63	580.46	1,414.67
	Catch per DF (lbs.)		481.48	5.96	0.88	316.75	3296.00	2005.42	1213.21	640.96	1,622.10
GB5	Number of observed tows		10	90	26	126	10	112	353	81	556
	Total trip catch, biomass adjusted (lbs)		1,210	354	29	1,593	1,554	41,034	84,564	11,100	138,252
	Total tow time (hours) on observed trips		9.40	84.50	28.60	122.50	10.40	96.50	279.10	83.30	469.30
	Catch per scallop pounds landed		0.05	0.01	0.00	0.02	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		60.69	5.44	3.22	16.92	1069.29	1186.30	901.79	510.52	912.20
	Catch per DF (lbs.)		76.04	5.90	3.75	19.03	1415.39	1447.55	1040.86	559.84	1,059.27
GB4	Number of observed tows		5	45	95	145	78	92	64	215	449
	Total trip catch, biomass adjusted (lbs)		542	14	6,286	6,842	16,261	29,939	13,114	69,198	128,512
	Total tow time (hours) on observed trips		3.70	37.40	82.90	124.00	131.40	38.40	52.00	182.60	404.40
	Catch per scallop pounds landed		0.61	0.00	0.13	0.11	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		955.30	1.04	188.16	144.11	997.58	2414.26	618.87	1353.89	1,272.37
	Catch per DF (lbs.)		1411.23	1.16	202.39	157.34	1067.76	3682.60	686.49	1463.50	1,431.98
GB3	Number of observed tows	25	2	38	28	93	49	31	71	161	312
	Total trip catch, biomass adjusted (lbs)	1,028	20	646	634	2,329	13,740	31,374	26,412	46,515	118,041
	Total tow time (hours) on observed trips	18.20	1.70	24.60	22.50	67.00	38.30	14.90	43.80	132.30	229.30
	Catch per scallop pounds landed	0.11	0.06	0.03	0.04	0.05	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	110.17	63.86	41.69	84.93	71.40	993.83	3561.76	1411.96	989.86	1,336.35
	Catch per DF (lbs.)	152.60	67.34	44.30	95.18	82.34	1251.08	4844.19	1496.86	1059.76	1,494.26
GB2	Number of observed tows	102	131	52	71	356	223	210	64	282	779
	Total trip catch, biomass adjusted (lbs)	20,257	22,524	3,186	10,898	56,866	154,162	111,692	21,831	94,096	381,781

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	96.00	67.00	48.60	61.90	273.50	170.90	147.10	55.50	141.70	515.20
	Catch per scallop pounds landed	0.20	0.27	0.15	0.14	0.20	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	199.28	364.74	166.93	297.66	259.54	1087.79	1400.75	1143.83	1520.72	1,262.42
	Catch per DF (lbs.)	264.51	461.22	179.29	362.07	328.15	1607.39	1729.80	1228.49	1771.52	1,650.13
GB15	Number of observed tows	7	25	155	57	244	7	25	184	58	274
	Total trip catch, biomass adjusted (lbs)	2,589	936	1,638	2,615	7,777	11,270	13,051	45,000	27,994	97,315
	Total tow time (hours) on observed trips	4.20	21.20	70.60	17.80	113.80	4.20	21.20	75.30	18.30	119.00
	Catch per scallop pounds landed	0.23	0.07	0.04	0.09	0.08	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	227.11	80.04	38.32	83.70	80.12	988.80	1116.16	1036.53	896.10	995.61
	Catch per DF (lbs.)	757.04	125.07	51.96	179.45	136.47	3296.00	1744.14	1408.52	1921.18	1,694.74
GB14	Number of observed tows		87	52		139	10	127	95	10	242
	Total trip catch, biomass adjusted (lbs)		3,654	3,280		6,934	2,620	110,515	73,850	8,108	195,093
	Total tow time (hours) on observed trips		51.30	56.00		107.30	6.90	89.90	93.10	9.90	199.80
	Catch per scallop pounds landed		0.03	0.06		0.04	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		66.36	111.03		81.96	1025.35	1971.67	2035.98	1651.06	1,955.04
	Catch per DF (lbs.)		108.55	193.79		137.07	1630.01	3238.03	3416.25	1915.09	3,167.67
GB13	Number of observed tows		49	28	20	97	21	86	85	200	392
	Total trip catch, biomass adjusted (lbs)		1,568	405	436	2,409	5,871	44,024	19,210	71,357	140,462
	Total tow time (hours) on observed trips		28.90	16.50	15.80	61.20	13.70	43.10	48.80	144.60	250.20
	Catch per scallop pounds landed		0.12	0.03	0.04	0.06	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		156.39	47.66	77.73	99.82	991.11	2117.24	1583.50	1002.92	1,276.96
	Catch per DF (lbs.)		172.86	49.95	92.51	110.03	1058.30	2883.95	1659.56	1122.52	1,463.81
GB11	Number of observed tows	103	46	104	160	413	106	124	348	313	891
	Total trip catch, biomass adjusted (lbs)	5,763	589	1,486	1,816	9,655	30,720	90,079	79,581	140,946	341,326
	Total tow time (hours) on observed trips	67.00	26.80	64.40	111.70	269.90	69.80	84.80	184.30	196.70	535.60
	Catch per scallop pounds landed	0.19	0.03	0.02	0.01	0.04	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	207.23	39.55	26.78	25.51	56.99	1066.81	2409.16	1309.64	1489.53	1,540.44

Rotation management area		Discards (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	Landings (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per DF (lbs.)	218.52	41.37	28.29	31.67	64.15	1124.49	2669.79	1384.80	1801.42	1,734.66
GB10	Number of observed tows		1	144	37	182	78	19	165	150	412
	Total trip catch, biomass adjusted (lbs)		1	133	474	607	20,909	2,311	64,650	37,804	125,674
	Total tow time (hours) on observed trips		1.20	128.30	31.80	161.30	55.00	11.00	145.10	114.10	325.20
	Catch per scallop pounds landed		0.00	0.00	0.02	0.01	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		2.36	3.65	25.29	10.98	902.24	977.83	1452.39	1138.76	1,217.20
	Catch per DF (lbs.)		2.50	3.94	31.04	12.36	1120.73	1354.03	1619.56	1420.75	1,446.36
GB1	Number of observed tows	70	2	51	102	225	312	102	91	349	854
	Total trip catch, biomass adjusted (lbs)	805	6	600	42	1,453	93,870	49,525	35,728	83,306	262,429
	Total tow time (hours) on observed trips	61.40	2.00	15.20	87.80	166.40	277.50	102.90	20.70	265.90	667.00
	Catch per scallop pounds landed	0.02	0.00	0.02	0.00	0.01	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	18.81	0.23	29.80	1.36	12.11	1018.64	1883.23	1578.49	651.42	975.69
	Catch per DF (lbs.)	19.71	0.24	92.23	1.48	14.44	1149.82	1967.24	4885.81	698.56	1,124.47
4270	Number of observed tows	82		5	5	92	148		5	62	215
	Total trip catch, biomass adjusted (lbs)	10,855		67	1	10,923	52,474		2,341	12,209	67,024
	Total tow time (hours) on observed trips	74.30		3.00	3.90	81.20	139.10		3.00	48.90	191.00
	Catch per scallop pounds landed	0.23		0.03	0.00	0.22	1.00		1.00	1.00	1.00
	Catch per DA (lbs.)	279.74		45.18	0.68	264.38	1150.07		1578.49	521.48	950.39
	Catch per DF (lbs.)	294.86		139.83	0.71	285.39	1232.02		4885.81	548.79	1,026.11
4269	Number of observed tows									1	1
	Total trip catch, biomass adjusted (lbs)									115	115
	Total tow time (hours) on observed trips									0.90	0.90
	Catch per scallop pounds landed									1.00	1.00
	Catch per DA (lbs.)									863.40	863.40
	Catch per DF (lbs.)									905.86	905.86
4268	Number of observed tows			1		1			1		1
	Total trip catch, biomass adjusted (lbs)			1		1			341		341
	Total tow time (hours) on observed			1.00		1.00			1.00		1.00

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed			0.00		0.00			1.00		1.00
	Catch per DA (lbs.)			3.02		3.02			1029.12		1,029.12
	Catch per DF (lbs.)			3.25		3.25			1109.23		1,109.23
4267	Number of observed tows		80	22	25	127	23	206	49	211	489
	Total trip catch, biomass adjusted (lbs)		122	1,188	165	1,476	9,852	71,258	11,715	49,341	142,166
	Total tow time (hours) on observed trips		59.90	22.00	10.50	92.40	18.00	160.60	45.80	109.90	334.30
	Catch per scallop pounds landed		0.01	0.13	0.01	0.03	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		4.07	90.54	8.62	23.67	920.44	1092.94	733.91	923.96	978.66
	Catch per DF (lbs.)		4.34	99.96	12.68	27.81	2503.81	1191.92	846.92	1078.52	1,153.01
4173	Number of observed tows							1			1
	Total trip catch, biomass adjusted (lbs)							140			140
	Total tow time (hours) on observed trips							0.80			0.80
	Catch per scallop pounds landed							1.00			1.00
	Catch per DA (lbs.)							624.00			624.00
	Catch per DF (lbs.)							691.20			691.20
4172	Number of observed tows									1	1
	Total trip catch, biomass adjusted (lbs)									188	188
	Total tow time (hours) on observed trips									0.80	0.80
	Catch per scallop pounds landed									1.00	1.00
	Catch per DA (lbs.)									759.26	759.26
	Catch per DF (lbs.)									1563.18	1,563.18
4171	Number of observed tows		49			49		49	2	5	56
	Total trip catch, biomass adjusted (lbs)		102			102		20,124	290	417	20,831
	Total tow time (hours) on observed trips		34.00			34.00		34.00	1.30	3.90	39.20
	Catch per scallop pounds landed		0.01			0.01		1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		10.66			10.66		2103.70	983.47	464.77	1,936.40
	Catch per DF (lbs.)		10.95			10.95		2161.10	1316.80	476.69	2,001.74

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
4170	Number of observed tows						27	2		24	53
	Total trip catch, biomass adjusted (lbs)						9,470	341		2,461	12,272
	Total tow time (hours) on observed trips						12.30	1.80		18.70	32.80
	Catch per scallop pounds landed						1.00	1.00		1.00	1.00
	Catch per DA (lbs.)						1102.71	1088.69		488.18	880.19
	Catch per DF (lbs.)						1891.69	1201.62		503.23	1,205.46
4169	Number of observed tows	8				8	11			27	38
	Total trip catch, biomass adjusted (lbs)	3,500				3,500	7,720			5,402	13,122
	Total tow time (hours) on observed trips	2.80				2.80	5.00			18.10	23.10
	Catch per scallop pounds landed	0.45				0.45	1.00			1.00	1.00
	Catch per DA (lbs.)	997.82				997.82	2163.08			690.52	1,151.85
	Catch per DF (lbs.)	2696.81				2,696.81	5691.37			803.61	1,624.29
4167	Number of observed tows		12		74	86	6	120		104	230
	Total trip catch, biomass adjusted (lbs)		738		1,407	2,145	460	44,218		16,798	61,476
	Total tow time (hours) on observed trips		7.90		21.60	29.50	4.40	51.70		32.30	88.40
	Catch per scallop pounds landed		0.08		0.08	0.08	1.00	1.00		1.00	1.00
	Catch per DA (lbs.)		95.80		60.16	68.99	416.48	1039.97		715.04	915.97
	Catch per DF (lbs.)		181.89		127.71	142.29	436.42	1255.78		1517.90	1,298.82
4166	Number of observed tows	18	24	272	12	326	40	82	439	110	671
	Total trip catch, biomass adjusted (lbs)	461	2,049	19,114	197	21,822	16,769	36,170	500,340	117,823	671,102
	Total tow time (hours) on observed trips	10.40	4.90	189.10	13.60	218.00	26.10	38.70	305.90	115.60	486.30
	Catch per scallop pounds landed	0.03	0.10	0.06	0.00	0.05	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	35.43	130.38	118.94	9.98	104.30	1011.35	1315.24	2228.89	2179.20	2,080.11
	Catch per DF (lbs.)	59.05	211.10	189.29	11.64	161.10	1813.75	2499.39	3412.19	2547.70	3,098.39
4073	Number of observed tows	6	2	1	33	42	189	148	114	375	826
	Total trip catch, biomass adjusted (lbs)	17	880	70	304	1,271	35,336	36,142	55,605	61,969	189,052
	Total tow time (hours) on observed trips	4.60	1.60	0.80	22.20	29.20	112.10	53.40	95.30	150.80	411.60

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Catch per scallop pounds landed	0.01	2.19	0.00	0.02	0.03	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	3.12	3286.50	5.09	11.75	28.03	777.51	1024.04	1401.66	840.50	973.79
	Catch per DF (lbs.)	3.30	3299.19	5.23	13.05	30.18	972.46	1213.40	1472.48	1062.82	1,165.61
4072	Number of observed tows						2	59		11	72
	Total trip catch, biomass adjusted (lbs)						497	14,820		1,156	16,473
	Total tow time (hours) on observed trips						1.10	43.70		8.50	53.30
	Catch per scallop pounds landed						1.00	1.00		1.00	1.00
	Catch per DA (lbs.)						2245.60	1216.23		548.98	1,135.11
	Catch per DF (lbs.)						3133.40	1257.07		560.40	1,175.74
4071	Number of observed tows				2	2	2			3	5
	Total trip catch, biomass adjusted (lbs)				2	2	245			116	361
	Total tow time (hours) on observed trips				1.70	1.70	1.20			2.60	3.80
	Catch per scallop pounds landed				0.03	0.03	1.00			1.00	1.00
	Catch per DA (lbs.)				12.82	12.82	1102.50			239.73	511.26
	Catch per DF (lbs.)				13.40	13.40	2756.25			351.99	862.71
4070	Number of observed tows									25	25
	Total trip catch, biomass adjusted (lbs)									104	104
	Total tow time (hours) on observed trips									33.30	33.30
	Catch per scallop pounds landed									1.00	1.00
	Catch per DA (lbs.)									548.79	548.79
	Catch per DF (lbs.)									584.86	584.86
4069	Number of observed tows	1	78	178	176	433	98	173	234	328	833
	Total trip catch, biomass adjusted (lbs)	8	12,873	742	19,527	33,150	25,785	156,609	59,956	135,297	377,647
	Total tow time (hours) on observed trips	0.60	29.50	134.60	161.70	326.40	77.80	59.10	174.90	289.70	601.50
	Catch per scallop pounds landed	0.03	0.27	0.01	0.17	0.15	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	31.05	405.98	12.69	253.94	198.12	924.07	2083.74	1003.47	1405.73	1,457.78
	Catch per DF (lbs.)	32.74	630.22	13.68	275.94	227.57	1003.88	3614.91	1081.77	1528.80	1,773.57
4068	Number of observed tows							1	1	7	9

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total trip catch, biomass adjusted (lbs)							221	130	648	999
	Total tow time (hours) on observed trips							0.90	0.90	6.90	8.70
	Catch per scallop pounds landed							1.00	1.00	1.00	1.00
	Catch per DA (lbs.)							1241.87	1174.00	521.93	652.84
	Catch per DF (lbs.)							2357.97	1645.79	545.35	734.05
4067	Number of observed tows		14	1	48	63	35	84	13	91	223
	Total trip catch, biomass adjusted (lbs)		2,766	1	19	2,786	5,275	44,260	2,283	16,251	68,069
	Total tow time (hours) on observed trips		13.20	0.90	57.90	72.00	30.20	88.80	9.00	102.30	230.30
	Catch per scallop pounds landed		0.12	0.01	0.00	0.09	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)		228.37	5.53	1.17	98.33	905.05	1221.37	1036.34	481.72	872.62
	Catch per DF (lbs.)		261.66	5.96	1.29	110.57	1059.04	1300.61	1387.92	516.44	943.78
4066	Number of observed tows									1	1
	Total trip catch, biomass adjusted (lbs)									136	136
	Total tow time (hours) on observed trips									1.00	1.00
	Catch per scallop pounds landed									1.00	1.00
	Catch per DA (lbs.)									377.91	377.91
	Catch per DF (lbs.)									393.12	393.12
4065	Number of observed tows			1		1			1		1
	Total trip catch, biomass adjusted (lbs)			7		7			344		344
	Total tow time (hours) on observed trips			1.30		1.30			1.30		1.30
	Catch per scallop pounds landed			0.02		0.02			1.00		1.00
	Catch per DA (lbs.)			13.55		13.55			666.02		666.02
	Catch per DF (lbs.)			14.52		14.52			713.60		713.60
3974	Number of observed tows						4		4		8
	Total trip catch, biomass adjusted (lbs)						378		240		618
	Total tow time (hours) on observed trips						2.70		2.10		4.80
	Catch per scallop pounds landed						1.00		1.00		1.00

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per DA (lbs.)						782.97		1613.16		978.54
	Catch per DF (lbs.)						898.46		1656.09		1,092.57
3874	Number of observed tows	32	5	1	1	39	118	147	12	28	305
	Total trip catch, biomass adjusted (lbs)	942	88	48	3	1,081	21,571	22,603	1,437	4,825	50,436
	Total tow time (hours) on observed trips	12.50	4.40	0.80	1.00	18.70	61.20	86.90	9.30	22.40	179.80
	Catch per scallop pounds landed	0.09	0.01	0.29	0.00	0.05	1.00	1.00	1.00	1.00	1.00
	Catch per DA (lbs.)	58.94	8.20	201.97	1.85	37.83	532.13	584.41	936.92	456.54	552.32
	Catch per DF (lbs.)	78.70	10.67	221.06	1.91	49.12	692.43	802.82	1232.75	506.38	720.50
3872	Number of observed tows	1				1	1				1
	Total trip catch, biomass adjusted (lbs)	2				2	160				160
	Total tow time (hours) on observed trips	0.80				0.80	0.80				0.80
	Catch per scallop pounds landed	0.01				0.01	1.00				1.00
	Catch per DA (lbs.)	4.08				4.08	326.08				326.08
	Catch per DF (lbs.)	4.27				4.27	341.25				341.25
3870	Number of observed tows							1			1
	Total trip catch, biomass adjusted (lbs)							260			260
	Total tow time (hours) on observed trips							0.80			0.80
	Catch per scallop pounds landed							1.00			1.00
	Catch per DA (lbs.)							1185.00			1,185.00
	Catch per DF (lbs.)							1202.54			1,202.54
3775	Number of observed tows						2	1			3
	Total trip catch, biomass adjusted (lbs)						210	2			212
	Total tow time (hours) on observed trips						2.10	0.60			2.70
	Catch per scallop pounds landed						1.00	1.00			1.00
	Catch per DA (lbs.)						1211.32	803.07			1,205.54
	Catch per DF (lbs.)						1495.28	925.13			1,486.64
3773	Number of observed tows		1			1	1	4			5
	Total trip catch, biomass adjusted (lbs)		42			42	140	1,321			1,461

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		1.30			1.30	0.80	4.00			4.80
	Catch per scallop pounds landed		0.08			0.08	1.00	1.00			1.00
	Catch per DA (lbs.)		118.03			118.03	540.91	1043.01			957.81
	Catch per DF (lbs.)		128.12			128.12	597.85	1143.21			1,051.31
3675	Number of observed tows									3	3
	Total trip catch, biomass adjusted (lbs)									105	105
	Total tow time (hours) on observed trips									1.80	1.80
	Catch per scallop pounds landed									1.00	1.00
	Catch per DA (lbs.)									870.53	870.53
	Catch per DF (lbs.)									914.75	914.75
3674	Number of observed tows								1		1
	Total trip catch, biomass adjusted (lbs)								224		224
	Total tow time (hours) on observed trips								1.40		1.40
	Catch per scallop pounds landed								1.00		1.00
	Catch per DA (lbs.)								768.51		768.51
	Catch per DF (lbs.)								822.42		822.42
Total Number of observed tows		1,221	1,630	1,773	1,439	6,063	4,982	6,130	5,464	5,549	22,125
Total trip catch, biomass adjusted (lbs)		167,425	137,224	77,352	66,992	448,993	1,728,194	2,472,630	1,930,874	1,568,674	7,700,372
Total tow time (hours) on observed trips		1055.90	1356.60	1409.60	1123.70	4945.80	3921.10	4563.00	4243.30	3984.90	16712.30
Total Catch per scallop pounds landed		0.17	0.11	0.06	0.08	0.11	1.00	1.00	1.00	1.00	1.00
Total Catch per DA (lbs.)		222.73	156.20	84.13	95.49	138.10	1,067.76	1,360.38	1,249.01	988.54	1,172.24
Total Catch per DF (lbs.)		271.69	183.58	103.02	115.34	166.58	1,319.67	1,617.34	1,492.50	1,146.84	1,400.08

Table 5. Monkfish discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one-minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	68	39	139	154	400	99	78	163	180	520
	Total trip catch, biomass adjusted (lbs)	770	502	1,378	1,685	4,336	7,357	2,257	4,719	11,859	26,192
	Total tow time (hours) on observed trips	48.60	41.60	91.70	128.90	310.80	46.40	75.40	97.90	152.50	372.20
	Catch per scallop pounds landed	0.03	0.02	0.04	0.07	0.04	0.24	0.09	0.14	**0.45**	0.23
	Catch per DA (lbs.)	35.42	23.93	34.79	35.26	33.32	255.95	91.43	134.58	224.71	185.40
	Catch per DF (lbs.)	44.01	25.51	45.01	42.81	40.46	328.47	97.99	178.90	268.32	225.78
MA8	Number of observed tows	542	378	267	277	1,464	677	356	269	512	1,814
	Total trip catch, biomass adjusted (lbs)	5,235	6,100	2,453	6,857	20,645	35,122	10,189	8,897	17,417	71,626
	Total tow time (hours) on observed trips	456.20	360.70	239.90	207.20	1264.00	591.80	331.60	238.40	427.60	1589.40
	Catch per scallop pounds landed	0.02	0.04	0.04	**0.09**	0.04	0.13	0.06	0.14	0.15	0.11
	Catch per DA (lbs.)	23.38	44.66	29.43	**63.63**	37.43	118.74	74.25	106.41	101.97	104.19
	Catch per DF (lbs.)	25.69	48.20	32.71	**72.18**	41.27	131.25	80.07	118.29	111.76	114.44
MA7	Number of observed tows	480	527	300	92	1,399	650	516	293	88	1,547
	Total trip catch, biomass adjusted (lbs)	6,119	9,681	3,356	1,745	20,901	27,511	17,555	5,735	4,584	55,385
	Total tow time (hours) on observed trips	430.40	507.70	254.40	34.20	1226.70	582.00	386.60	270.30	35.30	1274.20
	Catch per scallop pounds landed	0.03	0.04	0.04	0.07	0.04	0.12	0.07	0.06	0.19	0.09
	Catch per DA (lbs.)	31.16	46.47	33.36	**73.10**	39.50	120.92	74.32	47.24	190.23	90.91
	Catch per DF (lbs.)	34.44	49.57	38.13	**96.86**	43.63	134.33	81.41	53.40	250.61	101.42
MA6	Number of observed tows	519	588	443	214	1,764	700	585	456	471	2,212
	Total trip catch, biomass adjusted (lbs)	6,909	4,827	6,120	2,889	20,745	29,301	17,023	17,734	16,754	80,813
	Total tow time (hours) on observed trips	425.30	515.70	373.30	164.20	1478.50	558.00	555.30	389.30	330.40	1833.00
	Catch per scallop pounds landed	0.02	0.02	0.03	0.02	0.02	0.08	0.06	0.08	0.06	0.07

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Catch per DA (lbs.)	31.63	22.19	28.97	23.14	26.87	102.80	74.11	76.94	87.70	86.32
	Catch per DF (lbs.)	37.01	24.84	34.12	26.36	30.96	129.71	82.78	90.39	101.57	101.95
MA5	Number of observed tows	65	290	143	132	630	84	254	98	109	545
	Total trip catch, biomass adjusted (lbs)	897	2,958	2,077	843	6,775	2,536	5,655	2,243	1,678	12,112
	Total tow time (hours) on observed trips	36.10	224.90	141.80	114.90	517.70	53.10	227.60	101.30	102.40	484.40
	Catch per scallop pounds landed	0.05	0.03	0.04	0.02	0.03	0.13	0.05	0.05	0.05	0.06
	Catch per DA (lbs.)	34.80	26.06	33.36	14.89	26.25	77.10	48.73	39.76	34.21	47.61
	Catch per DF (lbs.)	39.58	28.67	36.43	16.15	28.83	84.73	53.88	43.45	36.46	52.09
MA4	Number of observed tows	307	650	253	134	1,344	507	724	106	70	1,407
	Total trip catch, biomass adjusted (lbs)	4,653	7,802	2,515	881	15,851	17,547	23,474	2,143	790	43,954
	Total tow time (hours) on observed trips	332.30	502.40	203.10	107.80	1145.60	599.00	525.40	61.70	60.20	1246.30
	Catch per scallop pounds landed	0.04	0.03	0.03	0.03	0.03	0.14	0.07	0.03	0.02	0.08
	Catch per DA (lbs.)	31.36	32.32	25.82	19.19	29.73	85.98	91.11	23.89	12.85	71.72
	Catch per DF (lbs.)	36.33	36.87	28.36	20.15	33.58	99.70	107.21	26.43	13.52	82.25
MA3	Number of observed tows	48	129	170	22	369	94	117	18	38	267
	Total trip catch, biomass adjusted (lbs)	749	970	1,152	103	2,974	7,018	2,703	147	921	10,788
	Total tow time (hours) on observed trips	53.40	104.20	203.40	16.30	377.30	-17.30	90.10	18.90	24.90	116.60
	Catch per scallop pounds landed	0.02	0.01	0.01	0.02	0.01	0.11	0.02	0.00	0.11	0.04
	Catch per DA (lbs.)	27.86	16.22	16.28	17.32	18.20	161.18	43.29	4.25	88.19	71.47
	Catch per DF (lbs.)	37.15	22.52	18.19	18.24	22.49	220.03	61.83	4.89	92.37	93.35
MA2	Number of observed tows	106	78	109	30	323	96	71	6		173
	Total trip catch, biomass adjusted (lbs)	1,921	485	714	110	3,231	5,822	10,002	40		15,864
	Total tow time (hours) on observed trips	56.20	71.40	132.10	21.30	281.00	58.00	64.60	5.60		128.20
	Catch per scallop pounds landed	0.03	0.01	0.01	0.02	0.01	0.08	0.26	0.00		0.13
	Catch per DA (lbs.)	56.62	22.59	19.82	16.08	32.87	161.02	453.42	4.15		233.99
	Catch per DF (lbs.)	91.98	25.41	22.37	17.07	41.23	253.39	512.68	4.84		312.91
MA1	Number of observed tows	19	5	68	13	105	41	6	7	56	110
	Total trip catch, biomass adjusted (lbs)	146	29	212	144	532	2,034	89	127	1,172	3,423

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	21.70	4.40	71.40	10.90	108.40	30.00	5.10	8.40	49.20	92.70
	Catch per scallop pounds landed	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.00	0.05	0.03
	Catch per DA (lbs.)	10.96	11.75	5.72	8.49	7.61	51.95	32.20	3.81	43.85	33.55
	Catch per DF (lbs.)	16.24	12.81	6.11	8.92	8.55	78.39	35.11	4.07	46.08	40.22
GB9	Number of observed tows			10	34	44	4		11	81	96
	Total trip catch, biomass adjusted (lbs)			241	397	638	70		1,072	9,321	10,463
	Total tow time (hours) on observed trips			9.80	25.90	35.70	3.50		10.80	64.60	78.90
	Catch per scallop pounds landed			**0.14**	**0.08**	0.09	0.01		**0.58**	**1.12**	0.52
	Catch per DA (lbs.)			**93.28**	40.65	51.67	4.28		**399.41**	**501.08**	278.08
	Catch per DF (lbs.)			**99.94**	48.29	60.01	4.55		434.22	**562.36**	303.95
GB8	Number of observed tows		36	39	98	173	1	70	170	228	469
	Total trip catch, biomass adjusted (lbs)		272	330	1,791	2,393	10	2,794	9,050	19,047	30,901
	Total tow time (hours) on observed trips		20.30	30.20	70.40	120.90	0.80	44.40	131.50	166.00	342.70
	Catch per scallop pounds landed		0.01	0.04	0.04	0.02	0.05	0.03	**0.43**	0.34	0.19
	Catch per DA (lbs.)		6.28	14.93	33.11	20.03	48.01	40.76	156.57	270.08	156.78
	Catch per DF (lbs.)		7.01	16.45	46.14	24.50	160.04	49.15	171.55	362.85	190.55
GB7	Number of observed tows	2	9	52	34	97	6	23	32	51	112
	Total trip catch, biomass adjusted (lbs)	7	27	1,228	434	1,696	189	265	1,346	9,753	11,552
	Total tow time (hours) on observed trips	1.60	7.70	36.90	16.90	63.10	3.80	14.00	22.20	31.10	71.10
	Catch per scallop pounds landed	0.00	0.00	**0.09**	0.04	0.04	0.03	0.02	0.10	**0.49**	0.23
	Catch per DA (lbs.)	2.42	2.57	**58.30**	27.83	33.75	21.73	25.32	73.73	**522.23**	206.00
	Catch per DF (lbs.)	8.07	5.57	62.94	37.13	45.86	95.54	55.03	89.35	**701.60**	323.14
GB6	Number of observed tows		28	3	8	39	1	55	5	19	80
	Total trip catch, biomass adjusted (lbs)		312	52	34	397	14	3,750	99	596	4,459
	Total tow time (hours) on observed trips		26.20	2.30	9.40	37.90	0.70	52.30	4.00	23.20	80.20
	Catch per scallop pounds landed		0.01	**0.09**	0.01	0.01	0.11	0.08	0.13	0.11	0.09
	Catch per DA (lbs.)		15.51	**95.17**	3.58	13.20	112.03	147.15	138.62	63.00	124.60

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per DF (lbs.)		17.60	102.58	3.96	14.83	373.42	169.56	158.12	69.56	142.25
GB5	Number of observed tows	2	63	258	50	373	4	89	329	77	499
	Total trip catch, biomass adjusted (lbs)	5	878	3,037	675	4,595	232	5,825	23,069	3,940	33,066
	Total tow time (hours) on observed trips	1.60	63.40	231.60	54.10	350.70	3.90	86.10	253.80	79.70	423.50
	Catch per scallop pounds landed	0.01	0.02	0.04	0.08	0.04	0.23	0.14	0.27	0.36	0.24
	Catch per DA (lbs.)	12.79	28.05	33.47	36.14	32.56	246.84	169.82	225.30	182.41	207.66
	Catch per DF (lbs.)	42.62	33.40	38.52	38.44	37.42	374.91	206.26	260.81	199.90	241.32
GB4	Number of observed tows	13	6	32	14	65	77	85	76	245	483
	Total trip catch, biomass adjusted (lbs)	62	10	308	251	632	473	5,199	1,334	10,198	17,203
	Total tow time (hours) on observed trips	9.50	3.80	26.30	13.30	52.90	202.50	33.90	62.00	208.80	507.20
	Catch per scallop pounds landed	0.00	0.00	0.02	0.01	0.01	0.01	0.18	0.07	0.12	0.10
	Catch per DA (lbs.)	4.09	1.71	14.70	7.29	8.25	10.10	433.46	35.96	150.11	105.00
	Catch per DF (lbs.)	4.37	2.97	16.31	7.79	9.17	10.79	651.59	39.45	161.06	115.53
GB3	Number of observed tows	8	2	40	8	58	11	25	57	236	329
	Total trip catch, biomass adjusted (lbs)	27	5	461	54	547	258	2,810	1,894	3,218	8,180
	Total tow time (hours) on observed trips	6.50	1.40	26.40	6.70	41.00	7.20	12.80	35.60	197.20	252.80
	Catch per scallop pounds landed	0.00	0.00	0.02	0.00	0.01	0.02	0.09	0.06	0.04	0.05
	Catch per DA (lbs.)	2.89	2.78	24.66	1.03	6.67	21.23	323.46	82.98	32.69	57.57
	Catch per DF (lbs.)	3.05	7.21	26.14	1.09	7.12	27.59	441.77	87.81	34.68	62.89
GB2	Number of observed tows	31	100	42	85	258	30	116	27	272	445
	Total trip catch, biomass adjusted (lbs)	229	474	391	534	1,629	1,296	3,864	212	14,245	19,618
	Total tow time (hours) on observed trips	29.90	70.80	34.90	69.40	205.00	19.00	76.20	24.20	133.60	253.00
	Catch per scallop pounds landed	0.00	0.01	0.02	0.01	0.01	0.02	0.03	0.01	0.08	0.05
	Catch per DA (lbs.)	2.64	7.39	20.69	12.20	7.63	18.30	48.80	11.21	158.87	75.86
	Catch per DF (lbs.)	4.08	9.35	22.22	14.37	10.08	33.44	60.21	12.04	184.41	99.17
GB15	Number of observed tows	6	6	67	1	80	1	8	153	19	181
	Total trip catch, biomass adjusted (lbs)	32	14	484	54	585	33	44	5,603	277	5,957
	Total tow time (hours) on observed	4.20	6.10	39.70	0.70	50.70	0.90	8.10	58.60	7.20	74.80

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.00	0.01	0.01	0.00	0.01	0.00	0.02	0.12	0.01	0.07
	Catch per DA (lbs.)	2.82	4.52	12.55	2.64	7.95	4.74	13.86	129.06	8.88	70.33
	Catch per DF (lbs.)	9.40	4.79	17.34	5.70	13.35	15.78	14.69	175.38	19.03	115.50
GB14	Number of observed tows		80	52		132	3	88	87	5	183
	Total trip catch, biomass adjusted (lbs)		946	597		1,544	78	2,380	1,907	248	4,613
	Total tow time (hours) on observed trips		69.50	53.60		123.10	1.60	63.20	86.20	5.00	156.00
	Catch per scallop pounds landed		0.01	0.01		0.01	0.03	0.02	0.03	0.03	0.02
	Catch per DA (lbs.)		17.26	17.02		17.16	33.39	42.96	52.58	50.45	46.63
	Catch per DF (lbs.)		28.18	28.77		28.41	55.65	70.44	88.23	58.51	75.57
GB13	Number of observed tows		50	65	10	125	4	64	75	150	293
	Total trip catch, biomass adjusted (lbs)		573	2,059	74	2,706	20	5,539	3,091	9,965	18,614
	Total tow time (hours) on observed trips		31.00	38.10	8.20	77.30	2.60	31.90	43.80	107.70	186.00
	Catch per scallop pounds landed		0.02	**0.11**	0.01	0.04	0.00	0.13	0.16	0.13	0.12
	Catch per DA (lbs.)		34.57	**169.72**	3.90	56.62	1.77	266.37	249.75	127.84	151.69
	Catch per DF (lbs.)		47.65	**177.87**	4.20	65.51	1.89	362.83	261.44	143.40	173.26
GB11	Number of observed tows	3	73	160	40	276	2	67	265	271	605
	Total trip catch, biomass adjusted (lbs)	8	539	2,264	349	3,161	35	2,637	9,502	5,054	17,227
	Total tow time (hours) on observed trips	2.10	52.80	95.20	32.30	182.40	1.70	51.80	138.40	184.90	376.80
	Catch per scallop pounds landed	0.00	0.02	0.03	0.00	0.01	0.06	0.03	0.12	0.03	0.05
	Catch per DA (lbs.)	0.30	21.60	38.10	5.73	18.25	35.73	71.25	156.36	38.76	75.18
	Catch per DF (lbs.)	0.32	23.16	40.27	6.50	19.81	37.25	79.01	165.34	45.28	84.70
GB10	Number of observed tows	3	8	136	71	218	37	14	147	169	367
	Total trip catch, biomass adjusted (lbs)	8	25	1,864	786	2,683	588	494	4,161	17,837	23,080
	Total tow time (hours) on observed trips	2.60	3.00	123.10	43.20	171.90	24.00	6.70	129.80	134.30	294.80
	Catch per scallop pounds landed	0.00	0.02	0.03	0.06	0.03	0.02	0.31	0.06	**0.45**	0.16
	Catch per DA (lbs.)	0.34	19.60	39.71	41.54	29.87	13.67	**327.01**	93.47	**456.47**	180.22
	Catch per DF (lbs.)	0.42	33.89	42.81	53.23	34.74	16.04	**519.35**	104.23	**554.54**	210.47

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
GB1	Number of observed tows	40	2	37	239	318	8	2	88	329	427
	Total trip catch, biomass adjusted (lbs)	211	4	59	2,092	2,366	164	11	4,268	15,003	19,446
	Total tow time (hours) on observed trips	34.90	2.00	10.60	167.20	214.70	4.70	2.20	20.20	272.30	299.40
	Catch per scallop pounds landed	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.12	0.17	0.10
	Catch per DA (lbs.)	4.00	0.16	2.64	16.51	10.39	4.30	0.98	188.57	110.40	93.39
	Catch per DF (lbs.)	4.70	0.17	8.19	17.71	12.12	5.34	1.02	583.67	118.36	110.59
4270	Number of observed tows	15		3	48	66	5		3	34	42
	Total trip catch, biomass adjusted (lbs)	164		3	407	574	63		48	1,282	1,394
	Total tow time (hours) on observed trips	11.70		1.80	37.70	51.20	4.20		1.80	26.60	32.60
	Catch per scallop pounds landed	0.00		0.00	0.03	0.01	0.00		0.02	0.10	0.03
	Catch per DA (lbs.)	4.98		1.88	18.04	10.07	2.88		32.65	55.70	30.00
	Catch per DF (lbs.)	5.30		5.83	18.95	10.85	3.16		101.06	58.51	32.86
4269	Number of observed tows									2	2
	Total trip catch, biomass adjusted (lbs)									12	12
	Total tow time (hours) on observed trips									1.80	1.80
	Catch per scallop pounds landed									0.05	0.05
	Catch per DA (lbs.)									46.13	46.13
	Catch per DF (lbs.)									48.40	48.40
4268	Number of observed tows			1		1			1		1
	Total trip catch, biomass adjusted (lbs)			16		16			12		12
	Total tow time (hours) on observed trips			1.00		1.00			1.00		1.00
	Catch per scallop pounds landed			0.05		0.05			0.04		0.04
	Catch per DA (lbs.)			49.70		49.70			36.45		36.45
	Catch per DF (lbs.)			53.57		53.57			39.28		39.28
4267	Number of observed tows	5	44	34	52	135	2	63	39	113	217
	Total trip catch, biomass adjusted (lbs)	15	112	451	554	1,132	77	544	10,268	19,700	30,588
	Total tow time (hours) on observed trips	4.50	21.40	32.70	16.10	74.70	1.70	55.90	36.90	54.50	149.00

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per scallop pounds landed	0.00	0.00	0.05	0.01	0.01	0.01	0.01	**0.85**	**0.40**	0.22
	Catch per DA (lbs.)	1.55	1.78	34.17	10.38	8.14	10.27	8.68	**603.23**	**368.90**	217.60
	Catch per DF (lbs.)	5.16	1.93	37.78	12.12	9.56	34.23	9.42	**697.52**	430.61	254.06
4173	Number of observed tows							1			1
	Total trip catch, biomass adjusted (lbs)							10			10
	Total tow time (hours) on observed trips							0.80			0.80
	Catch per scallop pounds landed							0.07			0.07
	Catch per DA (lbs.)							42.68			42.68
	Catch per DF (lbs.)							47.28			47.28
4172	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				3	3					
	Total tow time (hours) on observed trips				0.80	0.80					
	Catch per scallop pounds landed				0.01	0.01					
	Catch per DA (lbs.)				11.28	11.28					
	Catch per DF (lbs.)				23.23	23.23					
4171	Number of observed tows		47	2	4	53		45	2	5	52
	Total trip catch, biomass adjusted (lbs)		273	22	67	362		1,007	18	479	1,503
	Total tow time (hours) on observed trips		33.10	1.30	3.20	37.60		31.70	1.30	3.90	36.90
	Catch per scallop pounds landed		0.01	**0.08**	**0.16**	0.02		0.05	0.06	**1.15**	0.07
	Catch per DA (lbs.)		28.58	**74.70**	**74.24**	33.65		105.24	60.31	**533.99**	139.74
	Catch per DF (lbs.)		29.36	**100.02**	**76.15**	34.78		108.11	80.75	**547.68**	144.46
4170	Number of observed tows	21	1		3	25	11	2		11	24
	Total trip catch, biomass adjusted (lbs)	277	16		29	321	285	40		745	1,069
	Total tow time (hours) on observed trips	9.90	1.10		2.70	13.70	5.50	1.80		8.50	15.80
	Catch per scallop pounds landed	0.03	**0.74**		**0.94**	0.04	0.04	0.12		0.30	0.10
	Catch per DA (lbs.)	34.79	**652.21**		**514.63**	40.00	35.82	127.17		147.71	80.37
	Catch per DF (lbs.)	57.98	**666.26**		**548.45**	66.27	59.70	140.36		152.26	107.52
4169	Number of observed tows				1	1	7			20	27

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total trip catch, biomass adjusted (lbs)				2	2	602			93	695
	Total tow time (hours) on observed trips				0.50	0.50	3.60			12.80	16.40
	Catch per scallop pounds landed				0.00	0.00	0.08			0.01	0.04
	Catch per DA (lbs.)				0.82	0.82	171.67			5.93	36.28
	Catch per DF (lbs.)				0.90	0.90	463.97			6.90	47.14
4167	Number of observed tows							47		43	90
	Total trip catch, biomass adjusted (lbs)							775		1,045	1,820
	Total tow time (hours) on observed trips							27.90		17.00	44.90
	Catch per scallop pounds landed							0.02		0.06	0.04
	Catch per DA (lbs.)							22.86		45.21	31.92
	Catch per DF (lbs.)							25.54		95.97	44.13
4166	Number of observed tows	3	5	175	6	189	14	47	342	101	504
	Total trip catch, biomass adjusted (lbs)	14	23	2,399	50	2,486	339	836	10,130	2,348	13,654
	Total tow time (hours) on observed trips	2.40	1.20	141.30	5.80	150.70	9.80	23.40	237.50	106.20	376.90
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
	Catch per DA (lbs.)	3.91	1.83	11.19	3.80	10.20	23.74	31.50	34.54	50.83	35.90
	Catch per DF (lbs.)	6.52	2.66	17.24	4.44	15.41	40.88	59.45	53.07	59.40	54.01
4073	Number of observed tows	132	69	6	57	264	106	52	7	150	315
	Total trip catch, biomass adjusted (lbs)	877	519	126	542	2,064	3,700	2,012	130	4,018	9,860
	Total tow time (hours) on observed trips	67.90	21.00	5.10	35.10	129.10	53.20	27.50	5.60	59.20	145.50
	Catch per scallop pounds landed	0.02	0.02	0.01	0.01	0.02	0.11	0.07	0.00	0.08	0.07
	Catch per DA (lbs.)	19.29	20.24	25.21	9.67	15.62	84.74	75.44	6.50	64.26	64.50
	Catch per DF (lbs.)	24.13	25.13	29.37	12.10	19.45	106.36	93.08	6.75	84.65	80.06
4072	Number of observed tows	2	37		4	43	2	38		2	42
	Total trip catch, biomass adjusted (lbs)	5	305		41	351	63	836		33	932
	Total tow time (hours) on observed trips	1.10	25.40		2.80	29.30	1.10	27.50		1.40	30.00
	Catch per scallop pounds landed	0.01	0.02		0.06	0.02	0.13	0.06		0.05	0.06

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Catch per DA (lbs.)	21.94	25.03		47.67	26.45	285.26	68.61		38.14	70.25
	Catch per DF (lbs.)	30.62	25.87		47.98	27.40	398.03	70.91		38.38	72.80
4071	Number of observed tows				1	1	2			4	6
	Total trip catch, biomass adjusted (lbs)				2	2	77			184	261
	Total tow time (hours) on observed trips				0.90	0.90	1.20			3.50	4.70
	Catch per scallop pounds landed				0.04	0.04	0.31			0.76	0.53
	Catch per DA (lbs.)				6.22	6.22	344.65			231.68	256.33
	Catch per DF (lbs.)				11.31	11.31	861.62			293.60	364.03
4070	Number of observed tows				30	30				30	30
	Total trip catch, biomass adjusted (lbs)				807	807				10,285	10,285
	Total tow time (hours) on observed trips				37.50	37.50				37.00	37.00
	Catch per scallop pounds landed				7.76	7.76				98.89	98.89
	Catch per DA (lbs.)				4,258.88	4,258.88				54,271.65	54,271.65
	Catch per DF (lbs.)				4,538.77	4,538.77				57,838.34	57,838.34
4069	Number of observed tows	29	23	144	102	298	106	146	306	328	886
	Total trip catch, biomass adjusted (lbs)	133	204	1,085	1,312	2,734	598	47,066	7,724	20,683	76,071
	Total tow time (hours) on observed trips	21.20	15.00	134.10	98.20	268.50	82.80	53.10	200.60	288.60	625.10
	Catch per scallop pounds landed	0.01	0.00	0.02	0.01	0.01	0.01	0.30	0.08	0.14	0.17
	Catch per DA (lbs.)	6.65	2.84	16.55	16.08	11.44	13.01	626.23	85.74	190.31	237.81
	Catch per DF (lbs.)	7.19	5.03	17.89	17.35	14.00	14.12	1,086.40	91.49	206.13	281.29
4068	Number of observed tows		1	1	7	9		1	1	8	10
	Total trip catch, biomass adjusted (lbs)		14	6	243	263		52	102	695	849
	Total tow time (hours) on observed trips		0.90	0.90	6.80	8.60		0.90	0.90	7.70	9.50
	Catch per scallop pounds landed		0.06	0.05	0.70	0.38		0.24	0.78	1.07	0.85
	Catch per DA (lbs.)		77.92	55.25	264.13	217.61		292.22	920.83	559.58	554.63
	Catch per DF (lbs.)		147.96	77.45	274.76	248.79		554.84	1,290.88	584.69	623.62

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
4067	Number of observed tows		75	2	64	141	8	83	12	91	194
	Total trip catch, biomass adjusted (lbs)		1,679	16	650	2,346	140	11,714	782	6,060	18,696
	Total tow time (hours) on observed trips		80.40	1.80	71.80	154.00	6.90	88.20	8.40	102.30	205.80
	Catch per scallop pounds landed		0.04	0.01	0.04	0.04	0.03	0.27	0.34	0.37	0.27
	Catch per DA (lbs.)		47.14	10.69	19.28	33.09	24.02	323.72	308.58	179.63	238.82
	Catch per DF (lbs.)		50.00	14.47	20.67	35.45	28.11	344.50	402.26	192.58	258.25
4066	Number of observed tows									1	1
	Total trip catch, biomass adjusted (lbs)									158	158
	Total tow time (hours) on observed trips									1.00	1.00
	Catch per scallop pounds landed									1.16	1.16
	Catch per DA (lbs.)									439.09	439.09
	Catch per DF (lbs.)									456.76	456.76
4065	Number of observed tows			1		1			1		1
	Total trip catch, biomass adjusted (lbs)			34		34			36		36
	Total tow time (hours) on observed trips			1.30		1.30			1.30		1.30
	Catch per scallop pounds landed			0.10		0.10			0.11		0.11
	Catch per DA (lbs.)			64.89		64.89			70.51		70.51
	Catch per DF (lbs.)			69.52		69.52			75.55		75.55
3974	Number of observed tows	1				1	2				2
	Total trip catch, biomass adjusted (lbs)	21				21	85				85
	Total tow time (hours) on observed trips	1.20				1.20	1.70				1.70
	Catch per scallop pounds landed	0.06				0.06	0.24				0.24
	Catch per DA (lbs.)	49.59				49.59	195.72				195.72
	Catch per DF (lbs.)	52.01				52.01	210.28				210.28
3874	Number of observed tows	81	51	8	14	154	89	99	7	17	212
	Total trip catch, biomass adjusted (lbs)	420	177	72	68	737	3,863	2,713	347	295	7,218
	Total tow time (hours) on observed trips	40.40	36.80	7.00	10.70	94.90	39.40	67.60	6.10	14.20	127.30

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per scallop pounds landed	0.02	0.01	0.05	0.04	0.02	0.25	0.12	0.28	0.06	0.17
	Catch per DA (lbs.)	11.01	6.42	48.11	22.04	10.48	157.53	70.89	275.15	28.37	96.94
	Catch per DF (lbs.)	13.93	8.96	63.72	22.97	13.65	226.83	97.69	379.52	31.49	131.02
3872	Number of observed tows	1				1	3				3
	Total trip catch, biomass adjusted (lbs)	3				3	102				102
	Total tow time (hours) on observed trips	0.80				0.80	2.40				2.40
	Catch per scallop pounds landed	0.02				0.02	0.21				0.21
	Catch per DA (lbs.)	6.71				6.71	69.36				69.36
	Catch per DF (lbs.)	7.02				7.02	72.59				72.59
3870	Number of observed tows		1			1		1			1
	Total trip catch, biomass adjusted (lbs)		8			8		11			11
	Total tow time (hours) on observed trips		0.80			0.80		0.80			0.80
	Catch per scallop pounds landed		0.03			0.03		0.04			0.04
	Catch per DA (lbs.)		35.03			35.03		50.04			50.04
	Catch per DF (lbs.)		35.55			35.55		50.78			50.78
3775	Number of observed tows						1				1
	Total trip catch, biomass adjusted (lbs)						24				24
	Total tow time (hours) on observed trips						0.80				0.80
	Catch per scallop pounds landed						0.17				0.17
	Catch per DA (lbs.)						320.79				320.79
	Catch per DF (lbs.)						488.82				488.82
3773	Number of observed tows		4			4	1	4			5
	Total trip catch, biomass adjusted (lbs)		45			45	28	70			98
	Total tow time (hours) on observed trips		4.00			4.00	0.80	4.00			4.80
	Catch per scallop pounds landed		0.03			0.03	0.20	0.05			0.07
	Catch per DA (lbs.)		35.59			35.59	106.83	55.52			64.23
	Catch per DF (lbs.)		39.01			39.01	118.08	60.86			70.50
3675	Number of observed tows									1	1

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total trip catch, biomass adjusted (lbs)									11	11
	Total tow time (hours) on observed trips									1.00	1.00
	Catch per scallop pounds landed									0.11	0.11
	Catch per DA (lbs.)									94.63	94.63
	Catch per DF (lbs.)									99.43	99.43
Total Number of observed tows		2,552	3,505	3,262	2,154	11,473	3,496	4,042	3,659	4,637	15,834
Total trip catch, biomass adjusted (lbs)		29,919	40,809	37,583	27,560	135,871	147,754	192,244	137,991	242,001	719,991
Total tow time (hours) on observed trips		2114.20	2932.10	2798.10	1654.00	9498.40	2993.00	3156.40	2714.30	3545.30	12409.00
Total Catch per scallop pounds landed		0.02	0.02	0.02	0.02	0.02	0.09	0.08	0.07	0.13	0.09
Total Catch per DA (lbs.)		23.07	25.73	25.88	23.15	24.59	90.66	107.99	86.15	135.40	105.90
Total Catch per DF (lbs.)		27.54	30.03	31.03	26.43	28.91	110.42	128.07	104.27	155.52	125.90

Table 6. **Cod discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one-minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
MA9	Number of observed tows			1		1			1		1
	Total trip catch, biomass adjusted (lbs)			1		1			2		2
	Total tow time (hours) on observed trips			0.60		0.60			0.60		0.60
	Catch per scallop pounds landed			0.00		0.00			0.00		0.00
	Catch per DA (lbs.)			0.10		0.10			0.20		0.20
	Catch per DF (lbs.)			0.32		0.32			0.63		0.63
MA8	Number of observed tows	2				2	1	1			2
	Total trip catch, biomass adjusted (lbs)	13				13	10	6			16
	Total tow time (hours) on observed trips	2.30				2.30	1.00	0.90			1.90
	Catch per scallop pounds landed	0.00				0.00	0.01	0.00			0.00
	Catch per DA (lbs.)	2.77				2.77	4.80	1.62			2.74
	Catch per DF (lbs.)	2.91				2.91	4.98	1.73			2.90
MA7	Number of observed tows						2				2
	Total trip catch, biomass adjusted (lbs)						86				86
	Total tow time (hours) on observed trips						1.20				1.20
	Catch per scallop pounds landed										
	Catch per DA (lbs.)										
	Catch per DF (lbs.)										
MA6	Number of observed tows						5	1			6
	Total trip catch, biomass adjusted (lbs)						57	16			73
	Total tow time (hours) on observed trips						3.10	1.00			4.10
	Catch per scallop pounds landed						0.00	0.00			0.00
	Catch per DA (lbs.)						3.10	0.99			2.13

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Catch per DF (lbs.)						5.48	1.59			3.59
GB9	Number of observed tows	1				1	5		1	1	7
	Total trip catch, biomass adjusted (lbs)	1				1	35		6	19	60
	Total tow time (hours) on observed trips	0.80				0.80	3.90		1.00	0.80	5.70
	Catch per scallop pounds landed	0.00				0.00	0.01		**0.05**	**0.03**	0.01
	Catch per DA (lbs.)	0.14				0.14	3.16		**60.24**	22.08	5.00
	Catch per DF (lbs.)	0.14				0.14	3.36		**105.41**	32.79	5.45
GB8	Number of observed tows		47	12	6	65		10	9	20	39
	Total trip catch, biomass adjusted (lbs)		346	65	26	437		55	100	344	499
	Total tow time (hours) on observed trips		28.20	10.50	4.40	43.10		7.40	6.40	14.20	28.00
	Catch per scallop pounds landed		0.01	0.01	0.00	0.00		0.00	0.01	0.01	0.01
	Catch per DA (lbs.)		6.06	3.32	0.73	3.90		2.38	5.15	8.38	5.97
	Catch per DF (lbs.)		6.75	3.60	0.95	4.52		3.35	5.59	12.73	8.14
GB7	Number of observed tows		2	3	8	13	1	1	3	2	7
	Total trip catch, biomass adjusted (lbs)		14	24	74	113	11	2	44	52	109
	Total tow time (hours) on observed trips		1.30	2.40	9.30	13.00	0.80	0.80	2.90	1.60	6.10
	Catch per scallop pounds landed		**0.03**	**0.02**	0.01	0.01	0.00	0.00	0.01	0.00	0.00
	Catch per DA (lbs.)		**40.93**	8.11	6.34	7.50	3.81	0.19	8.06	5.63	4.22
	Catch per DF (lbs.)		**45.46**	8.92	8.20	9.34	12.70	0.50	12.47	8.21	7.91
GB5	Number of observed tows			2	1	3	1	1	1		3
	Total trip catch, biomass adjusted (lbs)			2	19	21	16	13	9		38
	Total tow time (hours) on observed trips			2.40	1.10	3.50	0.80	0.70	1.30		2.80
	Catch per scallop pounds landed			0.00	**0.02**	0.00	**0.19**	0.00	0.00		0.00
	Catch per DA (lbs.)			0.17	**12.33**	1.41	**188.91**	1.98	0.67		1.90
	Catch per DF (lbs.)			0.18	**13.68**	1.54	**629.69**	3.76	0.73		2.42
GB4	Number of observed tows	8	4	3	24	39	4	24		7	35
	Total trip catch, biomass adjusted (lbs)	68	9	15	165	257	37	210		73	320
	Total tow time (hours) on observed	78.40	2.70	2.40	21.20	104.70	3.40	12.20		5.60	21.20

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00	0.00	0.02		0.00	0.01
	Catch per DA (lbs.)	4.45	1.76	1.23	4.52	3.71	2.39	23.72		4.29	7.77
	Catch per DF (lbs.)	4.76	2.98	1.35	4.83	4.10	2.55	40.73		4.69	9.13
GB3	Number of observed tows	6	1	17	23	47		6	1	5	12
	Total trip catch, biomass adjusted (lbs)	31	6	88	138	263		129	11	33	173
	Total tow time (hours) on observed trips	5.00	0.80	10.50	19.10	35.40		3.10	0.80	4.10	8.00
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00		0.00	0.09	0.00	0.00
	Catch per DA (lbs.)	4.15	1.01	5.50	3.32	3.69		20.43	30.83	1.40	5.75
	Catch per DF (lbs.)	6.23	1.20	5.75	3.53	4.08		24.51	33.40	1.47	6.20
GB2	Number of observed tows	31	27	1	14	73	2	10	1	8	21
	Total trip catch, biomass adjusted (lbs)	204	73	6	69	351	136	58	23	93	310
	Total tow time (hours) on observed trips	24.90	16.70	0.60	11.30	53.50	1.90	9.00	1.00	5.60	17.50
	Catch per scallop pounds landed	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Catch per DA (lbs.)	2.59	1.39	41.48	5.62	2.45	4.47	1.33	1.84	4.11	2.84
	Catch per DF (lbs.)	4.03	1.78	43.47	6.31	3.43	11.99	1.79	1.99	4.67	4.12
GB15	Number of observed tows			7	2	9		1		1	2
	Total trip catch, biomass adjusted (lbs)			21	8	29		10		15	26
	Total tow time (hours) on observed trips			6.60	1.20	7.80		0.80		0.80	1.60
	Catch per scallop pounds landed			0.00	0.00	0.00		0.00		0.00	0.00
	Catch per DA (lbs.)			0.82	0.32	0.58		1.40		0.75	0.92
	Catch per DF (lbs.)			1.10	0.68	0.95		2.65		1.60	1.91
GB14	Number of observed tows						1				1
	Total trip catch, biomass adjusted (lbs)						5				5
	Total tow time (hours) on observed trips						0.80				0.80
	Catch per scallop pounds landed						0.00				0.00
	Catch per DA (lbs.)						2.34				2.34
	Catch per DF (lbs.)						3.89				3.89

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
GB13	Number of observed tows	7	12	14	20	53	1	5		4	10
	Total trip catch, biomass adjusted (lbs)	40	86	126	123	374	7	100		48	155
	Total tow time (hours) on observed trips	4.10	5.20	8.40	14.80	32.50	0.80	3.80		2.70	7.30
	Catch per scallop pounds landed	0.01	0.00	0.01	0.01	0.00	0.18	0.00		0.01	0.00
	Catch per DA (lbs.)	6.95	5.19	11.35	4.21	5.99	58.37	7.92		2.97	5.36
	Catch per DF (lbs.)	7.42	7.15	11.88	4.61	6.86	61.09	13.42		3.27	6.98
GB11	Number of observed tows	13	6	55	50	124		3	1	19	23
	Total trip catch, biomass adjusted (lbs)	21	33	356	284	694		65	26	1,416	1,507
	Total tow time (hours) on observed trips	8.90	3.70	31.60	40.20	84.40		1.60	1.20	8.70	11.50
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00		0.00	0.01	0.02	0.01
	Catch per DA (lbs.)	0.77	2.33	5.93	3.84	3.95		5.36	4.54	26.78	21.29
	Catch per DF (lbs.)	0.81	2.43	6.26	4.76	4.44		6.39	5.24	35.98	27.63
GB10	Number of observed tows	10	2	7	8	27		1	1	8	10
	Total trip catch, biomass adjusted (lbs)	109	23	46	54	232		5	26	119	151
	Total tow time (hours) on observed trips	7.20	1.50	6.10	6.30	21.10		0.60	1.00	7.60	9.20
	Catch per scallop pounds landed	0.01	0.01	0.00	0.01	0.00		0.00	0.01	0.02	0.01
	Catch per DA (lbs.)	5.65	10.73	1.80	5.32	4.05		4.11	7.07	16.18	12.17
	Catch per DF (lbs.)	6.23	15.32	1.93	7.46	4.62		7.11	12.37	24.03	19.23
GB1	Number of observed tows	20	2		9	31	8	4		11	23
	Total trip catch, biomass adjusted (lbs)	66	3		52	121	149	33		110	292
	Total tow time (hours) on observed trips	16.80	1.90		9.00	27.70	5.70	3.60		8.90	18.20
	Catch per scallop pounds landed	0.00	0.00		0.00	0.00	0.00	0.00		0.00	0.00
	Catch per DA (lbs.)	0.89	0.22		0.67	0.74	4.96	1.26		1.84	2.52
	Catch per DF (lbs.)	1.01	0.23		0.73	0.82	6.55	1.32		1.99	2.83
4270	Number of observed tows	6			3	9	4			2	6
	Total trip catch, biomass adjusted (lbs)	17			19	36	30			11	42
	Total tow time (hours) on observed trips	4.90			3.60	8.50	3.70			1.70	5.40

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Catch per scallop pounds landed	0.00			0.01	0.00	0.00			0.00	0.00
	Catch per DA (lbs.)	0.78			1.86	1.13	1.39			1.79	1.48
	Catch per DF (lbs.)	0.85			1.97	1.21	1.52			1.88	1.61
4267	Number of observed tows	1	10	7	10	28	1	12		3	16
	Total trip catch, biomass adjusted (lbs)	4	39	17	66	126	40	110		31	182
	Total tow time (hours) on observed trips	0.80	9.40	7.50	6.40	24.10	0.80	7.50		2.30	10.60
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00	0.01	0.00		0.00	0.00
	Catch per DA (lbs.)	0.60	0.91	2.21	1.34	1.18	5.39	2.43		0.63	1.78
	Catch per DF (lbs.)	2.00	1.00	2.37	1.54	1.38	17.96	2.62		0.73	2.08
4171	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		3			3					
	Total tow time (hours) on observed trips		0.60			0.60					
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		1.55			1.55					
	Catch per DF (lbs.)		1.59			1.59					
4170	Number of observed tows				1	1	1			1	2
	Total trip catch, biomass adjusted (lbs)				4	4	14			28	42
	Total tow time (hours) on observed trips				0.80	0.80	0.80			1.00	1.80
	Catch per scallop pounds landed				**0.15**	0.15	0.01			**7.12**	0.02
	Catch per DA (lbs.)				**82.70**	82.70	6.16			**3,907.74**	18.64
	Catch per DF (lbs.)				**88.14**	88.14	10.27			**4,164.56**	31.02
4169	Number of observed tows	3				3					
	Total trip catch, biomass adjusted (lbs)	10				10					
	Total tow time (hours) on observed trips	2.40				2.40					
	Catch per scallop pounds landed	0.00				0.00					
	Catch per DA (lbs.)	2.87				2.87					
	Catch per DF (lbs.)	7.75				7.75					
4167	Number of observed tows		10			10		8			8

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total trip catch, biomass adjusted (lbs)		52			52		73			73
	Total tow time (hours) on observed trips		6.80			6.80		4.70			4.70
	Catch per scallop pounds landed		0.00			0.00		0.00			0.00
	Catch per DA (lbs.)		1.57			1.57		2.52			2.52
	Catch per DF (lbs.)		1.76			1.76		3.14			3.14
4166	Number of observed tows	2	2	4		8		11	4		15
	Total trip catch, biomass adjusted (lbs)	5	13	22		40		196	16		212
	Total tow time (hours) on observed trips	1.60	1.70	3.70		7.00		8.20	3.80		12.00
	Catch per scallop pounds landed	0.00	0.00	0.00		0.00		0.01	0.00		0.00
	Catch per DA (lbs.)	0.51	3.10	0.74		0.91		15.53	0.46		4.44
	Catch per DF (lbs.)	0.85	7.38	1.16		1.48		40.14	0.70		7.66
4073	Number of observed tows						4			1	5
	Total trip catch, biomass adjusted (lbs)						22			14	36
	Total tow time (hours) on observed trips						2.50			0.70	3.20
	Catch per scallop pounds landed						0.00			0.01	0.00
	Catch per DA (lbs.)						1.30			10.24	1.94
	Catch per DF (lbs.)						1.99			10.30	2.86
4072	Number of observed tows						2				2
	Total trip catch, biomass adjusted (lbs)						34				34
	Total tow time (hours) on observed trips						1.10				1.10
	Catch per scallop pounds landed						0.07				0.07
	Catch per DA (lbs.)						153.57				153.57
	Catch per DF (lbs.)						214.28				214.28
4070	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				9	9					
	Total tow time (hours) on observed trips				1.70	1.70					
	Catch per scallop pounds landed				0.14	0.14					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Catch per DA (lbs.)				**78.35**	78.35					
	Catch per DF (lbs.)				**83.50**	83.50					
4069	Number of observed tows	6	30	15	59	110	7	38		4	49
	Total trip catch, biomass adjusted (lbs)	49	312	94	576	1,030	102	1,005		50	1,158
	Total tow time (hours) on observed trips	4.40	15.40	11.80	52.40	84.00	7.30	21.10		3.10	31.50
	Catch per scallop pounds landed	0.00	0.00	0.00	0.01	0.00	0.01	0.01		0.00	0.01
	Catch per DA (lbs.)	1.80	4.28	2.20	6.63	4.49	8.54	13.63		1.96	10.39
	Catch per DF (lbs.)	1.95	7.45	2.37	7.03	5.47	9.13	23.60		2.17	15.03
4067	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		6			6					
	Total tow time (hours) on observed trips		1.20			1.20					
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		0.51			0.51					
	Catch per DF (lbs.)		0.52			0.52					
Total Number of observed tows		116	157	148	239	660	50	137	23	97	307
Total trip catch, biomass adjusted (lbs)		640	1,017	884	1,684	4,224	792	2,088	263	2,457	5,601
Total tow time (hours) on observed trips		162.50	97.10	105.10	202.80	567.50	39.60	87.00	20.00	69.40	216.00
Total Catch per scallop pounds landed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
Total Catch per DA (lbs.)		2.04	3.06	3.21	3.37	2.97	4.56	6.20	2.55	6.95	
Total Catch per DF (lbs.)		2.52	3.85	3.70	3.89	3.55	6.61	8.72	3.38	8.50	

Table 7. **Fourspot flounder discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	36	23	73	120	252					
	Total trip catch, biomass adjusted (lbs)	354	136	129	484	1,103					
	Total tow time (hours) on observed trips	22.80	25.70	45.00	105.00	198.50					
	Catch per scallop pounds landed	0.02	0.01	0.01	0.02	0.01					
	Catch per DA (lbs.)	22.16	7.65	5.45	11.48	11.07					
	Catch per DF (lbs.)	29.39	8.17	7.94	13.67	13.72					
MA8	Number of observed tows	266	293	117	194	870					
	Total trip catch, biomass adjusted (lbs)	1,971	2,386	166	1,119	5,642					
	Total tow time (hours) on observed trips	241.10	271.20	102.00	152.90	767.20					
	Catch per scallop pounds landed	0.01	0.01	0.00	0.01	0.01					
	Catch per DA (lbs.)	11.65	17.47	2.16	9.03	11.14					
	Catch per DF (lbs.)	13.09	18.86	2.40	9.64	12.20					
MA7	Number of observed tows	267	474	72	79	892	1	1			2
	Total trip catch, biomass adjusted (lbs)	1,140	2,337	87	411	3,975	2	1			3
	Total tow time (hours) on observed trips	254.00	431.80	64.70	32.90	783.40	0.80	0.80			1.60
	Catch per scallop pounds landed	0.01	0.01	0.00	0.02	0.01	0.00	0.00			0.00
	Catch per DA (lbs.)	9.06	12.00	0.96	17.36	9.16	1.10	0.48			0.77
	Catch per DF (lbs.)	9.74	12.74	1.07	22.99	9.95	1.15	0.54			0.83
MA6	Number of observed tows	218	542	250	228	1,238		2			2
	Total trip catch, biomass adjusted (lbs)	1,534	2,304	605	1,016	5,459		3			3

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	201.50	395.70	214.40	169.10	980.70		1.60			1.60
	Catch per scallop pounds landed	0.01	0.01	0.00	0.01	0.01		0.00			0.00
	Catch per DA (lbs.)	9.07	10.71	2.96	7.16	7.48		0.32			0.32
	Catch per DF (lbs.)	10.35	11.99	3.47	8.41	8.59		0.33			0.33
MA5	Number of observed tows	23	140	56	76	295					
	Total trip catch, biomass adjusted (lbs)	81	286	89	138	595					
	Total tow time (hours) on observed trips	23.90	126.90	58.30	66.20	275.30					
	Catch per scallop pounds landed	0.01	0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)	6.77	2.58	1.68	2.68	2.61					
	Catch per DF (lbs.)	7.27	2.82	1.82	2.86	2.83					
MA4	Number of observed tows	140	341	101	101	683	1				1
	Total trip catch, biomass adjusted (lbs)	691	998	103	197	1,989	1				1
	Total tow time (hours) on observed trips	139.60	224.30	93.30	76.80	534.00	0.70				0.70
	Catch per scallop pounds landed	0.01	0.00	0.00	0.01	0.00	0.00				0.00
	Catch per DA (lbs.)	6.66	4.93	1.26	4.31	4.59	0.22				0.22
	Catch per DF (lbs.)	7.95	5.93	1.35	4.54	5.31	0.23				0.23
MA3	Number of observed tows	18	52	30	20	120					
	Total trip catch, biomass adjusted (lbs)	100	119	30	23	272					
	Total tow time (hours) on observed trips	21.50	34.90	35.40	15.00	106.80					
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)	4.34	2.30	0.43	1.87	1.75					
	Catch per DF (lbs.)	5.93	3.34	0.49	1.97	2.17					
MA2	Number of observed tows	28	37	74	29	168					
	Total trip catch, biomass adjusted (lbs)	127	70	91	46	333					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	21.20	32.70	96.90	20.60	171.40					
	Catch per scallop pounds landed	0.00	0.00	0.00	0.01	0.00					
	Catch per DA (lbs.)	4.30	4.11	2.59	6.66	3.77					
	Catch per DF (lbs.)	7.30	4.66	2.92	7.07	4.77					
MA1	Number of observed tows	1	3	25	10	39					
	Total trip catch, biomass adjusted (lbs)	5	6	20	1,278	1,308					
	Total tow time (hours) on observed trips	0.80	2.70	27.50	10.30	41.30					
	Catch per scallop pounds landed	0.00	0.00	0.00	**0.05**	0.02					
	Catch per DA (lbs.)	0.60	2.58	0.54	**47.79**	17.82					
	Catch per DF (lbs.)	0.96	2.80	0.58	**50.22**	19.61					
GB9	Number of observed tows			10	18	28					
	Total trip catch, biomass adjusted (lbs)			186	13	198					
	Total tow time (hours) on observed trips			10.70	14.80	25.50					
	Catch per scallop pounds landed			**0.11**	0.00	0.05					
	Catch per DA (lbs.)			**71.94**	1.68	19.83					
	Catch per DF (lbs.)			**77.08**	1.78	21.05					
GB8	Number of observed tows			24	13	37					
	Total trip catch, biomass adjusted (lbs)			76	13	89					
	Total tow time (hours) on observed trips			16.80	10.80	27.60					
	Catch per scallop pounds landed			0.01	0.01	0.01					
	Catch per DA (lbs.)			3.57	2.53	3.37					
	Catch per DF (lbs.)			3.87	2.68	3.63					
GB7	Number of observed tows			99		99					
	Total trip catch, biomass adjusted (lbs)			296		296					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips			77.90		77.90					
	Catch per scallop pounds landed			0.02		0.02					
	Catch per DA (lbs.)			14.24		14.24					
	Catch per DF (lbs.)			15.32		15.32					
GB6	Number of observed tows		55	3	14	72					
	Total trip catch, biomass adjusted (lbs)		773	57	91	921					
	Total tow time (hours) on observed trips		53.60	2.30	17.00	72.90					
	Catch per scallop pounds landed		0.02	0.10	0.02	0.02					
	Catch per DA (lbs.)		30.67	105.13	9.62	26.16					
	Catch per DF (lbs.)		35.11	113.31	10.62	29.63					
GB5	Number of observed tows		70	290	64	424					
	Total trip catch, biomass adjusted (lbs)		423	4,020	308	4,751					
	Total tow time (hours) on observed trips		72.50	242.80	68.00	383.30					
	Catch per scallop pounds landed		0.01	0.05	0.03	0.04					
	Catch per DA (lbs.)		17.18	46.01	16.03	36.21					
	Catch per DF (lbs.)		18.18	52.97	17.29	40.62					
GB4	Number of observed tows		2	28	57	87					
	Total trip catch, biomass adjusted (lbs)		3	166	159	328					
	Total tow time (hours) on observed trips		1.50	22.20	50.20	73.90					
	Catch per scallop pounds landed		0.00	0.01	0.00	0.00					
	Catch per DA (lbs.)		1.40	8.17	3.86	5.17					
	Catch per DF (lbs.)		2.30	9.09	4.07	5.61					
GB3	Number of observed tows			2	21	23					
	Total trip catch, biomass adjusted (lbs)			3	48	51					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips			1.00	19.40	20.40					
	Catch per scallop pounds landed			0.00	0.00	0.00					
	Catch per DA (lbs.)			1.05	1.51	1.47					
	Catch per DF (lbs.)			1.10	1.61	1.57					
GB2	Number of observed tows		3	2	19	24					
	Total trip catch, biomass adjusted (lbs)		7	15	62	84					
	Total tow time (hours) on observed trips		3.00	1.80	18.90	23.70					
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)		0.88	3.69	2.23	2.11					
	Catch per DF (lbs.)		1.05	3.98	2.42	2.33					
GB15	Number of observed tows		2	22		24			1		1
	Total trip catch, biomass adjusted (lbs)		3	88		91			4		4
	Total tow time (hours) on observed trips		2.00	18.80		20.80			0.80		0.80
	Catch per scallop pounds landed		0.00	0.00		0.00			0.00		0.00
	Catch per DA (lbs.)		0.94	2.04		1.97			0.22		0.22
	Catch per DF (lbs.)		1.00	2.77		2.61			0.32		0.32
GB14	Number of observed tows		87	24	4	115					
	Total trip catch, biomass adjusted (lbs)		206	72	33	311					
	Total tow time (hours) on observed trips		74.70	23.30	3.60	101.60					
	Catch per scallop pounds landed		0.00	0.00	0.01	0.00					
	Catch per DA (lbs.)		3.76	2.03	10.90	3.33					
	Catch per DF (lbs.)		6.14	3.41	12.78	5.43					
GB13	Number of observed tows			20	34	54					
	Total trip catch, biomass adjusted (lbs)			45	106	151					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips			10.90	30.30	41.20					
	Catch per scallop pounds landed			0.00	0.00	0.00					
	Catch per DA (lbs.)			3.84	3.79	3.80					
	Catch per DF (lbs.)			4.02	4.05	4.04					
GB11	Number of observed tows			167	42	209					
	Total trip catch, biomass adjusted (lbs)			530	284	814					
	Total tow time (hours) on observed trips			80.40	38.60	119.00					
	Catch per scallop pounds landed			0.01	0.00	0.01					
	Catch per DA (lbs.)			10.54	9.75	10.25					
	Catch per DF (lbs.)			11.02	10.29	10.75					
GB10	Number of observed tows		1	132	8	141					
	Total trip catch, biomass adjusted (lbs)		1	1,834	39	1,874					
	Total tow time (hours) on observed trips		0.80	119.50	6.50	126.80					
	Catch per scallop pounds landed		0.00	0.03	0.00	0.03					
	Catch per DA (lbs.)		1.53	**46.57**	2.73	34.46					
	Catch per DF (lbs.)		1.72	**50.24**	3.07	37.59					
GB1	Number of observed tows			22	105	127					
	Total trip catch, biomass adjusted (lbs)			26	441	467					
	Total tow time (hours) on observed trips			8.10	84.60	92.70					
	Catch per scallop pounds landed			0.00	0.01	0.01					
	Catch per DA (lbs.)			1.35	5.27	4.54					
	Catch per DF (lbs.)			4.19	5.70	5.59					
4270	Number of observed tows			4	9	13					
	Total trip catch, biomass adjusted (lbs)			7	17	24					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips			2.40	7.60	10.00					
	Catch per scallop pounds landed			0.00	0.00	0.00					
	Catch per DA (lbs.)			4.72	0.88	1.15					
	Catch per DF (lbs.)			14.61	0.92	1.27					
4268	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			25		25					
	Total tow time (hours) on observed trips			1.00		1.00					
	Catch per scallop pounds landed			**0.07**		0.07					
	Catch per DA (lbs.)			**75.45**		75.45					
	Catch per DF (lbs.)			**81.32**		81.32					
4267	Number of observed tows		5	32	1	38					
	Total trip catch, biomass adjusted (lbs)		6	244	1	251					
	Total tow time (hours) on observed trips		5.20	31.50	0.70	37.40					
	Catch per scallop pounds landed		0.00	0.03	0.00	0.00					
	Catch per DA (lbs.)		0.32	20.00	0.03	3.86					
	Catch per DF (lbs.)		0.34	21.66	0.03	4.08					
4171	Number of observed tows		14	1		15					
	Total trip catch, biomass adjusted (lbs)		16	1		17					
	Total tow time (hours) on observed trips		9.50	0.70		10.20					
	Catch per scallop pounds landed		0.00	0.01		0.00					
	Catch per DA (lbs.)		1.63	4.90		1.70					
	Catch per DF (lbs.)		1.68	5.24		1.75					
4170	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		2			2					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		1.10			1.10					
	Catch per scallop pounds landed		**0.10**			0.10					
	Catch per DA (lbs.)		**83.81**			83.81					
	Catch per DF (lbs.)		**85.62**			85.62					
4169	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				1	1					
	Total tow time (hours) on observed trips				0.70	0.70					
	Catch per scallop pounds landed				0.00	0.00					
	Catch per DA (lbs.)				0.19	0.19					
	Catch per DF (lbs.)				0.23	0.23					
4167	Number of observed tows		2		2	4					
	Total trip catch, biomass adjusted (lbs)		3		2	5					
	Total tow time (hours) on observed trips		0.60		1.20	1.80					
	Catch per scallop pounds landed		0.00		0.01	0.00					
	Catch per DA (lbs.)		0.14		4.10	0.23					
	Catch per DF (lbs.)		0.16		8.70	0.26					
4166	Number of observed tows		6	137	58	201					
	Total trip catch, biomass adjusted (lbs)		13	557	91	661					
	Total tow time (hours) on observed trips		1.40	111.10	60.70	173.20					
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)		1.03	2.96	2.08	2.70					
	Catch per DF (lbs.)		1.49	4.52	2.44	3.91					
4073	Number of observed tows		93	7	26	126				1	1
	Total trip catch, biomass adjusted (lbs)		468	16	42	527				1	1

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		24.50	5.90	16.40	46.80				0.50	0.50
	Catch per scallop pounds landed		0.01	0.00	0.00	0.01				0.00	0.00
	Catch per DA (lbs.)		17.46	0.87	0.96	5.89				0.11	0.11
	Catch per DF (lbs.)		21.49	0.92	1.16	6.97				0.24	0.24
4072	Number of observed tows		33		2	35					
	Total trip catch, biomass adjusted (lbs)		420		2	422					
	Total tow time (hours) on observed trips		22.30		1.70	24.00					
	Catch per scallop pounds landed		0.03		0.01	0.03					
	Catch per DA (lbs.)		34.47		2.06	32.07					
	Catch per DF (lbs.)		35.63		2.12	33.15					
4071	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				4	4					
	Total tow time (hours) on observed trips				1.80	1.80					
	Catch per scallop pounds landed				0.03	0.03					
	Catch per DA (lbs.)				8.27	8.27					
	Catch per DF (lbs.)				12.14	12.14					
4070	Number of observed tows				22	22					
	Total trip catch, biomass adjusted (lbs)				307	307					
	Total tow time (hours) on observed trips				27.20	27.20					
	Catch per scallop pounds landed				**3.04**	3.04					
	Catch per DA (lbs.)				**1,670.77**	1,670.77					
	Catch per DF (lbs.)				**1,780.57**	1,780.57					
4069	Number of observed tows		7	66	136	209		1			1
	Total trip catch, biomass adjusted (lbs)		29	207	971	1,207		2			2

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips		3.00	53.40	127.40	183.80		0.90			0.90
	Catch per scallop pounds landed		0.00	0.00	0.01	0.01		0.00			0.00
	Catch per DA (lbs.)		1.20	3.54	11.70	7.28		**0.50**			0.50
	Catch per DF (lbs.)		1.78	3.81	12.37	8.09		**0.95**			0.95
4068	Number of observed tows			1	6	7					
	Total trip catch, biomass adjusted (lbs)			17	23	40					
	Total tow time (hours) on observed trips			0.90	6.00	6.90					
	Catch per scallop pounds landed			**0.13**	**0.07**	0.08					
	Catch per DA (lbs.)			**153.52**	24.76	38.58					
	Catch per DF (lbs.)			**215.22**	25.76	41.28					
4067	Number of observed tows	8	82	7	84	181					
	Total trip catch, biomass adjusted (lbs)	10	1,886	148	374	2,419					
	Total tow time (hours) on observed trips	6.90	90.70	5.30	93.90	196.80					
	Catch per scallop pounds landed	0.00	**0.04**	**0.07**	0.02	0.04					
	Catch per DA (lbs.)	2.00	**52.31**	**84.43**	11.09	31.60					
	Catch per DF (lbs.)	2.21	**55.55**	**114.81**	11.88	33.95					
4066	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				0	0					
	Total tow time (hours) on observed trips				1.00	1.00					
	Catch per scallop pounds landed				0.00	0.00					
	Catch per DA (lbs.)				0.83	0.83					
	Catch per DF (lbs.)				0.87	0.87					
4065	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			19		19					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips			1.30		1.30					
	Catch per scallop pounds landed			**0.05**		0.05					
	Catch per DA (lbs.)			**36.59**		36.59					
	Catch per DF (lbs.)			**39.21**		39.21					
3874	Number of observed tows	22	39	2	3	66					
	Total trip catch, biomass adjusted (lbs)	100	102	4	7	213					
	Total tow time (hours) on observed trips	9.60	36.80	1.80	2.60	50.80					
	Catch per scallop pounds landed	0.02	0.01	0.00	0.00	0.01					
	Catch per DA (lbs.)	12.05	4.04	3.36	2.89	5.74					
	Catch per DF (lbs.)	16.51	5.45	4.38	3.01	7.61					
3872	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	1				1					
	Total tow time (hours) on observed trips	0.80				0.80					
	Catch per scallop pounds landed	0.00				0.00					
	Catch per DA (lbs.)	1.02				1.02					
	Catch per DF (lbs.)	1.07				1.07					
3773	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		1			1					
	Total tow time (hours) on observed trips		1.30			1.30					
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		2.81			2.81					
	Catch per DF (lbs.)		3.05			3.05					
Total Number of observed tows		1,028	2,408	1,902	1,609	6,947	2	4	1	1	8
Total trip catch, biomass adjusted (lbs)		6,113	13,005	9,978	8,150	37,246	3	6	4	1	15
Total tow time (hours) on observed trips		943.70	1950.40	1589.30	1360.40	5843.80	1.50	3.30	0.80	0.50	6.10

Rotation management area	Discards (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	Landings (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
Total Catch per scallop pounds landed	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Total Catch per DA (lbs.)	9.13	10.37	7.61	7.81	8.70	0.47	0.39	0.22	0.11	0.29
Total Catch per DF (lbs.)	10.61	11.94	9.07	8.59	10.03	0.49	0.47	0.32	0.24	0.40

Table 8. **Sand-dab flounder discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	25		24	67	116			4	1	5
	Total trip catch, biomass adjusted (lbs)	108		49	264	421			4	1	5
	Total tow time (hours) on observed trips	19.40		14.70	58.50	92.60			2.50	1.10	3.60
	Catch per scallop pounds landed	0.00		0.00	0.02	0.01			0.00	0.00	0.00
	Catch per DA (lbs.)	6.23		4.64	7.08	6.46			0.52	0.23	0.41
	Catch per DF (lbs.)	8.11		10.22	8.24	8.39			1.59	0.41	1.01
MA8	Number of observed tows	484	11		136	631	2				2
	Total trip catch, biomass adjusted (lbs)	2,580	18		1,066	3,664	2				2
	Total tow time (hours) on observed trips	381.60	8.90		130.80	521.30	1.40				1.40
	Catch per scallop pounds landed	0.02	0.00		0.02	0.02	0.00				0.00
	Catch per DA (lbs.)	14.94	1.13		12.20	13.28	0.09				0.09
	Catch per DF (lbs.)	16.78	1.25		12.60	14.50	0.10				0.10
MA7	Number of observed tows	50	34	9	5	98					
	Total trip catch, biomass adjusted (lbs)	206	56	12	32	305					
	Total tow time (hours) on observed trips	32.80	29.10	6.00	3.60	71.50					
	Catch per scallop pounds landed	0.00	0.00	0.00	**0.04**	0.00					
	Catch per DA (lbs.)	3.64	0.68	1.03	16.65	2.01					
	Catch per DF (lbs.)	4.12	0.75	1.04	17.09	2.23					
MA6	Number of observed tows	153	192	179	172	696					
	Total trip catch, biomass adjusted (lbs)	652	889	758	656	2,955					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	85.50	81.20	151.20	113.70	431.60					
	Catch per scallop pounds landed	0.00	0.01	0.01	0.01	0.00					
	Catch per DA (lbs.)	4.88	7.91	5.63	6.03	6.04					
	Catch per DF (lbs.)	6.44	9.20	6.49	7.00	7.24					
MA5	Number of observed tows	7	13	5	1	26					
	Total trip catch, biomass adjusted (lbs)	9	14	23	1	47					
	Total tow time (hours) on observed trips	6.80	11.50	5.10	1.20	24.60					
	Catch per scallop pounds landed	0.01	0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)	4.73	0.47	2.16	0.06	0.91					
	Catch per DF (lbs.)	5.51	0.51	2.30	0.06	0.99					
MA4	Number of observed tows	21	17	16	4	58			1		1
	Total trip catch, biomass adjusted (lbs)	50	21	30	7	108			3		3
	Total tow time (hours) on observed trips	14.00	16.50	10.50	4.30	45.30			1.00		1.00
	Catch per scallop pounds landed	0.00	0.00	0.01	0.01	0.00			0.01		0.01
	Catch per DA (lbs.)	2.05	0.34	3.16	5.45	1.11			5.23		5.23
	Catch per DF (lbs.)	2.43	0.47	3.43	5.67	1.44			5.73		5.73
MA3	Number of observed tows		3	14		17					
	Total trip catch, biomass adjusted (lbs)		6	21		27					
	Total tow time (hours) on observed trips		3.10	14.80		17.90					
	Catch per scallop pounds landed		0.01	0.00		0.00					
	Catch per DA (lbs.)		6.92	0.68		0.86					
	Catch per DF (lbs.)		10.54	0.78		0.98					
MA2	Number of observed tows		2	1		3					
	Total trip catch, biomass adjusted (lbs)		2	1		3					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		2.00	1.30		3.30					
	Catch per scallop pounds landed		0.00	0.00		0.00					
	Catch per DA (lbs.)		4.05	0.04		0.18					
	Catch per DF (lbs.)		4.43	0.04		0.21					
MA1	Number of observed tows			7		7					
	Total trip catch, biomass adjusted (lbs)			7		7					
	Total tow time (hours) on observed trips			7.30		7.30					
	Catch per scallop pounds landed			0.00		0.00					
	Catch per DA (lbs.)			0.23		0.23					
	Catch per DF (lbs.)			0.24		0.24					
GB9	Number of observed tows	8		9	11	28					
	Total trip catch, biomass adjusted (lbs)	9		34	20	63					
	Total tow time (hours) on observed trips	7.00		8.90	9.30	25.20					
	Catch per scallop pounds landed	0.00		0.02	0.01	0.00					
	Catch per DA (lbs.)	0.53		13.31	2.18	2.26					
	Catch per DF (lbs.)	0.56		14.26	2.44	2.43					
GB8	Number of observed tows	3	82	16	36	137		10			10
	Total trip catch, biomass adjusted (lbs)	4	316	79	759	1,158		20			20
	Total tow time (hours) on observed trips	2.40	53.70	11.80	22.20	90.10		7.00			7.00
	Catch per scallop pounds landed	0.01	0.00	0.01	0.04	0.01		0.00			0.00
	Catch per DA (lbs.)	7.59	4.56	3.88	**35.87**	10.40		2.11			2.11
	Catch per DF (lbs.)	8.01	5.48	4.21	**55.93**	12.79		4.57			4.57
GB7	Number of observed tows	9	3	102	7	121	2	2			4
	Total trip catch, biomass adjusted (lbs)	96	4	921	559	1,581	7	2			9

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	5.10	2.10	80.10	4.10	91.40	1.50	1.60			3.10
	Catch per scallop pounds landed	0.02	0.00	0.07	0.05	0.04	0.00	0.00			0.00
	Catch per DA (lbs.)	11.05	0.51	44.36	82.10	35.32	2.37	0.25			0.82
	Catch per DF (lbs.)	48.57	1.31	47.71	119.25	53.92	7.91	0.66			2.33
GB6	Number of observed tows	2	11		16	29					
	Total trip catch, biomass adjusted (lbs)	34	43		93	170					
	Total tow time (hours) on observed trips	1.40	10.70		19.90	32.00					
	Catch per scallop pounds landed	0.09	0.00		0.02	0.00					
	Catch per DA (lbs.)	92.50	2.10		10.59	5.75					
	Catch per DF (lbs.)	308.34	2.40		11.75	6.57					
GB5	Number of observed tows	9	55	40	38	142		5			5
	Total trip catch, biomass adjusted (lbs)	126	598	278	150	1,152		30			30
	Total tow time (hours) on observed trips	9.50	40.40	46.60	39.10	135.60		3.40			3.40
	Catch per scallop pounds landed	0.09	0.03	0.01	0.02	0.02		0.00			0.00
	Catch per DA (lbs.)	95.08	27.19	6.31	11.48	14.32		3.60			3.60
	Catch per DF (lbs.)	128.84	35.66	6.87	12.69	16.46		7.03			7.03
GB4	Number of observed tows	73	17	46	169	305		6			6
	Total trip catch, biomass adjusted (lbs)	490	36	290	700	1,516		17			17
	Total tow time (hours) on observed trips	127.60	9.70	38.20	140.70	316.20		4.20			4.20
	Catch per scallop pounds landed	0.03	0.00	0.03	0.01	0.01		0.00			0.00
	Catch per DA (lbs.)	30.06	4.13	17.10	16.87	18.16		2.19			2.19
	Catch per DF (lbs.)	32.18	6.36	19.07	18.06	20.25		3.30			3.30
GB3	Number of observed tows	22	2	12	77	113					
	Total trip catch, biomass adjusted (lbs)	88	5	34	293	420					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	17.40	1.40	7.70	61.50	88.00					
	Catch per scallop pounds landed	0.01	0.00	0.00	0.01	0.00					
	Catch per DA (lbs.)	10.73	0.77	2.17	8.30	6.37					
	Catch per DF (lbs.)	11.29	0.94	2.30	8.86	6.87					
GB2	Number of observed tows	153	14	17	28	212	4				4
	Total trip catch, biomass adjusted (lbs)	1,100	18	74	79	1,271	29				29
	Total tow time (hours) on observed trips	118.60	13.20	16.20	22.30	170.30	3.10				3.10
	Catch per scallop pounds landed	0.01	0.00	0.00	0.00	0.01	0.00				0.00
	Catch per DA (lbs.)	11.19	0.98	3.89	3.73	8.11	1.35				1.35
	Catch per DF (lbs.)	13.61	1.02	4.18	3.94	9.35	2.55				2.55
GB15	Number of observed tows		14	16	32	62		6	84	20	110
	Total trip catch, biomass adjusted (lbs)		219	28	330	577		16	436	31	482
	Total tow time (hours) on observed trips		11.20	17.90	9.80	38.90		4.40	35.10	4.30	43.80
	Catch per scallop pounds landed		0.02	0.00	0.01	0.01		0.00	**0.01**	0.00	0.01
	Catch per DA (lbs.)		25.73	0.78	10.55	7.61		1.83	**13.73**	3.30	9.71
	Catch per DF (lbs.)		**48.85**	1.11	22.61	13.02		3.48	**20.23**	7.00	15.84
GB14	Number of observed tows	9	56	14	5	84					
	Total trip catch, biomass adjusted (lbs)	119	105	19	81	324					
	Total tow time (hours) on observed trips	6.10	43.50	14.20	4.90	68.70					
	Catch per scallop pounds landed	**0.05**	0.00	0.00	0.01	0.00					
	Catch per DA (lbs.)	**46.76**	1.88	0.65	17.83	3.51					
	Catch per DF (lbs.)	**74.33**	3.09	1.12	20.89	5.74					
GB13	Number of observed tows	21	21	74	54	170		8		5	13
	Total trip catch, biomass adjusted (lbs)	92	158	317	802	1,369		52		76	128

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	13.60	8.60	42.00	46.40	110.60		4.00		2.60	6.60
	Catch per scallop pounds landed	0.02	0.00	0.02	0.01	0.01		0.00		0.00	0.00
	Catch per DA (lbs.)	15.53	7.60	27.04	17.44	16.22		**12.37**		6.57	8.13
	Catch per DF (lbs.)	16.58	10.35	28.30	19.56	18.75		**16.12**		9.60	11.51
GB11	Number of observed tows	45	5	242	92	384		1		13	14
	Total trip catch, biomass adjusted (lbs)	154	6	991	270	1,420		7		31	38
	Total tow time (hours) on observed trips	29.60	3.90	122.10	69.00	224.60		0.80		6.00	6.80
	Catch per scallop pounds landed	0.00	0.00	0.01	0.00	0.01		0.00		0.00	0.00
	Catch per DA (lbs.)	5.33	0.23	16.43	3.54	7.46		0.55		1.11	0.94
	Catch per DF (lbs.)	5.62	0.25	17.35	4.35	8.37		0.65		1.88	1.42
GB10	Number of observed tows	72	8	153	46	279					
	Total trip catch, biomass adjusted (lbs)	482	11	1,048	1,254	2,795					
	Total tow time (hours) on observed trips	52.50	4.80	136.50	39.80	233.60					
	Catch per scallop pounds landed	0.02	0.00	0.02	**0.04**	0.02					
	Catch per DA (lbs.)	20.82	4.88	26.21	**50.98**	31.09					
	Catch per DF (lbs.)	25.86	6.97	28.28	**60.26**	35.82					
GB1	Number of observed tows	241	49	13	101	404			7		7
	Total trip catch, biomass adjusted (lbs)	1,884	72	15	224	2,196			8		8
	Total tow time (hours) on observed trips	217.00	48.90	4.40	83.90	354.20			2.70		2.70
	Catch per scallop pounds landed	0.02	0.00	0.00	0.00	0.01			0.00		0.00
	Catch per DA (lbs.)	20.68	2.73	0.78	2.81	10.12			0.51		0.51
	Catch per DF (lbs.)	23.36	2.85	2.43	3.06	11.84			1.58		1.58
4270	Number of observed tows	136			30	166					
	Total trip catch, biomass adjusted (lbs)	1,031			89	1,120					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	127.60			24.60	152.20					
	Catch per scallop pounds landed	0.02			0.01	0.02					
	Catch per DA (lbs.)	23.11			4.79	17.72					
	Catch per DF (lbs.)	24.76			5.06	18.91					
4267	Number of observed tows	12	18	1	10	41	3	1	2		6
	Total trip catch, biomass adjusted (lbs)	80	25	1	47	152	8	10	6		25
	Total tow time (hours) on observed trips	8.90	16.10	1.10	6.40	32.50	2.60	1.10	1.60		5.30
	Catch per scallop pounds landed	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
	Catch per DA (lbs.)	7.44	0.40	0.31	3.06	1.66	1.12	0.54	4.99		0.90
	Catch per DF (lbs.)	20.25	0.43	0.33	4.51	2.04	3.73	0.57	7.35		1.20
4171	Number of observed tows		13		4	17					
	Total trip catch, biomass adjusted (lbs)		9		55	64					
	Total tow time (hours) on observed trips		9.50		3.20	12.70					
	Catch per scallop pounds landed		0.00		**0.13**	0.00					
	Catch per DA (lbs.)		0.94		**61.35**	6.12					
	Catch per DF (lbs.)		0.97		**62.92**	6.28					
4170	Number of observed tows	24	1		18	43	5				5
	Total trip catch, biomass adjusted (lbs)	1,023	9		43	1,075	22				22
	Total tow time (hours) on observed trips	10.70	1.10		13.70	25.50	3.70				3.70
	Catch per scallop pounds landed	**0.13**	**0.43**		0.02	0.10	0.00				0.00
	Catch per DA (lbs.)	**128.62**	**381.34**		8.54	82.61	2.75				2.75
	Catch per DF (lbs.)	**214.36**	**389.55**		8.80	111.05	4.59				4.59
4169	Number of observed tows	1			12	13					
	Total trip catch, biomass adjusted (lbs)	1			32	33					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	0.80			8.20	9.00					
	Catch per scallop pounds landed	0.03			0.01	0.01					
	Catch per DA (lbs.)	8.15			12.02	11.93					
	Catch per DF (lbs.)	8.53			13.04	12.94					
4167	Number of observed tows	2	74		89	165		8		49	57
	Total trip catch, biomass adjusted (lbs)	2	618		317	937		26		91	117
	Total tow time (hours) on observed trips	1.50	46.60		29.00	77.10		4.70		16.10	20.80
	Catch per scallop pounds landed	0.00	0.01		0.02	0.02		0.00		0.01	0.00
	Catch per DA (lbs.)	2.22	14.54		13.49	14.05		0.91		3.96	2.27
	Catch per DF (lbs.)	2.33	17.56		28.64	19.96		1.14		8.40	3.48
4166	Number of observed tows	24	35	26	3	88	2	4			6
	Total trip catch, biomass adjusted (lbs)	152	97	61	7	318	7	8			15
	Total tow time (hours) on observed trips	18.70	20.00	25.50	3.70	67.90	1.60	3.20			4.80
	Catch per scallop pounds landed	0.01	0.01	0.00	0.00	0.00	**0.01**	0.00			0.00
	Catch per DA (lbs.)	9.77	6.78	1.04	0.75	3.26	**8.31**	0.99			1.74
	Catch per DF (lbs.)	17.02	17.45	1.67	0.88	5.39	13.85	2.50			4.17
4073	Number of observed tows	150	93	106	141	490				1	1
	Total trip catch, biomass adjusted (lbs)	1,110	502	2,949	733	5,294				4	4
	Total tow time (hours) on observed trips	94.50	17.80	88.30	83.40	284.00				0.70	0.70
	Catch per scallop pounds landed	0.03	0.02	**0.05**	0.01	0.03				0.00	0.00
	Catch per DA (lbs.)	24.63	20.02	**74.55**	10.94	29.97				3.07	3.07
	Catch per DF (lbs.)	30.85	24.99	**78.32**	13.31	35.58				3.26	3.26
4072	Number of observed tows	1	2		5	8					
	Total trip catch, biomass adjusted (lbs)	1	6		15	22					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	0.50	1.40		4.00	5.90					
	Catch per scallop pounds landed	0.00	0.00		0.01	0.00					
	Catch per DA (lbs.)	6.29	0.90		7.12	2.50					
	Catch per DF (lbs.)	8.78	0.91		7.27	2.54					
4071	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				1	1					
	Total tow time (hours) on observed trips				0.80	0.80					
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				6.41	6.41					
	Catch per DF (lbs.)				6.70	6.70					
4070	Number of observed tows				19	19					
	Total trip catch, biomass adjusted (lbs)				202	202					
	Total tow time (hours) on observed trips				26.10	26.10					
	Catch per scallop pounds landed				**2.00**	2.00					
	Catch per DA (lbs.)				**1,094.95**	1,094.95					
	Catch per DF (lbs.)				**1,166.91**	1,166.91					
4069	Number of observed tows	79	92	195	215	581		23		1	24
	Total trip catch, biomass adjusted (lbs)	496	952	963	2,862	5,272		151		2	153
	Total tow time (hours) on observed trips	63.90	31.70	144.50	181.40	421.50		13.50		0.60	14.10
	Catch per scallop pounds landed	0.02	0.01	0.02	**0.04**	0.02		0.00		**0.01**	0.00
	Catch per DA (lbs.)	17.76	12.67	16.12	**41.59**	22.76		2.33		**10.58**	2.35
	Catch per DF (lbs.)	19.29	21.98	17.37	45.71	28.19		4.00		**17.86**	4.04
4068	Number of observed tows		1		1	2					
	Total trip catch, biomass adjusted (lbs)		5		4	9					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		0.90		0.90	1.80					
	Catch per scallop pounds landed		0.02		0.01	0.02					
	Catch per DA (lbs.)		28.66		12.47	18.25					
	Catch per DF (lbs.)		54.41		13.20	22.94					
4067	Number of observed tows	28	4		46	78					
	Total trip catch, biomass adjusted (lbs)	89	29		212	330					
	Total tow time (hours) on observed trips	24.10	2.80		55.50	82.40					
	Catch per scallop pounds landed	0.02	0.00		0.02	0.01					
	Catch per DA (lbs.)	15.26	1.23		13.18	7.24					
	Catch per DF (lbs.)	17.86	1.26		14.63	7.75					
4065	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			4		4					
	Total tow time (hours) on observed trips			1.30		1.30					
	Catch per scallop pounds landed			0.01		0.01					
	Catch per DA (lbs.)			7.36		7.36					
	Catch per DF (lbs.)			7.88		7.88					
3874	Number of observed tows	75	40	2	1	118					
	Total trip catch, biomass adjusted (lbs)	319	60	3	5	387					
	Total tow time (hours) on observed trips	31.70	22.00	1.30	0.70	55.70					
	Catch per scallop pounds landed	0.02	0.00	0.00	0.02	0.01					
	Catch per DA (lbs.)	13.75	2.06	3.11	10.42	7.22					
	Catch per DF (lbs.)	18.84	3.11	4.29	10.72	10.36					
Total Number of observed tows		1,939	982	1,340	1,692	5,953	18	74	98	90	280
Total trip catch, biomass adjusted (lbs)		12,585	4,909	9,010	12,259	38,763	75	339	457	236	1,106
Total tow time (hours) on observed trips		1530.80	574.30	1019.50	1326.60	4451.20	13.90	47.90	42.90	31.40	136.10

Rotation management area	Discards					Landings				
	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
Total Catch per scallop pounds landed	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00
Total Catch per DA (lbs.)	14.15	5.54	12.00	13.71	11.33	1.22	1.90	8.01	3.03	2.95
Total Catch per DF (lbs.)	16.99	6.95	14.17	16.03	13.61	1.89	2.92	**14.98**	5.42	4.82

Table 9. **Summer flounder discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	36	26		119	181	10	6	3	36	55
	Total trip catch, biomass adjusted (lbs)	339	264		794	1,396	72	11	11	301	395
	Total tow time (hours) on observed trips	24.80	30.10		104.50	159.40	7.50	4.50	1.80	32.10	45.90
	Catch per scallop pounds landed	0.02	0.01		0.05	0.02	0.01	0.01	0.00	0.07	0.02
	Catch per DA (lbs.)	21.54	12.76		18.70	17.71	12.97	4.03	1.51	25.32	14.36
	Catch per DF (lbs.)	28.47	13.65		22.10	20.80	14.57	4.46	4.66	43.34	23.64
MA8	Number of observed tows	440	180		252	872	18	37		25	80
	Total trip catch, biomass adjusted (lbs)	3,775	995		2,101	6,870	897	195		355	1,448
	Total tow time (hours) on observed trips	418.90	173.80		228.10	820.80	12.20	29.00		18.60	59.80
	Catch per scallop pounds landed	0.02	0.01		0.02	0.02	0.02	0.00		0.01	0.01
	Catch per DA (lbs.)	22.17	8.41		16.87	16.63	19.70	2.97		14.31	10.63
	Catch per DF (lbs.)	24.62	9.11		18.10	18.14	24.28	3.20		17.46	12.23
MA7	Number of observed tows	419	389	4	16	828	112	40		21	173
	Total trip catch, biomass adjusted (lbs)	2,680	3,220	8	84	5,992	545	128		210	883
	Total tow time (hours) on observed trips	404.30	375.10	3.80	13.30	796.50	93.90	33.80		8.00	135.70
	Catch per scallop pounds landed	0.01	0.01	0.00	0.00	0.01	0.01	0.00		0.01	0.01
	Catch per DA (lbs.)	14.63	16.23	0.84	4.26	14.58	5.76	2.12		12.13	5.12
	Catch per DF (lbs.)	16.40	17.32	0.93	5.96	16.10	6.41	2.26		17.80	5.75
MA6	Number of observed tows	403	338	26	278	1,045	153	175	15	91	434
	Total trip catch, biomass adjusted (lbs)	2,697	1,602	120	2,605	7,024	1,174	1,374	67	657	3,272

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	388.90	249.20	18.00	247.00	903.10	142.90	73.60	13.90	53.60	284.00
	Catch per scallop pounds landed	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01
	Catch per DA (lbs.)	11.85	8.90	2.91	18.23	11.87	13.11	10.31	1.54	9.71	9.80
	Catch per DF (lbs.)	14.59	9.59	3.26	21.43	13.77	14.74	11.90	1.72	12.92	11.49
MA5	Number of observed tows	59	194	2	81	336	24	11		10	45
	Total trip catch, biomass adjusted (lbs)	486	858	3	523	1,870	179	24		37	240
	Total tow time (hours) on observed trips	40.20	143.20	1.90	83.00	268.30	0.50	12.30		9.80	22.60
	Catch per scallop pounds landed	0.06	0.01	0.00	0.02	0.01	0.03	0.00		0.01	0.00
	Catch per DA (lbs.)	28.77	8.49	1.54	12.27	11.48	22.55	0.52		7.05	4.04
	Catch per DF (lbs.)	30.61	9.45	1.74	13.42	12.66	24.16	0.59		9.38	4.64
MA4	Number of observed tows	341	321	1	53	716	145	37		2	184
	Total trip catch, biomass adjusted (lbs)	5,287	2,677	3	377	8,344	1,154	109		3	1,266
	Total tow time (hours) on observed trips	385.60	275.00	0.70	46.40	707.70	139.20	34.10		2.00	175.30
	Catch per scallop pounds landed	0.05	0.01	0.00	0.04	0.02	0.02	0.00		0.00	0.01
	Catch per DA (lbs.)	37.73	13.90	0.56	25.04	23.67	15.06	1.34		2.35	7.97
	Catch per DF (lbs.)	45.14	16.27	0.77	25.84	27.84	17.36	1.57		2.66	9.24
MA3	Number of observed tows	102	144		37	283	76			3	79
	Total trip catch, biomass adjusted (lbs)	4,958	1,172		516	6,646	1,989			5	1,994
	Total tow time (hours) on observed trips	-17.00	109.30		24.80	117.10	-51.00			2.50	-48.50
	Catch per scallop pounds landed	**0.08**	0.01		0.06	0.03	**0.06**			0.01	0.05
	Catch per DA (lbs.)	**117.43**	19.37		51.74	58.98	**66.66**			4.93	64.47
	Catch per DF (lbs.)	**161.84**	27.05		54.23	79.62	**85.39**			5.07	81.88
MA2	Number of observed tows	102	40			142	10	2			12
	Total trip catch, biomass adjusted (lbs)	2,297	371			2,667	39	7			47

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips	54.00	38.90			92.90	8.60	1.70			10.30
	Catch per scallop pounds landed	0.03	0.01			0.03	0.00	0.00			0.00
	Catch per DA (lbs.)	67.68	26.57			55.70	1.39	1.04			1.32
	Catch per DF (lbs.)	109.95	32.02			82.15	2.24	1.10			1.92
MA1	Number of observed tows	68	9		82	159	45				45
	Total trip catch, biomass adjusted (lbs)	3,854	25		1,704	5,583	2,353				2,353
	Total tow time (hours) on observed trips	41.10	7.60		62.10	110.80	15.80				15.80
	Catch per scallop pounds landed	0.05	0.01		0.07	0.05	0.05				0.05
	Catch per DA (lbs.)	96.76	9.03		63.72	80.52	81.45				81.45
	Catch per DF (lbs.)	146.29	9.84		66.96	102.76	120.63				120.63
GB9	Number of observed tows						1				1
	Total trip catch, biomass adjusted (lbs)						2				2
	Total tow time (hours) on observed trips						0.80				0.80
	Catch per scallop pounds landed						0.00				0.00
	Catch per DA (lbs.)						0.16				0.16
	Catch per DF (lbs.)						0.17				0.17
GB8	Number of observed tows		10	3	2	15		7		2	9
	Total trip catch, biomass adjusted (lbs)		35	12	28	74		26		64	89
	Total tow time (hours) on observed trips		5.80	2.30	0.90	9.00		5.10		0.90	6.00
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00		0.00		0.00	0.00
	Catch per DA (lbs.)		0.92	1.19	1.84	1.19		1.16		4.23	2.40
	Catch per DF (lbs.)		1.02	1.31	2.73	1.40		1.61		6.29	3.42
GB7	Number of observed tows			4		4			1		1
	Total trip catch, biomass adjusted (lbs)			24		24			12		12

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips			2.90		2.90			1.00		1.00
	Catch per scallop pounds landed			0.00		0.00			0.00		0.00
	Catch per DA (lbs.)			1.90		1.90			2.66		2.66
	Catch per DF (lbs.)			2.04		2.04			4.65		4.65
GB6	Number of observed tows				3	3	1				1
	Total trip catch, biomass adjusted (lbs)				18	18	3				3
	Total tow time (hours) on observed trips				3.60	3.60	0.70				0.70
	Catch per scallop pounds landed				0.00	0.00	0.02				0.02
	Catch per DA (lbs.)				2.77	2.77	24.26				24.26
	Catch per DF (lbs.)				3.07	3.07	80.87				80.87
GB5	Number of observed tows		25	1	2	28		2			2
	Total trip catch, biomass adjusted (lbs)		117	2	10	129		16			16
	Total tow time (hours) on observed trips		27.20	1.20	2.30	30.70		1.70			1.70
	Catch per scallop pounds landed		0.01	0.00	0.01	0.00		0.00			0.00
	Catch per DA (lbs.)		5.33	0.34	5.91	4.48		2.27			2.27
	Catch per DF (lbs.)		6.32	0.37	6.55	5.20		4.32			4.32
GB4	Number of observed tows		3	6	7	16		11			11
	Total trip catch, biomass adjusted (lbs)		5	18	58	81		50			50
	Total tow time (hours) on observed trips		1.80	4.80	6.60	13.20		6.60			6.60
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00		0.00			0.00
	Catch per DA (lbs.)		0.79	1.49	2.82	2.10		8.13			8.13
	Catch per DF (lbs.)		1.37	1.65	3.01	2.41		12.90			12.90
GB3	Number of observed tows		1		1	2		1			1
	Total trip catch, biomass adjusted (lbs)		2		2	4		2			2

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		0.60		1.10	1.70		0.50			0.50
	Catch per scallop pounds landed		0.00		0.00	0.00		0.00			0.00
	Catch per DA (lbs.)		3.20		7.48	4.90		3.20			3.20
	Catch per DF (lbs.)		5.52		7.83	6.73		5.52			5.52
GB2	Number of observed tows		5		5	10		3			3
	Total trip catch, biomass adjusted (lbs)		9		38	47		8			8
	Total tow time (hours) on observed trips		2.60		4.40	7.00		1.90			1.90
	Catch per scallop pounds landed		0.00		0.01	0.00		0.00			0.00
	Catch per DA (lbs.)		0.24		7.86	1.06		0.34			0.34
	Catch per DF (lbs.)		0.32		8.70	1.40		0.59			0.59
GB13	Number of observed tows		7	6	7	20		6			6
	Total trip catch, biomass adjusted (lbs)		20	25	22	67		62			62
	Total tow time (hours) on observed trips		4.30	3.40	5.50	13.20		3.60			3.60
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00		0.00			0.00
	Catch per DA (lbs.)		2.41	2.30	0.73	1.36		6.22			6.22
	Catch per DF (lbs.)		2.52	2.41	0.80	1.46		6.87			6.87
GB11	Number of observed tows		5	3	2	10					
	Total trip catch, biomass adjusted (lbs)		6	11	5	21					
	Total tow time (hours) on observed trips		2.10	1.70	1.70	5.50					
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)		0.39	0.23	0.31	0.28					
	Catch per DF (lbs.)		0.41	0.24	0.33	0.29					
GB10	Number of observed tows		2	4	1	7		3			3
	Total trip catch, biomass adjusted (lbs)		3	14	5	21		11			11

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	Total tow time (hours) on observed trips		1.20	3.30	0.80	5.30		1.10			1.10
	Catch per scallop pounds landed		0.00	0.00	0.01	0.00		0.01			0.01
	Catch per DA (lbs.)		2.38	0.41	3.00	0.59		8.32			8.32
	Catch per DF (lbs.)		4.11	0.44	3.20	0.64		14.38			14.38
GB1	Number of observed tows	5			2	7				1	1
	Total trip catch, biomass adjusted (lbs)	12			3	16				3	3
	Total tow time (hours) on observed trips	4.30			1.70	6.00				0.90	0.90
	Catch per scallop pounds landed	0.00			0.00	0.00				0.00	0.00
	Catch per DA (lbs.)	0.89			0.28	0.60				0.09	0.09
	Catch per DF (lbs.)	0.93			0.33	0.66				0.11	0.11
4270	Number of observed tows				3	3				1	1
	Total trip catch, biomass adjusted (lbs)				7	7				7	7
	Total tow time (hours) on observed trips				2.40	2.40				0.80	0.80
	Catch per scallop pounds landed				0.00	0.00				0.00	0.00
	Catch per DA (lbs.)				0.66	0.66				0.66	0.66
	Catch per DF (lbs.)				0.70	0.70				0.70	0.70
4267	Number of observed tows		2			2					
	Total trip catch, biomass adjusted (lbs)		4			4					
	Total tow time (hours) on observed trips		1.70			1.70					
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		0.16			0.16					
	Catch per DF (lbs.)		0.17			0.17					
4171	Number of observed tows		49		5	54					
	Total trip catch, biomass adjusted (lbs)		584		79	663					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips		34.00		3.90	37.90					
	Catch per scallop pounds landed		0.03		0.19	0.03					
	Catch per DA (lbs.)		61.04		88.51	63.39					
	Catch per DF (lbs.)		62.71		90.78	65.12					
4170	Number of observed tows		1		3	4					
	Total trip catch, biomass adjusted (lbs)		2		26	28					
	Total tow time (hours) on observed trips		1.10		2.70	3.80					
	Catch per scallop pounds landed		0.07		0.84	0.53					
	Catch per DA (lbs.)		65.67		459.29	342.39					
	Catch per DF (lbs.)		67.08		489.47	360.26					
4167	Number of observed tows		5			5		6			6
	Total trip catch, biomass adjusted (lbs)		17			17		25			25
	Total tow time (hours) on observed trips		2.00			2.00		3.40			3.40
	Catch per scallop pounds landed		0.00			0.00		0.00			0.00
	Catch per DA (lbs.)		0.81			0.81		1.19			1.19
	Catch per DF (lbs.)		0.90			0.90		1.32			1.32
4166	Number of observed tows			4		4					
	Total trip catch, biomass adjusted (lbs)			30		30					
	Total tow time (hours) on observed trips			3.20		3.20					
	Catch per scallop pounds landed			0.00		0.00					
	Catch per DA (lbs.)			1.88		1.88					
	Catch per DF (lbs.)			2.83		2.83					
4073	Number of observed tows	5	87	68	63	223		97	34	43	174
	Total trip catch, biomass adjusted (lbs)	11	442	1,263	752	2,468		850	333	280	1,464

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	3.30	19.90	60.80	42.20	126.20		27.40	30.20	27.20	84.80
	Catch per scallop pounds landed	0.00	0.02	0.03	0.03	0.02		0.03	0.01	0.01	0.02
	Catch per DA (lbs.)	0.57	18.24	39.27	22.65	22.83		29.17	18.09	6.99	16.70
	Catch per DF (lbs.)	0.67	22.81	41.15	28.01	26.57		35.62	19.25	9.42	20.64
4072	Number of observed tows		25		9	34		19			19
	Total trip catch, biomass adjusted (lbs)		81		36	117		69			69
	Total tow time (hours) on observed trips		17.20		7.00	24.20		12.10			12.10
	Catch per scallop pounds landed		0.01		0.03	0.01		0.01			0.01
	Catch per DA (lbs.)		6.66		17.16	8.21		10.37			10.37
	Catch per DF (lbs.)		6.88		17.52	8.47		10.41			10.41
4071	Number of observed tows				1	1	2			1	3
	Total trip catch, biomass adjusted (lbs)				3	3	39			23	62
	Total tow time (hours) on observed trips				0.90	0.90	1.20			0.90	2.10
	Catch per scallop pounds landed				0.06	0.06	**0.16**			**0.45**	0.21
	Catch per DA (lbs.)				9.43	9.43	**174.62**			**70.71**	112.69
	Catch per DF (lbs.)				17.14	17.14	**436.54**			**128.57**	230.25
4070	Number of observed tows				23	23					
	Total trip catch, biomass adjusted (lbs)				222	222					
	Total tow time (hours) on observed trips				29.90	29.90					
	Catch per scallop pounds landed				**2.14**	2.14					
	Catch per DA (lbs.)				**1,174.05**	1,174.05					
	Catch per DF (lbs.)				**1,251.21**	1,251.21					
4069	Number of observed tows	1	7	5	83	96		27		2	29
	Total trip catch, biomass adjusted (lbs)	2	43	15	1,057	1,116		331		3	333

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	0.80	4.70	3.90	81.00	90.40		14.50		2.00	16.50
	Catch per scallop pounds landed	0.00	0.00	0.00	0.01	0.01		0.00		0.00	0.00
	Catch per DA (lbs.)	0.13	1.44	0.30	15.15	6.94		4.70		0.12	3.57
	Catch per DF (lbs.)	0.14	2.20	0.32	16.02	7.84		8.33		0.12	5.41
4068	Number of observed tows							1			1
	Total trip catch, biomass adjusted (lbs)							5			5
	Total tow time (hours) on observed trips							0.90			0.90
	Catch per scallop pounds landed							0.02			0.02
	Catch per DA (lbs.)							29.53			29.53
	Catch per DF (lbs.)							56.07			56.07
4067	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				16	16					
	Total tow time (hours) on observed trips				3.50	3.50					
	Catch per scallop pounds landed				0.00	0.00					
	Catch per DA (lbs.)				0.99	0.99					
	Catch per DF (lbs.)				1.09	1.09					
3974	Number of observed tows	1		3		4					
	Total trip catch, biomass adjusted (lbs)	3		14		17					
	Total tow time (hours) on observed trips	1.20		1.70		2.90					
	Catch per scallop pounds landed	0.01		0.06		0.03					
	Catch per DA (lbs.)	8.32		92.92		30.51					
	Catch per DF (lbs.)	8.73		95.39		31.82					
3874	Number of observed tows	87	78	1	10	176	7	5		9	21
	Total trip catch, biomass adjusted (lbs)	1,003	284	8	28	1,323	21	10		48	78

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	48.00	42.20	0.40	8.70	99.30	7.50	4.90		7.00	19.40
	Catch per scallop pounds landed	0.05	0.01	**0.16**	0.01	0.03	0.00	0.00		0.02	0.01
	Catch per DA (lbs.)	26.97	8.19	**256.66**	3.24	16.41	1.91	1.44		6.36	3.10
	Catch per DF (lbs.)	34.26	11.70	**263.49**	3.65	21.56	2.21	1.48		7.25	3.45
3872	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	4				4					
	Total tow time (hours) on observed trips	1.70				1.70					
	Catch per scallop pounds landed	0.03				0.03					
	Catch per DA (lbs.)	8.60				8.60					
	Catch per DF (lbs.)	9.00				9.00					
3870	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		3			3					
	Total tow time (hours) on observed trips		0.80			0.80					
	Catch per scallop pounds landed		0.01			0.01					
	Catch per DA (lbs.)		11.54			11.54					
	Catch per DF (lbs.)		11.71			11.71					
3775	Number of observed tows	1	1			2	1				1
	Total trip catch, biomass adjusted (lbs)	31	2			34	20				20
	Total tow time (hours) on observed trips	0.80	0.60			1.40	0.80				0.80
	Catch per scallop pounds landed	**0.22**	**1.18**			0.24	**0.15**				0.15
	Catch per DA (lbs.)	**416.21**	**946.42**			433.15	**269.31**				269.31
	Catch per DF (lbs.)	**634.23**	**1,090.27**			653.30	**410.38**				410.38
3773	Number of observed tows	1	1			2	1				1
	Total trip catch, biomass adjusted (lbs)	2	4			6	6				6

Rotation management area		Discards (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	Landings (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	0.80	1.10			1.90	0.80				0.80
	Catch per scallop pounds landed	0.02	0.01			0.02	0.04				0.04
	Catch per DA (lbs.)	9.11	11.56			10.50	24.28				24.28
	Catch per DF (lbs.)	10.07	13.31			11.88	26.84				26.84
3675	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				42	42					
	Total tow time (hours) on observed trips				1.80	1.80					
	Catch per scallop pounds landed				**0.40**	0.40					
	Catch per DA (lbs.)				**346.44**	346.44					
	Catch per DF (lbs.)				**364.04**	364.04					
Total Number of observed tows		2,072	1,956	141	1,156	5,325	606	496	53	247	1,402
Total trip catch, biomass adjusted (lbs)		27,442	12,845	1,569	11,161	53,016	8,494	3,314	423	1,995	14,225
Total tow time (hours) on observed trips		1801.70	1573.10	114.00	1021.80	4510.60	381.40	272.70	46.90	166.30	867.30
Total Catch per scallop pounds landed		0.03	0.01	0.00	0.02	0.02	0.02	0.00	0.01	0.01	0.01
Total Catch per DA (lbs.)		28.82	10.92	5.49	16.57	17.17	19.81	5.52	5.76	7.91	10.50
Total Catch per DF (lbs.)		34.52	12.47	6.03	18.61	19.75	23.56	6.70	6.94	10.07	12.77

Table 10. **Winter flounder discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	8	1	72	88	169	2		44	10	56
	Total trip catch, biomass adjusted (lbs)	14	6	165	261	446	5		115	35	156
	Total tow time (hours) on observed trips	6.90	1.10	40.50	75.40	123.90	1.40		22.00	8.70	32.10
	Catch per scallop pounds landed	0.00	0.02	0.01	0.01	0.01	0.00		0.01	0.01	0.01
	Catch per DA (lbs.)	2.79	34.44	6.28	6.57	6.27	1.78		7.24	3.53	5.40
	Catch per DF (lbs.)	2.92	35.38	8.97	7.63	7.76	1.83		13.28	5.92	8.91
MA8	Number of observed tows	170	34	74	114	392	21	26		20	67
	Total trip catch, biomass adjusted (lbs)	308	60	119	561	1,048	27	150		73	251
	Total tow time (hours) on observed trips	166.70	34.60	75.40	94.10	370.80	17.40	21.80		16.00	55.20
	Catch per scallop pounds landed	0.00	0.00	0.00	0.01	0.00	0.00	0.00		0.00	0.00
	Catch per DA (lbs.)	2.17	1.22	3.38	5.48	3.19	0.86	3.43		1.96	2.22
	Catch per DF (lbs.)	2.36	1.28	3.58	5.93	3.44	0.90	3.71		2.12	2.38
MA7	Number of observed tows	3	28	10	13	54		2	1	15	18
	Total trip catch, biomass adjusted (lbs)	10	49	14	43	116		5	2	70	77
	Total tow time (hours) on observed trips	2.40	24.90	9.00	6.50	42.80		1.20	0.80	7.40	9.40
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
	Catch per DA (lbs.)	0.56	0.63	0.68	2.37	0.86		1.10	0.22	4.13	2.57
	Catch per DF (lbs.)	0.66	0.73	0.75	3.40	1.01		1.57	0.23	6.10	3.43
MA6	Number of observed tows	97	90	125	141	453	15	126	25	26	192
	Total trip catch, biomass adjusted (lbs)	1,184	262	177	456	2,078	81	810	62	104	1,056
	Total tow time (hours) on observed	104.70	61.50	117.60	124.30	408.10	9.70	38.60	23.80	15.10	87.20

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
	Catch per DA (lbs.)	12.06	3.06	1.49	3.67	4.87	8.47	14.94	0.97	1.99	5.89
	Catch per DF (lbs.)	14.73	3.43	1.76	4.35	5.74	10.58	20.87	1.27	2.75	7.94
MA5	Number of observed tows	1	10	2	1	14	2	1			3
	Total trip catch, biomass adjusted (lbs)	1	20	5	1	27	11	7			18
	Total tow time (hours) on observed trips	0.80	12.00	2.10	0.90	15.80	1.30	1.20			2.50
	Catch per scallop pounds landed	0.00	0.00	0.00	0.00	0.00	0.03	0.00			0.01
	Catch per DA (lbs.)	0.36	1.48	0.58	0.06	0.77	3.64	1.88			2.68
	Catch per DF (lbs.)	0.38	1.54	0.62	0.06	0.81	3.76	1.99			2.81
MA4	Number of observed tows	9	13			22	1	4		1	6
	Total trip catch, biomass adjusted (lbs)	46	15			61	2	10		4	15
	Total tow time (hours) on observed trips	6.70	12.70			19.40	0.90	5.10		1.00	7.00
	Catch per scallop pounds landed	0.01	0.00			0.00	0.00	0.00		0.02	0.00
	Catch per DA (lbs.)	4.75	0.37			1.21	0.68	0.39		9.69	0.54
	Catch per DF (lbs.)	5.79	0.38			1.29	0.93	0.59		10.25	0.81
MA2	Number of observed tows		1			1		1			1
	Total trip catch, biomass adjusted (lbs)		2			2		2			2
	Total tow time (hours) on observed trips		0.80			0.80		0.80			0.80
	Catch per scallop pounds landed		0.00			0.00		0.00			0.00
	Catch per DA (lbs.)		0.51			0.51		0.51			0.51
	Catch per DF (lbs.)		0.52			0.52		0.52			0.52
GB9	Number of observed tows	8		5		13	29		5	1	35
	Total trip catch, biomass adjusted (lbs)	9		35		44	104		26	18	148
	Total tow time (hours) on observed	6.50		5.00		11.50	23.70		4.90	0.80	29.40

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.00		0.02		0.00	0.01		0.02	0.01	0.01
	Catch per DA (lbs.)	0.54		13.71		2.36	6.45		10.19	10.57	7.27
	Catch per DF (lbs.)	0.56		14.69		2.49	6.77		10.92	15.54	7.85
GB8	Number of observed tows	1	102	15	20	138	9	45	26	15	95
	Total trip catch, biomass adjusted (lbs)	1	480	129	215	825	31	558	256	174	1,019
	Total tow time (hours) on observed trips	0.70	60.30	11.30	13.60	85.90	6.90	31.50	19.60	9.00	67.00
	Catch per scallop pounds landed	0.00	0.01	0.02	**0.03**	0.01	0.01	0.01	**0.03**	0.01	0.01
	Catch per DA (lbs.)	2.56	7.43	6.00	26.77	8.73	4.55	9.23	11.90	10.95	9.74
	Catch per DF (lbs.)	2.71	8.75	6.51	31.55	10.08	4.76	10.94	13.07	19.59	11.86
GB7	Number of observed tows	1	5	98	1	105		2	25		27
	Total trip catch, biomass adjusted (lbs)	5	31	914	6	956		4	110		114
	Total tow time (hours) on observed trips	0.80	3.40	77.40	0.90	82.50		0.80	18.20		19.00
	Catch per scallop pounds landed	0.00	**0.03**	**0.07**	0.01	0.06		0.00	0.01		0.01
	Catch per DA (lbs.)	1.79	**30.35**	**46.65**	26.77	40.86		0.49	5.83		4.22
	Catch per DF (lbs.)	5.97	**33.99**	**50.15**	28.01	47.50		1.33	6.31		5.57
GB6	Number of observed tows		2		1	3					
	Total trip catch, biomass adjusted (lbs)		8		2	10					
	Total tow time (hours) on observed trips		1.90		1.30	3.20					
	Catch per scallop pounds landed		0.00		0.00	0.00					
	Catch per DA (lbs.)		0.42		0.86	0.47					
	Catch per DF (lbs.)		0.48		0.96	0.53					
GB5	Number of observed tows	5			2	7	5	1	1	8	15
	Total trip catch, biomass adjusted (lbs)	5			3	8	40	9	2	39	89
	Total tow time (hours) on observed	5.90			2.30	8.20	5.90	0.70	0.80	6.90	14.30

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.01			0.00	0.00	0.05	0.00	0.00	0.01	0.00
	Catch per DA (lbs.)	6.75			0.62	1.59	51.75	1.30	0.13	6.00	2.91
	Catch per DF (lbs.)	7.15			0.66	1.69	54.79	2.46	0.15	6.61	3.48
GB4	Number of observed tows	12	2	47	91	152	22	16	9	28	75
	Total trip catch, biomass adjusted (lbs)	25	11	301	446	783	70	119	80	86	354
	Total tow time (hours) on observed trips	8.80	1.40	39.00	78.20	127.40	16.90	10.00	7.50	23.40	57.80
	Catch per scallop pounds landed	0.00	0.01	0.03	0.02	0.01	0.00	0.00	0.03	0.00	0.01
	Catch per DA (lbs.)	1.56	18.56	18.06	15.76	12.67	4.59	10.82	10.60	3.67	6.20
	Catch per DF (lbs.)	1.67	27.42	20.11	16.65	13.65	4.90	15.65	11.49	3.87	6.95
GB3	Number of observed tows	22	2	59	62	145	4	8	10	4	26
	Total trip catch, biomass adjusted (lbs)	182	10	681	242	1,116	23	81	61	16	181
	Total tow time (hours) on observed trips	16.50	1.50	35.40	54.10	107.50	2.60	4.70	7.20	2.10	16.60
	Catch per scallop pounds landed	0.03	0.00	0.03	0.01	0.02	0.00	0.00	0.00	0.00	0.00
	Catch per DA (lbs.)	28.12	5.53	37.11	6.39	17.29	4.62	10.31	3.84	2.89	5.29
	Catch per DF (lbs.)	29.68	13.48	39.33	6.87	18.77	8.89	13.95	4.08	3.38	6.46
GB2	Number of observed tows	85	60	19	180	344	41	21	7	118	187
	Total trip catch, biomass adjusted (lbs)	795	169	64	1,437	2,464	981	81	18	972	2,053
	Total tow time (hours) on observed trips	84.60	53.30	11.50	65.10	214.50	30.70	18.10	6.80	83.50	139.10
	Catch per scallop pounds landed	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.02	0.01
	Catch per DA (lbs.)	8.58	2.56	4.26	28.10	10.96	15.62	1.07	1.11	54.37	11.88
	Catch per DF (lbs.)	10.10	3.13	4.57	30.94	12.77	22.60	1.33	1.20	61.11	15.16
GB15	Number of observed tows		12	6	11	29		11	58	14	83
	Total trip catch, biomass adjusted (lbs)		141	38	34	214		160	496	155	811
	Total tow time (hours) on observed		9.70	4.60	3.60	17.90		7.90	43.60	7.10	58.60

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.01	0.00	0.00	0.00		0.02	0.01	0.01	0.01
	Catch per DA (lbs.)		12.07	1.62	1.24	3.40		18.84	15.63	4.96	11.35
	Catch per DF (lbs.)		18.87	2.06	2.66	5.49		**35.77**	23.03	10.63	19.99
GB14	Number of observed tows			2		2	1				1
	Total trip catch, biomass adjusted (lbs)			3		3	10				10
	Total tow time (hours) on observed trips			1.90		1.90	1.20				1.20
	Catch per scallop pounds landed			0.00		0.00	**0.04**				0.04
	Catch per DA (lbs.)			0.86		0.86	**48.21**				48.21
	Catch per DF (lbs.)			1.74		1.74	**51.05**				51.05
GB13	Number of observed tows	18	50	73	71	212	1	15	10	14	40
	Total trip catch, biomass adjusted (lbs)	175	315	533	254	1,276	3	171	58	128	360
	Total tow time (hours) on observed trips	21.10	31.40	43.00	56.70	152.20	0.80	7.00	6.00	8.90	22.70
	Catch per scallop pounds landed	**0.03**	0.02	0.03	0.01	0.02	**0.09**	0.01	0.00	0.01	0.01
	Catch per DA (lbs.)	**30.15**	**31.43**	**43.93**	4.23	14.53	**27.78**	13.15	7.40	3.93	6.74
	Catch per DF (lbs.)	**32.20**	**34.73**	**46.04**	4.58	15.67	29.07	14.99	7.75	4.29	7.38
GB11	Number of observed tows	101	87	309	113	610	16	33	19	94	162
	Total trip catch, biomass adjusted (lbs)	1,130	523	3,518	594	5,765	123	206	190	698	1,217
	Total tow time (hours) on observed trips	65.90	53.50	160.70	88.10	368.20	10.40	27.10	11.50	40.00	89.00
	Catch per scallop pounds landed	**0.04**	0.01	**0.04**	0.01	0.02	0.00	0.00	0.00	0.01	0.00
	Catch per DA (lbs.)	**39.92**	14.00	**58.37**	7.53	28.15	4.43	5.62	3.17	18.72	7.53
	Catch per DF (lbs.)	**42.09**	15.52	**61.61**	9.28	31.73	4.67	6.24	3.35	27.84	8.61
GB10	Number of observed tows	12	3	118	4	137		1	27	3	31
	Total trip catch, biomass adjusted (lbs)	39	9	503	41	592		3	84	28	116
	Total tow time (hours) on observed	8.90	2.60	97.50	3.40	112.40		0.60	21.60	2.90	25.10

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.00	0.01	0.01	**0.05**	0.01		0.00	0.00	**0.03**	0.00
	Catch per DA (lbs.)	2.03	10.96	12.76	27.07	9.70		2.69	2.41	18.83	3.08
	Catch per DF (lbs.)	2.24	12.36	13.77	28.85	10.54		4.65	2.58	20.07	3.34
GB1	Number of observed tows	237	50	42	120	449	58	17	39	32	146
	Total trip catch, biomass adjusted (lbs)	2,121	96	92	456	2,765	911	44	67	188	1,210
	Total tow time (hours) on observed trips	235.60	60.60	14.90	102.30	413.40	44.20	17.30	14.00	28.10	103.60
	Catch per scallop pounds landed	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01
	Catch per DA (lbs.)	23.25	3.67	4.07	4.32	11.26	13.30	1.70	2.97	2.72	6.49
	Catch per DF (lbs.)	26.20	3.83	12.61	4.64	13.07	15.27	1.77	9.18	2.91	7.73
4270	Number of observed tows	64			18	82	17			3	20
	Total trip catch, biomass adjusted (lbs)	152			62	215	55			8	63
	Total tow time (hours) on observed trips	59.10			14.90	74.00	14.70			2.70	17.40
	Catch per scallop pounds landed	0.00			0.01	0.00	0.00			0.01	0.00
	Catch per DA (lbs.)	3.42			2.89	3.25	1.90			5.50	2.08
	Catch per DF (lbs.)	3.67			3.04	3.46	2.07			6.22	2.26
4267	Number of observed tows		13	16	113	142	2	20	7	28	57
	Total trip catch, biomass adjusted (lbs)		41	78	1,279	1,398	7	91	64	320	482
	Total tow time (hours) on observed trips		13.70	13.80	67.90	95.40	1.10	12.20	5.50	18.90	37.70
	Catch per scallop pounds landed		0.00	0.01	**0.04**	0.01	0.02	0.00	**0.03**	0.01	0.01
	Catch per DA (lbs.)		0.67	6.38	**37.38**	12.90	6.17	1.78	**26.99**	9.34	5.43
	Catch per DF (lbs.)		0.72	6.91	**39.11**	13.84	6.46	1.94	**36.01**	9.77	5.85
4171	Number of observed tows		38	2	3	43					
	Total trip catch, biomass adjusted (lbs)		97	3	12	112					
	Total tow time (hours) on observed		27.20	1.30	2.50	31.00					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.00	0.01	0.03	0.01					
	Catch per DA (lbs.)		10.13	9.22	13.71	10.41					
	Catch per DF (lbs.)		10.41	12.34	14.06	10.76					
4170	Number of observed tows	8	2		9	19	12	1		4	17
	Total trip catch, biomass adjusted (lbs)	81	5		17	104	82	7		50	140
	Total tow time (hours) on observed trips	4.00	1.80		6.70	12.50	7.60	0.70		3.50	11.80
	Catch per scallop pounds landed	0.01	0.01		0.01	0.01	0.01	0.02		0.02	0.01
	Catch per DA (lbs.)	10.22	16.14		3.45	7.80	10.35	24.46		10.67	10.78
	Catch per DF (lbs.)	17.04	17.82		3.55	10.43	17.25	27.18		11.00	14.54
4169	Number of observed tows				11	11					
	Total trip catch, biomass adjusted (lbs)				18	18					
	Total tow time (hours) on observed trips				7.70	7.70					
	Catch per scallop pounds landed				0.00	0.00					
	Catch per DA (lbs.)				2.25	2.25					
	Catch per DF (lbs.)				2.62	2.62					
4167	Number of observed tows		57		32	89	2	44		56	102
	Total trip catch, biomass adjusted (lbs)		666		88	754	9	624		639	1,272
	Total tow time (hours) on observed trips		13.40		14.40	27.80	1.50	28.50		24.30	54.30
	Catch per scallop pounds landed		0.02		0.01	0.01	0.03	0.01		0.04	0.02
	Catch per DA (lbs.)		15.68		3.96	11.66	16.06	15.01		27.19	19.38
	Catch per DF (lbs.)		18.93		8.41	16.52	16.85	18.15		57.72	27.66
4166	Number of observed tows			6	36	42		1	17		18
	Total trip catch, biomass adjusted (lbs)			10	208	217		9	41		50
	Total tow time (hours) on observed			5.30	39.00	44.30		0.00	12.40		12.40

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed			0.00	0.00	0.00		0.01	0.00		0.00
	Catch per DA (lbs.)			0.16	10.51	2.66		7.13	0.80		0.95
	Catch per DF (lbs.)			0.24	12.30	3.75		13.54	1.24		1.49
4073	Number of observed tows	42	34	33	48	157	17	65		58	140
	Total trip catch, biomass adjusted (lbs)	128	185	145	193	652	55	439		345	839
	Total tow time (hours) on observed trips	31.00	16.40	27.70	34.00	109.10	12.20	12.70		33.60	58.50
	Catch per scallop pounds landed	0.00	0.01	0.00	0.01	0.00	0.00	0.02		0.01	0.01
	Catch per DA (lbs.)	3.27	7.01	3.78	4.09	4.30	2.07	22.31		9.67	10.26
	Catch per DF (lbs.)	4.19	8.66	3.97	4.76	5.04	2.75	29.22		11.61	12.97
4072	Number of observed tows	1	7			8	1				1
	Total trip catch, biomass adjusted (lbs)	2	27			29	7				7
	Total tow time (hours) on observed trips	0.60	4.80			5.40	0.60				0.60
	Catch per scallop pounds landed	0.00	0.00			0.00	0.01				0.01
	Catch per DA (lbs.)	11.13	4.84			5.08	**33.39**				33.39
	Catch per DF (lbs.)	15.53	4.86			5.16	**46.59**				46.59
4071	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				2	2					
	Total tow time (hours) on observed trips				1.70	1.70					
	Catch per scallop pounds landed				**0.04**	0.04					
	Catch per DA (lbs.)				14.56	14.56					
	Catch per DF (lbs.)				15.22	15.22					
4070	Number of observed tows				20	20				23	23
	Total trip catch, biomass adjusted (lbs)				128	128				329	329
	Total tow time (hours) on observed				26.30	26.30				31.10	31.10

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				1.26	1.26				3.16	3.16
	Catch per DA (lbs.)				693.10	693.10				1,734.22	1,734.22
	Catch per DF (lbs.)				738.65	738.65				1,848.19	1,848.19
4069	Number of observed tows	38	10	193	201	442	43	47	10	20	120
	Total trip catch, biomass adjusted (lbs)	163	96	1,176	1,968	3,403	207	1,621	214	139	2,181
	Total tow time (hours) on observed trips	28.20	7.50	144.40	183.50	363.60	33.90	22.80	8.40	16.90	82.00
	Catch per scallop pounds landed	0.01	0.00	0.02	0.02	0.01	0.02	0.03	0.01	0.01	0.02
	Catch per DA (lbs.)	5.96	1.39	20.11	25.86	14.73	17.33	45.51	7.05	4.10	19.50
	Catch per DF (lbs.)	6.48	2.45	21.68	27.34	17.87	18.51	69.23	7.38	4.44	22.97
4068	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				6	6					
	Total tow time (hours) on observed trips				0.90	0.90					
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				19.17	19.17					
	Catch per DF (lbs.)				20.29	20.29					
4067	Number of observed tows	1			1	2	2			2	4
	Total trip catch, biomass adjusted (lbs)	1			2	3	10			3	14
	Total tow time (hours) on observed trips	1.10			1.20	2.30	2.10			2.60	4.70
	Catch per scallop pounds landed	0.00			0.00	0.00	0.03			0.00	0.00
	Catch per DA (lbs.)	2.70			0.55	0.72	32.45			0.26	1.03
	Catch per DF (lbs.)	2.86			0.61	0.80	34.36			0.27	1.07
4066	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				2	2					
	Total tow time (hours) on observed				1.00	1.00					

Rotation management area		Discards (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	Landings (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				6.74	6.74					
	Catch per DF (lbs.)				7.01	7.01					
4065	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			4		4					
	Total tow time (hours) on observed trips			1.30		1.30					
	Catch per scallop pounds landed			0.01		0.01					
	Catch per DA (lbs.)			7.43		7.43					
	Catch per DF (lbs.)			7.96		7.96					
3874	Number of observed tows	2	3			5					
	Total trip catch, biomass adjusted (lbs)	10	5			16					
	Total tow time (hours) on observed trips	1.30	3.40			4.70					
	Catch per scallop pounds landed	0.02	0.00			0.00					
	Catch per DA (lbs.)	9.13	1.00			2.50					
	Catch per DF (lbs.)	27.06	1.03			2.91					
Total Number of observed tows		946	716	1,327	1,529	4,518	323	508	340	597	1,768
Total trip catch, biomass adjusted (lbs)		6,588	3,330	8,707	9,036	27,661	2,854	5,212	1,946	4,621	14,633
Total tow time (hours) on observed trips		868.80	515.40	940.60	1172.50	3497.30	247.70	271.30	234.60	394.50	1148.10
Total Catch per scallop pounds landed		0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
Total Catch per DA (lbs.)		9.74	4.56	13.66	9.63	9.27	8.64	9.65	4.55	9.12	8.11
Total Catch per DF (lbs.)		11.12	5.34	16.03	11.04	10.73	10.23	12.03	5.62	11.33	9.98

Table 11. **Yellowtail flounder discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation managemen t area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	29	48	98	89	264	11	6	43	26	86
	Total trip catch, biomass adjusted (lbs)	285	137	620	766	1,808	205	8	225	254	692
	Total tow time (hours) on observed trips	24.80	41.20	56.70	76.70	199.40	7.60	5.80	18.70	21.30	53.40
	Catch per scallop pounds landed	0.01	0.01	0.02	0.04	0.02	0.03	0.00	0.01	0.02	0.02
	Catch per DA (lbs.)	14.26	7.49	19.62	18.61	16.29	29.35	3.38	15.22	17.36	17.84
	Catch per DF (lbs.)	19.00	8.04	26.36	21.43	19.81	40.89	3.72	28.72	24.77	27.39
MA8	Number of observed tows	495	123	141	200	959	159	21	10	15	205
	Total trip catch, biomass adjusted (lbs)	4,084	1,184	631	3,378	9,277	1,140	472	68	128	1,807
	Total tow time (hours) on observed trips	477.00	102.50	140.90	166.10	886.50	115.90	11.40	7.90	12.10	147.30
	Catch per scallop pounds landed	0.03	0.02	0.01	0.04	0.03	0.01	0.02	0.00	0.01	0.01
	Catch per DA (lbs.)	22.64	18.70	9.27	29.71	21.80	12.62	29.19	1.90	4.45	10.58
	Catch per DF (lbs.)	25.35	20.20	10.21	32.33	24.04	14.55	32.26	2.20	5.61	12.34
MA7	Number of observed tows	70	102	86	22	280	24	26	6	8	64
	Total trip catch, biomass adjusted (lbs)	264	427	319	195	1,206	209	74	35	55	373
	Total tow time (hours) on observed trips	61.90	95.20	101.80	15.40	274.30	15.40	20.80	5.30	5.50	47.00
	Catch per scallop pounds landed	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00
	Catch per DA (lbs.)	2.58	3.24	4.60	9.43	3.72	7.03	1.96	2.38	3.23	3.76
	Catch per DF (lbs.)	2.93	3.49	5.18	12.95	4.16	8.11	2.14	2.69	4.78	4.39
MA6	Number of observed tows	103	245	157	99	604	96	89	55	27	267
	Total trip catch, biomass adjusted (lbs)	626	1,731	683	627	3,667	1,247	1,077	272	193	2,789
	Total tow time (hours) on observed	90.40	301.90	139.30	61.60	593.20	53.00	51.00	52.90	11.70	168.60

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.01	0.01
	Catch per DA (lbs.)	4.94	12.01	5.58	7.77	7.74	15.58	13.27	3.56	8.73	10.74
	Catch per DF (lbs.)	6.58	13.23	6.71	8.85	9.20	27.56	15.51	4.51	11.88	14.58
MA5	Number of observed tows	4	10	2		16	3	3			6
	Total trip catch, biomass adjusted (lbs)	9	10	2		20	9	9			18
	Total tow time (hours) on observed trips	3.60	9.90	1.90		15.40	2.20	1.60			3.80
	Catch per scallop pounds landed	0.01	0.00	0.00		0.00	0.01	0.00			0.00
	Catch per DA (lbs.)	5.46	1.08	0.97		1.61	5.57	0.79			1.36
	Catch per DF (lbs.)	5.93	1.14	1.01		1.70	6.20	1.15			1.90
MA4	Number of observed tows	4	2	11		17	3	2			5
	Total trip catch, biomass adjusted (lbs)	7	13	9		29	15	2			17
	Total tow time (hours) on observed trips	3.90	2.60	10.10		16.60	2.70	1.60			4.30
	Catch per scallop pounds landed	0.00	0.00	0.00		0.00	0.01	0.00			0.00
	Catch per DA (lbs.)	0.50	1.34	0.32		0.55	4.30	0.10			0.78
	Catch per DF (lbs.)	0.56	1.41	0.33		0.59	5.89	0.10			0.84
GB9	Number of observed tows	12		4	8	24	7		1		8
	Total trip catch, biomass adjusted (lbs)	42		6	167	216	35		3		38
	Total tow time (hours) on observed trips	10.30		3.90	9.30	23.50	6.20		1.00		7.20
	Catch per scallop pounds landed	0.01		0.00	0.03	0.02	0.01		0.02		0.01
	Catch per DA (lbs.)	7.20		2.48	17.60	12.03	6.25		26.43		6.61
	Catch per DF (lbs.)	7.86		2.66	20.80	13.65	6.62		46.26		7.05
GB8	Number of observed tows		44	46	39	129		25	7	16	48
	Total trip catch, biomass adjusted (lbs)		111	705	640	1,456		252	86	453	791
	Total tow time (hours) on observed		30.40	34.10	32.40	96.90		15.50	5.60	12.50	33.60

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed		0.00	0.09	0.02	0.01		0.00	0.01	0.02	0.01
	Catch per DA (lbs.)		2.82	32.00	13.67	13.45		7.45	4.35	20.10	10.39
	Catch per DF (lbs.)		3.60	34.85	16.98	16.39		9.68	4.76	26.50	12.91
GB7	Number of observed tows	6	12	47	25	90	6	14	4	6	30
	Total trip catch, biomass adjusted (lbs)	77	39	196	1,251	1,563	85	50	65	752	953
	Total tow time (hours) on observed trips	4.70	8.00	32.80	18.60	64.10	4.70	8.60	3.50	3.30	20.10
	Catch per scallop pounds landed	0.01	0.00	0.01	0.06	0.03	0.02	0.00	0.09	0.09	0.04
	Catch per DA (lbs.)	13.93	4.27	8.78	67.00	28.14	15.36	6.19	42.92	261.86	52.75
	Catch per DF (lbs.)	46.43	10.05	9.53	90.02	39.13	51.21	16.66	53.12	374.08	120.27
GB6	Number of observed tows		40	2	19	61	1		1	2	4
	Total trip catch, biomass adjusted (lbs)		225	21	171	418	6		7	5	18
	Total tow time (hours) on observed trips		37.50	1.50	23.20	62.20	0.70		0.80	2.20	3.70
	Catch per scallop pounds landed		0.01	0.04	0.03	0.01	0.05		0.01	0.00	0.00
	Catch per DA (lbs.)		10.79	38.91	18.10	13.52	47.77		12.97	0.70	2.33
	Catch per DF (lbs.)		12.36	41.94	19.99	15.30	159.23		13.98	0.77	2.59
GB5	Number of observed tows	6	93	178	64	341	5	24	91	18	138
	Total trip catch, biomass adjusted (lbs)	40	849	2,560	336	3,785	46	398	1,358	82	1,883
	Total tow time (hours) on observed trips	6.80	79.70	185.90	67.80	340.20	5.30	14.20	71.90	19.60	111.00
	Catch per scallop pounds landed	0.04	0.02	0.03	0.03	0.03	0.05	0.03	0.02	0.01	0.02
	Catch per DA (lbs.)	44.19	25.15	28.73	15.96	26.14	48.67	42.59	19.49	6.35	20.29
	Catch per DF (lbs.)	47.09	30.64	33.07	17.22	30.17	73.92	81.34	22.82	6.71	24.41
GB4	Number of observed tows	63	41	57	192	353	22	48	7	9	86
	Total trip catch, biomass adjusted (lbs)	679	246	280	1,109	2,314	109	762	136	510	1,516
	Total tow time (hours) on observed	134.00	21.30	47.00	164.10	366.40	17.20	23.60	5.90	5.40	52.10

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.04	0.01	0.02	0.02	0.02	0.01	0.03	0.05	**0.08**	0.03
	Catch per DA (lbs.)	41.63	23.53	13.32	22.24	23.69	7.14	66.41	18.14	**243.52**	41.73
	Catch per DF (lbs.)	44.56	35.48	14.74	23.97	26.47	7.62	97.86	19.65	**347.89**	49.76
GB3	Number of observed tows	39	8	62	110	219	1	16	1	3	21
	Total trip catch, biomass adjusted (lbs)	387	42	647	1,449	2,524	9	508	6	10	534
	Total tow time (hours) on observed trips	40.90	5.00	37.30	94.00	177.20	0.90	7.20	0.60	2.30	11.00
	Catch per scallop pounds landed	0.03	0.00	0.02	0.04	0.02	0.00	0.02	0.00	0.00	0.01
	Catch per DA (lbs.)	27.96	4.83	34.59	37.94	31.79	2.86	59.81	2.34	1.89	26.88
	Catch per DF (lbs.)	35.19	6.56	36.67	40.26	35.54	9.79	82.22	2.45	2.21	37.21
GB2	Number of observed tows	180	124	21	174	499	46	49	13	112	220
	Total trip catch, biomass adjusted (lbs)	4,684	798	85	2,695	8,262	6,068	592	109	2,182	8,951
	Total tow time (hours) on observed trips	158.30	103.90	19.80	135.60	417.60	28.70	29.60	13.10	79.40	150.80
	Catch per scallop pounds landed	0.04	0.01	0.00	0.03	0.03	**0.07**	0.01	0.01	0.05	0.04
	Catch per DA (lbs.)	46.77	10.08	4.51	48.68	32.59	**90.30**	9.24	6.68	**86.79**	51.80
	Catch per DF (lbs.)	56.23	12.43	4.84	56.99	38.90	**133.46**	11.75	7.20	**113.12**	68.69
GB15	Number of observed tows	5	16	89	2	112	5	14	42	1	62
	Total trip catch, biomass adjusted (lbs)	76	125	688	5	895	84	226	686	5	1,001
	Total tow time (hours) on observed trips	3.40	13.90	54.40	1.20	72.90	3.40	11.90	23.40	0.60	39.30
	Catch per scallop pounds landed	0.01	0.01	0.02	0.00	0.01	0.01	0.02	0.02	0.00	0.02
	Catch per DA (lbs.)	6.68	10.72	15.85	0.56	11.79	7.40	19.29	21.62	1.46	17.13
	Catch per DF (lbs.)	22.25	16.76	21.53	1.20	18.93	24.66	30.14	31.86	3.09	29.32
GB14	Number of observed tows	10	123	89	10	232	10	40	33	1	84
	Total trip catch, biomass adjusted (lbs)	203	860	669	90	1,822	175	208	184	10	578
	Total tow time (hours) on observed	6.90	88.90	88.10	9.90	193.80	6.90	30.70	32.80	1.10	71.50

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.08	0.01	0.01	0.01	0.01	0.07	0.00	0.00	0.07	0.00
	Catch per DA (lbs.)	79.47	15.35	18.44	18.25	18.26	68.53	3.73	5.36	26.08	6.21
	Catch per DF (lbs.)	126.34	25.21	30.95	21.17	29.59	108.94	6.12	9.12	27.13	10.28
GB13	Number of observed tows	16	44	41	63	164		27	1	7	35
	Total trip catch, biomass adjusted (lbs)	183	271	219	157	830		960	4	2,413	3,377
	Total tow time (hours) on observed trips	19.00	26.40	24.10	49.60	119.10		11.10	0.60	3.40	15.10
	Catch per scallop pounds landed	0.03	0.01	0.01	0.01	0.01		0.02	0.00	0.07	0.04
	Catch per DA (lbs.)	31.55	14.74	18.03	4.46	11.60		46.18	0.52	147.66	75.09
	Catch per DF (lbs.)	33.70	20.46	18.89	4.94	13.37		62.91	0.55	203.25	97.56
GB11	Number of observed tows	79	63	268	116	526	5	9	5	31	50
	Total trip catch, biomass adjusted (lbs)	615	304	1,500	331	2,750	27	262	33	317	640
	Total tow time (hours) on observed trips	53.20	45.30	141.60	95.30	335.40	3.20	3.00	3.00	16.30	25.50
	Catch per scallop pounds landed	0.02	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	Catch per DA (lbs.)	21.71	8.13	24.87	3.74	12.81	0.98	21.72	2.01	8.57	6.86
	Catch per DF (lbs.)	22.89	9.00	26.26	4.54	14.42	1.04	25.90	2.11	12.76	8.31
GB10	Number of observed tows	71	10	156	57	294		4	22	12	38
	Total trip catch, biomass adjusted (lbs)	1,248	40	530	2,137	3,956		27	41	1,237	1,305
	Total tow time (hours) on observed trips	54.10	4.90	139.30	48.70	247.00		1.80	17.10	9.20	28.10
	Catch per scallop pounds landed	0.07	0.03	0.01	0.06	0.03		0.02	0.00	0.07	0.02
	Catch per DA (lbs.)	64.75	30.43	13.00	64.38	41.83		21.07	1.29	69.67	25.64
	Catch per DF (lbs.)	71.39	52.59	14.03	80.33	47.87		36.41	1.39	88.15	29.33
GB1	Number of observed tows	281	95	71	198	645	68	9	56	68	201
	Total trip catch, biomass adjusted (lbs)	4,795	915	885	2,134	8,730	1,072	33	420	618	2,142
	Total tow time (hours) on observed	270.90	121.70	20.10	151.10	563.80	54.40	9.30	16.00	33.80	113.50

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.05	0.02	0.02	0.03	0.03	0.02	0.00	0.01	0.01	0.01
	Catch per DA (lbs.)	52.48	34.78	39.12	18.82	34.41	22.57	1.27	18.53	7.46	11.96
	Catch per DF (lbs.)	59.28	36.34	121.08	20.25	39.90	27.32	1.32	57.37	7.96	14.37
4270	Number of observed tows	134		5	28	167	52		4	7	63
	Total trip catch, biomass adjusted (lbs)	2,506		111	215	2,832	653		16	79	747
	Total tow time (hours) on observed trips	156.90		3.00	22.80	182.70	43.40		2.40	6.00	51.80
	Catch per scallop pounds landed	0.05		0.05	0.02	0.04	0.01		0.01	0.08	0.02
	Catch per DA (lbs.)	55.72		74.98	9.55	41.05	17.19		10.71	47.68	18.18
	Catch per DF (lbs.)	59.70		232.07	10.05	44.34	18.46		33.15	53.47	20.03
4269	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				6	6					
	Total tow time (hours) on observed trips				0.90	0.90					
	Catch per scallop pounds landed				0.05	0.05					
	Catch per DA (lbs.)				46.31	46.31					
	Catch per DF (lbs.)				48.59	48.59					
4267	Number of observed tows	6	130	39	37	212	4	45	8	18	75
	Total trip catch, biomass adjusted (lbs)	118	317	776	435	1,646	72	294	109	290	764
	Total tow time (hours) on observed trips	5.00	108.70	37.50	15.40	166.60	3.30	29.70	6.40	10.30	49.70
	Catch per scallop pounds landed	0.01	0.00	0.08	0.01	0.01	0.01	0.01	0.06	0.02	0.01
	Catch per DA (lbs.)	12.33	5.05	57.45	8.15	11.83	7.48	6.49	45.79	15.10	10.01
	Catch per DF (lbs.)	41.11	5.49	63.87	9.51	13.89	24.94	7.00	61.09	22.20	12.81
4173	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		0			0					
	Total tow time (hours) on observed		0.80			0.80					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		0.51			0.51					
	Catch per DF (lbs.)		0.57			0.57					
4171	Number of observed tows		32		5	37					
	Total trip catch, biomass adjusted (lbs)		18		54	71					
	Total tow time (hours) on observed trips		23.40		3.90	27.30					
	Catch per scallop pounds landed		0.00		**0.13**	0.00					
	Catch per DA (lbs.)		1.84		**59.86**	6.81					
	Catch per DF (lbs.)		1.89		61.39	7.00					
4170	Number of observed tows	16	1		5	22	5			3	8
	Total trip catch, biomass adjusted (lbs)	248	6		76	329	68			43	111
	Total tow time (hours) on observed trips	8.50	1.10		4.10	13.70	2.40			2.70	5.10
	Catch per scallop pounds landed	0.03	**0.26**		0.03	0.03	0.01			**1.37**	0.01
	Catch per DA (lbs.)	31.15	**231.46**		16.17	25.95	8.60			**753.53**	13.85
	Catch per DF (lbs.)	51.91	**236.44**		16.67	35.15	14.33			**803.06**	22.99
4169	Number of observed tows	1			5	6	3				3
	Total trip catch, biomass adjusted (lbs)	6			86	92	35				35
	Total tow time (hours) on observed trips	0.80			3.40	4.20	1.20				1.20
	Catch per scallop pounds landed	0.00			0.02	0.01	0.00				0.00
	Catch per DA (lbs.)	1.68			11.01	8.12	10.06				10.06
	Catch per DF (lbs.)	4.53			12.82	11.48	27.20				27.20
4167	Number of observed tows		6		7	13		8		1	9
	Total trip catch, biomass adjusted (lbs)		81		19	99		128		5	133
	Total tow time (hours) on observed		4.30		3.80	8.10		6.00		0.50	6.50

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed		0.01		0.00	0.00		0.01		0.00	0.01
	Catch per DA (lbs.)		9.74		0.95	3.59		16.59		0.46	6.92
	Catch per DF (lbs.)		17.59		2.03	7.23		31.51		0.97	14.01
4166	Number of observed tows	37	78	392	109	616	29	17	235	18	299
	Total trip catch, biomass adjusted (lbs)	745	952	3,444	1,076	6,217	407	365	1,713	129	2,614
	Total tow time (hours) on observed trips	23.50	37.10	290.50	117.80	468.90	18.50	8.50	174.90	18.30	220.20
	Catch per scallop pounds landed	0.04	0.03	0.01	0.01	0.01	0.02	0.01	0.00	0.00	0.01
	Catch per DA (lbs.)	44.94	34.63	15.39	19.89	19.31	24.52	16.21	8.99	5.28	10.29
	Catch per DF (lbs.)	80.59	65.82	23.54	23.26	28.75	43.97	29.26	14.21	6.19	16.03
4073	Number of observed tows	66	6		4	76	56			2	58
	Total trip catch, biomass adjusted (lbs)	312	15		19	347	704			6	711
	Total tow time (hours) on observed trips	49.70	4.90		2.50	57.10	20.40			0.60	21.00
	Catch per scallop pounds landed	0.01	0.01		0.00	0.01	0.05			0.00	0.03
	Catch per DA (lbs.)	8.73	12.20		2.07	7.51	34.85			0.70	24.25
	Catch per DF (lbs.)	11.48	12.38		2.10	9.26	51.04			1.52	39.52
4072	Number of observed tows		39			39	1				1
	Total trip catch, biomass adjusted (lbs)		179			179	6				6
	Total tow time (hours) on observed trips		30.10			30.10	0.60				0.60
	Catch per scallop pounds landed		0.01			0.01	0.01				0.01
	Catch per DA (lbs.)		14.69			14.69	26.77				26.77
	Catch per DF (lbs.)		15.18			15.18	37.36				37.36
4071	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				28	28					
	Total tow time (hours) on observed				1.70	1.70					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed				**0.44**	0.44					
	Catch per DA (lbs.)				**180.31**	180.31					
	Catch per DF (lbs.)				**188.51**	188.51					
4070	Number of observed tows				15	15				3	3
	Total trip catch, biomass adjusted (lbs)				155	155				48	48
	Total tow time (hours) on observed trips				20.50	20.50				4.90	4.90
	Catch per scallop pounds landed				**1.53**	1.53				**0.78**	0.78
	Catch per DA (lbs.)				**841.25**	841.25				**430.31**	430.31
	Catch per DF (lbs.)				**896.53**	896.53				**458.59**	458.59
4069	Number of observed tows	73	79	142	288	582	24	105	3	26	158
	Total trip catch, biomass adjusted (lbs)	562	1,764	728	4,809	7,863	175	5,050	12	1,531	6,768
	Total tow time (hours) on observed trips	37.00	36.30	111.70	258.60	443.60	20.20	43.20	2.50	21.00	86.90
	Catch per scallop pounds landed	0.02	0.01	0.01	0.04	0.02	0.01	0.03	0.00	0.02	0.02
	Catch per DA (lbs.)	20.59	24.59	12.18	50.23	30.90	14.64	**67.19**	0.41	24.17	37.43
	Catch per DF (lbs.)	22.39	43.61	13.14	54.59	37.61	15.64	**116.56**	0.43	26.48	47.89
4068	Number of observed tows				7	7		1		1	2
	Total trip catch, biomass adjusted (lbs)				21	21		10		4	14
	Total tow time (hours) on observed trips				6.40	6.40		0.90		0.80	1.70
	Catch per scallop pounds landed				0.03	0.03		0.05		0.01	0.03
	Catch per DA (lbs.)				16.56	16.56		58.15		4.47	13.16
	Catch per DF (lbs.)				17.30	17.30		**110.41**		4.65	14.77
4067	Number of observed tows	30	15	3	86	134	2	1	5	33	41
	Total trip catch, biomass adjusted (lbs)	179	59	16	645	899	8	6	67	201	282
	Total tow time (hours) on observed	25.90	14.80	2.60	98.10	141.40	1.80	0.60	3.40	36.20	42.00

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.04	0.00	0.01	0.04	0.01	0.02	**0.09**	0.03	0.01	0.02
	Catch per DA (lbs.)	33.70	1.66	8.84	19.12	11.75	25.69	**116.30**	38.19	5.95	7.87
	Catch per DF (lbs.)	37.09	1.76	12.02	20.50	12.62	27.20	**220.82**	51.93	6.38	8.53
4066	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				6	6					
	Total tow time (hours) on observed trips				1.00	1.00					
	Catch per scallop pounds landed				0.04	0.04					
	Catch per DA (lbs.)				16.00	16.00					
	Catch per DF (lbs.)				16.64	16.64					
4065	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			107		107					
	Total tow time (hours) on observed trips			1.30		1.30					
	Catch per scallop pounds landed			**0.31**		0.31					
	Catch per DA (lbs.)			**206.39**		206.39					
	Catch per DF (lbs.)			**221.13**		221.13					
3874	Number of observed tows	4	10			14	13	4			17
	Total trip catch, biomass adjusted (lbs)	12	11			23	70	13			83
	Total tow time (hours) on observed trips	3.50	7.70			11.20	6.30	2.70			9.00
	Catch per scallop pounds landed	0.00	0.00			0.00	0.01	0.00			0.01
	Catch per DA (lbs.)	0.92	0.51			0.67	4.79	1.12			3.14
	Catch per DF (lbs.)	1.27	0.72			0.93	6.57	1.91			4.72
Total Number of observed tows		1,840	1,640	2,208	2,087	7,775	661	607	653	474	2,395
Total trip catch, biomass adjusted (lbs)		22,993	11,729	16,434	25,290	76,448	12,739	11,786	5,657	11,559	41,740
Total tow time (hours) on observed trips		1734.90	1409.40	1727.20	1781.50	6653.00	446.50	350.30	469.70	341.00	1607.50
Total Catch per scallop pounds landed		0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.01

Rotation management area	Discards					Landings				
	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
Total Catch per DA (lbs.)	25.24	11.97	15.89	23.13	19.02	24.40	19.88	8.97	23.95	18.73
Total Catch per DF (lbs.)	30.42	14.50	19.63	26.50	22.78	32.93	26.41	12.01	29.66	24.64

Table 12. **Unclassified skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	75	2	86	91	254					
	Total trip catch, biomass adjusted (lbs)	25,313	85	24,565	35,201	85,163					
	Total tow time (hours) on observed trips	48.20	1.70	34.50	76.20	160.60					
	Catch per scallop pounds landed	0.91	0.08	**1.23**	**2.91**	1.40					
	Catch per DA (lbs.)	1093.83	51.79	**1607.78**	**1453.97**	1,325.19					
	Catch per DF (lbs.)	1480.06	57.36	**3145.12**	**2028.45**	1,946.92					
MA8	Number of observed tows	372	53	29	161	615					
	Total trip catch, biomass adjusted (lbs)	96,831	5,732	1,138	48,331	152,031					
	Total tow time (hours) on observed trips	342.00	52.40	17.30	138.50	550.20					
	Catch per scallop pounds landed	0.72	0.20	0.11	0.85	0.66					
	Catch per DA (lbs.)	705.59	324.00	105.89	735.67	657.11					
	Catch per DF (lbs.)	813.72	378.09	178.50	836.52	766.65					
MA7	Number of observed tows	298	80	63	72	513					
	Total trip catch, biomass adjusted (lbs)	36,638	8,581	8,296	23,043	76,558					
	Total tow time (hours) on observed trips	248.60	62.10	45.60	21.30	377.60					
	Catch per scallop pounds landed	0.31	0.23	0.37	1.10	0.38					
	Catch per DA (lbs.)	398.63	337.37	377.68	**1,229.00**	484.36					
	Catch per DF (lbs.)	473.34	378.59	572.55	1,743.47	599.16					
MA6	Number of observed tows	560	312	257	325	1,454			1		1
	Total trip catch, biomass adjusted (lbs)	61,023	29,553	33,745	54,480	178,801			284		284
	Total tow time (hours) on observed	350.30	173.30	177.60	155.40	856.60			0.90		0.90

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.33	0.19	0.36	0.53	0.33			0.01		0.01
	Catch per DA (lbs.)	349.42	271.61	448.62	664.57	405.77			17.61		17.61
	Catch per DF (lbs.)	491.46	328.46	634.99	878.32	542.96			20.50		20.50
MA5	Number of observed tows	30	118	26	1	175					
	Total trip catch, biomass adjusted (lbs)	3,353	11,348	3,251	1	17,952					
	Total tow time (hours) on observed trips	31.20	59.80	20.40	0.90	112.30					
	Catch per scallop pounds landed	0.26	0.25	0.21	0.00	0.23					
	Catch per DA (lbs.)	374.98	286.07	281.71	0.13	276.67					
	Catch per DF (lbs.)	431.02	335.95	322.00	0.14	319.92					
MA4	Number of observed tows	201	326	46		573	1				1
	Total trip catch, biomass adjusted (lbs)	27,429	13,075	3,427		43,930	22				22
	Total tow time (hours) on observed trips	174.10	210.40	34.10		418.60	0.90				0.90
	Catch per scallop pounds landed	0.37	0.07	0.32		0.16	0.02				0.02
	Catch per DA (lbs.)	351.04	123.30	306.41		224.87	7.03				7.03
	Catch per DF (lbs.)	459.45	170.16	422.63		303.71	7.58				7.58
MA3	Number of observed tows	75	113			188					
	Total trip catch, biomass adjusted (lbs)	17,546	2,068			19,615					
	Total tow time (hours) on observed trips	54.10	78.40			132.50					
	Catch per scallop pounds landed	0.30	0.02			0.10					
	Catch per DA (lbs.)	605.50	50.52			280.52					
	Catch per DF (lbs.)	939.68	83.75			452.25					
MA2	Number of observed tows	112	23			135					
	Total trip catch, biomass adjusted (lbs)	9,119	501			9,620					
	Total tow time (hours) on observed	58.90	24.20			83.10					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.13	0.02			0.10					
	Catch per DA (lbs.)	266.75	76.40			236.11					
	Catch per DF (lbs.)	431.18	109.21			373.79					
MA1	Number of observed tows	60				60	1				1
	Total trip catch, biomass adjusted (lbs)	8,124				8,124	423				423
	Total tow time (hours) on observed trips	34.60				34.60	1.40				1.40
	Catch per scallop pounds landed	0.11				0.11	0.02				0.02
	Catch per DA (lbs.)	217.57				217.57	55.80				55.80
	Catch per DF (lbs.)	336.90				336.90	89.28				89.28
GB9	Number of observed tows	29		2	15	46					
	Total trip catch, biomass adjusted (lbs)	1,466		252	11,447	13,165					
	Total tow time (hours) on observed trips	22.60		2.00	8.90	33.50					
	Catch per scallop pounds landed	0.39		**2.00**	**3.71**	1.89					
	Catch per DA (lbs.)	133.33		**2,515.48**	**3,042.85**	886.09					
	Catch per DF (lbs.)	141.85		**4,402.10**	**4,495.40**	1,017.51					
GB8	Number of observed tows	22	56	9	111	198			4		4
	Total trip catch, biomass adjusted (lbs)	310	14,207	1,413	27,766	43,696			130		130
	Total tow time (hours) on observed trips	15.60	34.50	6.10	58.00	114.20			3.20		3.20
	Catch per scallop pounds landed	0.15	0.27	0.89	0.61	0.43			0.19		0.19
	Catch per DA (lbs.)	48.07	408.16	929.32	527.23	457.87			217.29		217.29
	Catch per DF (lbs.)	50.30	536.25	1,332.00	782.28	631.42			320.22		320.22
GB7	Number of observed tows	14	37	10	50	111			2		2
	Total trip catch, biomass adjusted (lbs)	3,117	5,947	854	5,177	15,096			50		50
	Total tow time (hours) on observed	9.20	16.70	5.00	30.10	61.00			2.00		2.00

Rotation management area		**Discards**					**Landings**				
		(1) Jan-Mar	**(2) Apr-Jun**	**(3) Jul-Sep**	**(4) Oct-Dec**	**Total**	**(1) Jan-Mar**	**(2) Apr-Jun**	**(3) Jul-Sep**	**(4) Oct-Dec**	**Total**
	trips										
	Catch per scallop pounds landed	0.55	0.52	0.15	0.26	0.35			0.21		0.21
	Catch per DA (lbs.)	358.35	647.52	188.31	277.21	367.33			244.57		244.57
	Catch per DF (lbs.)	1,575.59	1,663.23	326.80	372.43	684.02			360.42		360.42
GB6	Number of observed tows	2	22	2		26					
	Total trip catch, biomass adjusted (lbs)	221	1,003	47		1,271					
	Total tow time (hours) on observed trips	1.40	20.80	1.70		23.90					
	Catch per scallop pounds landed	0.61	0.03	0.24		0.04					
	Catch per DA (lbs.)	599.56	51.22	277.80		63.16					
	Catch per DF (lbs.)	1,998.52	59.73	389.44		74.64					
GB5	Number of observed tows	3	47	106	11	167		1	1		2
	Total trip catch, biomass adjusted (lbs)	388	5,093	11,028	507	17,017		83	181		264
	Total tow time (hours) on observed trips	2.70	29.50	41.40	8.80	82.40		1.30	0.90		2.20
	Catch per scallop pounds landed	0.94	0.34	0.43	0.21	0.39		0.07	0.01		0.01
	Catch per DA (lbs.)	929.35	442.93	500.57	179.55	462.74		112.40	11.67		16.28
	Catch per DF (lbs.)	3,097.84	798.67	702.79	244.73	701.22		133.32	16.37		22.64
GB4	Number of observed tows		91	1	153	245	16	5			21
	Total trip catch, biomass adjusted (lbs)		15,717	51	17,444	33,211	85	243			329
	Total tow time (hours) on observed trips		38.40	0.80	131.60	170.80	12.50	3.70			16.20
	Catch per scallop pounds landed		0.52	0.24	0.29	0.37	0.01	0.27			0.02
	Catch per DA (lbs.)		1,267.38	284.60	455.05	652.30	5.60	428.90			20.76
	Catch per DF (lbs.)		1,933.20	398.97	496.20	765.02	5.98	633.61			22.40
GB3	Number of observed tows	30	27		34	91	11			1	12
	Total trip catch, biomass adjusted (lbs)	2,815	6,133		1,307	10,256	112			14	126
	Total tow time (hours) on observed	21.60	13.20		21.70	56.50	9.00			0.60	9.60

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.30	0.20		0.11	0.20	0.05			0.01	0.03
	Catch per DA (lbs.)	301.62	721.91		181.61	409.77	48.24			12.08	36.45
	Catch per DF (lbs.)	417.79	992.44		205.67	532.08	51.54			20.39	44.23
GB2	Number of observed tows	76	62		14	152	2	3			5
	Total trip catch, biomass adjusted (lbs)	14,973	1,352		606	16,932	29	137			166
	Total tow time (hours) on observed trips	41.80	19.60		11.30	72.70	1.60	0.80			2.40
	Catch per scallop pounds landed	0.18	0.04		0.01	0.10	0.09	0.02			0.02
	Catch per DA (lbs.)	207.85	43.88		27.46	135.51	90.03	25.65			29.38
	Catch per DF (lbs.)	498.11	68.05		35.22	252.15	96.17	37.90			42.46
GB15	Number of observed tows	7	16	161	55	239			113		113
	Total trip catch, biomass adjusted (lbs)	401	4,569	12,226	7,140	24,336			6,633		6,633
	Total tow time (hours) on observed trips	4.20	12.00	56.70	18.30	91.20			42.30		42.30
	Catch per scallop pounds landed	0.04	0.43	0.33	0.26	0.28			0.18		0.18
	Catch per DA (lbs.)	35.14	536.69	378.74	228.55	291.68			209.02		209.02
	Catch per DF (lbs.)	117.13	1,019.03	559.64	490.00	549.08			308.03		308.03
GB14	Number of observed tows	9	51	75		135		1			1
	Total trip catch, biomass adjusted (lbs)	1,213	5,679	5,679		12,571		178			178
	Total tow time (hours) on observed trips	5.70	40.90	77.10		123.70		0.80			0.80
	Catch per scallop pounds landed	0.51	0.18	0.09		0.14		0.01			0.01
	Catch per DA (lbs.)	518.60	278.70	182.03		233.17		20.74			20.74
	Catch per DF (lbs.)	864.33	547.49	313.96		420.95		40.47			40.47
GB13	Number of observed tows	4	34		105	143	1	12		3	16
	Total trip catch, biomass adjusted (lbs)	69	11,084		6,636	17,789	20	495		72	587
	Total tow time (hours) on observed	2.20	11.80		73.70	87.70	0.80	6.40		1.80	9.00

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	1.73	0.33		0.13	0.21	0.00	0.17		0.03	0.05
	Catch per DA (lbs.)	562.78	878.40		176.96	354.08	3.39	267.79		43.02	62.91
	Catch per DF (lbs.)	588.96	1,488.17		206.74	448.51	3.62	395.60		72.64	76.46
GB11	Number of observed tows	96	14		153	263				15	15
	Total trip catch, biomass adjusted (lbs)	1,387	2,032		5,561	8,979				316	316
	Total tow time (hours) on observed trips	63.20	5.20		72.60	141.00				7.30	7.30
	Catch per scallop pounds landed	0.05	0.03		0.08	0.05				0.01	0.01
	Catch per DA (lbs.)	49.01	77.47		124.78	90.62				11.98	11.98
	Catch per DF (lbs.)	51.68	85.89		173.19	108.71				20.23	20.23
GB10	Number of observed tows	7	13	5	113	138	4				4
	Total trip catch, biomass adjusted (lbs)	815	839	844	28,213	30,710	27				27
	Total tow time (hours) on observed trips	2.70	5.50	1.80	80.50	90.50	2.40				2.40
	Catch per scallop pounds landed	0.21	0.58	0.02	0.81	0.35	0.05				0.05
	Catch per DA (lbs.)	209.19	645.03	29.34	1,092.89	513.73	52.17				52.17
	Catch per DF (lbs.)	697.31	1,114.87	33.10	1,436.48	652.58	55.73				55.73
GB1	Number of observed tows	31		90	1	122					
	Total trip catch, biomass adjusted (lbs)	10,965		20,649	19	31,634					
	Total tow time (hours) on observed trips	16.30		20.70	0.70	37.70					
	Catch per scallop pounds landed	0.82		0.58	0.01	0.62					
	Catch per DA (lbs.)	864.37		912.29	28.63	878.95					
	Catch per DF (lbs.)	1,635.29		2,823.77	40.90	2,183.57					
4270	Number of observed tows	2		5		7					
	Total trip catch, biomass adjusted (lbs)	131		89		220					
	Total tow time (hours) on observed	1.70		3.00		4.70					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.16		0.04		0.07					
	Catch per DA (lbs.)	164.95		59.96		96.53					
	Catch per DF (lbs.)	312.06		185.59		244.60					
4267	Number of observed tows	23	2	10	59	94			5		5
	Total trip catch, biomass adjusted (lbs)	1,962	24	1,266	7,221	10,473			427		427
	Total tow time (hours) on observed trips	18.00	1.60	8.50	18.80	46.90			4.00		4.00
	Catch per scallop pounds landed	0.20	0.04	0.39	0.15	0.17			**0.30**		0.30
	Catch per DA (lbs.)	183.26	53.82	463.75	135.21	155.65			**340.75**		340.75
	Catch per DF (lbs.)	498.51	102.18	743.72	157.83	202.87			**502.16**		502.16
4173	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		106			106					
	Total tow time (hours) on observed trips		0.80			0.80					
	Catch per scallop pounds landed		0.76			0.76					
	Catch per DA (lbs.)		471.62			471.62					
	Catch per DF (lbs.)		522.41			522.41					
4172	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				386	386					
	Total tow time (hours) on observed trips				0.80	0.80					
	Catch per scallop pounds landed				**2.06**	2.06					
	Catch per DA (lbs.)				**1,560.48**	1,560.48					
	Catch per DF (lbs.)				**3,212.75**	3,212.75					
4171	Number of observed tows		48	1	5	54					
	Total trip catch, biomass adjusted (lbs)		1,447	582	1,660	3,690					
	Total tow time (hours) on observed		33.30	0.60	3.90	37.80					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.07	4.07	3.98	0.18					
	Catch per DA (lbs.)		151.31	6,426.93	1,851.45	349.62					
	Catch per DF (lbs.)		155.44	19,892.88	1,898.92	361.18					
4170	Number of observed tows	25				25					
	Total trip catch, biomass adjusted (lbs)	3,443				3,443					
	Total tow time (hours) on observed trips	10.70				10.70					
	Catch per scallop pounds landed	0.36				0.36					
	Catch per DA (lbs.)	400.85				400.85					
	Catch per DF (lbs.)	687.66				687.66					
4169	Number of observed tows	8				8					
	Total trip catch, biomass adjusted (lbs)	3,182				3,182					
	Total tow time (hours) on observed trips	4.40				4.40					
	Catch per scallop pounds landed	0.41				0.41					
	Catch per DA (lbs.)	891.53				891.53					
	Catch per DF (lbs.)	2,345.75				2,345.75					
4167	Number of observed tows	5	11		102	118					
	Total trip catch, biomass adjusted (lbs)	65	6,946		11,685	18,695					
	Total tow time (hours) on observed trips	3.60	7.90		31.60	43.10					
	Catch per scallop pounds landed	0.20	0.73		0.70	0.70					
	Catch per DA (lbs.)	65.81	902.01		497.39	581.07					
	Catch per DF (lbs.)	68.87	1,712.69		1,055.87	1,164.10					
4166	Number of observed tows	36	58	269	78	441	1		1		2
	Total trip catch, biomass adjusted (lbs)	5,953	2,302	18,941	3,617	30,812	64		13		78

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	23.70	34.40	230.60	83.70	372.40	0.80		1.00		1.80
	Catch per scallop pounds landed	0.35	0.12	0.06	0.05	0.07	0.07		0.00		0.00
	Catch per DA (lbs.)	359.01	155.21	123.52	131.52	145.16	74.02		0.63		3.53
	Catch per DF (lbs.)	643.85	400.04	191.18	153.77	223.94	123.37		1.32		7.34
4073	Number of observed tows	93	123	72	283	571				1	1
	Total trip catch, biomass adjusted (lbs)	13,400	9,869	18,434	34,473	76,176				170	170
	Total tow time (hours) on observed trips	35.90	32.70	61.10	94.10	223.80				0.80	0.80
	Catch per scallop pounds landed	0.80	0.35	0.52	0.72	0.59				0.02	0.02
	Catch per DA (lbs.)	545.27	396.57	831.47	647.58	610.07				18.81	18.81
	Catch per DF (lbs.)	752.06	496.38	853.60	876.05	772.22				18.92	18.92
4072	Number of observed tows	2			1	3					
	Total trip catch, biomass adjusted (lbs)	1,517			5	1,522					
	Total tow time (hours) on observed trips	1.10			0.80	1.90					
	Catch per scallop pounds landed	**3.05**			0.01	1.33					
	Catch per DA (lbs.)	**6,855.40**			5.72	1,408.61					
	Catch per DF (lbs.)	**9,565.68**			5.75	1,503.53					
4071	Number of observed tows	2			1	3					
	Total trip catch, biomass adjusted (lbs)	676			318	994					
	Total tow time (hours) on observed trips	1.20			0.90	2.10					
	Catch per scallop pounds landed	**2.76**			**6.12**	3.35					
	Catch per DA (lbs.)	**3,042.83**			970.42	1,807.62					
	Catch per DF (lbs.)	**7,607.08**			1,764.41	3,693.52					
4069	Number of observed tows	4	159		201	364	20	58		2	80
	Total trip catch, biomass adjusted (lbs)	70	32,211		19,618	51,899	134	8,111		57	8,302

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	26.80	55.40		177.30	259.50	15.10	20.20		1.20	36.50
	Catch per scallop pounds landed	0.15	0.21		0.17	0.19	0.01	0.19		0.03	0.15
	Catch per DA (lbs.)	80.92	428.58		329.31	382.73	11.19	298.43		37.64	204.27
	Catch per DF (lbs.)	84.87	743.50		363.29	528.75	11.95	447.53		63.54	274.87
4068	Number of observed tows		1	1	1	3					
	Total trip catch, biomass adjusted (lbs)		52	64	106	221					
	Total tow time (hours) on observed trips		0.90	0.90	0.90	2.70					
	Catch per scallop pounds landed		0.23	0.49	0.35	0.34					
	Catch per DA (lbs.)		291.79	574.67	329.93	363.26					
	Catch per DF (lbs.)		554.02	805.61	349.21	465.35					
4067	Number of observed tows	2	6	11		19					
	Total trip catch, biomass adjusted (lbs)	342	233	843		1,418					
	Total tow time (hours) on observed trips	1.60	4.80	7.40		13.80					
	Catch per scallop pounds landed	0.67	0.01	0.43		0.05					
	Catch per DA (lbs.)	661.16	18.32	516.03		95.27					
	Catch per DF (lbs.)	2,203.88	21.17	732.21		115.02					
3974	Number of observed tows	4		4		8					
	Total trip catch, biomass adjusted (lbs)	95		186		282					
	Total tow time (hours) on observed trips	2.00		2.10		4.10					
	Catch per scallop pounds landed	3.41		0.78		1.05					
	Catch per DA (lbs.)	1,483.42		1,253.38		1,322.84					
	Catch per DF (lbs.)	4,395.31		1,286.74		1,691.87					
3874	Number of observed tows	94	85	10		189					
	Total trip catch, biomass adjusted (lbs)	9,167	15,968	902		26,037					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	Total tow time (hours) on observed trips	38.20	28.60	7.90		74.70					
	Catch per scallop pounds landed	0.60	1.36	0.71		0.92					
	Catch per DA (lbs.)	397.27	801.33	697.95		587.82					
	Catch per DF (lbs.)	564.90	1,318.45	954.66		889.14					
3872	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	56				56					
	Total tow time (hours) on observed trips	0.80				0.80					
	Catch per scallop pounds landed	0.35				0.35					
	Catch per DA (lbs.)	113.46				113.46					
	Catch per DF (lbs.)	118.74				118.74					
3775	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	85				85					
	Total tow time (hours) on observed trips	0.80				0.80					
	Catch per scallop pounds landed	0.60				0.60					
	Catch per DA (lbs.)	1,122.12				1,122.12					
	Catch per DF (lbs.)	1,709.90				1,709.90					
3773	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		22			22					
	Total tow time (hours) on observed trips		1.30			1.30					
	Catch per scallop pounds landed		0.04			0.04					
	Catch per DA (lbs.)		62.59			62.59					
	Catch per DF (lbs.)		67.93			67.93					
Total Number of observed tows		2,415	1,992	1,351	2,197	7,955	57	80	127	22	286
Total trip catch, biomass adjusted (lbs)		363,659	213,777	168,772	351,967	1,098,175	917	9,247	7,718	630	18,511

Rotation management area	Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
Total tow time (hours) on observed trips	1721.70	1112.10	864.90	1321.30	5020.00	44.50	33.20	54.30	11.70	143.70
Total Catch per scallop pounds landed	0.36	0.17	0.22	0.41	0.28	0.02	0.14	0.06	0.01	0.06
Total Catch per DA (lbs.)	416.62	301.69	357.30	502.41	398.70	19.18	209.08	89.15	15.83	84.78
Total Catch per DF (lbs.)	585.64	419.48	531.33	648.81	551.65	21.80	325.84	133.28	23.16	119.02

Table 13. **Barndoor skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA8	Number of observed tows	6				6					
	Total trip catch, biomass adjusted (lbs)	4				4					
	Total tow time (hours) on observed trips	5.40				5.40					
	Catch per scallop pounds landed	0.00				0.00					
	Catch per DA (lbs.)	0.17				0.17					
	Catch per DF (lbs.)	0.18				0.18					
MA6	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	11				11					
	Total tow time (hours) on observed trips	0.80				0.80					
	Catch per scallop pounds landed	0.01				0.01					
	Catch per DA (lbs.)	4.91				4.91					
	Catch per DF (lbs.)	5.21				5.21					
GB9	Number of observed tows			6		6					
	Total trip catch, biomass adjusted (lbs)			22		22					
	Total tow time (hours) on observed trips			5.90		5.90					
	Catch per scallop pounds landed			0.01		0.01					
	Catch per DA (lbs.)			8.65		8.65					
	Catch per DF (lbs.)			9.27		9.27					
GB8	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				115	115					
	Total tow time (hours) on observed				2.10	2.10					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				23.80	23.80					
	Catch per DF (lbs.)				24.90	24.90					
GB6	Number of observed tows		12		4	16					
	Total trip catch, biomass adjusted (lbs)		10		25	35					
	Total tow time (hours) on observed trips		11.50		5.00	16.50					
	Catch per scallop pounds landed		0.00		0.00	0.00					
	Catch per DA (lbs.)		0.49		2.89	1.22					
	Catch per DF (lbs.)		0.56		3.21	1.38					
GB5	Number of observed tows		16	54	20	90					
	Total trip catch, biomass adjusted (lbs)		59	302	119	479					
	Total tow time (hours) on observed trips		16.50	62.50	21.30	100.30					
	Catch per scallop pounds landed		0.00	0.00	0.02	0.00					
	Catch per DA (lbs.)		2.59	3.72	10.21	4.15					
	Catch per DF (lbs.)		2.73	4.28	10.90	4.65					
GB4	Number of observed tows			3	32	35					
	Total trip catch, biomass adjusted (lbs)			11	53	63					
	Total tow time (hours) on observed trips			2.40	27.00	29.40					
	Catch per scallop pounds landed			0.00	0.00	0.00					
	Catch per DA (lbs.)			1.31	3.81	2.88					
	Catch per DF (lbs.)			1.46	4.02	3.10					
GB3	Number of observed tows			2	3	5					
	Total trip catch, biomass adjusted (lbs)			7	85	92					
	Total tow time (hours) on observed			1.30	1.90	3.20					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed			0.00	0.00	0.00					
	Catch per DA (lbs.)			1.11	3.61	3.06					
	Catch per DF (lbs.)			1.16	3.78	3.20					
GB2	Number of observed tows	10			9	19					
	Total trip catch, biomass adjusted (lbs)	282			783	1,065					
	Total tow time (hours) on observed trips	10.50			5.60	16.10					
	Catch per scallop pounds landed	0.01			**0.34**	0.05					
	Catch per DA (lbs.)	13.64			**194.72**	43.15					
	Catch per DF (lbs.)	14.61			**216.27**	46.48					
GB15	Number of observed tows		2	3		5					
	Total trip catch, biomass adjusted (lbs)		5	57		62					
	Total tow time (hours) on observed trips		2.00	3.20		5.20					
	Catch per scallop pounds landed		0.00	0.01		0.01					
	Catch per DA (lbs.)		1.55	8.33		6.18					
	Catch per DF (lbs.)		1.64	8.93		6.60					
GB14	Number of observed tows		4	4	1	9					
	Total trip catch, biomass adjusted (lbs)		6	127	1	134					
	Total tow time (hours) on observed trips		4.10	3.60	1.10	8.80					
	Catch per scallop pounds landed		0.00	**0.03**	0.01	0.00					
	Catch per DA (lbs.)		0.62	**63.70**	3.48	11.46					
	Catch per DF (lbs.)		0.95	**88.73**	3.62	16.96					
GB13	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				2	2					
	Total tow time (hours) on observed				1.70	1.70					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				0.00	0.00					
	Catch per DA (lbs.)				1.38	1.38					
	Catch per DF (lbs.)				1.46	1.46					
GB11	Number of observed tows			4		4					
	Total trip catch, biomass adjusted (lbs)			19		19					
	Total tow time (hours) on observed trips			2.00		2.00					
	Catch per scallop pounds landed			0.00		0.00					
	Catch per DA (lbs.)			0.65		0.65					
	Catch per DF (lbs.)			0.68		0.68					
GB10	Number of observed tows	2		26	3	31					
	Total trip catch, biomass adjusted (lbs)	63		165	4	232					
	Total tow time (hours) on observed trips	1.50		21.80	2.90	26.20					
	Catch per scallop pounds landed	0.00		0.00	0.00	0.00					
	Catch per DA (lbs.)	3.36		5.06	1.08	4.20					
	Catch per DF (lbs.)	3.71		5.46	1.14	4.57					
GB1	Number of observed tows	5			35	40					
	Total trip catch, biomass adjusted (lbs)	112			788	901					
	Total tow time (hours) on observed trips	5.50			25.90	31.40					
	Catch per scallop pounds landed	0.01			**0.03**	0.02					
	Catch per DA (lbs.)	5.91			**21.52**	16.19					
	Catch per DF (lbs.)	6.33			**22.89**	17.27					
4270	Number of observed tows				7	7					
	Total trip catch, biomass adjusted (lbs)				87	87					
	Total tow time (hours) on observed				5.10	5.10					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				10.50	10.50					
	Catch per DF (lbs.)				10.79	10.79					
4267	Number of observed tows		2	6	6	14					
	Total trip catch, biomass adjusted (lbs)		7	12	102	120					
	Total tow time (hours) on observed trips		2.00	6.30	5.90	14.20					
	Catch per scallop pounds landed		0.00	0.00	0.00	0.00					
	Catch per DA (lbs.)		0.23	1.12	2.99	1.64					
	Catch per DF (lbs.)		0.24	1.20	3.13	1.73					
4166	Number of observed tows			19		19					
	Total trip catch, biomass adjusted (lbs)			408		408					
	Total tow time (hours) on observed trips			18.40		18.40					
	Catch per scallop pounds landed			0.00		0.00					
	Catch per DA (lbs.)			6.12		6.12					
	Catch per DF (lbs.)			8.59		8.59					
4073	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				21	21					
	Total tow time (hours) on observed trips				0.70	0.70					
	Catch per scallop pounds landed				0.01	0.01					
	Catch per DA (lbs.)				3.90	3.90					
	Catch per DF (lbs.)				3.92	3.92					
4070	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				59	59					
	Total tow time (hours) on observed				3.30	3.30					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				1.68	1.68					
	Catch per DA (lbs.)				923.06	923.06					
	Catch per DF (lbs.)				983.72	983.72					
4069	Number of observed tows	2		10	18	30					
	Total trip catch, biomass adjusted (lbs)	83		46	102	231					
	Total tow time (hours) on observed trips	1.40		8.00	16.00	25.40					
	Catch per scallop pounds landed	0.01		0.00	0.00	0.00					
	Catch per DA (lbs.)	10.22		1.12	2.29	2.46					
	Catch per DF (lbs.)	11.28		1.19	2.41	2.61					
4068	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				2	2					
	Total tow time (hours) on observed trips				0.80	0.80					
	Catch per scallop pounds landed				0.01	0.01					
	Catch per DA (lbs.)				2.38	2.38					
	Catch per DF (lbs.)				2.48	2.48					
4067	Number of observed tows		36		20	56					
	Total trip catch, biomass adjusted (lbs)		172		148	321					
	Total tow time (hours) on observed trips		38.10		22.40	60.50					
	Catch per scallop pounds landed		0.00		0.01	0.01					
	Catch per DA (lbs.)		4.84		4.39	4.62					
	Catch per DF (lbs.)		5.13		4.71	4.93					
4066	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				1	1					
	Total tow time (hours) on observed				1.00	1.00					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				0.01	0.01					
	Catch per DA (lbs.)				2.67	2.67					
	Catch per DF (lbs.)				2.77	2.77					
Total Number of observed tows		26	72	137	170	405					
Total trip catch, biomass adjusted (lbs)		556	258	1,177	2,498	4,489					
Total tow time (hours) on observed trips		25.10	74.20	135.40	149.70	384.40					
Total Catch per scallop pounds landed		0.01	0.00	0.00	0.01	0.00					
Total Catch per DA (lbs.)		5.88	2.16	4.09	10.57	6.08					
Total Catch per DF (lbs.)		6.29	2.37	4.73	11.19	6.70					

Table 14. **Clearnose skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one-minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	1	3			4					
	Total trip catch, biomass adjusted (lbs)	70	250			320					
	Total tow time (hours) on observed trips	1.00	2.70			3.70					
	Catch per scallop pounds landed	0.50	0.34			0.37					
	Catch per DA (lbs.)	418.23	355.16			367.27					
	Catch per DF (lbs.)	438.59	385.81			396.24					
MA8	Number of observed tows	6	2		21	29					
	Total trip catch, biomass adjusted (lbs)	294	51		413	758					
	Total tow time (hours) on observed trips	8.10	2.10		18.40	28.60					
	Catch per scallop pounds landed	0.09	0.14		0.02	0.03					
	Catch per DA (lbs.)	87.66	115.46		32.08	45.45					
	Catch per DF (lbs.)	94.79	123.21		41.52	56.27					
MA7	Number of observed tows	41	1			42					
	Total trip catch, biomass adjusted (lbs)	2,412	65			2,477					
	Total tow time (hours) on observed trips	45.50	0.90			46.40					
	Catch per scallop pounds landed	0.09	0.31			0.09					
	Catch per DA (lbs.)	69.21	321.43			70.67					
	Catch per DF (lbs.)	73.05	349.17			74.60					
MA6	Number of observed tows	6	10		11	27					
	Total trip catch, biomass adjusted (lbs)	203	275		172	650					
	Total tow time (hours) on observed	5.10	9.20		8.80	23.10					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.02	0.01		0.00	0.01					
	Catch per DA (lbs.)	12.28	11.96		5.26	9.00					
	Catch per DF (lbs.)	13.89	12.23		5.51	9.51					
MA5	Number of observed tows	30	30	12	48	120					
	Total trip catch, biomass adjusted (lbs)	1,170	378	250	647	2,445					
	Total tow time (hours) on observed trips	25.70	25.30	12.10	43.40	106.50					
	Catch per scallop pounds landed	0.74	0.03	0.02	0.03	0.04					
	Catch per DA (lbs.)	117.96	24.40	20.88	17.34	32.73					
	Catch per DF (lbs.)	139.67	27.52	22.39	18.51	35.83					
MA4	Number of observed tows	129	76	12	49	266					
	Total trip catch, biomass adjusted (lbs)	6,508	8,983	143	877	16,510					
	Total tow time (hours) on observed trips	180.90	68.70	11.50	40.20	301.30					
	Catch per scallop pounds landed	0.24	0.32	0.00	0.10	0.18					
	Catch per DA (lbs.)	86.96	297.19	5.97	60.35	115.07					
	Catch per DF (lbs.)	93.81	327.68	6.27	62.17	123.56					
MA3	Number of observed tows	32	77	82	35	226					
	Total trip catch, biomass adjusted (lbs)	893	3,221	1,346	821	6,281					
	Total tow time (hours) on observed trips	-67.00	58.50	109.70	33.20	134.40					
	Catch per scallop pounds landed	0.11	0.17	0.02	0.10	0.06					
	Catch per DA (lbs.)	56.64	145.09	41.80	80.39	78.15					
	Catch per DF (lbs.)	62.78	164.70	45.35	84.20	85.79					
MA2	Number of observed tows	5	18	35		58					
	Total trip catch, biomass adjusted (lbs)	70	905	277		1,252					
	Total tow time (hours) on observed	4.10	15.00	44.60		63.70					

Rotation management area		Discards (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	Landings (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.13	0.18	0.01		0.03					
	Catch per DA (lbs.)	31.47	179.54	21.62		62.36					
	Catch per DF (lbs.)	33.50	195.23	24.02		68.57					
MA1	Number of observed tows	4	6	10	77	97					
	Total trip catch, biomass adjusted (lbs)	115	34	38	1,903	2,090					
	Total tow time (hours) on observed trips	3.90	5.30	10.50	52.80	72.50					
	Catch per scallop pounds landed	0.09	0.01	0.00	0.08	0.05					
	Catch per DA (lbs.)	47.92	13.69	1.75	71.16	39.14					
	Catch per DF (lbs.)	52.97	14.93	1.87	74.77	41.56					
GB8	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		2			2					
	Total tow time (hours) on observed trips		0.50			0.50					
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		0.09			0.09					
	Catch per DF (lbs.)		0.10			0.10					
GB7	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		1			1					
	Total tow time (hours) on observed trips		0.80			0.80					
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		2.09			2.09					
	Catch per DF (lbs.)		2.36			2.36					
GB6	Number of observed tows		2			2					
	Total trip catch, biomass adjusted (lbs)		70			70					
	Total tow time (hours) on observed		1.90			1.90					

Rotation management area		Discards (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	Landings (1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.00			0.00					
	Catch per DA (lbs.)		4.93			4.93					
	Catch per DF (lbs.)		5.65			5.65					
GB2	Number of observed tows				29	29					
	Total trip catch, biomass adjusted (lbs)				513	513					
	Total tow time (hours) on observed trips				21.30	21.30					
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				64.09	64.09					
	Catch per DF (lbs.)				77.38	77.38					
GB11	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				20	20					
	Total tow time (hours) on observed trips				0.60	0.60					
	Catch per scallop pounds landed				0.19	0.19					
	Catch per DA (lbs.)				794.37	794.37					
	Catch per DF (lbs.)				979.36	979.36					
4166	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			6		6					
	Total tow time (hours) on observed trips			1.20		1.20					
	Catch per scallop pounds landed			0.00		0.00					
	Catch per DA (lbs.)			11.93		11.93					
	Catch per DF (lbs.)			13.16		13.16					
4073	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				12	12					
	Total tow time (hours) on observed				2.60	2.60					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				0.00	0.00					
	Catch per DA (lbs.)				4.92	4.92					
	Catch per DF (lbs.)				5.29	5.29					
4069	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	15				15					
	Total tow time (hours) on observed trips	0.80				0.80					
	Catch per scallop pounds landed	0.00				0.00					
	Catch per DA (lbs.)	1.85				1.85					
	Catch per DF (lbs.)	2.04				2.04					
3974	Number of observed tows	1		1		2					
	Total trip catch, biomass adjusted (lbs)	130		40		170					
	Total tow time (hours) on observed trips	1.20		0.60		1.80					
	Catch per scallop pounds landed	0.37		**0.73**		0.42					
	Catch per DA (lbs.)	310.68		**1,173.20**		375.67					
	Catch per DF (lbs.)	325.81		**1,204.43**		393.32					
3874	Number of observed tows	1		2	10	13					
	Total trip catch, biomass adjusted (lbs)	200		45	178	423					
	Total tow time (hours) on observed trips	1.10		0.90	8.60	10.60					
	Catch per scallop pounds landed	**2.08**		**0.88**	0.04	0.09					
	Catch per DA (lbs.)	267.78		**1,423.37**	17.94	39.53					
	Catch per DF (lbs.)	**489.34**		**1,461.26**	19.99	45.27					
3775	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		20			20					
	Total tow time (hours) on observed		0.60			0.60					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed										
	Catch per DA (lbs.)										
	Catch per DF (lbs.)										
3773	Number of observed tows	1	1			2					
	Total trip catch, biomass adjusted (lbs)	10	25			35					
	Total tow time (hours) on observed trips	0.80	0.80			1.60					
	Catch per scallop pounds landed	0.07	0.09			0.08					
	Catch per DA (lbs.)	38.64	92.72			66.23					
	Catch per DF (lbs.)	42.70	100.72			72.56					
3675	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				30	30					
	Total tow time (hours) on observed trips				1.80	1.80					
	Catch per scallop pounds landed				0.29	0.29					
	Catch per DA (lbs.)				248.72	248.72					
	Catch per DF (lbs.)				261.36	261.36					
Total Number of observed tows		258	229	155	287	929					
Total trip catch, biomass adjusted (lbs)		12,090	14,280	2,144	5,586	34,100					
Total tow time (hours) on observed trips		211.20	192.30	191.10	231.70	826.30					
Total Catch per scallop pounds landed		0.14	0.09	0.01	0.03						
Total Catch per DA (lbs.)		71.29	103.75	20.78	36.07						
Total Catch per DF (lbs.)		77.73	114.19	22.34	38.96						

Table 15. **Little skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	12	93	86	92	283					
	Total trip catch, biomass adjusted (lbs)	2,197	11,412	9,594	19,615	42,819					
	Total tow time (hours) on observed trips	-12.50	85.80	70.50	78.60	222.40					
	Catch per scallop pounds landed	0.93	0.53	0.66	**1.43**	0.82					
	Catch per DA (lbs.)	**778.95**	487.95	478.83	**711.02**	579.94					
	Catch per DF (lbs.)	**836.34**	523.84	510.47	**757.08**	619.51					
MA8	Number of observed tows	188	323	262	290	1,063					
	Total trip catch, biomass adjusted (lbs)	14,396	40,636	18,881	116,210	190,122					
	Total tow time (hours) on observed trips	168.00	296.00	243.00	257.70	964.70					
	Catch per scallop pounds landed	0.16	0.31	0.31	**2.05**	0.56					
	Catch per DA (lbs.)	174.36	335.44	240.32	**1,337.12**	514.98					
	Catch per DF (lbs.)	191.91	358.09	255.79	**1,397.99**	550.39					
MA7	Number of observed tows	274	590	334	31	1,229					
	Total trip catch, biomass adjusted (lbs)	26,978	36,895	16,493	3,420	83,786					
	Total tow time (hours) on observed trips	232.10	462.90	253.00	22.00	970.00					
	Catch per scallop pounds landed	0.38	0.17	0.20	0.73	0.23					
	Catch per DA (lbs.)	315.36	191.73	169.22	552.57	219.55					
	Catch per DF (lbs.)	336.09	206.76	181.13	590.16	235.64					
MA6	Number of observed tows	271	440	631	270	1,612				1	1
	Total trip catch, biomass adjusted (lbs)	16,230	51,215	48,326	24,556	140,327				4	4
	Total tow time (hours) on observed	270.30	457.40	503.00	227.40	1458.10				0.90	0.90

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.09	0.37	0.35	0.17	0.23				0.00	0.00
	Catch per DA (lbs.)	137.38	356.68	294.10	219.38	260.84				0.60	0.60
	Catch per DF (lbs.)	148.96	375.28	313.79	234.43	278.33				0.63	0.63
MA5	Number of observed tows	30	224	144	160	558					
	Total trip catch, biomass adjusted (lbs)	4,461	7,787	6,909	4,879	24,035					
	Total tow time (hours) on observed trips	3.70	235.30	152.50	150.60	542.10					
	Catch per scallop pounds landed	0.97	0.09	0.14	0.13	0.14					
	Catch per DA (lbs.)	581.84	93.09	117.03	85.31	115.81					
	Catch per DF (lbs.)	633.98	98.87	126.37	92.58	124.43					
MA4	Number of observed tows	118	451	263	168	1,000					
	Total trip catch, biomass adjusted (lbs)	4,710	26,756	6,159	5,223	42,848					
	Total tow time (hours) on observed trips	115.20	357.40	190.20	140.80	803.60					
	Catch per scallop pounds landed	0.14	0.23	0.07	0.16	0.16					
	Catch per DA (lbs.)	93.66	205.81	69.87	104.72	134.61					
	Catch per DF (lbs.)	103.51	215.97	74.84	110.29	143.28					
MA3	Number of observed tows	1	3	54	32	90					
	Total trip catch, biomass adjusted (lbs)	74	17	686	808	1,586					
	Total tow time (hours) on observed trips	1.00	3.40	55.50	21.10	81.00					
	Catch per scallop pounds landed	0.71	0.03	0.02	0.08	0.03					
	Catch per DA (lbs.)	99.38	40.82	18.18	66.66	31.06					
	Catch per DF (lbs.)	120.46	44.73	20.84	70.06	34.88					
MA2	Number of observed tows	4	48	39	25	116					
	Total trip catch, biomass adjusted (lbs)	292	2,700	369	86	3,446					
	Total tow time (hours) on observed	2.90	42.40	35.00	18.00	98.30					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.55	0.23	0.03	0.02	0.12					
	Catch per DA (lbs.)	141.80	223.71	30.38	12.51	104.12					
	Catch per DF (lbs.)	157.60	229.24	34.70	13.29	112.28					
MA1	Number of observed tows			3	1	4					
	Total trip catch, biomass adjusted (lbs)			15	5	20					
	Total tow time (hours) on observed trips			3.50	0.80	4.30					
	Catch per scallop pounds landed			0.00	0.00	0.00					
	Catch per DA (lbs.)			0.75	0.29	0.54					
	Catch per DF (lbs.)			0.80	0.31	0.57					
GB9	Number of observed tows	27		9	33	69					
	Total trip catch, biomass adjusted (lbs)	863		2,602	4,622	8,088					
	Total tow time (hours) on observed trips	23.10		8.80	27.90	59.80					
	Catch per scallop pounds landed	0.14		1.51	1.78	0.76					
	Catch per DA (lbs.)	154.43		1,007.14	622.94	518.66					
	Catch per DF (lbs.)	163.51		1,079.08	658.98	550.00					
GB8	Number of observed tows	3	220	83	51	357					
	Total trip catch, biomass adjusted (lbs)	170	13,619	7,531	3,459	24,779					
	Total tow time (hours) on observed trips	2.50	128.40	64.00	43.70	238.60					
	Catch per scallop pounds landed	0.44	0.23	0.94	0.59	0.34					
	Catch per DA (lbs.)	502.30	253.15	337.19	263.33	276.53					
	Catch per DF (lbs.)	531.85	282.49	365.59	275.61	303.36					
GB7	Number of observed tows		6	107		113					
	Total trip catch, biomass adjusted (lbs)		213	11,121		11,334					
	Total tow time (hours) on observed		4.50	84.10		88.60					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.21	0.83		0.78					
	Catch per DA (lbs.)		197.33	535.40		518.69					
	Catch per DF (lbs.)		219.19	575.82		558.73					
GB6	Number of observed tows		6	3	19	28					
	Total trip catch, biomass adjusted (lbs)		234	85	1,188	1,507					
	Total tow time (hours) on observed trips		6.40	2.30	23.20	31.90					
	Catch per scallop pounds landed		0.01	0.15	0.22	0.04					
	Catch per DA (lbs.)		14.84	156.91	125.54	58.42					
	Catch per DF (lbs.)		16.79	169.12	138.62	65.45					
GB5	Number of observed tows	6	54	191	66	317			1		1
	Total trip catch, biomass adjusted (lbs)	1,839	2,776	12,803	7,036	24,455			198		198
	Total tow time (hours) on observed trips	6.80	55.90	204.50	72.40	339.60			1.20		1.20
	Catch per scallop pounds landed	**1.81**	0.18	0.23	0.83	0.31			0.02		0.02
	Catch per DA (lbs.)	**2,060.36**	162.17	193.89	376.92	238.09			14.87		14.87
	Catch per DF (lbs.)	**2,181.55**	165.66	210.93	400.94	255.14			16.19		16.19
GB4	Number of observed tows			60	54	114					
	Total trip catch, biomass adjusted (lbs)			10,263	1,858	12,122					
	Total tow time (hours) on observed trips			49.60	45.60	95.20					
	Catch per scallop pounds landed			0.80	0.19	0.54					
	Catch per DA (lbs.)			488.46	145.45	358.76					
	Catch per DF (lbs.)			540.87	153.23	389.72					
GB3	Number of observed tows	4	2	63	94	163					
	Total trip catch, biomass adjusted (lbs)	21	24	1,123	2,815	3,983					
	Total tow time (hours) on observed	3.90	1.70	37.90	82.80	126.30					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.01	0.08	0.05	0.10	0.07					
	Catch per DA (lbs.)	13.34	76.68	68.80	87.80	79.26					
	Catch per DF (lbs.)	13.86	80.86	72.08	93.10	83.66					
GB2	Number of observed tows	60	93	57	63	273					
	Total trip catch, biomass adjusted (lbs)	1,080	1,732	8,966	1,839	13,617					
	Total tow time (hours) on observed trips	64.60	78.60	51.10	-18.20	176.10					
	Catch per scallop pounds landed	0.02	0.03	0.41	0.09	0.09					
	Catch per DA (lbs.)	22.93	51.67	469.78	75.66	109.81					
	Catch per DF (lbs.)	24.12	54.07	504.55	83.55	116.80					
GB15	Number of observed tows		3	21		24					
	Total trip catch, biomass adjusted (lbs)		22	2,015		2,037					
	Total tow time (hours) on observed trips		3.00	19.00		22.00					
	Catch per scallop pounds landed		0.01	0.25		0.19					
	Catch per DA (lbs.)		7.06	180.96		142.34					
	Catch per DF (lbs.)		7.49	199.44		155.50					
GB14	Number of observed tows	1	58	13	10	82					
	Total trip catch, biomass adjusted (lbs)	99	730	773	718	2,320					
	Total tow time (hours) on observed trips	1.20	32.70	10.30	9.90	54.10					
	Catch per scallop pounds landed	0.40	0.01	0.06	0.09	0.02					
	Catch per DA (lbs.)	458.91	20.95	157.30	146.28	51.70					
	Catch per DF (lbs.)	485.91	31.28	228.45	169.68	74.49					
GB13	Number of observed tows		50	83	78	211					
	Total trip catch, biomass adjusted (lbs)		2,522	4,616	1,880	9,017					
	Total tow time (hours) on observed		31.10	47.60	60.40	139.10					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.24	0.24	0.11	0.19					
	Catch per DA (lbs.)		308.47	380.50	65.49	184.00					
	Catch per DF (lbs.)		322.58	398.78	68.62	192.74					
GB11	Number of observed tows		80	330	101	511					
	Total trip catch, biomass adjusted (lbs)		4,986	13,509	4,849	23,343					
	Total tow time (hours) on observed trips		45.80	170.80	87.10	303.70					
	Catch per scallop pounds landed		0.26	0.17	0.08	0.14					
	Catch per DA (lbs.)		334.93	223.02	117.69	200.10					
	Catch per DF (lbs.)		350.37	235.52	127.63	213.03					
GB10	Number of observed tows		6	148	29	183					
	Total trip catch, biomass adjusted (lbs)		30	26,843	3,197	30,070					
	Total tow time (hours) on observed trips		5.50	122.40	28.60	156.50					
	Catch per scallop pounds landed		0.03	0.45	1.11	0.47					
	Catch per DA (lbs.)		27.84	659.58	433.08	611.89					
	Catch per DF (lbs.)		31.01	711.46	458.83	658.68					
GB1	Number of observed tows	215	90		175	480					
	Total trip catch, biomass adjusted (lbs)	6,328	1,894		5,758	13,981					
	Total tow time (hours) on observed trips	187.10	90.60		151.50	429.20					
	Catch per scallop pounds landed	0.10	0.04		0.10	0.08					
	Catch per DA (lbs.)	104.90	72.03		60.93	77.18					
	Catch per DF (lbs.)	110.91	75.24		66.07	82.54					
4270	Number of observed tows	143			35	178					
	Total trip catch, biomass adjusted (lbs)	4,735			498	5,233					
	Total tow time (hours) on observed	135.90			29.40	165.30					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.09			0.09	0.09					
	Catch per DA (lbs.)	105.60			37.59	90.09					
	Catch per DF (lbs.)	112.27			40.03	95.81					
4269	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				35	35					
	Total tow time (hours) on observed trips				0.90	0.90					
	Catch per scallop pounds landed				0.30	0.30					
	Catch per DA (lbs.)				259.84	259.84					
	Catch per DF (lbs.)				272.62	272.62					
4268	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			15		15					
	Total tow time (hours) on observed trips			1.00		1.00					
	Catch per scallop pounds landed			0.04		0.04					
	Catch per DA (lbs.)			45.31		45.31					
	Catch per DF (lbs.)			48.84		48.84					
4267	Number of observed tows		120	36		156					
	Total trip catch, biomass adjusted (lbs)		1,498	4,670		6,169					
	Total tow time (hours) on observed trips		87.30	35.20		122.50					
	Catch per scallop pounds landed		0.03	0.58		0.12					
	Catch per DA (lbs.)		31.17	383.69		102.40					
	Catch per DF (lbs.)		33.64	415.46		110.60					
4171	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			154		154					
	Total tow time (hours) on observed			0.70		0.70					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed			1.05		1.05					
	Catch per DA (lbs.)			**755.14**		755.14					
	Catch per DF (lbs.)			**807.80**		807.80					
4170	Number of observed tows		2		24	26					
	Total trip catch, biomass adjusted (lbs)		293		2,867	3,161					
	Total tow time (hours) on observed trips		1.80		18.70	20.50					
	Catch per scallop pounds landed		0.86		**1.17**	1.13					
	Catch per DA (lbs.)		**936.85**		568.73	590.27					
	Catch per DF (lbs.)		**1,034.04**		586.26	610.82					
4167	Number of observed tows	1	108			109					
	Total trip catch, biomass adjusted (lbs)	74	5,476			5,551					
	Total tow time (hours) on observed trips	0.80	44.20			45.00					
	Catch per scallop pounds landed	0.53	0.16			0.16					
	Catch per DA (lbs.)	602.32	157.29			158.85					
	Catch per DF (lbs.)	637.75	175.77			177.49					
4166	Number of observed tows		20	97	28	145					
	Total trip catch, biomass adjusted (lbs)		140	1,221	1,751	3,111					
	Total tow time (hours) on observed trips		1.70	27.10	29.70	58.50					
	Catch per scallop pounds landed		0.01	0.01	0.04	0.02					
	Catch per DA (lbs.)		11.48	20.35	65.89	31.51					
	Catch per DF (lbs.)		16.66	32.42	77.03	45.24					
4073	Number of observed tows	91	25	30	77	223		1			1
	Total trip catch, biomass adjusted (lbs)	3,802	3,028	6,185	9,447	22,462		18			18
	Total tow time (hours) on observed	73.20	20.70	23.60	57.10	174.60		0.80			0.80

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.20	0.40	0.31	0.35	0.31		0.14			0.14
	Catch per DA (lbs.)	182.17	290.87	355.72	256.53	262.73		108.32			108.32
	Catch per DF (lbs.)	205.32	305.68	385.16	262.96	279.36		111.15			111.15
4072	Number of observed tows		58		11	69					
	Total trip catch, biomass adjusted (lbs)		14,697		1,384	16,081					
	Total tow time (hours) on observed trips		43.00		8.50	51.50					
	Catch per scallop pounds landed		0.99		1.20	1.01					
	Catch per DA (lbs.)		1,206.12		657.43	1,125.27					
	Catch per DF (lbs.)		1,246.61		671.11	1,160.91					
4071	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				831	831					
	Total tow time (hours) on observed trips				1.70	1.70					
	Catch per scallop pounds landed				12.98	12.98					
	Catch per DA (lbs.)				5,324.96	5,324.96					
	Catch per DF (lbs.)				5,566.86	5,566.86					
4070	Number of observed tows				31	31					
	Total trip catch, biomass adjusted (lbs)				18,876	18,876					
	Total tow time (hours) on observed trips				38.50	38.50					
	Catch per scallop pounds landed				181.50	181.50					
	Catch per DA (lbs.)				99,603.64	99,603.64					
	Catch per DF (lbs.)				106,149.53	106,149.53					
4069	Number of observed tows			224	99	323					
	Total trip catch, biomass adjusted			15,991	2,587	18,578					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	(lbs)										
	Total tow time (hours) on observed trips			167.20	88.00	255.20					
	Catch per scallop pounds landed			0.27	0.12	0.23					
	Catch per DA (lbs.)			267.63	71.17	193.32					
	Catch per DF (lbs.)			288.52	75.65	207.28					
4068	Number of observed tows				7	7					
	Total trip catch, biomass adjusted (lbs)				408	408					
	Total tow time (hours) on observed trips				6.80	6.80					
	Catch per scallop pounds landed				1.17	1.17					
	Catch per DA (lbs.)				443.28	443.28					
	Catch per DF (lbs.)				461.12	461.12					
4067	Number of observed tows	3	65	1	87	156					
	Total trip catch, biomass adjusted (lbs)	361	6,694	20	10,968	18,043					
	Total tow time (hours) on observed trips	2.90	71.60	0.90	98.50	173.90					
	Catch per scallop pounds landed	0.99	0.32	0.11	0.67	0.48					
	Catch per DA (lbs.)	1,127.42	284.76	110.76	325.10	312.46					
	Catch per DF (lbs.)	1,193.74	290.90	119.38	348.54	328.35					
4066	Number of observed tows				1	1					
	Total trip catch, biomass adjusted (lbs)				218	218					
	Total tow time (hours) on observed trips				1.00	1.00					
	Catch per scallop pounds landed				1.60	1.60					
	Catch per DA (lbs.)				605.33	605.33					
	Catch per DF (lbs.)				629.70	629.70					
4065	Number of observed tows			1		1					
	Total trip catch, biomass adjusted			75		75					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	(lbs)										
	Total tow time (hours) on observed trips			1.30		1.30					
	Catch per scallop pounds landed			0.22		0.22					
	Catch per DA (lbs.)			144.81		144.81					
	Catch per DF (lbs.)			155.15		155.15					
3974	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			5		5					
	Total tow time (hours) on observed trips			0.60		0.60					
	Catch per scallop pounds landed										
	Catch per DA (lbs.)										
	Catch per DF (lbs.)										
3874	Number of observed tows		60	1	23	84				1	1
	Total trip catch, biomass adjusted (lbs)		6,355	9	856	7,220				10	10
	Total tow time (hours) on observed trips		56.30	0.60	18.60	75.50				0.80	0.80
	Catch per scallop pounds landed		0.59	**2.96**	0.18	0.46				0.00	0.00
	Catch per DA (lbs.)		339.69	**2,397.61**	81.01	246.58				1.37	1.37
	Catch per DF (lbs.)		397.00	**2,407.05**	89.85	282.70				1.56	1.56
3870	Number of observed tows		1			1					
	Total trip catch, biomass adjusted (lbs)		15			15					
	Total tow time (hours) on observed trips		0.80			0.80					
	Catch per scallop pounds landed		0.06			0.06					
	Catch per DA (lbs.)		68.43			68.43					
	Catch per DF (lbs.)		69.44			69.44					
3773	Number of observed tows		1			1					
	Total trip catch, biomass adjusted		30			30					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	(lbs)										
	Total tow time (hours) on observed trips		0.80			0.80					
	Catch per scallop pounds landed		0.14			0.14					
	Catch per DA (lbs.)		98.51			98.51					
	Catch per DF (lbs.)		104.31			104.31					
Total Number of observed tows		1,452	3,300	3,377	2,268	10,397		1	1	2	4
Total trip catch, biomass adjusted (lbs)		88,710	244,425	238,027	264,747	835,909		18	198	15	231
Total tow time (hours) on observed trips		1282.70	2753.00	2636.80	1929.30	8601.80		0.80	1.20	1.70	3.70
Total Catch per scallop pounds landed		0.15	0.21	0.24	0.39			0.14	0.02	0.00	0.01
Total Catch per DA (lbs.)		166.75	226.85	232.01	316.53			108.32	14.87	1.00	8.21
Total Catch per DF (lbs.)		179.96	245.09	254.79	338.32			111.15	16.19	1.09	8.97

Table 16. **Smooth skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA8	Number of observed tows	186		1		187					
	Total trip catch, biomass adjusted (lbs)	8,555		34		8,590					
	Total tow time (hours) on observed trips	121.20		0.70		121.90					
	Catch per scallop pounds landed	0.15		0.41		0.15					
	Catch per DA (lbs.)	165.94		131.93		165.77					
	Catch per DF (lbs.)	174.99		157.33		174.91					
MA7	Number of observed tows	78		5		83					
	Total trip catch, biomass adjusted (lbs)	2,373		137		2,510					
	Total tow time (hours) on observed trips	87.70		3.00		90.70					
	Catch per scallop pounds landed	0.06		0.33		0.06					
	Catch per DA (lbs.)	83.43		107.33		84.46					
	Catch per DF (lbs.)	90.74		128.00		92.20					
MA6	Number of observed tows			13		13					
	Total trip catch, biomass adjusted (lbs)			410		410					
	Total tow time (hours) on observed trips			8.90		8.90					
	Catch per scallop pounds landed			0.17		0.17					
	Catch per DA (lbs.)			56.37		56.37					
	Catch per DF (lbs.)			67.23		67.23					
GB9	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			5		5					
	Total tow time (hours) on observed			0.80		0.80					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed			0.03		0.03					
	Catch per DA (lbs.)			10.42		10.42					
	Catch per DF (lbs.)			12.42		12.42					
GB8	Number of observed tows			2		2					
	Total trip catch, biomass adjusted (lbs)			261		261					
	Total tow time (hours) on observed trips			1.40		1.40					
	Catch per scallop pounds landed			**0.58**		0.58					
	Catch per DA (lbs.)			**188.15**		188.15					
	Catch per DF (lbs.)			**224.38**		224.38					
GB7	Number of observed tows			3		3					
	Total trip catch, biomass adjusted (lbs)			64		64					
	Total tow time (hours) on observed trips			1.90		1.90					
	Catch per scallop pounds landed			0.16		0.16					
	Catch per DA (lbs.)			51.89		51.89					
	Catch per DF (lbs.)			61.89		61.89					
GB6	Number of observed tows		13			13					
	Total trip catch, biomass adjusted (lbs)		1,365			1,365					
	Total tow time (hours) on observed trips		12.10			12.10					
	Catch per scallop pounds landed		0.04			0.04					
	Catch per DA (lbs.)		73.90			73.90					
	Catch per DF (lbs.)		84.67			84.67					
GB5	Number of observed tows		5	12		17					
	Total trip catch, biomass adjusted (lbs)		310	507		817					
	Total tow time (hours) on observed		5.00	8.70		13.70					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed		0.03	0.25		0.07					
	Catch per DA (lbs.)		60.33	80.17		71.27					
	Catch per DF (lbs.)		69.12	95.61		83.47					
GB4	Number of observed tows	66				66					
	Total trip catch, biomass adjusted (lbs)	2,569				2,569					
	Total tow time (hours) on observed trips	121.60				121.60					
	Catch per scallop pounds landed	0.17				0.17					
	Catch per DA (lbs.)	167.91				167.91					
	Catch per DF (lbs.)	179.37				179.37					
GB3	Number of observed tows	11			12	23					
	Total trip catch, biomass adjusted (lbs)	574			422	996					
	Total tow time (hours) on observed trips	9.00			9.10	18.10					
	Catch per scallop pounds landed	0.25			0.11	0.16					
	Catch per DA (lbs.)	**247.31**			96.17	148.42					
	Catch per DF (lbs.)	**264.19**			104.34	160.17					
GB2	Number of observed tows	7			24	31					
	Total trip catch, biomass adjusted (lbs)	340			377	717					
	Total tow time (hours) on observed trips	5.90			16.20	22.10					
	Catch per scallop pounds landed	0.21			0.08	0.11					
	Catch per DA (lbs.)	**208.34**			66.25	97.85					
	Catch per DF (lbs.)	**222.56**			71.88	105.80					
GB13	Number of observed tows	19			12	31					
	Total trip catch, biomass adjusted (lbs)	532			283	815					
	Total tow time (hours) on observed	12.50			7.80	20.30					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.09			0.10	0.09					
	Catch per DA (lbs.)	91.71			58.45	76.58					
	Catch per DF (lbs.)	97.97			70.66	86.38					
GB11	Number of observed tows				24	24					
	Total trip catch, biomass adjusted (lbs)				510	510					
	Total tow time (hours) on observed trips				17.90	17.90					
	Catch per scallop pounds landed				0.07	0.07					
	Catch per DA (lbs.)				59.22	59.22					
	Catch per DF (lbs.)				64.25	64.25					
GB10	Number of observed tows	5				5					
	Total trip catch, biomass adjusted (lbs)	399				399					
	Total tow time (hours) on observed trips	3.10				3.10					
	Catch per scallop pounds landed	**0.78**				0.78					
	Catch per DA (lbs.)	**784.86**				784.86					
	Catch per DF (lbs.)	**838.43**				838.43					
GB1	Number of observed tows				11	11					
	Total trip catch, biomass adjusted (lbs)				248	248					
	Total tow time (hours) on observed trips				-15.60	-15.60					
	Catch per scallop pounds landed				0.09	0.09					
	Catch per DA (lbs.)				74.60	74.60					
	Catch per DF (lbs.)				80.94	80.94					
4267	Number of observed tows			3		3					
	Total trip catch, biomass adjusted (lbs)			66		66					
	Total tow time (hours) on observed			2.10		2.10					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed			0.19		0.19					
	Catch per DA (lbs.)			62.07		62.07					
	Catch per DF (lbs.)			74.02		74.02					
4169	Number of observed tows				22	22				1	1
	Total trip catch, biomass adjusted (lbs)				1,246	1,246				135	135
	Total tow time (hours) on observed trips				14.70	14.70				0.90	0.90
	Catch per scallop pounds landed				0.23	0.23				**0.06**	0.06
	Catch per DA (lbs.)				159.22	159.22				**50.75**	50.75
	Catch per DF (lbs.)				185.30	185.30				**55.07**	55.07
4069	Number of observed tows	52			1	53					
	Total trip catch, biomass adjusted (lbs)	1,234			34	1,268					
	Total tow time (hours) on observed trips	40.60			0.60	41.20					
	Catch per scallop pounds landed	0.10			0.12	0.10					
	Catch per DA (lbs.)	103.36			106.94	103.45					
	Catch per DF (lbs.)	110.41			116.03	110.56					
4067	Number of observed tows		9	1		10					
	Total trip catch, biomass adjusted (lbs)		369	59		427					
	Total tow time (hours) on observed trips		8.70	0.70		9.40					
	Catch per scallop pounds landed		0.02	**0.46**		0.02					
	Catch per DA (lbs.)		30.44	150.44		34.18					
	Catch per DF (lbs.)		34.88	179.41		39.21					
3974	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			10		10					
	Total tow time (hours) on observed			0.60		0.60					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips Catch per scallop pounds landed Catch per DA (lbs.) Catch per DF (lbs.)										
Total Number of observed tows		424	27	42	106	599				1	1
Total trip catch, biomass adjusted (lbs)		16,576	2,044	1,552	3,120	23,292				135	135
Total tow time (hours) on observed trips		401.60	25.80	28.80	50.70	506.90				0.90	0.90
Total Catch per scallop pounds landed		0.12	0.03	0.24	0.11					**0.06**	0.06
Total Catch per DA (lbs.)		141.07	57.21	79.04	89.14					**50.75**	50.75
Total Catch per DF (lbs.)		150.49	65.55	94.26	99.64					**55.07**	55.07

Table 17. **Thorny skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA6	Number of observed tows		4			4					
	Total trip catch, biomass adjusted (lbs)		54			54					
	Total tow time (hours) on observed trips		4.70			4.70					
	Catch per scallop pounds landed		0.05			0.05					
	Catch per DA (lbs.)		40.30			40.30					
	Catch per DF (lbs.)		46.43			46.43					
MA5	Number of observed tows		11			11					
	Total trip catch, biomass adjusted (lbs)		2,470			2,470					
	Total tow time (hours) on observed trips		10.30			10.30					
	Catch per scallop pounds landed		**1.29**			1.29					
	Catch per DA (lbs.)		**1,039.06**			1,039.06					
	Catch per DF (lbs.)		**1,197.00**			1,197.00					
MA4	Number of observed tows		23			23					
	Total trip catch, biomass adjusted (lbs)		2,000			2,000					
	Total tow time (hours) on observed trips		24.10			24.10					
	Catch per scallop pounds landed		0.13			0.13					
	Catch per DA (lbs.)		103.29			103.29					
	Catch per DF (lbs.)		118.99			118.99					
GB8	Number of observed tows				15	15					
	Total trip catch, biomass adjusted (lbs)				605	605					
	Total tow time (hours) on observed				10.40	10.40					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed				0.12	0.12					
	Catch per DA (lbs.)				125.28	125.28					
	Catch per DF (lbs.)				131.08	131.08					
GB6	Number of observed tows		12			12					
	Total trip catch, biomass adjusted (lbs)		456			456					
	Total tow time (hours) on observed trips		11.10			11.10					
	Catch per scallop pounds landed		0.02			0.02					
	Catch per DA (lbs.)		32.17			32.17					
	Catch per DF (lbs.)		36.85			36.85					
GB5	Number of observed tows	1	5	1		7					
	Total trip catch, biomass adjusted (lbs)	10	249	1		260					
	Total tow time (hours) on observed trips	0.90	5.00	1.30		7.20					
	Catch per scallop pounds landed	0.08	0.03	0.00		0.02					
	Catch per DA (lbs.)	69.96	48.50	0.19		24.64					
	Catch per DF (lbs.)	77.20	55.58	0.21		27.50					
GB4	Number of observed tows	10				10					
	Total trip catch, biomass adjusted (lbs)	590				590					
	Total tow time (hours) on observed trips	8.10				8.10					
	Catch per scallop pounds landed	**0.67**				0.67					
	Catch per DA (lbs.)	**589.67**				589.67					
	Catch per DF (lbs.)	**650.67**				650.67					
GB3	Number of observed tows	2			1	3					
	Total trip catch, biomass adjusted (lbs)	19			2	21					
	Total tow time (hours) on observed	2.20			1.00	3.20					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.03			0.00	0.01					
	Catch per DA (lbs.)	30.86			0.39	3.69					
	Catch per DF (lbs.)	33.04			0.44	4.10					
GB2	Number of observed tows	63		1	79	143					
	Total trip catch, biomass adjusted (lbs)	1,105		11	1,733	2,849					
	Total tow time (hours) on observed trips	45.40		0.80	57.00	103.20					
	Catch per scallop pounds landed	0.05		0.09	0.05	0.05					
	Catch per DA (lbs.)	48.24		60.99	173.81	86.18					
	Catch per DF (lbs.)	51.65		67.77	210.01	95.59					
GB11	Number of observed tows				6	6					
	Total trip catch, biomass adjusted (lbs)				105	105					
	Total tow time (hours) on observed trips				4.00	4.00					
	Catch per scallop pounds landed				0.06	0.06					
	Catch per DA (lbs.)				235.48	235.48					
	Catch per DF (lbs.)				290.32	290.32					
GB10	Number of observed tows	64				64					
	Total trip catch, biomass adjusted (lbs)	5,183				5,183					
	Total tow time (hours) on observed trips	47.70				47.70					
	Catch per scallop pounds landed	**0.31**				0.31					
	Catch per DA (lbs.)	**276.07**				276.07					
	Catch per DF (lbs.)	**304.63**				304.63					
GB1	Number of observed tows	49			4	53					
	Total trip catch, biomass adjusted (lbs)	1,642			75	1,717					
	Total tow time (hours) on observed	57.60			3.40	61.00					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.09			0.01	0.06					
	Catch per DA (lbs.)	86.49			4.42	47.75					
	Catch per DF (lbs.)	92.62			4.96	52.25					
4270	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				6	6					
	Total tow time (hours) on observed trips				1.10	1.10					
	Catch per scallop pounds landed				0.02	0.02					
	Catch per DA (lbs.)				9.25	9.25					
	Catch per DF (lbs.)				10.35	10.35					
4267	Number of observed tows		1		147	148					
	Total trip catch, biomass adjusted (lbs)		6		4,023	4,029					
	Total tow time (hours) on observed trips		1.10		88.40	89.50					
	Catch per scallop pounds landed		0.00		0.12	0.09					
	Catch per DA (lbs.)		0.58		117.56	90.47					
	Catch per DF (lbs.)		0.62		123.01	94.94					
4166	Number of observed tows			1		1					
	Total trip catch, biomass adjusted (lbs)			11		11					
	Total tow time (hours) on observed trips			1.50		1.50					
	Catch per scallop pounds landed			0.00		0.00					
	Catch per DA (lbs.)			1.10		1.10					
	Catch per DF (lbs.)			1.21		1.21					
4069	Number of observed tows	39		3		42					
	Total trip catch, biomass adjusted (lbs)	3,125		32		3,157					
	Total tow time (hours) on observed	8.20		-20.60		-12.40					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.23		0.01		0.19					
	Catch per DA (lbs.)	207.06		5.93		154.08					
	Catch per DF (lbs.)	228.48		6.59		170.33					
4067	Number of observed tows	29	9			38					
	Total trip catch, biomass adjusted (lbs)	351	660			1,011					
	Total tow time (hours) on observed trips	24.90	8.70			33.60					
	Catch per scallop pounds landed	0.08	0.03			0.04					
	Catch per DA (lbs.)	70.32	54.52			59.13					
	Catch per DF (lbs.)	77.59	62.46			67.00					
Total Number of observed tows		257	65	6	254	582					
Total trip catch, biomass adjusted (lbs)		12,024	5,896	55	6,549	24,524					
Total tow time (hours) on observed trips		195.00	65.00	-17.00	165.30	408.30					
Total Catch per scallop pounds landed		0.16	0.07	0.00	0.07	0.08					
Total Catch per DA (lbs.)		145.74	90.94	2.63	90.76	102.03					
Total Catch per DF (lbs.)		158.34	103.06	2.90	98.95	112.36					

Table 18. **Winter (big) skate discards and landings per pound of scallop landings and per unit effort by rotational management area and quarter. Data include hail weights on observed tows only on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Tows outside of the rotational management areas are binned by one -minute squares. Highlighted cells represent catch per scallop or catch per unit effort that are in the top 10% of all cells.**

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
MA9	Number of observed tows	3	9	4	2	18					
	Total trip catch, biomass adjusted (lbs)	1,491	1,034	51	8	2,585					
	Total tow time (hours) on observed trips	2.80	14.70	3.40	1.60	22.50					
	Catch per scallop pounds landed	2.84	0.28	0.03	0.01	0.37					
	Catch per DA (lbs.)	2801.95	433.72	20.55	2.81	314.97					
	Catch per DF (lbs.)	3026.11	451.36	21.98	2.89	330.21					
MA8	Number of observed tows	81	91	5	24	201					
	Total trip catch, biomass adjusted (lbs)	4,866	17,412	33	508	22,819					
	Total tow time (hours) on observed trips	62.70	76.00	4.80	19.60	163.10					
	Catch per scallop pounds landed	0.08	0.36	0.01	0.03	0.17					
	Catch per DA (lbs.)	102.10	401.82	4.63	17.15	178.72					
	Catch per DF (lbs.)	110.02	421.33	5.05	17.69	188.96					
MA7	Number of observed tows	69	130	1	3	203					
	Total trip catch, biomass adjusted (lbs)	1,565	8,959	6	23	10,553					
	Total tow time (hours) on observed trips	63.10	148.70	1.20	3.00	216.00					
	Catch per scallop pounds landed	0.09	0.07	0.00	0.02	0.07					
	Catch per DA (lbs.)	100.26	93.34	1.50	25.82	90.40					
	Catch per DF (lbs.)	108.73	99.01	1.83	29.97	96.70					
MA6	Number of observed tows	144	12	34	11	201	1				1
	Total trip catch, biomass adjusted (lbs)	22,776	209	418	517	23,920	2				2
	Total tow time (hours) on observed	157.10	10.50	32.10	9.60	209.30	0.80				0.80

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.16	0.02	0.01	0.03	0.11	0.01				0.01
	Catch per DA (lbs.)	355.01	12.70	5.79	21.22	135.00	3.54				3.54
	Catch per DF (lbs.)	387.72	13.07	6.21	22.57	144.98	3.82				3.82
MA5	Number of observed tows	3	2	2	58	65					
	Total trip catch, biomass adjusted (lbs)	153	39	125	1,555	1,872					
	Total tow time (hours) on observed trips	2.80	3.00	2.00	64.10	71.90					
	Catch per scallop pounds landed	0.20	0.00	0.01	0.09	0.05					
	Catch per DA (lbs.)	134.99	3.66	15.53	59.63	40.68					
	Catch per DF (lbs.)	147.88	3.83	16.64	64.76	43.71					
MA4	Number of observed tows	49	12		3	64					
	Total trip catch, biomass adjusted (lbs)	2,034	280		36	2,350					
	Total tow time (hours) on observed trips	32.10	11.40		3.00	46.50					
	Catch per scallop pounds landed	0.12	0.01		0.01	0.04					
	Catch per DA (lbs.)	86.42	6.15		4.53	30.52					
	Catch per DF (lbs.)	93.63	6.42		4.74	32.23					
MA3	Number of observed tows	32				32					
	Total trip catch, biomass adjusted (lbs)	482				482					
	Total tow time (hours) on observed trips	-66.50				-66.50					
	Catch per scallop pounds landed	0.06				0.06					
	Catch per DA (lbs.)	34.04				34.04					
	Catch per DF (lbs.)	37.62				37.62					
MA1	Number of observed tows	2				2					
	Total trip catch, biomass adjusted (lbs)	20				20					
	Total tow time (hours) on observed	1.90				1.90					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.02				0.02					
	Catch per DA (lbs.)	8.18				8.18					
	Catch per DF (lbs.)	9.04				9.04					
GB9	Number of observed tows	2				2					
	Total trip catch, biomass adjusted (lbs)	9				9					
	Total tow time (hours) on observed trips	1.60				1.60					
	Catch per scallop pounds landed	0.00				0.00					
	Catch per DA (lbs.)	1.58				1.58					
	Catch per DF (lbs.)	1.67				1.67					
GB8	Number of observed tows	2	33	70	5	110		1			1
	Total trip catch, biomass adjusted (lbs)	24	1,074	4,611	63	5,771		32			32
	Total tow time (hours) on observed trips	1.70	23.50	54.40	4.40	84.00		0.70			0.70
	Catch per scallop pounds landed	0.06	0.02	**0.62**	0.01	0.07		0.00			0.00
	Catch per DA (lbs.)	69.53	18.16	**215.70**	6.72	64.00		2.19			2.19
	Catch per DF (lbs.)	73.62	20.26	**233.97**	6.91	70.28		2.43			2.43
GB7	Number of observed tows		2	3		5					
	Total trip catch, biomass adjusted (lbs)		94	120		214					
	Total tow time (hours) on observed trips		1.20	2.50		3.70					
	Catch per scallop pounds landed		**0.15**	0.07		0.10					
	Catch per DA (lbs.)		**193.61**	39.97		61.22					
	Catch per DF (lbs.)		**214.99**	43.98		67.43					
GB6	Number of observed tows				3	3					
	Total trip catch, biomass adjusted (lbs)				48	48					
	Total tow time (hours) on observed				3.80	3.80					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed				0.01	0.01					
	Catch per DA (lbs.)				7.51	7.51					
	Catch per DF (lbs.)				8.33	8.33					
GB5	Number of observed tows	2		41	6	49					
	Total trip catch, biomass adjusted (lbs)	10		678	122	810					
	Total tow time (hours) on observed trips	2.10		46.50	6.70	55.30					
	Catch per scallop pounds landed	0.01		0.01	0.04	0.01					
	Catch per DA (lbs.)	15.18		11.08	24.14	12.10					
	Catch per DF (lbs.)	16.07		12.03	26.78	13.16					
GB4	Number of observed tows			22	7	29					
	Total trip catch, biomass adjusted (lbs)			762	74	836					
	Total tow time (hours) on observed trips			18.30	6.00	24.30					
	Catch per scallop pounds landed			0.07	0.01	0.04					
	Catch per DA (lbs.)			38.27	6.11	26.10					
	Catch per DF (lbs.)			42.50	6.44	28.41					
GB3	Number of observed tows			5	17	22			2		2
	Total trip catch, biomass adjusted (lbs)			257	153	410			11		11
	Total tow time (hours) on observed trips			3.50	15.30	18.80			1.50		1.50
	Catch per scallop pounds landed			0.15	0.01	0.01			0.00		0.00
	Catch per DA (lbs.)			93.76	5.86	14.24			2.86		2.86
	Catch per DF (lbs.)			107.29	6.16	15.07			2.99		2.99
GB2	Number of observed tows	3	40	16	115	174					
	Total trip catch, biomass adjusted (lbs)	13	816	758	4,166	5,753					
	Total tow time (hours) on observed	3.80	42.90	16.70	85.30	148.70					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed	0.00	0.02	0.05	0.09	0.04					
	Catch per DA (lbs.)	0.47	30.74	46.45	**160.18**	59.81					
	Catch per DF (lbs.)	0.50	32.91	50.07	**180.87**	64.80					
GB15	Number of observed tows		1	6		7					
	Total trip catch, biomass adjusted (lbs)		12	392		404					
	Total tow time (hours) on observed trips		1.00	5.20		6.20					
	Catch per scallop pounds landed		0.00	0.11		0.07					
	Catch per DA (lbs.)		3.70	88.85		53.21					
	Catch per DF (lbs.)		3.92	102.37		59.16					
GB14	Number of observed tows		69	15		84					
	Total trip catch, biomass adjusted (lbs)		2,737	1,736		4,473					
	Total tow time (hours) on observed trips		44.00	12.40		56.40					
	Catch per scallop pounds landed		0.03	0.12		0.05					
	Catch per DA (lbs.)		76.72	**341.93**		109.76					
	Catch per DF (lbs.)		115.20	**491.61**		163.91					
GB13	Number of observed tows				8	8				13	13
	Total trip catch, biomass adjusted (lbs)				178	178				453	453
	Total tow time (hours) on observed trips				6.70	6.70				9.80	9.80
	Catch per scallop pounds landed				0.01	0.01				**0.04**	0.04
	Catch per DA (lbs.)				7.20	7.20				17.45	17.45
	Catch per DF (lbs.)				7.44	7.44				18.27	18.27
GB11	Number of observed tows		29	13	44	86				12	12
	Total trip catch, biomass adjusted (lbs)		675	488	1,120	2,283				309	309
	Total tow time (hours) on observed		33.60	9.00	35.10	77.70				8.60	8.60

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed		0.04	0.11	0.02	0.03				0.10	0.10
	Catch per DA (lbs.)		62.62	76.14	30.56	42.40				31.79	31.79
	Catch per DF (lbs.)		69.47	87.88	33.14	46.53				37.14	37.14
GB10	Number of observed tows			18	1	19					
	Total trip catch, biomass adjusted (lbs)			590	21	611					
	Total tow time (hours) on observed trips			14.20	1.00	15.20					
	Catch per scallop pounds landed			0.01	0.03	0.01					
	Catch per DA (lbs.)			16.25	13.91	16.16					
	Catch per DF (lbs.)			17.54	14.83	17.43					
GB1	Number of observed tows	4	3		60	67				1	1
	Total trip catch, biomass adjusted (lbs)	22	8		2,606	2,636				53	53
	Total tow time (hours) on observed trips	3.70	3.20		52.60	59.50				0.80	0.80
	Catch per scallop pounds landed	0.00	0.00		0.05	0.03				0.01	0.01
	Catch per DA (lbs.)	0.95	0.68		31.24	22.37				5.98	5.98
	Catch per DF (lbs.)	1.02	0.71		33.84	24.08				6.29	6.29
4270	Number of observed tows	5			2	7					
	Total trip catch, biomass adjusted (lbs)	24			49	73					
	Total tow time (hours) on observed trips	4.40			1.70	6.10					
	Catch per scallop pounds landed	0.00			0.05	0.00					
	Catch per DA (lbs.)	1.11			29.95	3.20					
	Catch per DF (lbs.)	1.20			33.60	3.46					
4267	Number of observed tows		58	4		62					
	Total trip catch, biomass adjusted (lbs)		1,676	114		1,790					
	Total tow time (hours) on observed		66.60	2.80		69.40					

Rotation management area		Discards					Landings				
		(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
	trips										
	Catch per scallop pounds landed		0.02	0.10		0.03					
	Catch per DA (lbs.)		26.75	63.52		27.77					
	Catch per DF (lbs.)		29.06	73.29		30.22					
4170	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				21	21					
	Total tow time (hours) on observed trips				1.70	1.70					
	Catch per scallop pounds landed				0.01	0.01					
	Catch per DA (lbs.)				4.42	4.42					
	Catch per DF (lbs.)				4.55	4.55					
4167	Number of observed tows		12			12		15			15
	Total trip catch, biomass adjusted (lbs)		430			430		240			240
	Total tow time (hours) on observed trips		8.20			8.20		9.00			9.00
	Catch per scallop pounds landed		0.04			0.04		0.01			0.01
	Catch per DA (lbs.)		34.43			34.43		11.52			11.52
	Catch per DF (lbs.)		38.84			38.84		12.80			12.80
4166	Number of observed tows		20	113	1	134					
	Total trip catch, biomass adjusted (lbs)		347	4,864	4	5,216					
	Total tow time (hours) on observed trips		1.70	41.00	1.00	43.70					
	Catch per scallop pounds landed		0.02	0.03	0.00	0.02					
	Catch per DA (lbs.)		28.55	62.50	0.49	52.80					
	Catch per DF (lbs.)		41.41	93.54	0.57	76.81					
4073	Number of observed tows	14	9	1	27	51					
	Total trip catch, biomass adjusted (lbs)	161	279	135	1,335	1,911					
	Total tow time (hours) on observed	12.00	7.80	1.10	20.50	41.40					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.01	0.05	0.05	0.08	0.05					
	Catch per DA (lbs.)	9.20	42.06	27.61	65.72	38.72					
	Catch per DF (lbs.)	10.59	44.62	28.69	66.62	41.34					
4072	Number of observed tows		3		3	6					
	Total trip catch, biomass adjusted (lbs)		17		59	76					
	Total tow time (hours) on observed trips		2.20		2.30	4.50					
	Catch per scallop pounds landed		0.00		0.05	0.01					
	Catch per DA (lbs.)		3.05		27.95	9.92					
	Catch per DF (lbs.)		3.07		28.53	10.00					
4070	Number of observed tows				2	2					
	Total trip catch, biomass adjusted (lbs)				42	42					
	Total tow time (hours) on observed trips				2.60	2.60					
	Catch per scallop pounds landed				**0.44**	0.44					
	Catch per DA (lbs.)				**240.86**	240.86					
	Catch per DF (lbs.)				**256.69**	256.69					
4069	Number of observed tows			26	24	50			17		17
	Total trip catch, biomass adjusted (lbs)			631	485	1,116			124		124
	Total tow time (hours) on observed trips			21.60	21.40	43.00			11.80		11.80
	Catch per scallop pounds landed			0.01	0.02	0.01			0.00		0.00
	Catch per DA (lbs.)			11.67	13.43	12.37			4.09		4.09
	Catch per DF (lbs.)			12.60	14.27	13.28			4.28		4.28
4067	Number of observed tows	2		1	13	16					
	Total trip catch, biomass adjusted (lbs)	17		11	478	506					
	Total tow time (hours) on observed	1.90		0.90	15.90	18.70					

Rotation management area		Discards (1) Jan-Mar	Discards (2) Apr-Jun	Discards (3) Jul-Sep	Discards (4) Oct-Dec	Discards Total	Landings (1) Jan-Mar	Landings (2) Apr-Jun	Landings (3) Jul-Sep	Landings (4) Oct-Dec	Landings Total
	trips										
	Catch per scallop pounds landed	0.05		0.06	0.05	0.05					
	Catch per DA (lbs.)	52.09		62.24	29.79	30.58					
	Catch per DF (lbs.)	55.16		67.09	33.05	33.88					
3974	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	67				67					
	Total tow time (hours) on observed trips	1.20				1.20					
	Catch per scallop pounds landed										
	Catch per DA (lbs.)										
	Catch per DF (lbs.)										
3874	Number of observed tows	17			2	19					
	Total trip catch, biomass adjusted (lbs)	736			34	769					
	Total tow time (hours) on observed trips	19.00			2.10	21.10					
	Catch per scallop pounds landed	0.12			0.06	0.12					
	Catch per DA (lbs.)	44.00			42.06	43.92					
	Catch per DF (lbs.)	50.67			45.13	50.40					
3773	Number of observed tows	1				1					
	Total trip catch, biomass adjusted (lbs)	15				15					
	Total tow time (hours) on observed trips	0.80				0.80					
	Catch per scallop pounds landed	0.11				0.11					
	Catch per DA (lbs.)	56.85				56.85					
	Catch per DF (lbs.)	62.84				62.84					
Total Number of observed tows		436	535	400	443	1,814	1	16	19	26	62
Total trip catch, biomass adjusted (lbs)		34,481	36,099	16,782	13,705	101,067	2	272	135	816	1,224
Total tow time (hours) on observed trips		308.20	500.20	293.60	387.00	1489.00	0.80	9.70	13.30	19.20	43.00
Total Catch per scallop pounds landed		0.10	0.06	0.03	0.04		0.01	0.01	0.00	0.04	0.01

Rotation management area	Discards					Landings				
	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total	(1) Jan-Mar	(2) Apr-Jun	(3) Jul-Sep	(4) Oct-Dec	Total
Total Catch per DA (lbs.)	122.36	78.25	40.97	33.14		3.54	7.67	3.96	**18.28**	10.67
Total Catch per DF (lbs.)	133.23	86.22	47.08	35.45		3.82	8.52	4.14	**19.60**	11.48

APPENDIX X

Written Comments Received by the Council on Draft Amendment 10 and the DSEIS

These comments are available by reaching the Council Office

APPENDIX XI

Public Hearing Summary of Comments
On Draft Amendment 10 and the DSEIS

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
Thomas R. Hill, *Chairman* | Paul J. Howard, *Executive Director*

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Hyannis, MA
May 20, 2003

The meeting was chaired by Mr. Mark Amorello, chairman of the Council's Scallop Committee. Also attending were Council staff members Andrew Applegate and Deirdre Valentine, as well as Dr. Dvora Hart of the NMFS, Northeast Fisheries Science Center. The audience consisted of five vessel owners or operators with general category permits (John Wood, Phillip Michaud Jr., Phillip Michaud, Sr., Hal Roke, and Chris Davis), one with a limited access permit (Barbara Bradgon), a representative of Oceania (Gib Brogan) and of the Fisheries Survival Fund (Dr. Trevor Kenchington).

Mark Amorello, acting as public hearing officer, opened the meeting at 7:10 pm with a short summary of the agenda for the meeting. Mr. Applegate presented a summary of the alternatives and the estimated impacts, pausing for questions and specific comments on occasion. The first part was on area rotation and other ways to improve scallop yield, followed by area access alternatives, initial management measures, overfishing definitions, minimizing bycatch, minimizing habitat impacts, data collection and monitoring, and framework adjustments and other process modifications.

Main points made by people offering comments included:

1. Requiring VMS on general category vessels would need the Council to change the general category possession limit to account for these costs.

2. A TAC for the general category fishery is acceptable, but should be adapted for each area based on the historic percent of total landings for each area. If a TAC is approved, the Gulf of Maine should have a TAC that is separate from the rest of the resource areas and should not apply to state waters.

3. Area rotation could have significant costs for fishermen targeting scallops under general category rules, especially if area rotation caused closures of large, nearshore areas, like those off of Cape Cod.

4. Indirectly, area rotation could also have significant effects on small vessels with general category permits, if limited access vessels fished on inshore scallop beds in response to area rotation closures elsewhere.

5. The Council should adopt 4-inch rings across the board as soon as possible.

6. The proposed alternative with bycatch closures could have unintended consequences and implications, when combined with area rotation and other alternatives that propose closing areas.

Commenting on fixed area management boundaries, Mr. Michaud (Jr., who made additional comments below), said that general category boats on the cape were only able to access the western part of those proposed zones. Of all the blocks on Georges Bank, many general category boats wouldn't travel that far for 400 lbs. of scallops. The general category fishery is limited by the 400 lbs., but would be hurt by closures of inshore rotation areas and would not be able to access other areas that might be open offshore.

Mrs. Bragdon commented that she supported going to 4-inch rings for all areas and to do it now, while the fishery is healthy, [rather than at a later time when using larger rings would have more impacts on the fishery].

Mr. Wood, a fisherman with a general category permit from Machias, ME; said that he is concerned about the effect of nearshore closed areas. He said that the proposal to require a VMS system would be an enormous expense for small vessels, not worth the benefits that would come from being able to fish in other controlled access areas. Closure of inshore areas would require the vessels to steam for long areas and might not be profitable for the vessels to do so, he explained. He thought that using VMS equipment might be profitable for those vessels if there were higher possession limits.

Mr. Michaud added that fishing in the rotation area labeled "GB1" area is very critical for Provincetown. He suggested that if the area rotation plan needed to close GB1, the Council should consider using the 70° W longitude line as the westward boundary. He added that VMS would be expensive, but might be worthwhile if it allowed general category access to areas when they were closed to the limited access vessels for area rotation. To limit the scallop catches from general category boats while it was closed to limited access fishing, he suggested lowering the scallop possession limit to 300 lb. for example. Responding from a question about being able to fish inside of Massachusetts waters during an area rotation closure, he explained that areas inside of three miles are closed between May 1 to Oct 31, when they are overloaded with lobster trap gear. Most of the general category vessels from the cape fish for scallops in federal waters, except for rare instances during the winter months. He added that the amount of scallops inshore of three miles would be insufficient to support general category scallop vessels in the area for very long.

Dvora Hart asked what the effect be if at most one of the two areas were closed at any one part of time. Mr. Michaud answered that the current price below $4/lb. makes it less profitable to fish GB2/Pollock Rip. He also indicated that access was constrained by draft in the shallow inlets near GB2. All the boats in one area might be too much for that area alone, he added.

After the presentation on the access options and effort allocations, Dr. Kenchington commented that the limited access fleet will have some bottom line positions on the Amendment 10 alternatives, including a sufficient number of days. 81 days will be insufficient. Mrs. Bradgon said that she doesn't understand why the full-time fleet would get 81 days when the resource is rebuilt. She asked why Amendment 10 would allow adding more general category permits when the full-time fleet would get only 81 days.

Mr. Michaud added that general category vessels would find it difficult to benefit from the proposed access program, due to cost and fuel capacity. Dockage in the summer in months prevents him from moving to closer ports. Increasing the general category possession limit would make it more feasible, but he thought it would be a mistake to do so because the general category fishery is open access. Such an action would increase the amount and size of vessels targeting scallops, he feared. He doesn't want to see those changes, because they might also target scallops inshore and affect other vessels.

Mr. Davis, owning a general category vessel fishing from Chatham, commented that the proposed habitat closures would have a greater impact on small boats with less than 50 days-at-sea. Habitat alternative 7 would close large portions of Pollock Rip and would have drastic effects, he predicted. Mr. Michaud agreed with Mr. Davis' comment, but the alternative would not affect the Provincetown fleet. It would, however, have substantial effects on the vessels from Chatham, or force vessels into open areas near Provincetown, increasing fishing pressure there. Mr. Davis added that Amendment 10 appears that someone is aiming at the general category to wipe it out.

Dr. Kenchington, commenting on the seasonal closure area alternative in Amendment 10, pointed out that the previous emphasis for seasonal closures was to avoid opening areas when high bycatch were expected. Thus bycatch would be minimized by not allowing concentrated fishing activity associated with a re-opening to occur when bycatch levels were high. He claimed that during the development of Amendment 10, this strategy had morphed into an alternative to have seasonal closures in general, open areas. He thought that seasonal closures to avoid bycatch may have some complicated interactions with spawning activity and other regulations, such as potential summer closures to protect turtles.

Mr. Wood supported the idea of allowing general category vessels to access the controlled access areas with VMS, but this action would need the Council to set a higher possession limit to pay for the VMS cost. He was concerned about the 2200 general category permits and suggested that the Council consider closing the general category and possibly eliminating unused permits. Mr. Michaud, on the other hand, recommends keeping the possession limit at 400 lbs, but thought that the TAC for the general category fishery would be problematic for vessels that fish for other species. The TAC would create and opening day and a big race to fish. A scallop season, thus created, might close before the end of the seasons that he and others fish for other species. Mr. Davis supported the alternative to prevent limited access vessels from fishing under general category rules.

Mr. Michaud, commenting on the proposed fishing year change explained that the general category boats benefit because the price is much better during the winter because the limited access vessels held over days, giving general category vessels an opportunity to fish for near shore scallops. He noted that some limited access vessels last year held over some days to the end of the fishing year, so that they could get an early start on their first trip for the new fishing year, possibly providing them with an extra 25 to 50 cents per pound. A shift of the start of the fishing year to the summer months would cause the seasonal price to be lower during the winter months when the general category vessels fish in his area, because the limited access vessels wouldn't be holding back on their fishing effort at that time in anticipation of a new fishing year day-at-sea allocation, he predicted.

He commented that small boats loose when management doesn't differentiate between the small boats and large boats. For example, the groundfish rolling closures hurt the small boat fleet because they were forced to tie up when the large boats could fish offshore or in other areas during the closures. Coupled with the day-at-sea reductions based on recent history during the rolling closures, it has hurt the Provincetown groundfish fleet.

Offshore boats benefited from the limited access program, since small vessels cannot steam to distant scallop beds and they often participate in other seasonal fisheries. Rotation closures can have same effect on the small ports as the groundfish rolling closures do. As an example of the type of effect that large boat management can have on inshore, small vessels, he explained that three years ago as inshore stocks increased local boats caught their limit in a few hours and began making money. Even with about 30 general category vessels fishing in the area, the biomass continued to increase even with this fishing effort. Then during the spring of 2002, twenty full-time scallop boats worked the area and the local catch rates declined within six weeks. Then the full-time boats moved offshore, but the small inshore vessels did not have that option. Currently, off of Provincetown the catches are now very low. Fishing earlier this winter near Pollock Rip, it was quite risky in a 42' boat, but it was necessary to survive. He asked that the Council keep the small boats in mind when making decisions.

No more comments were offered and Mark Amorello wrapped up the hearing, announcing the remaining hearings and the opportunity to provide written comment through July 16.

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Gloucester, MA
May 21, 2003

The meeting was chaired by Mr. Bud Fernandes, a member of the Council's Scallop Committee. Also attending were Council staff members Andrew Applegate and Deirdre Valentine. The audience consisted two representatives of the Fisheries Survival Fund (Dr. Trevor Kenchington and Mr. Shaun Gehan), a scallop advisor (Richard Taylor), R.J. Learson, and Janice Plante (Commercial Fisheries News).

Mr. Fernandes open the meeting at 7:15 with a short introduction about the meeting agenda. He also summarized the schedule for future public hearings and explained the schedule for providing written comment. Many of the audience had been closely involved in the development of Amendment 10 and were therefore familiar with the documents. Everyone agreed that the planned presentation on the alternatives and their effects was not needed.

Main points made by people offering comments included:

1. The Council should approve the status quo overfishing definition for use in Amendment 10 with area rotation.

2. There must be sufficient access in Amendment 10 to the large scallop biomass in the groundfish closed areas.

3. There is support for the day-at-sea tradeoff alternative, but there must be a more favorable tradeoff to attract fishing effort into the controlled access program.

4. There is insufficient analysis and justification for adopting closed areas to protect sensitive habitat.

5. Vessels with general category permits should benefit from area rotation and be allowed to participate in controlled access programs.

Dr. Kenchington said the FSF planned to be at most of the public hearings, with main input to be given at Fairhaven. By being at this meeting, he had hoped to hear the concerns and issues from general category and groundfish fishermen from Gloucester. He said that the FSF recognizes that we need a management plan that works for everybody, under NEPA rules. There has been considerable work on the Amendment, to everyone's credit. He thought that more work would be needed however before the Council could choose a final alternative.

One of the FSF concerns, Dr. Kenchington explained, was that the original core purpose of Amendment 10 was to increase the productivity of the resource. At least one of the central objectives of the amendment should be increasing sustainable yields, but he thought that turtle and habitat issues has caused the Council to lose sight of the main objective. FSF encourages the Council to pay attention to the crises issues, but not loose sight of the core purpose of the amendment. He explained that the single, most important thing in Amendment 10 is the amount of access to the groundfish closed areas, which now will be implemented through Framework 39 and there must be progress on those issues before the Council can make a rational choice among the Amendment 10 alternatives.

Dr, Kenchington added that one of the key issues for the full time industry is a large enough day-at-sea allocation to get by, which brings up the issue of whether fewer days with higher catches is or is not viable for the industry. Commenting on the day-at-sea allocations, he noted that the chair of the scallop committee promised that the Amendment 7 day-at-sea schedule would disappear with Amendment 10. His impression was that it is implicit that the Amendment 7 day-at-sea schedule would be removed with Amendment 10, but that he feared that the Amendment 7 schedule might continue and require annual frameworks to replace an obsolete day-at-sea allocation schedule.

He observed that people want to have an idea of how many days they would have in 2004. The FSFs position is that there should be no habitat closures in Amendment 10, but he will bring this up at a later meeting. On allocation of access to re-opened areas, the FSF position supports the trade-off option in the document, although it has some serious problems because it is the only thing left that isn't opposed by industry, such as use it or loose it alternative (with this the problem would be for vessels in the extreme north or south), or to allow trading of allocations. There are industry people that would like trading, Dr. Kenchington explained, but the FSF position opposes trading, for the same reasons as individual quotas. The only thing left with flexibility is the tradeoff system, but there are insufficient incentives to fish in the areas, by fixing the deficiencies in the old system.

One of the changes he recommended would be to make sure that the pounds per day are rich enough to entice fishing in the controlled access program. Increasing the pounds per day-at-sea, means that fewer days would be allocated, which may not be popular, but would have to be acceptable, he argued. The other thing that needs to be done is to charge 10 days no matter the length of the trip, even if it takes more days to take the controlled access possession limit.

Both of these suggestions may seem to be contrary to some people, Dr. Kenchington elaborated. The idea was that 120 days could be used in the open areas, but that fewer days would be used than allocated under the tradeoff system. An idea suggested a few years ago for Amendment 10 was to change the logic. Vessels would have so many days to fish in the open areas and a set number of pounds to be taken from the controlled access areas. It wouldn't matter how many days would be used in the open areas, since days would only be a currency of exchange. The alternatives to day-at-sea tradeoffs will be unacceptable to the industry, he re-iterated.

The FSF position is no habitat closures in Amendment 10. At present there are five reasons:

First, applying habitat closures doesn't make sense from a single species point of view. Scallops don't move [so the effects on fishery productivity are too high???].

Second, the DSEIS analysis fails to justify closures, Dr. Kenchington asserted. At a certain point about our knowledge, there is a gulf of information lacking about the changes that dredges cause on the cod habitat. It requires a big leap in assumptions to justify using closures to protect habitat using closures.

Third, Amendment 10 can only affect closures on scallop gear and the effects of single gear closures are not very effective for habitat conservation. Therefore, Dr. Kenchington thought that habitat closure alternatives are not a viable means to protect sensitive habitat, because it would continue to be affected by other types of mobile bottom tending gear.

Fourth, the Council is required to make a major decision about habitat closures in a Amendment 13, so in effect Amendment 10 would pre-judge what the analysis and public comment would be for Amendment 13. He added making these decisions in Amendment 10 would be a very awkward approach. He pointed out that Amendment 13 will have to consider closures to protect groundfish EFH from scallop gear, so it doesn't make sense to do in the scallop plan.

Lastly, one of the two preferred closure alternatives in Amendment 13, developed by the Joint Advisory Panel, is not even viable in Amendment 10 because it was not available for analysis in time.

Mr. Gehan, commenting on behalf of the FSF, said that the industry's intent is to have the members and the scallop fishermen comment on the issues themselves, primarily at the Fairhaven meeting but also in NJ and VA. He observed that there are certainly plenty of alternatives with closures to snatch defeat from the jaws of victory. At the end of the day, he said their comments will be supportive of adaptive management. He stated that the Council needs to show that we can manage a rebuilt resource – the success story of the northeast fisheries. The FSF recognizes that we want to manage so there won't be the boom and bust cycle as there had been before. On the other hand, he predicted that people won't understand 50 percent or greater reductions when the resource is rebuilt.

The regulations when talking about closures would identify special or unique areas of the ocean that closures is the only way to protect them. He thinks the analysis does not show this sufficiently to justify adopting closures as the main mechanism to protect EFH. To meet the obligations, the system needs to recognize the dramatic reductions in effort and existing closures and gear restrictions have already minimize the habitat effects. In the AOC case, Judge Kessler found that the plan had met the Magnuson Act responsibilities. What was wrong was under NEPA, was that there were insufficient range of alternatives that were required to be given a hard look. Considering the range with habitat closures and other alternatives, he thought Amendment 10 would meet all requirements of the settlement agreement, but it doesn't require the Council to close areas for habitat protection. Instead, he recommended that the Council rely on the existing and future scallop management actions that have already or will continue to minimize habitat impacts, through day-at-sea and gear regulation.

Mr. Taylor began his comment, expressing appreciation for the incredible amount of work that went into the development of Amendment 10. He thought that area rotation to gain growth and reproductive potential has been the main focus, but that the amendment has ballooned to address other options. A few years ago a decision was made to close no additional areas for scallop growth purpose, but all knew there were benefits to closing areas, but no guarantee that areas would re-open. He believed that Amendment 10 provides the roadmap to ensure that scallop closures would re-open and allow closures as part of a rational area rotation plan. The existing closures and future rotation areas do not have an identified measure of their value to habitat.

The controlled access day-at-sea tradeoffs need to be a positive choice, he recommended, taking effort off scallops off other areas. Lastly he recommended that access to the re-opened areas must be made available to the general category vessels, with whatever monitoring was required. Otherwise all the government for scallops is being done for a very small number of citizens, a policy that he said did not make sense. The habitat issue are already behind the 8-ball by keeping the HAPC closed for all this time, an area with considerable biomass. In a 1998 survey, it was estimated that 37.5 percent of the biomass in Closed Area II was within the HAPC boundaries. This amounted to about 10 to 15 million pounds of scallops, worth 10 to 20 million dollars per year, on par with the entire codfish fishery. He thought that the HAPC had been invoked because of a Valentine paper suggested that the codfish might benefit form the speckled gravel found there. Yet the highest centroid of Canadian fishery coincides with the centroid of the cod habitat in the Valentine paper. He thought it would be a legitimate transboundary issue to work on.

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Ellsworth, ME
May 27, 2003

The meeting was chaired by Mr. John Williamson, a member of the Council's Scallop Committee. Also attending were Council member Mr. Dana Rice and Council staff member Andrew Applegate. The audience consisted of several vessel owners or operators with general category permits (Gloria Britto, Ivory & Valerie Preston, Benjamin Crocker Sr. and Benjamin Crocker Jr., Russell & Daniel Leach, Adam Stanward, Stanley Sargeant, and Laurie Shreiber), one with a limited access permit (Gary Hatch, a scallop advisor), and a representative of the Conservation Law Foundation (Roger Fleming).

Mr. Willaimson, acting as public hearing officer, opened the meeting at 7:00 pm with a short summary of the agenda for the meeting. Due to the composition and interests of people attending the hearing, Mr. Williamson asked that the presentation focus on issues that might affect owners and operators of general category vessels. Mr. Applegate began the presentation by saying that it was important to review some of the parts of the amendment that could have an indirect effect on the general category fishery, including area rotation. He said that it may have a direct effect by temporarily closing some areas that are traditional fishing areas for general category vessels and an indirect effect by causing limited access vessels to fish in those areas in response to a rotation closure. He also indicated that some of the habitat and bycatch alternatives could have a direct effect as well. Issues such as effort allocation and the overfishing definition might have less effect on the general category fishery, and he would shorten the presentation in those areas. Mr. Applegate presented a summary of the alternatives and the estimated impacts, pausing for questions and specific comments on occasion. The first part was on area rotation and other ways to improve scallop yield, followed by area access alternatives, initial management measures, overfishing definitions, minimizing bycatch, minimizing habitat impacts, data collection and monitoring, and framework adjustments and other process modifications.

Main points made by people offering comments included:

1. Requiring VMS on general category vessels is acceptable if the Council changed the general category possession limit to account for these costs.

2. A TAC for the general category fishery is acceptable, but should be adapted for each area based on the historic percent of total landings for each area. If a TAC is approved, the Gulf of Maine should have a TAC that is separate from the rest of the resource areas and should not apply to state waters.

3. Area rotation could have significant costs for fishermen targeting scallops under general category rules, especially if area rotation caused closures of large, nearshore areas, like those off of Cape Cod.

4. Indirectly, area rotation could also have significant effects on small vessels with general category permits, if limited access vessels fished on inshore scallop beds in response to area rotation closures elsewhere.

5. The rotation management alternative that takes into consideration the sensitivity and recovery potential of habitat is not well developed to be useful for managing area rotation.

Mr. Felming asked about why Alternative 13 was not further developed. Mr. Applegate replied that data were lacking to define specific criteria relative to habitat sensitivity and recovery potential. Also, first pass of the dredge.

Mr. Stanward, a fisherman with general category permit with a 52' eastern rig, was concerned about getting back and forth from port with a 400-pound limit. He asked if it would be possible to have a multi-day bag limit or 500 – 600 lbs. per day, if general category vessels were required to use VMS. His boat has a 7' draft, which presents problems using some of the Cape Cod inlets. He said that this change would him to access areas farther offshore, if he had a multi-day possession limit. His primary fishery is for scallops.

Mr. Hatch, a limited access permit holder and scallop advisor, asked if the new style VMS transponder could be used, with considerably less cost. Mr. Williamson said that Boatracs is proposing a new system and NMFS may be accepting other vendors. He was also concerned about the TAC, wonders if it might cause problems in the Gulf of Maine if the local boats begin scalloping after a good year class. As a proposal, he recommended looking at a TAC east of Cape Cod to meet the needs of the local fishermen, separate from the rest of the resource. He suggested using 1985 to 1990 trip reports for anyone that landed scallops in the Gulf of Maine, would provide a good number for boats still fishing in the fishery.

Many fishermen commented about large vessels coming to fish when a good year class occurs near shore, making large catches and depleting local scallop beds.

Mr. Sargent, commenting on general category permit, prefers option 1. He was concerned with the impacts of setting a TAC because it may be insufficient for good year classes at nearshore beds. Recommends a split for the general category TAC for different areas, because each area has unique characteristics. Areas within three miles of Maine should not be included in a TAC set aside, because it is not part of the scheme of what the Council is trying to do. The preferred alternative of the 400 lb. possession limit should be raised or allotted in an amount for each vessel for a season, especially if with more reporting requirements. Many fishermen choose the general category permit, because they could not justify the cost of fishing under the limited access rules, Mr. Sargent reported. He thought that there was enough triggers or mechanisms that we don't need what is being proposed.

In the preferred alternative, Mr. Sargent asked if the vessels that exceed 45 days of scallop fishing would fall into another permit category. Mr. Applegate explained that the difference is that vessels fishing less than 45 days could participate in a call in program, but vessels that fished more than 45 days would have to operate VMS equipment. Mr. Sargent opposed the preferred option to keep the possession limit at 400 lbs. and recommended increasing the possession limit to 1,500 lb. per day for general category vessels with VMS requirements. VMS should not be required if the 400 lb. possession limit is retained, he thought.

Mr. Hatch recommended that the VMS polling costs are high and there should be a way to declare clocked out to be able to shut the VMS off while in port, similar to the program used in the herring fishery.

Mr. Fleming, from CLF, observed that the Council is getting good at maximizing yield. In addition, he encouraged the Council to get better at minimize risks to ecosystems, especially those for juvenile cod, which need special habitats for shelter and food. The current status is that we are at an all time low in the number of cod reaching adulthood. More specifically to Amendment 10, Mr. Fleming was disappointed that there is not a better developed alternative with habitat management incorporated into area rotation management. Also, he was somewhat disappointed that there is not a broader range of preferred alternatives, to solicit better public comment. In general, CLF supports rotation management that incorporates habitat concerns. They also support closed areas focused on hard bottom habitats in South Channel and northern edge of Georges Bank, like Alternative 3a.

Meeting adjourned at 9:30.

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Fairhaven, MA
May 29, 2003

The meeting was chaired by Mr. Mark Amorello, chairman of the Council's Scallop Committee. Also attending were Council staff members Andrew Applegate and Leslie-Ann McGee, Council member Jim Kendall, and PDT member Bill DuPaul (VIMS). Hearing attendees included vessel owners or operators with general category or limited access permits (Roy Enocksen, Edward Welch, James Welch, Wayne Frye, Hans & Rosemary Davidsen, Ronald Enoksen, Frank Weckessen, Herman Bruce, Russ Posia, Max & Gail Isakson, Ray Starvish, Bob Brevard, Gabriel Moranda, Bob Morris, and John Reardon), , a representative of Oceania (Chris Zeman) and of the Fisheries Survival Fund (Dr. Trevor Kenchington, David Frulla, Ronald Smolowitz, Shaun Gehan).

Mark Amorello, acting as public hearing officer, opened the meeting at 7:00 pm with a short summary of the agenda for the meeting. Mr. Applegate presented a summary of the alternatives and the estimated impacts, pausing for questions and specific comments on occasion. The first part was on area rotation and other ways to improve scallop yield, followed by area access alternatives, initial management measures, overfishing definitions, minimizing bycatch, minimizing habitat impacts.

Main points made by people offering comments included:

1. There is insufficient analysis of the negative impacts of the status quo on habitat and insufficient justification for using closed areas to protect sensitive habitat.

2. Requiring vessels to have two types of dredge gear and changing the fishing year will be very costly to the fishing industry, with insufficient benefits to justify the costs.

3. There was support for area rotation to improve scallop yield, but a system that closed areas very selectively. The habitat benefits of area rotation have not been adequately analyzed.

Mr. Zeman commented that the Amendment 10 document contained insufficient analysis of environmental impacts of area rotation and an inadequate discussion of the environmental effects of status quo.

Dr. Kenchington commented that the area rotational alternatives range from mechanical to adaptive, but it is the wrong way to look at the alternatives. The right way is to look at area rotation as an automatic rotation vs. something only to include closures only when and where needed. Therefore there are only two area rotation alternatives, he argued. Although the status quo (no rotation) is not formally classified as area rotation, but the real status quo is the Council closing areas when there is a real benefit to closures. Dr. Kenchington concluded that the only alternative with a real yield increase is adaptive rotation and flexible boundaries. The primary objection to the flexible boundaries is the complexity. The only reason it looks complicated on paper is in comparison to the status quo, which includes an ad hoc flexible boundary management approach.

The intent of the FSF strawman was to take the Council decisions in the status quo and formalize them into a systematic approach. Doing so would make them run comparatively smoothly, he contended, compared to doing things in a hurry with an emergency action. The industry is behind targeted rotation, but there is little support for a system that doesn't target the beds of small scallops for rotational closure.

Mr. Smolowitz, FSF, thought that the presentation might be misleading, but it makes several assumptions. In other words, the Council is not managing and that the overfishing definition is the only thing that controls mortality. He pointed out that the Council can make other decisions to achieve a lower target, which has happened in the recent past. We manage the scallops as one resource over the entire range, because the fleet is very mobile. The document refers to localized overfishing, but the fleet operates on an optimal mix of scallops, advised Mr. Smolowitz. The assumptions used to analyze area rotation do not accurately reflect what actually takes place in the fishery. The existing overfishing definition provides the Council the flexibility to take into account all the unknowns and uncertainties, while the proposed overfishing definition is too restrictive. He urged the Council to approve continuing the status quo overfishing definition.

Mr. Frulla asked about the comparison of the relative costs of the habitat alternatives, and that the difference in the costs between habitat alternative 3a and 8b of only 1 million lbs. different. Mr. Applegate replied that during the four year period for which the short term costs were calculated, the preferred alternative controlled access option would allow for fishing in Closed Area I and Nantucket Lightship Area during 2004, with a TAC of about 6 million lbs., which when divided by the four year period, only averages one million pounds per year.

Dr. Kenchington reported that at the Gloucester public hearing, comments were made that there should be no habitat closures in Amendment 10. He felt that there was insufficient demonstration of the effects of fishing on habitat and insufficient justification of using closures to protect sensitive habitat. He pointed out that there is no legal requirements to choose closed area alternatives or reduce habitat impacts. Under the law, some increases in habitat effects are permissible in the Magnuson Stevens Act. He commented that the alternatives to minimize habitat impacts should be subjected to one constraint – they have to be practicable.

Dr. Kenchington reported that the Gear Effects Workshop identified four methods to minimize habitat impacts: Closures, effort reduction, gear substitution, and gear modification.

Unlike other species, the practicality of using closures to protect sensitive habitat is affected by the sedentary nature of scallops – long term closure takes that much of the scallop resource out of production. A closure on prime scallop bottom has a large and known cost. If there is a habitat closure, there has to be a demonstrable benefit, which is not provided in the DSEIS. There is circumstantial justification, but the proposed closures do not pass the benefits test as they are presented to us at the present time. There are gaps in the logic. There is a case made that scallop fishing alters the seabed, but no indication that the alterations made effect the value of that seabed to the species.

A second approach is to reduce fishing effort, Dr. Kenchington offered, which has already been cut considerably more than 50 percent and will likely be cut further by the actions in Amendment 10. There will not be a case that further effort cuts to minimize habitat impacts is practicable, given the already low amounts of fishing effort that are anticipated by Amendment 10 to optimize yield.

Applying gear substitution to minimize habitat impacts, there are simply no alternatives that are practicable to harvest scallops offshore, Dr. Kenchington concluded. As far as gear modifications, the DSEIS suggests restrictions on rock chains, but there is no evidence that it would be beneficial to habitat, since the gear could be more damaging to habitat when the rocks are brought onboard, rather than being deflected by the rock chains. It is not at all clear that the intent to modify the gear to keep fishermen away from hard bottom will counteract the damaged caused by using inappropriate gear in these areas. Other gear modifications to address the issue have yet to be made and developed, and therefore cannot be applied.

He concluded that all practicable measures have already been taken or will be taken in Amendment 10, which may have little or no cost because they are intended to improve scallop yield. There is scope for adjusting the rotation system, taking habitat into account, but it does not appear as an analysis in the DSEIS. Dr. Kenchington suggested that everything that can practicably be done [to minimize habitat impacts] is being done, so there is no grounds for additional measures.

Mr. Smolowitz asked what is the time period for the landings data were used in the analysis of the habitat options. Mr. Applegate replied that data from 1994 to 2001 had been used because of the effects of the groundfish closed areas on the fishery and because it relied on VTR data, which began in 1994. Mr. Smolowitz wondered how that type of analysis could be done at all without accounting for the effect of various area closures and access programs during that time. Mr. Applegate replied that the retrospective results had to be taken in context of the management circumstances, but that all available data had been used including the effort distribution from VMS data since 1998. Mr. Smolowitz asked if a comparison of the habitat alternatives had been done looking at the historic value of landings, before the area closures began? Mr. Applegate replied that the comparative analysis of the habitat alternatives using long-term projections addresses that issue, because it relies on scallop productivity (i.e. recruitment) from 1982 to 2002 that were much less influenced by the distribution of closed areas and high fishing mortality.

Another important question, Mr. Smolowitz posed, is that the proposed access programs with possession limit and day-at-sea tradeoffs, in the current system vessels that choose not to fish in controlled access areas could use those days to fish in other areas. What would be the impacts from the habitat alternatives of the use it or loose it day-at-sea tradeoff approach? Mr. Applegate replied that the day-at-sea use might be a smaller proportion of the total if vessels did not use area-specific days to fish – the management response might be to liberalize the day-at-sea allocation to account for this response.

Mr. Zeman restated that he could not find the analysis of environmental impacts of the area rotation alternatives. What he saw was a completely inadequate discussion of certain alternatives, for example, the status quo and no action alternatives in which there is no discussion of negative impacts of the alternatives on EFH and the marine environment. All he can find is some discussion is that the status quo and no action may have some incidental benefits. The document does not describe the problem of status quo or no action, therefore the justification of using closures to protect habitat is unclear. The document, Mr. Zeman thought, takes a “glass half-full approach” rather than an objective analysis of what is going on in the water and what habitat is being effected.

There is very little tie to the recommendations of the Habitat Tech Team. The technical team advised that the distribution of effort has more of an effect on habitat than the amount of fishing effort that occurs. Even 10 days-at-sea in the most sensitive habitat will have a significant impact, he argued, but the document does not explain that. What really matters is where the effort is occurring and that is not being addressed. He pointed out that the Habitat Tech Team advice was that it was very unlikely that effort reductions would have much habitat benefits. Mr. Zeman added that the analysis points to reductions in bottom contact time when large scallops are available and dredges with larger rings are used, but if there are no large scallops available the fishery, using larger rings will generate longer tow times and cause greater habitat impacts.

Mr. Zeman said that Oceana has weight into the process for several years and introduced numerous alternatives but they have not been included in the document. During the scoping period, they requested that considerations of HAPCs have been analyzed but were told that that would not be in the document. However, at the last minute the industry has come together, and this has been rapidly included in the document, which is more that he could say about previous Oceana alternatives that they recommended. Process is fundamentally flawed, because it does not provide a proper baseline of sensitive habitat or where we have data that describe what the negative effects of scallops dredging are. For some species, Mr. Zeman thought we have very good data, especially for juvenile cod. It may be mentioned as a cite to a scientific study, but it is not applied. EIS must be an applied environmental analysis and the document has not executive summary that describes what each alternative does. The document does not describe the major or minor benefits. The conclusions are very vague because there is no analysis beyond 2004 and as only a year of analysis, this is inadequate. The discussion is often completely qualitative and we can do much better than that, Mr. Zeman argued.

Mr. Kendal, New Bedford seafood consulting, complimented the staff on developing draft Amendment 10. He disagreed that there is no analysis given or presented in Amendment 10, comments which based on the amount of analysis in the document is totally inappropriate. Issues have been raised tonight about habitat effects, but they are not based on facts, Mr. Kendall replied. There is very little credit given to the proactive participation by industry in the success of the management plan. There is no executive summary of the habitat benefits, because they cannot be concretely described, he argued. Mr. Kendall rebutted the comment that Amendment 10 does not contain alternatives recommended by Oceana during scoping, but Alternative 7 in the closed area options and the rock chains have been included, in response to scoping comments by Oceana. There are alternatives in the document that were initially recommended by the environmental groups.

The composite biomass is slightly above the B_{MSY} target, but it is really considerably above the target. In contrast with the scientific advice and assumptions, Mr. Kendall thought that closed areas have been a boon to recruitment. With all the changes in the fishery, the open area biomass has rebounded to levels not seen before. He thought that there has to be some obvious link to the closed areas and the recruitment that they have provided. It points out that the resource in closed areas is not permanently locked in that area, which needs to be taken into account.

The habitat closure in Closed Area II, with the westward expansion would have a large impact on vessels that usually fish there, Mr. Kendall advised. He thought that the analysis does not show this cost. On the overfishing definition, there was much work completed in support of maintaining the current definition. The industry believes that scallops should be managed as one stock, perhaps with two management areas. Breaking up the resource into multiple areas would change the character of the fishery since its inception, Mr. Kendall predicted.

General comments after presentation:

Mr. Bruce, commenting on changing the fishing year, the start of the year in August to September would cause adverse economic effects, considering the changes in scallop yield and hurricane season. Many boats are not capable of fishing during the winter with a seven-man crew, Mr. Bruce advised. In March and April, the change in the fishing year would concentrate landings within a five-month period, which would cause prices to drop. He thought that the six month gain in using more recent data would not be worth the cost and burden on the fishing industry caused by changing the fishing year. Mr. Bruce recommended that the fishing year should start no later than May 1.

On the 4-inch rings, last year with a 30 count and under standard, his boat landed 77.60 scallops that were 30 count and under and 11.33 percent of the scallops that were over 30 count. The 3.5-inch rings are doing an adequate job, Mr. Bruce advised. With 4-inch rings, vessels would need to pay for two different types of gear with minimal benefits. The 4-inch rings when left on the dock for 10 months will be closer to 5-inch rings when they are needed again. Loss of day-at-sea, more gear costs, and a change in the fishing year will have major economic consequences, Mr. Bruce predicted.

Mr. Davidson, a scallop fisherman since 1973, recommended not allowing more vessels to get general category permits. The general category vessels should all have VMS onboard, especially considering that the limited access vessels were only landing 500 lbs. per day. Not enough research has been conducted on the 4-inch rings, Mr. Davidson thought. He recommended continuing to use the current overfishing definition, because the new overfishing definition would have a drastic effect on days. More cuts in days are unnecessary, considering the rebuilding that has been achieved. He also agreed that changing the fishing year to August would be very costly, but thought that a one or two month change to accommodate area rotation would be workable.

Mr. Gehan, a representative of the FSF, commented that not enough is understood about the effect of fishing on scallop EFH. Mr. Applegate replied that scallop EFH was not excluded in the analysis, but the primary focus was on protecting finfish EFH which scientist believe is more vulnerable than scallop EFH. It's not clear that the actions considered in Amendment 10 are required by the Magnuson Stevens Act. There is a strong mandate to determine what is necessary for the various species. Closures are the ultimate weapon to achieve habitat conservation. A better practicality analysis of what is necessary for certain species is not adequately described in the document, Mr. Gehan argued. There are compelling reasons for protecting scallop EFH, he stated, but he is disturbed by the discussion of protecting habitat. This goal should not be the primary goal of the fishery plan. There is insufficient justification and analysis that the impacts of fishing are adverse and that closures are the best way to address that issue.

Mr. Welch, a commercial fisherman, agreed with the previous comments on the 4-inch rings. The 3.5 inch rings have worked and the larger rings need more research before imposing more industry costs. He feared that the plan would evolve into having closed areas everywhere. Once closed to protect habitat, those areas would be off limits for a long time. Why not change the year of the data collection, he asked? If the general category boats have a TAC, the action might make a directed fishery out of it. There more vessels fishing for the 400 lbs., with fewer limits than those that apply to limited access vessels. He recommended keeping the general category scallop possession limit at 400 lbs. and limit the crew size to three men, with mandatory reporting.

Mr. Moranda, Capt. on the Friendship, opposed all the alternatives. If ring size were increased, bigger rings would be required later, he predicted. Capt. Moranda wanted to know what habitat we are trying to protect, which the impacts have already been minimized with existing measures. The existing closed areas have forced vessels off of the soft bottom and to fish in harder habitat to the west of Closed Area I, he advised. The resource is not being overfished, but now that is proposed to change with a new overfishing definition, he thought.

Mr. Roy Enockson, a boat owner, commenting on rotational closures suggested that rotating for the sake of rotating makes no sense. The habitat issues, he agreed with previous comments, if there was real proof of the adverse, but he thought all of the analysis is smoke and mirrors. There is insufficient evidence to prove that the dredges are damaging habitat, he argued. There is even uncertainty over what is defined as cobble.

Dr. Pierce replied that the function of various substrates as habitat should be subject to a greater amount of evaluation, analysis, and debate. He agree that there was some confusion, but Amendment 10 makes some very important statements that should be a concern of everyone in the room. A clear statement is that the Amendment 10 has many alternatives that reduce bottom contact time and also contain closure alternatives including vulnerable and sensitive habitat and would benefit from closure to scallop fishing.

He was concerned with definitions of the charged words – what exactly the meaning of sensitive and vulnerable bottom habitat; and what is a negative impact?

Mr. Enockson agreed that there are an awful a lot of unknowns, but there are pretty server alternatives included in the amendment. On the change of the fishing year, Mr. Enockson, recommended that the fishing year should start in the spring, after vessels have tied up during the winter. A shift of the fishing year would be costly and perilous, with vessels fishing during the hurricane season and winter.

Mr. Dan Eleckson, a boat owner and fisherman, said that he has worked with SMAST on tagging and surveys. He reported that videos are taken after fishing had occurred. He was afraid of the results, but the video before/after shots showed little or no differences. He cannot accept that we know what will be gained through area closures to protect habitat. He recommended that the Council proceed with the rotation plan, but closures should not occur unless there are good reasons, with beds of seed. He said that he has observed strong new year classes. He recommended not changing the overfishing definition, because we need the flexibility in the old overfishing definition. He didn't want closed areas that are unrelated to the scallop fishery, which also changes the amount of effort that can be allocated. He thought that the higher standards in the amendment are unjustified. He also was concerned that the general category alternatives would create a whole new fishery, which is occurring under the current situation with no limits.

Mr. Smolowitz claimed that he had advocated concerns about habitat. One of the advantages of closed areas is allowing fish to exist undisturbed, but there is little hard evidence that this is beneficial. Many advisors believe the same thing, he reported. The analysis in the documents are highly flawed, Mr. Smolowitz thought. Mr. Smolowitz recommended that the Council should not implement habitat closures in Amendment 10 and Amendment 13 and continue the joint advisors effort in the omnibus amendment. One of the species identified as being affected by scallop gear is redfish, but there is no overlap of redfish and scallops. Redfish catches in scallop gear are almost non-existent. Mr. Smolowitz thought that these statements in the document serve as legal fodder for those that would sue the Council. More discussion is needed on why habitat closures would be needed to justify closures.

Mr. Kendall, New Bedford Seafood Consulting, thought that the general category process the status quo is not listed as an option. Mr. Applegate replied that the status quo alternative is described on page 28 of the public hearing document. Commenting on observer coverage alternatives, Mr. Kendall did not think that any other fisheries that bear the costs of the observers. One reason that the controlled access programs have not been attractive is the cost of the observer program, including the cost of handling the product to pay for the observer.

Closed areas will be cumulative, Mr. Kendall predicted, especially with regard to the groundfish closed areas, overlaying area rotation closures, and habitat closures. This will force the industry to fish in much smaller areas, causing greater habitat impacts. He wants the document to demonstrate that there is a damaging effect of fishing on habitat before these alternatives would be acceptable. A recent court case that the judge found for the industry, because National Standard 2 was not followed, Mr. Kendall reported. The management decision was driven by unsupported conjecture.

Mr. Weckessen., a boat owner with a general category, reported that many boats are not taking 400 lbs., most go with 2-3 men. All are little boats, fishing 2-3 miles in state waters, landing 1 percent of the total, which is a small sacrifice for the larger vessels. The fishery has a very little impact on the scallop resource, yet offers an opportunity for new people to participate in the fishery and for those that regulations have been cut out of other fisheries.

NO more comment, meeting adjourned at 10 pm.

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Absecon, NJ
June 3, 2003

The meeting was chaired by Ms. Michelle Peabody, a Mid-Atlantic Council member and also a member of the New England Council's Scallop Committee. Also attending New England Council staff member Andrew Applegate.

Hearing attendees consisted of limited access scallop boat owners, fishermen, and processors (David Wiscott, Bennyu Rose, John Gashen, Jr., Charles Wiscott, Brady Lybarger, Owen & Ashley Shick, Daniel Cohen, John Larson, Keith Larson, Kirk Larson, Ed Eckert, Michael Francis,William Wasilowski, James Gutowski, Ken & Kathy Roma), six representatives of environmental organizations [Chris Zeman (Oceana), Fred Akers and Julie Albus (Great Egg harbor Watershed Association), John Williamson (Audobon Society), Bill Phoel (Nickersen Research Foundation), and Capt. J. S. fogel (Waterwatch International)], and two representatives of fishermen's organizations (Nils Stolpe of the Garden State Seafoood Association and Shaun Gehan of the Fisheries Survival Fund). Also attending were Aaron Shyents, Dave Knutson, Kendra Flynn, Andrew & Marilyn Applegate, Gef Flimin (Rutgers Cooperative Extension), John & Elizabeth Gross, Alexis Plotkin, Don & Louise Myers, plus three other unidentified people.

Ms. Peabody, acting as public hearing officer, opened the meeting at 7:15 pm with a short summary of the agenda for the meeting. Mr. Applegate presented a summary of the alternatives and the estimated impacts, pausing for questions and specific comments on occasion. The first part was on area rotation and other ways to improve scallop yield, followed by area access alternatives, initial management measures, overfishing definitions, minimizing bycatch, minimizing habitat impacts, data collection and monitoring, and framework adjustments and other process modifications. Several breaks in the agenda were taken to allow the attendees to ask questions and/or comment on specific portions of the amendment.

Main points made by people offering comments included:

1. It would be inequitable to allow other vessels with general category permits to target sea scallops when not on a day-at-sea and prohibit limited access vessels from doing so.

2. Vessels targeting sea scallops under general category rules should be required to use VMS equipment. The trip limit should remain the same, but the Council should set a TAC at the historic limit, about two percent of total landings.

3. There is insufficient analysis of the habitat effects of the status quo and the bycatch alternatives are not adequately developed.

4. Many of the habitat closure alternatives are simply variations of the status quo and are therefore unacceptable. Oceana favors selection of Alternative 3a over the other alternatives. On the other hand, many fishermen thought that the existing scallop management measures already have done

a good job minimizing habitat impacts and opposed additional closures.

5. Sensitive and valuable habitat would not benefit from area rotation closures because it could not recover to an undisturbed state in the time frame that areas would be closed for scallop area rotation.

6. Many fishermen supported the adaptive, flexible boundary area rotation system, but opposed new rotation closures without better access to existing areas that are practically closed to scallop fishing.

7. On the overfishing definition alternatives, many fishermen wanted to be sure that all areas would be counted in terms of determining stock status, which would be true for biomass under both overfishing definitions. On the other hand, only the mortality rate for scallops that would contribute to yield (i.e. not those within long-term closures) would be considered for determining whether overfishing were occurring for the proposed overfishing definition.

Mr. Zeman, Oceana, was disappointed with the discussion of the negative gear impacts of the status quo, only the benefits of the existing groundfish closed areas. He asked where is the discussion of the effects of the fishery on habitat in the ocean. Such as which habitats are affected and which are not? What are habitats of concern? He felt that the analysis was not applied to come up with the impacts statement of the existing fishery on the existing ocean.

Why are the habitat effects of area rotation not well analyzed, Mr. Zeman asked? He noted that there was an area rotation alternative that integrated habitat considerations, but it did not seem to be developed and asked why. Mr. Applegate replied that the description of the habitat and the gear effects evaluation was in Section 6.2 while the effects of area rotation on habitat are in Section 7.5. He indicated that the area rotation alternative that integrated habitat considerations into its management (as opposed to ovcrlaying habitat closures on it) was not more fully developed because the information about the effect of various levels of scallop fishing was lacking and that information about the potential for habitat recovery was not well understood, therefore developing criteria and limits for the frequency and intensity of fishing activity could not be developed further than it was. The long-term effects on all the species that rely on various habitat were not well known or quantifiable. It requires more research that we don't have and coincidentally there is an Amendment 10 alternative that would promote just this kind of habitat research using scallop TAC set-aside funding.

Mr. Zeman review answers prepared by the Habitat Technical Team to the Scallop PDT. The responses identified that certain sensitive habitats, like gravel and hard bottom habitats with juvenile cod EFH are sensitive to dredging. Even one pass of the dredge could take years to decades of no fishing to recover, and he felt that there was usable information about various recovery rates.

On the total area swept alternatives, those numbers were much less than what the fishery is affecting presently, about 2,500 nm2 for the area rotation alternatives vs. about 7,000 to 8,000 nm2. Mr. Applegate replied that Mr. Zeman's estimate was actually incorrect and that the current fishery dredges about 4,000 to 4,500 nm2, if the dredge paths were arranged end to end and side by side, which is not how the fishery actually operates. The amount of fishing time in each square nm2 and summed up, indicated that the fishery swept about 12,000 nm2 in the early 90s and due to day-at-sea reductions, gear restrictions and crew limits this has dropped to the current level. With the day-at-sea allocations and area rotation, this value could come down further. The area rotation estimates given include only the open scallop fishing areas only and excluded any addition from controlled access. Get this from tape ???

Oceana supports a primarily closed area rotation system to protect habitat areas as a primary goal as well as maximize yield which can clearly be done, Mr. Zeman replied. The disconcerting part of the adaptive, flexible boundary rotation system is that the document does not have any environmental analysis of the alternative. He believed that the document contained no environmental analyses of the area rotation alternatives beyond 2004. Because it is so flexible and adaptive, in terms of NEPA, how is this going to be analyzed – each and every year or to be included in the final amendment. Mr. Applegate replied that the analysis of area rotation results had been projected over a 30-year period with 400 simulations of potential outcomes, based on what we know about scallop yield and recruitment to determine the range of potential outcomes and where the fishery would potentially occur over that 30 year period.

Mr. Zeman contended that that was only about scallop yield and didn't provide information about where the fishery would dredge in 2006 or where it will not dredge in 2008. Mr. Applegate replied that the analysis goes well beyond that period and the various rotation areas have been characterized as to what types of habitat and bottom substrates (cobble, gravel, sand, etc.) could be affected within the rotation areas. In most of those cases, the amout of area protected would be about five percent compared to status quo, Mr. Zeman asked? Mr. Applegate replied that the difference would be similar to the effects caused by a reduction in swept area, i.e. the ground covered by the total amount of fishing time with gear on the bottom. Mr. Applegate added that many of the habitat closure alternatives also provided benefits to close areas covering about 5 to 10 percent of the EFH designations for species that rely on bottom habitats that are vulnerable to scallop fishing.

Mr. Zeman said that the document repeatedly said that the analysis did not go beyond 2004-2007 because we really didn't know where the small scallops will be, and that it would all be based on future surveys. Mr. Applegate replied that the projections for area rotation had been run out for 30 years to provide stochastic projections, and that statements were made by the habitat technical team members that these were too uncertain to be used to estimate the effect on specific habitats.

Mr. Cohen spoke in favor of the preferred alternative, adaptive areas and boundaries with cooperative surveys. He thought that area rotation offers the best opportunity to maximize yield by focusing effort in beds of large, mature scallops, reducing impacts on the environment. Clearly, intuitively, the cumulative impacts have been to significantly reduce impacts of gear on habitat, Mr. Cohen argued. Effort has been reduced by 50%, with greater reductions in total fishing time and area swept. Even today with greater concentrations of scallops, vessels are laying to (not fishing) while shucking. The cumulative impact has been to reduce impacts on the environment, he concluded. Although not clearly stated in the document, we have to look at the issue on a five-year term to reduce the effects of wild swings in yield. Stability should be a management goal as well, Mr. Cohen recommended.

Mr. Zeman commented that the focus was on day-at-sea reductions in the past, which must provide some level of habitat benefits. The key concern is where the fishery is dredging. But the problem is that most of the impacts are done with the first pass of the dredge and recovery of the most sensitive habitats can take decades, he claimed. He said that scientists have concluded that in these habitats the first pass of the dredge results in the most impacts. While there may have been a reduction of days, the reduce intensity of fishing in sensitive habitat may not really have a significant impact. Quoting from the habitat technical team reply, "At a minimum, some subset of all habitat types should be protected from all fishing impacts at all times. However, there are habitats that are considered important to some managed species that require years and maybe decades to recover from the disturbance from bottom-tending fishing gear. Because the recovery period is so long for some of these habitats and because they are considered to be the most important in an undisturbed state it is not practical to manage them using a rotational area scheme, so they should be protected from fishing with scallop dredges and trawls."

Mr. Kirk Larson, speaking as chairman of industry advisory panel, was frustrated by not having support from SMAST at the meeting. The camera studies provide good data on scallops, and habitat, etc. What is habitat? Has it been defined? Everything is habitat. He said that he was disgusted by the vagueness of Oceana's description of habitat. No one understands what habitat is. We think habitat is where scallops grow, which is where we want to be allowed to fish, especially on Georges Bank. The industry has bent over backwards to reduce their impacts on the environment, he argued. He said that the industry had spent four meeting days, working with Ron Smolowitz and habitat advisors, didn't understand what is the habitat that they want us to stay out of.

Capt Joel Fogel, Executive Director of Waterwatch. International, commented that his concern is simple, placing restrictions and requirements on our fishermen, what good does it do to restrict these gentlemen unless there is a coalition made with other countries to also look at these same restrictions to provide habitat conservation for the entire ocean? Restricting local fishermen only does no good when foreign fishing factories come into our waters and fish without restrictions. International vessels should not be allowed to fish in our waters, he stated.

Mr. Gehan, FSF, commented that the fishery needs places to fish. If the industry does not have access, the management plan will be a failure, he predicted. With regard to habitat and habitat closures, he supported the statements of the Habitat Technical Team provided by Mr. Zeman. In response, the joint advisors undertook the task of looking at hard bottoms and important areas to close, he reported. This alternative has been presented along with Amendment 10 that could be included in groundfish Amendment 13 to protect juvenile cod habitat. Most of what has been included as closure alternatives in Amendment 10 would lead the industry to bankrupt the fishery, especially when coupled with the proposed overfishing definition. Mr. Gehan reported that the FSF helped develop and supports the adaptive rotation system, but opposes habitat closures in Amendment 10, and recommends that the JAR proposals go forward in Amendment 13.

Mr. Gehan stated that the habitat alternatives are required in a FMP, but also requires that each FMP include a fisheries impact statement, the impacts on the industry of all the alternatives. These impacts are underestimated compared to status quo or the adaptive management system, he claimed. Mr. Gehan commented that this Council and committee have bent over backwards to take a hard look at habitat conservation alternatives.

Mr. Wasilowski said that he has reservations about Amendment 10 and was concerned about the implications in respect to lower recruitment on Georges Bank and higher recruitment in the highly-fished areas of the Mid-Atlantic.

Ken Roma spoke in opposition to any more closed areas. He said that area rotation is a great idea in real time, but it takes too long to get things done. The ones we have now are not working that great, because the access program is dangerous at best, with vessels loosing trips or days. The way it is being managed does not warrant more closures, he argued.

Mrs. Akers, student environmental association, said that she found the meetings discussion to be interesting. She commented that the habitat protections should benefit a lot of species, including rare and endangered species and including other species that are not caught for consumption. Why not cut the harvest in half and get a better price with much fewer environmental impacts, she asked rhetorically? The plan should address the sea turtle fishery and habitat that supports the cod fishery, she recommended. A winning situation would be to close important habitat areas and scale back, with a minimum of cost to the industry. She believes in the research that has been done, but says that she didn't know enough about what is in the document to comment. What impact will have on other species if the habitat is lost? She emphasized that the resources belong to everybody, not just the fishing industry.

Mr. Cohen acknowledged that these concerns are appropriate, but the scallop fishery is not endangering the marine habitat. He felt that the scallop fishing impacts are not threatening biodiversity or endangering other species. He stated that the environmentalists at the meeting are only seeing one part of a much larger public process, associated with the development of Amendment 10, including the consideration of impacts on turtles, which is of great concern to the industry. He commented that it is not possible to go into many specific details in a short presentation, that some of the information require people to read deeper into the document to understand the ramifications and what has been considered. He added that there has to some balance between the amount and type of fishing and the amount and quality of impacts on the environment. The industry will only survive with a healthy marine environment. Some envision a pristine environment, but a different position is a balanced environment with people making a meaningful living while there is a healthy environment, he explained. On the other hand, the balance also requires the Council to look at the practicality of various conservation alternatives to manage the scallop resource.

Mr. Larson thought that everyone wants to buy into the area rotation, but the problem is getting back into the areas or what kind of stringent regulations will apply to be able to fish there again. He wanted to be able to see all the area closures being proposed, especially with statements that the first pass of the dredge damages habitat for thousands of years. He feared that the Hudson Canyon Area may never be fully open again.

Mr. Zeman thought that the rotational areas, labeled in blue were reported to provide protection to some hard bottom, gravel habitat. Mr. Applegate replied that that was not what was stated about the controlled access alternatives, which was that the areas within the groundfish closed areas that would remain closed include important habitat for groundfish. Mr. Zeman replied that most of the cobble habitats occur outside the existing groundfish closures, and only a small part of the cobble bottom is in the northern part of Closed Area II. From the Habitat Tech Teams comments to the Scallop PDT, Mr. Zeman restated that, "Even if a gravel or hard bottom habitat is in a three-year rotation area it won't have much of a benefit. The recovery period varies according to habitat type. For example, a reduction in fishing effort on gravel habitat with attached epifauna will not be beneficial because the gravel habitat might require a recovery period of greater than five years and possibly a decade or more to recover to its undisturbed state. In this case, even reduced fishing effort will prevent recovery, thus it can be argued that some habitats should not be disturbed at all because the habitat would not recover at all to its most undisturbed state."

Mr. Cohen said that the proposed controlled access alternative is to be given trips in closed areas. He supported the preferred alternative, but we have not perfected the ability of vessels to go into the areas without losing the trips. Concerning the discussions of area management, all harvest from management areas should include the ability for vessels to leave for any reasons and return to finish their trips, with some mechanism to recover part of the days automatically charged. In general, Mr. Zeman concerns are valid Mr. Cohen acknowledged, but the real issue is that there must be a balance to identify the most important habitat and discuss

Mr. Williamson, Conservation Committee of the Audubon Society, said that their interest is in biodiversity of multiple, sustainable populations. The primary intent of Amendment 10 is on the other hand to improve yield, and minimize adverse impacts. So far, he heard a lot about the spatial aspect of the amendment, but not about the impact on other fisheries on the marine environment. The title Amendment 10, public hearing document is not what one would expect given what has been presented, he believed. The title should be scallop fishermen public hearing document, given the presentation at the meeting.

Given the desire of the hearing attendees to focus on habitat impacts, Mr. Applegate re-organized the presentation to take up habitat alternatives and summary of impacts next.

Mr. Zeman commented that while reviewing the alternatives and the analyses, the no action or status quo alternative, he tried to find the full environmental analysis but was unable to locate the analysis he sought. The habitat effects in the document are described in terms of incidental benefits, but not in terms of their adverse impacts, he claimed. Mr. Zeman argued that it is highly unlikely that the past effort have fortuitously reduced and minimized habitat impacts.

The majority of alternatives are slight variations of the status quo, he thought. For example Alternative 2 is a variation of alternative 1. Alternatives 3 and 4 are variations of the status quo. Mr. Zeman reported that Oceania supports alternative 3a, although it is a narrow alternative, because the Habitat Technical Team was given a narrow focus by the Council. Thus other areas away from the groundfish areas were overlooked. Mr. Zeman commented in opposition to the other habitat alternatives. Oceana does not believe alternative 5a and 5b were developed in a sound, scientific process. Alternative 6 is a weakening of the groundfish closed areas. Alternative 7 tried to include some of the concepts that they originally submitted during the process, it achieved that, but he cannot find the methodology to develop the alternative described in the document. Alternative 8a is to maintain only the HAPC. Alternative 9 is simply a slight nuance to the status quo, by designating the groundfish areas as habitat closures.

Mr. Zeman reported that during the development of the JARs, he walked out of the third day of the meeting, because there was no balance at the meeting. He had hoped to work out situation to have industry and environmental groups find a compromise, but he felt that his ideas were stonewalled. He saw it as clear that there is virtually no fishing in the proposed areas outside the groundfish closed areas.

Mr. Akers, a river administrator to the Great Egg Harbor River, provided general comments in support of habitat, supporting strong measures to minimize all known takes of endangered and threatened sea turtles and to protect from destructive overall environmental effects on species other than scallops, including sensitive sponge and coral habitats. A proactive effort to evaluate the overall effects of the industry on species other than scallops is needed, he said. Any balance between habitat and preservations of species and need to harvest them, should only be based on sound science he said, which is a burden of proof.

Mr. Gehan thought that part of what is being said is a misunderstanding of the law, and explained that the focus of the Magnuson Stevens Act is on achieving maximum sustainable yield and preventing overfishing. He was happy to point out that the FSF is doing some of the things that others are recommending - to collect sound scientific data – supporting gear research to minimize turtle interactions and reduce habitat impacts. He added that FSF is actively supporting video surveys and habitat mapping, using the information to measure impacts of dredges in light and heavily fished areas.

He said that there is no EFH definition for benthos, bryozoans, etc. The legal requirement is to identify EFH for managed species, Mr. Gehan argued. All the science with respect to juvenile cod and cobble, was based on a fish tank study, and it showed no statistical differences between complex and non-complex habitats.

Mr. Cohen asked about area access and the use of 2003 survey data in Amendment 10 closures. He recommended that Amendment 10 should have no permanent closures, deferring the decision to Amendment 13, which will be completed in nearly the same time frame.

Mr. Owen Smith, a scallop fisherman, strongly opposed any additional closures. The economics (associated with the day-at-sea tradeoff system) prevent people from fishing where small scallops occur, and more closures are unnecessary. It isn't necessary with current resource conditions, he contended.

Mr. Zeman, commenting on bycatch alternatives, pointed out that no observer coverage was allocated to scallop trips in most of the open areas. He was concerned about the analysis of bycatch patterns based on the few discards reported by VTR. He added that there was little development of bycatch reduction alternatives, except to say actions to minimize bycatch will be done by framework. On the other hand, the Council has historically taken little action to reduce bycatch and habitat impacts in a framework action. As such, relying on the framework process is insufficient as a viable means for addressing bycatch and habitat alternatives. More direct action and alternatives should have been included in the amendment.

Mr. Cohen felt it is politically untenable to disallow general category fishing, but he supports the same reporting requirements as any vessel targeting scallops. An incidental cap on total harvest by the general category should apply and he recommended that it be no more than the historical one to two percent of total scallop landings. To the extent there are general category landings by limited access vessels not on a day-at-sea, he thought that there were no differences between a groundfish vessel and a scallop vessel fishing for scallops off the day-at-sea clock. A limited access should be allowed the same limit, subject to the TAC, Mr. Cohen recommended. He thought that all vessels fishing under general category rules should use 10.5 dredge and must have VMS for the entire time, as opposed to the 45-day exemption. The possession limit should not be raised, because it would attract more vessels or cause a derby fishery when combined with a TAC, he said.

Mr. Roma also agreed with requiring VMS and recommended that the Council should not raise the possession limit. He thought a TAC between one to five percent is acceptable and recommended that the Council allow limited access vessels to fish under general category rules, mainly to keep some income for their crew. He believes the resource conditions will worsen, despite management efforts. During the drops, the part-time day fish category, kept him from going bankrupt. It would be unjust to exclude limited access vessels from the general category rules.

Mr. Wescott, agreed with Mr. Cohen, recommending approval of a 2 percent TAC for the general category fishery. Mr. Catagowski, agreed with the above points, also.

Mr. Cohen recommended that the Council should require occasional vessel to use VMS, especially if general category permit vessels are also required to have them. He supports bag tags and standard bags in Amendment 10, to enforce TACs and trip limits, reducing the potent anal for unintended violations. The concept of broader observer coverage, cannot be supported unless implemented in a way that is economically viable, Mr. Cohen added. The current amount of compensation is insufficient to pay for the observer costs. He suggested that the compensation be set at $900/d in extra scallop landings to pay for the $700 observer cost, with no compensation for the crew to process the scallops. The compensation needs to by at least twice the amount of the observer cost, he said.

David Wescott thought that anyone accessing the controlled access areas should contribute to paying for the observer. Mr. Roma added that he thought the observer should be paid for whatever scallops the observer can process.

Mr. Larson stated that he could operate satisfactorily with a fishing year starting in July and August. But the process worked before with the current fishing year, even when the survey data were delayed.

Mr. Cohen added that the biggest problem with closed area management is the observer program. But the observer coverage with a one percent set aside, the tradeoff is insufficient to induce the crew to process the scallops. He explained that some vessels cannot carry observers because of insufficient accommodations, increasing the burden on vessels that can. If every boat were required to pay one percent of their gross for observers, the costs would be shared fairly by everyone. Under the current system, one vessel would pay $6,500 for an observer on a $65,000 trip, which the burden only falls on the vessel carrying the observer, which only includes only about 10 percent of trips.

General comments after presentation:

Mr. Gehan stated that the FSF supports the status quo overfishing definition.

Mr. Roma urged the Council not to reduce the day-at-sea allocations – there is no need to reduce days at this time, given the resource conditions which has allowed recovery while the limited access scallop fishery was allocated 120 days. With fewer days on the upcycle, then the days allocation will be even less when the resource conditions are worse. 120 days will never kill the fishery, he believed. He said that once the catch levels declined to 200 or 300 pounds per day, fishing would become unprofitable and there would be no more harm to the resource and the stocks will recover by themselves on the next good recruitment. He felt that there is no reason to reduce the day-at-sea allocations.

Mr. Cohen commented that the allocation would harvest about 20,000 days, according to the projections. Mr. Applegate replied that this is the projection estimates of allowable days used, which is equivalent to about 25,000 days allocated. Added to this would be some additional days to account for the effect of a day-at-sea tradeoff under a controlled access system, Mr. Applegate concluded. Mr. Applegate said that with the status quo overfishing definition the total would be about 110 days with the status quo overfishing definition and 81 days with the proposed overfishing definition, but this may be revised because the proposed overfishing definition would allow the mortality target to become closer to the threshold depending on how much spawning biomass is in closed areas. He added that the PDT was also working to revise the controlled access TAC estimates using more data than were available for the draft report. He thought that the effort allocations could be a bit higher when revised for the final draft.

There was some uncertainty whether the public needed to send in written comments before the committee met on June 13, to discuss the public hearing comments. Mr. Applegate assured everyone that the committee was only meeting to hear the public hearing comments and any written comments received to date. No decisions would be made at that meeting, he added, and that comments received after that meeting during the public comment period would be just as valid as earlier comments.

No additional comments were offered beyond those given during the presentation and Ms. Peabody adjourned the meeting at 10:45 pm.

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Newport News, VA
June 4, 2003

The meeting was chaired by Ms. Michelle Peabody, a Mid-Atlantic Council member and also a member of the New England Council's Scallop Committee. Also attending New England Council staff member Andrew Applegate, Scallop PDT member Dr. Willaim DuPaul, and scientists Winnie Ryan and David Weathers.

Hearing attendees consisted of several people with limited access permits (Greg Fulcher, William Mullis, William Pedie, Frank W. Peabody, Randy Owens, Michael Ireland, Frank McLaughlin, Lynn Bollock, Earl Mullis, Mark Shackelford, Johnnie Mercer, Debbie Peabody, Kathleen O'Neal, Denny O'Neal, Vernon Peabody, and Frank Peabody) and a representative of the Fisheries Survival Fund (David Frulla). Also attending were Lynn Bollock (Atlantic East Seafood, Inc.), Chank Ngoc Huhnh, and Chris Brauen

Ms. Peabody, acting as public hearing officer, opened the meeting at 7:00 pm with a short summary of the agenda for the meeting. Mr. Applegate presented a summary of the alternatives and the estimated impacts, pausing for questions and specific comments on occasion. The first part was on area rotation and other ways to improve scallop yield, followed by area access alternatives, initial management measures, overfishing definitions, minimizing bycatch, minimizing habitat impacts, data collection and monitoring, and framework adjustments and other process modifications. Several breaks in the agenda were taken to allow the attendees to ask questions and/or comment on specific portions of the amendment.

Main points made by people offering comments included:

1. Landings for the general category fishing effort should be capped and vessels should be required to operate with VMS equipment.

2. Limited access permit holders recommended capping landings with a TAC equal to two percent of the total TAC and also recommended not changing the scallop possession limit. They supported allowing limited access vessels to continue targeting scallops under general category rules, because other types of day-at-sea vessels would be allowed to do so in the Amendment 10 alternatives.

3. General category permit holders supported a more liberal TAC and a modest increase in the possession limit (~600 lbs.) to allow smaller vessels flexibility to work in several fisheries, adjusting to regulations and resource conditions.

4. Fishermen supported the concept of area rotation, but opposed any more closures unless equivalent size areas open at the same time. Controlled access under current tradeoffs and administration were not understood as being 'open' to fishing.

5. There was strong support for habitat alternative 2, since all felt that the current and proposed scallop management measures were sufficient to minimize impacts on essential fish habitat.

6. All were opposed to the proposed overfishing definition, because it allowed for lower day-at-sea allocations and TAC for the resource. All opposed changing the fishing year to accommodate area rotation and more complicated management.

7. Many supported the day-at-sea tradeoff system, but acknowledged that the current system is not working, due to insufficient tradeoffs and higher risks caused by the treatment of broken trips.

Lynn Bollock, Atlantic east seafood, said that at this point in the presentation (initial measures in 2004), she did not understand the long-term strategy, that is what areas would close and for how long. What would be the landings when these areas re-opened? What would be the plan for fishing while the proposed areas are closed? Mr. Applegate replied that the details will vary according to the rotation alternative selected by the Council, but depending on the option chosen, the rotational closures would exist for about 3 to 4 years and during this time the Council proposes controlled access to portions of the Georges Bank closed areas.

Bill Mueller, a fisherman with a limited access scallop boat, didn't understand why the biomass target keeps changing and doesn't trust the math. Mr. Applegate explained that the formulas and reference points were not being changed and that the value of B_{max} was being re-estimated by including more recent information since they were last estimated in 1997.

Bill Wells, a limited access vessel owner and processor, explained that everyone is here because there is a vested interest in the fishery. That, he thought was one of the main reasons why the scallop fishery is successful today. Personally, he supports the preferred alternative, but he cannot explain why the closed rotation areas have been beneficial. On the other hand, it appears that they have been effective and have lead to the recent success of the management plan. He therefore supports the preferred alternative for area rotation, which is also the Fishery Survival Fund (FSF) position.

Mr. Frank Peabody said that he understands closing the three areas, but what is missing is other areas that are still and will remain closed. Closing prime scallop grounds and the Georges Bank closures, if permanent, would reduce the yield from the fishery with the proposed overfishing definition. He thought there was enough scallops in the Georges Bank closed areas to sustain the scallop fishery, access to which would be needed to justify area rotation that closes other areas, but many of these areas are slated for indefinite closures. Mr. McLaughlin was opposed to any more areas without access to Georges Bank closed areas.

Mr. Wells explained that no one would be for closed areas, unless there is access to the areas that are now closed. He emphasized that there has to be a simultaneous opening of another area when another area closes for rotation, providing the industry an opportunity to do at least as well as the area being closed. For area rotation to be acceptable, there has to be access to now closed areas with equal or greater landings potential to the areas to be closed for rotation.

Mr. Mullis asked if biomass targets are different in the proposed overfishing definition. He said that his personal belief is that not fishing in the closed areas, would lead to lower recruitment, like has been observed on Georges Bank. Can the low recruitment be blamed on no fishing activity, he asked? Recruitment or yield per shell cut, has improved in open areas to 20 – 22 count scallops. What is the natural mortality in the closed areas, he asked? Mr. Applegate replied that the same formulas and reference points were being recommended for both overfishing definitions, but that in the proposed overfishing definition, the allowable amount of effort would reflect the productivity of scallops only in areas that are or will be open to fishing. Mr. Applegate added that natural mortality does vary and it is possible to have mass mortality from environmental factors, but the amount of clappers in closed areas has not been alarmingly high.

Mr. Frulla stated that the initial PDT analysis identified rotation areas for closure that were too big and had too many short term costs to the fishing industry. He asked whether the areas could be smaller to reflect the distribution of the smallest scallops within the areas proposed for closure. He also asked whether there were provisions to allow closed rotation areas to re-open faster if other events come in. Mr. Applegate replied that the Council sent the initial area recommendations back to the PDT for more work and analysis, and that the areas in the Amendment 10 document were the revisions that the PDT recommended after that further analysis. He also replied that several of the rotation alternatives with adaptive closure duration could allow the proposed areas to re-open in less than 3-4 years, depending on the measured. Mr. Frulla asked if the rotational closures could be re-opened if there were no access to other areas for external reasons like finfish bycatch, habitat closures, or sea turtle interactions, thereby mitigating the downside risk. Mr. Applegate replied that these considerations can come into play during the framework adjustment process, choosing whether or not to close or to re-open closed rotation areas, considering these issues and the available resource area to the fishery in a given year.

Mr. Frulla also said that a major concern about the proposed access program is the gamble and risk of fishing in the areas with a day-at-sea tradeoff, because of the possibility that the trip has to be aborted and there is no relieve of the automatic day-at-sea charge. He added that the combined effect of the large rotation closures and the problems with the controlled access program would make the proposals unacceptable to industry. He asked if the proposed rotation closure boundaries be modified at this point, to which Mr. Applegate replied that they could be based on the public comment. Mr. Applegate described the recent changes in the discretionary policy that the Council granted to the Regional Administrator to grant exemptions to the day-at-sea tradeoff on a case by case basis. He said that the Regional Office indicated a willingness to expand the consideration to trips that landed a small amount of sea scallops. In response to the Mr. Frulla's question about the treatment of this in Amendment 10, Mr. Applegate indicated that this discretionary policy would continue under Amendment 10 with the day-at-sea tradeoff system.

Mr. Fletcher asked what would be the mortality rate if the entire fleet were using 4-inch rings. He recommended that the Council consider applying 4-inch rings in areas when they re-open and stay at 4 inches after that. Mr. Applegate replied that the higher selectivity of a larger ring could help increase the value of F_{max}, which defines the mortality target, by reducing discard and non-catch mortality. He thought that this increase could be as much as 50 percent. Mr. Fletcher thought that with the area-specific day-at-sea allocations with tradeoffs, the plan needed to allow changes in limited access vessel characteristics to make them the same or very close to it.

Mike Ireland, owner of the full-time scallop vessel FV Fortune Hunter, commented that the plan in effect now is working, and the vessels are catching much more than they used to. We have good recruitment, limited amount of boats, but the conditions have been ideal, he explained. He thought that recruitment could fall quite a bit and wondered what kind of day-at-sea reductions would be needed if that were to occur. He commented in favor of area rotation, provided there is access to some of the areas on Georges Bank. But he was against area rotation if the only areas left for fishing are no tow zones (i.e. unproductive areas). Is there a backup plan if the areas close and there were poor recruitment, would the Council then lower the day-at-sea allocations in response to the worsening conditions, he asked? The mortality on unfished scallops had mass mortalities in other areas, which he feared could occur here. If the industry supported more closed areas, what would be the worse case for the industry?

Mr. Wells pointed out that federal mandates requires consideration of the effects of EFH measures on the fishery and requires consideration of a broad range of alternatives. He added that habitat alternative 1, the status quo, is a defensible choice. Mr. Wells commented in favor of habitat alternative 2, the rationale being is that what is currently been done or will be done will suffice to mitigate the scallop fishery impacts on habitat.

The JAR recommendations were developed in the context of an overlay of what fishermen needed to have access to, Mr. Wells added. All the fisheries needed access to the same areas, but they could identify areas when and where juvenile cod and juveniles of other species occurred. Industry was acting responsibly in doing this, meeting with different types of fishermen and there were at least five environmentalists in the room. He felt that this approach was the most promising approach and the right way to develop management strategies. He concluded that he supports habitat alternative 2 at this time, but in the future he thought that the JAR was a preferable approach.

Jim O'Malley reported that the hearing at the previous night in Cape May had representatives of five environmental organizations. These political forces have a clear agenda, in his opinion. At first, they were trying to stop overfishing to achieve sustainable fishery, then attack bycatch, then attack habitat effects, all in an effort to keep the industry off Georges Bank. He urged the industry to have the habitat issues work for the fishery, for example the Nantucket Lightship Area peanut beds serve as a generator for the scallop resource further south in the Mid-Atlantic. The Council is being nudged into doing something not required by the law and not being very sensible. They are trying to stave off the desire to create MPAs, by doing it through the Magnuson Stevens Act. The phrase minimize the impact on habitat is not a stated goal, he argued, the laws says minimize adverse effects of fishing on essential fish habitat, which is a different goal. Mr. O'Malley argued that a different goal of minimizing habitat impacts is acknowledging that there needs to be pristine marine parks, in the name of minimize adverse impacts of fishing. We must know what they are habitat impacts and that the adverse habitat impacts are adverse on EFH, he maintained. Not just that the fishing effects reduces biodiversity.

ICES research on the effects of fishing gear has shown that there are a varied type of impacts of fishing on the environment, some of them beneficial. What is going to happen when the Council learns, that scallop fishing has an adverse impact on cod and haddock, but has a beneficial impact on flatfish, scallops and the potentially endangered barndoor skate, Mr. O'Malley asked. He warned that the Council in evaluating management alternatives that address adverse impacts on EFH will have to make a choice among the differential effects on EFH for various species, some of which benefit from the effects of fishing. The issue is more complicated than closing areas because it is a good place as a marine park? He didn't see any help from the current administration. The one executive order that President Bush left in place was for a commission to examine the use of marine parks in the ocean. He urged the Council and industry to put in the time and energy, similar to the approach used for the JARs, to make these potential areas work to the benefit of the fishing industry, as much as possible. Mr. O'Malley recommended that the Council's job is to not minimize effects on habitat, but to minimize adverse impacts on EFH.

Mr. Peabody opposed changing the overfishing definition. He also commented against using closures to protect habitat.

Mr. McLaughlin, Chesapeake Bay Packing Co. form Newport News and an owner of some limited access scallop vessels, understood that the new overfishing definition wouldn't be credited for the biomass in the controlled access programs for determining days (81 days with the proposed overfishing definition and 110 days with the status quo overfishing definition), and commented in favor of the status quo. He alos opposed closing more rotation areas without access equivalent access to the Georges Bank closed areas. He was also opposed to more rotation closures unless there were a guarantee (a definite date) that the areas would reopen to fishing at some future time.

Mr. Fultcher, a manager of five limited access vessels and speaking on behalf of six limited access vessels owned by his uncle, also commented against changing the overfishing definition, and supports Mr. O'Malley's points on adverse effects on EFH. Is there not a seasonal time to close for protecting habitat, he asked? Mr. Applegate replied that it has been the position of the scientists on the Habitat Technical Team that seasonal or even short-term closures to conserve habitat would be ineffective because of the slow recovery rates of benthic habitat. Mr. Fultcher said that he doesn't see the potential to affect habitat, with the very short tow times that exist in the fishery today. It doesn't make sense to protect groundfish habitat and let millions of pounds of scallops go to waste, he claimed. As with the previous speakers, he didn't support new scallop closures without equal Georges Bank groundfish access.

Mr. Frank W. Peabody, manages eight scallop boats, also commented in support of the status quo overfishing definition. Mr. Johnny Mercer, a limited access scallop trawler, thought that the calculations were based on all the permits being used to calculate the TAC. He therefore didn't understand that the allocations therefore had to be cut because more permits had come into the fishery or more days were being used by vessels with permits. Mr. Applegate replied that the day-at-sea allocation adjustments and those in Amendment 7 were based on total days used, figuring the amount of active permits and the proportion of allocated days that had been used in the prior year. Mr. Peabody added that he opposes any change in the overfishing definition and opposes closing any additional areas to protect habitat. He believed that the Magnuson Act requires that the resource be managed as a unit and that the spawning activity in the closed areas justifies fishing harder in open areas than would be allowed by the proposed overfishing definition. He claimed that there was no conclusive evidence in a west coast study that fisheries had any damage to habitat. Mr. Wells also supported maintaining the current overfishing definition.

Mr. O'Malley urged the Council to not be inadvertently being "back-doored" into reducing optimum yield without the proper discussion of that choice. The criteria used to be that MSY as modified by economic and social considerations, he argued, now the standard is "as reduced" by economic and social conditions. He related the subject that in the summer flounder, that a huge portion of the resource were allocated to discards. He urged the Council to debate optimum yield, before deciding whether to change the overfishing definition.

Mr. Mullis also spoke favorably about keeping the status quo overfishing definition and in support of habit alternative 2. He was not in favor of any closed areas until the broken trip issue is adequately addressed. NMFS has showed zero leniency for these broken trips, he explained. He emphatically said that there should be nothing more closed until there is guaranteed access to the areas that are currently closed. The Council needs to make the system equitable and fair. People don't deserve the treatment from a document like this, he believed. He said that it contains broken promises and he doesn't trust the Council system.

Mr. O'Neal, owner of six full time vessels, asked about the 310 active permits in the day-at-sea allocation calculations. He said that there was a moratorium on permits in the early 90s, when there was about 150 full time permits. He wanted to know the breakdown of the number of permits by category, which was identified during the meeting from the tables.

Area rotation in theory would not be a bad thing, Mr. O'Neal felt, but the way that the alternatives have been developed has not been well thought out. He was against closing more bottoms, unless there is a specific criteria to open areas with as much biomass as the areas that would be closed. He spoke in support of the status quo overfishing definition and habitat alternative 2.

Mr. Fultcher said he is not against the general category fishery, but supports a 2 percent TAC and limited access vessels should not be prohibited from scallop fishing under the general category rules. Mr. Vernon

Peabody also commented that general category vessels should be subject to a VMS requirement and no more than a 2 percent TAC. Bill Mullis also agreed with this. Mr. Peabody also supported the 2 percent TAC, but all general category permits should be required to use VMS to reduce cheating. He opposed raising the possession limit above 400 lbs. Mr. Mercer thought that all vessels participating in the scallop fishery should have a VMS to track and monitor effort and landings.

General comments after presentation:

Mr. Frulla, FSF, reported that his organization participated at five of the six hearings and intends to submit additional technical comments on the overfishing definition and habitat alternatives. Their views are the views of the industry active in the meetings. As an organization, we hope at the end the amendment will be simple and workable to everyone's benefit.

Mr. Wells commented against changing the fishing year, explaining that the benefits to the scientific community do not outweigh the costs and safety issue to the industry, forcing the industry to fish in the fall and winter. Breakdowns has been an issue many times that has not been properly addressed in Amendment 10, he felt. Mr. Wells explained that no one wants to be an area that they can't leave without substantial costs for leaving early. The only alternative that solves the problem is the one with the direct allocation of days, but some boats would never be equal unless they enter a closed area as currently managed with the day-at-sea tradeoff. In a direct day-at-sea allocation, the vessels with older crew cannot be as successful as other vessels with younger crew, he added.

Mr. Wells said that there is a small part about increasing the carry-over days and explained that most people are working on multiple boats to work more day-at-sea. When there are unpredictable events, it forces them to do things that might be unsafe, because they have to burn the days at the end of the year. Supports an increase any increase to more than 10 days to carry over between years. It would hurt no one and would benefit the fleet, crew, and boat owners, he reported. Mr. Wells thought that the public hearing document was well done and complimented Andy on it.

Mr. O'Neil added that the 30 day-at-sea carry over would improve safety as well and supported an increase of the number of crew allowed on vessels. Mr. Peabody opposed changing the fishing year, supported increasing the carry over and supported habitat alternative 2.

Mr. O'Malley expressed appreciation for the work that went into the documents. He asked, Is the Council imprisoned in the thinking that the fishing year and the day-at-sea allocation year couldn't be different, to allow the current fishing year and the resource/fishery data availability to work appropriately in the management process? He suggested that the regulatory changes could occur in August or September, but yet the annual allocation of days would still occur on March1 .

Mr. Dan Bollock said he cannot support any reduction of days-at-sea, and recommended that TAC should be based on the total biomass, not excluding closed areas. If areas close later on, it would further reduce the amount of days.

No more comments were offered and Ms. Peabody adjourned the meeting at 11 pm.

Scallop Fishery Management Plan

Amendment 10

Public hearing summary – Washington, NC
June 5, 2003

The meeting was chaired by Mr. Dennis Spitsbergen, a Mid-Atlantic Council member and also a member of the New England Council's Scallop Committee. Also attending was Mrs. Michelle Peabody from the Mid-Atlantic Council, New England Council staff member Andrew Applegate, Robert Hines from NC Sea Grant, and NC Marine Fisheries Division Chief Jim Johnson.

Hearing attendees consisted of vessel owners or operators with general category permits or limited access scallop permits (with full-time allocations): Mike Ireland, Johnny Mercer, Robert Mercer, Walter Tate, George T. Ormond, Chris Falcher, Ed Cross, Don Cross, Birdie Potter, Rodney Hopkins, and Helena Mayo.

Mr. Spitsbergen, acting as public hearing officer, opened the meeting at 7:05 pm with a short summary of the agenda for the meeting. Mr. Applegate presented a summary of the alternatives and the estimated impacts, pausing for questions and specific comments on occasion. The first part was on area rotation and other ways to improve scallop yield, followed by area access alternatives, initial management measures, overfishing definitions, minimizing bycatch, minimizing habitat impacts, data collection and monitoring, and framework adjustments and other process modifications. Several breaks in the agenda were taken to allow the attendees to ask questions and/or comment on specific portions of the amendment.

Main points made by people offering comments included:

8. Landings for the general category fishing effort should be capped and vessels should be required to operate with VMS equipment.

9. Limited access permit holders recommended capping landings with a TAC equal to two percent of the total TAC and also recommended not changing the scallop possession limit.

10. General category permit holders supported a more liberal TAC and a modest increase in the possession limit (~600 lbs.) to allow smaller vessels flexibility to work in several fisheries, adjusting to regulations and resource conditions.

11. It was apparent during the meeting that some vessels have begun targeting sea scallops with nets under general category rules, and it wasn't certain that the current rules allowed vessels to do so. If the general category rules in the Mid-Atlantic changes to reduce the allowable dredge size to 10½-feet, some suggested that a proportionate change in the maximum net size should also be considered.

12. Both types of fishermen supported the concept of area rotation, but opposed any more closures unless equivalent size areas open at the same time. Controlled access under current tradeoffs and administration were not understood as being 'open' to fishing.

13. All were opposed to the proposed overfishing definition, because it permitted lower day-at-sea allocations and TAC for the resource. All opposed changing the fishing year to accommodate area rotation and more complicated management.

14. Many supported the day-at-sea tradeoff system, but acknowledged that the current system is not working, due to insufficient tradeoffs and higher risks caused by the treatment of broken trips.

Mr. Ireland, a fisherman with a limited access scallop boat, said he was concerned about the effects of area rotation and asked how many areas would be opened closed within one region at one time. Mr. Applegate replied that most of the Amendment 10 area rotation alternatives would have a cap or limit on the total amount of exploitable biomass in closed rotation areas and that a 25% cap was applied in many of the analyses. This would mean that areas larger than 25 percent of the scallop grounds may be closed, since the closed areas would be closed because of an abundance of young scallops and an absence of large scallops, he explained. At the same time, the intent of the alternatives would be to close areas distributed more widely, rather than all in one area to minimize community effects, but this would need closer examination each time decisions were made on what areas to close under the rotation system. Mr. Ireland added that the area rotation system proposes to close an area that is producing more scallops than any other area on the coast. He was concerned that the economic results did not take into account the lower prices caused by higher landings.

Commenting on mechanical rotation, Mr. Ireland was concerned about the effect on recruitment because in the closed area on Georges Bank recent recruitment is at a low point since 1994, yet scallop recruitment has been highest in areas that had been fished. Also, he expressed uncertainty about the results because as production goes up, and when supply exceeds demand, the price declines. Mr. Applegate explained that the SAW examined the effects of closed areas on year class strength in the Georges Bank closed areas and found little difference in recruitment inside and outside the closed areas. He reported that there have been some opinions by scallop scientists and others that the spawning biomass in closed areas may have been contributing to the above average recruitment in the Mid-Atlantic, however.

Mr. Ireland, said that at present his vessel is catching 3,400 lbs. per day and asked how can it be more profitable to fish in the controlled access areas. Also there are few scallops left in areas that are in remaining open fishing areas, he explained, offering much less opportunity to fish. He thought that the current controlled access areas are not working very well because it is not profitable to fish in them, rather than where he can make more by fishing elsewhere. He thought that the proposed area rotation closures would leave insufficient areas to fish in where the scallop catch rates are much lower. Mr. Ireland urged the Council to make adjustments after the survey comes in if it is then necessary. Mr. Applegate said that the next survey may indicate that the proposed areas are not the right ones to close if it shows strong year classes of young scallops elsewhere, but that waiting for this information would delay Amendment 10 well beyond the start of the 2004 fishing year. One response might be to initiate a framework adjustment later this year if the 2003 survey is very different from the 2002 survey results. Mr. Ireland urged the Council to consider making adjustments on area rotation after the survey data comes in, if it shows that if indeed such action is necessary. Mr. Applegate pointed out that classically, where strong year classes occur, it is in areas that have the highest catch rates, but they are of small scallops. So in many cases, the areas slated for closure under area rotation might be coincidentally the most profitable areas to fish, unless at the time there are also re-opened areas that had large scallops from a period of previous closure.

Robert Mercer explained that the scallops that are caught with the area that Amendment 10 identifies as a rotation area closure currently produce 18-30 ct scallops, an ideal size for the scallop market. He didn't understand why this area needed to be closed given the large size of scallops coming from it. Replying to Mr. Mercer's question, Mr. Applegate said that the optimum size that scallops would be at under area rotation would be about 15 to 20 count. Mr. Mercer claimed that all the scallops that are now coming from the proposed closure areas are 19 to 21 count. He feared that a closure would get the scallops to a U10 size, which is not the size that the market desires.

Mr. Ireland recommended that the Council continue using the status quo overfishing definition. Mr. Johnny Mercer, also supported continuing the status quo overfishing definition due to the extensive movement of scallop larvae from closed areas to settle out in other areas (something that is not accounted for in the proposed overfishing definition). Landings and biomass are increasing every year and the current overfishing definition is too conservative, he added.

Mr. Robert Mercer, commenting on the effort allocation results and the day-at-sea increase from 23,000 to 30,000 days, pointed out that part of the increase in days has been due to vessels using less productive small dredges, and asked if that had been accounted for in the analysis. Mr. Applegate replied that the day-at-sea use had increased from three sources: increasing number of permits using days, increases in days used by active permits that had used fewer days in previous years, and category upgrades for vessels switching to small dredges. He said that the total number of allowable days was accounted for in the projections, based on average catch rates by all vessels.

Mr. Johnny Mercer said he was against the closure of areas for habitat protection, since there has already been a 2/3rd reduction in area swept through existing management measures and day-at-sea reductions. There is no scientific evidence in the document of permanent damage to habitat from fishing, he explained, and no discussion of human effects on essential fish habitat. Even though the resource has rebuilt, Amendment 10 proposes more reductions in days-at-sea, which he failed to understand why this is necessary given the rebuilt condition of the resource. Mr. Mercer added that there must be revenue and certainty about what will happen in the future, which is currently preventing investment to maintain and replace vessels that become obsolete. He recommended keeping the plan as simple and consistent as possible.

Mr. Ireland, commenting on the habitat alternatives, said that there are several conservation groups that would like to see the fishing industry not make another tow. He recommended selecting preferred alternative 2, because it has been successful in minimizing habitat impacts.

Robert Mercer, and owner of two full-time scallop boats, just a question about the effects of the general category proposals, if it would affect the full-time scallop fishermen. Mr. Applegate replied that with a TAC, increasing the general category possession limit would not affect the full-time day-at-sea allocations, but that the general category fishery might close by reaching a TAC earlier in the year. Without a TAC, Mr. Applegate warned that a higher general category possession limit could attract more fishing activity and cut the limited access day-at-sea allocations because of the higher fishing effort and mortality of scallops from the general category fishery.

Mr. Johnny Mercer recommended that the TAC for the general category permit sector should be limited to 2 percent and the vessels should be required to operate VMS, on all trips. Someone asked if there was a comparable net size limits for vessels using nets to target sea scallops under the 400 lb. limit and said that shrimp vessels have begun using nets to target sea scallops. Mr. Applegate replied that only the mesh size was limited. Mr. Ireland said that he is in favor of the general category retaining open access, but with mandatory VMS, with a 10½-foot dredge with or comparable net size, and with a 2 percent TAC cap on general category landings.

Mr. Tate, operator of a net vessel targeting scallops with nets, explained that many vessels that are now fishing that way because of the problems with shrimp availability. He added that it is not feasible to fish far north in the Mid-Atlantic on only a 400 lb. possession limit if large parts of the resource were closed for area rotation. Replying to a question from Mr. Spitsbergen, he said he uses a 55-foot net with 6" mesh. He recommended that the Council increase the general category possession limit, up to 600 lbs. He explained that there are quite a few boats from as far south as Georgia fishing from Md. He thought that the scallop fishery ought to offer and accommodate the needs of small vessels and new fishermen, by making the appropriate adjustments and allowances.

Mr. Johnny Mercer said that his boat does not have a shrimp or lobster permit. Since he cannot fish in other fisheries, he didn't think it is fair to increase the general category TAC to accommodate more vessels, allowing vessels from other fisheries to begin targeting sea scallops.

George T. Ormond, from NC, commented that being young he did not have the opportunity to qualify for a full-time limited access permit. There should be an opportunity for a young fisherman to get a full-time permit, he believed. He recommended increasing the 400 lb. possession limit to give young fishermen with small vessels an opportunity to enter the fishery.

General comments after presentation:

Ms. Peabody, commenting on the general category issues as an owner of scallop vessels and as a scallop processor, thought that the FMP should have a hard TAC of no more than 2 percent with the same reporting requirement as limited access vessels. She opposed changing the overfishing definition and cuts in day-at-sea allocations. She added that even thought the catches are estimated to increase; sometimes higher pounds is not enough to sustain the fishery. Habitat should be protected to the extent practical and she therefore supports habitat alternative 2. Other actions should be taken up in Amendment 13, she recommended, because the action would pertain to all fisheries to protect groundfish habitat. Ms. Peabody was in favor of using rock chains to reduce finfish bycatch, turtle bycatch, and address safety issues.

Mr. Ireland recommended maintaining the present management process instead of changing the fishing year, because the meat yield declines in Sept and Oct and because of bad weather during that time of year. Normal start up costs are around $7,500 and so stopping the vessels from fishing (to conserved day-at-sea allocations for more favorable seasons) is not an option. He recommended changing the survey timing, especially since the fishery has already operated before the current survey takes place, which he saw as a poor indicator of the biomass before the fishery occurs. Mr. Ireland was in favor of supporting the survey research with funds through a TAC set aside for the cost of the trip and the crew.

Mr. Robert Mercer was opposed to any closures and any day-at-sea reductions. Drawing a comparison, he commented that no other business functions on only 120 days per year. The industry couldn't stand more reductions, he claimed. Mr. Johnny Mercer believed that the science supports the current level of fishing effort and thought that further day-at-sea reductions were unnecessary. He was also opposed to area rotation unless there is a guarantee of access to areas that are now closed. Mr. Johnny Mercer added that the science supports the current allocations or even an increase. He was opposed to any new area rotation closures without equivalent access to the areas that are presently closed.

Mr. Falcher, owner of six scallop full time boats, was also opposed to reductions in day-at-sea allocations. He recommended that the general category catches should be limited to 2 percent or less, but that VMS should be required on the vessels. He also opposed any more closed areas, unless there is access to areas that are now closed.

Mr. Cross, Pamlico Packing Company owning three part time vessels, said that the smaller boats are trying to survive and there has to be a place for these vessels to work. He recommended that something more than 2 percent is needed. Trying to get all the landings up to a U10 count is similar to what happened in the summer flounder fishery (where he explained that the larger flounders drew less money than medium flounders), and predicted that the management measures would raise the average scallop size to unmarketable sizes. He claimed that the import market supplied the small flounder market, and would do the same for scallops if only large domestic scallops are landed.

Mrs. Mayo, owner of a full-time and part-time scallop boat, was also opposed to changing the overfishing definition and opposed to reducing days less than 120 days per year. She also opposed to having more closed rotation areas unless access to areas now closed is guaranteed. There is a big revenue impact from the scallop fishery, which would have larger economic implications if the industry declines. She doesn't want to see small areas being opened and large areas being closed. The current rules and 120 days are working adequately, she added.

Mr. Robbie Mercer explained that the fleet is not working on 40 ct scallops because of the crew limits. He was against any type of rotation because there has been no tradeoffs to replace the proposed closures. Mr. Tate thought that opening Georges Bank areas and closing Mid-Atlantic areas does not offer them an opportunity to fish because the smaller southern vessels cannot run that far.

Mr. Johnny Mercer explained that the biggest problem of fishing in the controlled access areas is that the vessels can catch greater amounts of scallops per day-at-sea elsewhere. Also the boat is at risk for loosing days because of breakdowns or other events, he said. Mr. Mercer recommended that the controlled access possession limit should increase to 3,000 to 3,500 lbs. per day-at-sea charged and a method for vessels to be exempted from the day-at-sea tradeoff for aborted trips should be explored.

No further comments were offered and Mr. Spitsbergen adjourned the meeting at 10:00 pm.

ADDENDUM

To Amendment 10 to the

Sea Scallop Fishery Management Plan

DESCRIPTION AND RATIONALE OF THE JOINT ADVISORY PANEL RECOMMENDATIONS 1-9 FOR POTENTIAL HABITT CLOSURE ALTERNATIVES

Prepared by the
New England Fishery Management Council
National Marine Fisheries Service

Date Submitted: _________, 2003

Executive Summary

This Addendum is intended to describe the nine recommendations from the Joint Advisory Panel Representative's Meeting (Feb 6-7, 2003). At its March 6, 2003 meeting, the New England Fishery Management Council (NEFMC) selected the following range of habitat alternatives as preferred alternatives to fulfill requirements of the December 5, 2001 joint stipulation and order under American Oceans Campaign v. Donald Evans: Habitat Alternative 2 – Complementary benefits of other Amendment 10 Alternatives and Habitat Alternative 6 – Closed areas consistent with the Framework Adjustment 13 scallop closed area access program. Additionally, the NEFMC voted to include recommendations 1-9 from the Joint Advisory Panel Representative's Meeting (Feb 6-7, 2003) as the basis for another preferred habitat alternative.

The Council was informed from staff and legal counsel that it was too late to incorporate a preferred habitat alternative into the Amendment 10 DSEIS that was not already analyzed in the document. Because the analysis is incomplete, and these recommendations are not yet fully developed, it should not be included as an individual habitat alternative in Amendment 10. The Council also selected this alternative as one of the preferred habitat alternatives in the DSEIS for the EFH components of Amendment 13 to the Multispecies FMP, thus the Council is interested in receiving public comment on these recommendations in the Amendment 10 process as well since the fisheries overlap. Although the Council had not defined the alternative and analysis was unavailable for the Amendment 10 DSEIS, the Council wanted to include the Joint Advisory Panel Recommendations (or related alternative identified before public hearing) in the material for comment al the Amendment 10 public hearings. The Council wanted to identify the Joint Advisory Panel Recommendations (JAR's) as preferred to get adequate attention during the public comment period. Therefore, this addendum describes the panel recommendations although they are not fully developed or analyzed in time for Amendment 10, but will be ready for Amendment 13 and would apply to fishing gears that impact groundfish EFH, including scallop fishing gear. Since at the time of filing of the Draft Amendment 10 DSEIS, the JAR alternatives were not fully identified or analyzed, the Council will provide material at public hearings for public comment, but the Council will be unable to choose the JAR alternative(s) in Amendment 10. Further discussion, analysis, and opportunity for public comment will be available when the Council submits Draft Amendment 13 to the Northeast Multispecies FMP.

Joint Advisory Panel Recommendations 1 – 9

The Chairs of the Groundfish, Scallop and Habitat Advisory Panels conducted a Joint Advisors meeting on February 6 and 7, 2003. Overall, the group came up with nine recommendations (JARs 1-9) for the Council to consider when reviewing the habitat alternatives in Amendment 10 and Amendment 13.

- JAR 1 - Recommend that the Habitat Technical Team analyze a modification to the Cod HAPC in Closed Area II
- JAR 2 - Recommend that the existing Western Gulf of Maine (WGOM) closure remain as it is currently configured, or that the Habitat Technical Team examine the impacts of a modification to it's eastern boundary
- JAR 3 - Recommend that the Habitat Technical Team look at the Multi-beam research in more detail to determine if the WGOM closure should be defined more accurately to contain only the sensitive habitat types intended for closure
- JAR 4 - Recommend that the Habitat Technical Team analyze a modification to the Cashes Ledge habitat closure and include a closure proposed for Jeffrey's Bank
- JAR 5 - Recommend that the Habitat Technical Team analyze a modification to the Nantucket Lightship closed area
- JAR 6 - Recommend that the Council recognize that the Great South Channel is an important "hot spot" for a variety of species and sediment types, but also that this area is very important to numerous fishing industries and should not be closed
- JAR 7 - Recommend that the Habitat Technical Team analyze a modification to Closed Area I

JAR 8 - Recommend that if the Council approves to implement a habitat closed area, it should have a sunset period of no longer than ten years. After that date, the habitat closure should expire, unless the review suggests that the area should remain closed for habitat purposes.

JAR 9 - Recommend that the Council seriously consider a VMS requirement for the entire fleet if that would help implement smaller, more refined closed areas for mortality and habitat protection

List of Figures

Description and Rationale for the Joint Advisory Recommendations

- **JAR 1 - Recommend that the Habitat Technical Team analyze a modification to the Cod HAPC in Closed Area II**

Advisor Rationale: The group first discussed Closed Area II, and the Habitat Alternatives associated with this area (8a and 8b). Alternative 8a is the existing Cod HAPC, and Alternative 8b extends those boundaries to the west for habitat purposes (this alternative does NOT change the HAPC definition)(See Figure 1). A few Advisors pointed out that the extension to the west does contain some important cod and haddock areas, as well as important fishing grounds. Survey data suggests that young of the year cod are in the HAPC in the summer near the rocky bottom that is along the Northern edge boundary. However, it was brought up that this area contains cod seasonally only, while it contains a significant amount of scallops all year round. It was suggested that a seasonal closure might be more appropriate. It was identified that there is a significant amount of sensitive habitat in the middle of the HAPC, but is should be noted that this habitat changes dramatically after big storms. One Advisor suggested that the Council and the public have to become more aware of the fact that these areas are changing all the time, and storm impacts have more adverse impacts on EFH then we currently understand. The group explored the idea of moving the existing boundary of the Cod HAPC to the South to include more diverse sediment types that are there, and allow scallop access in the north of the Cod HAPC. Some groundfish fishermen stated that the northern boundary enclosed area deeper than 50 fathoms that does not contain important cod or scallop habitat. Some members of the group argued that this modification is more practical, because it still protects important habitat to the south, but allows access to the north; a true balance of conflicting demands on the area. The scallop industry members present identified the areas where the scallop resource was greatest, and the line was drawn directly south of that boundary. The groundfish industry members present identified how far south groundfish spawning areas existed, and the southern boundary was drawn there. However, a few Advisors were hesitant to allow access in the northern part of the existing Cod HAPC because that area has been identified as important for cod spawning. It was also pointed out that there is a significant amount of lobster gear (approximately $20 million in gear) that is worked in the southwest portion of the Cod HAPC, and that would have to be permitted to continue.

The group identified that there are scallops in the northern part of CAII to about the 50-fathom curve. The industry members present identified that the new proposed closure is made up of mostly gravel with sand fingers. The lower portion was also identified as an important spawning ground for cod in the winter; in fact this area is still referred to as the "winter fishing ground" on nautical charts. There was general agreement that the northern boundary of the Cod HAPC is too high, and if it were moved to the south, more benefit would be generated for cod and other groundfish species that live there. There was not complete consensus on this modification; pros were that it would contain more historic spawning areas and provide access for the scallop industry in the north, the primary con was that juvenile cod found in the north of the existing HAPC would be subject to disturbance. In general, the group was not worried about the habitat impacts of herring and lobster gear, but some members recommended that this modification go forward as a Level 2 closure. Furthermore, the majority of the group was not concerned about the habitat impacts of the recreational fleet in offshore areas like this, but very concerned about their impact on inshore areas.

This modification could potentially impact habitat alternatives 3a, 3b, 4 8a, and 8b.

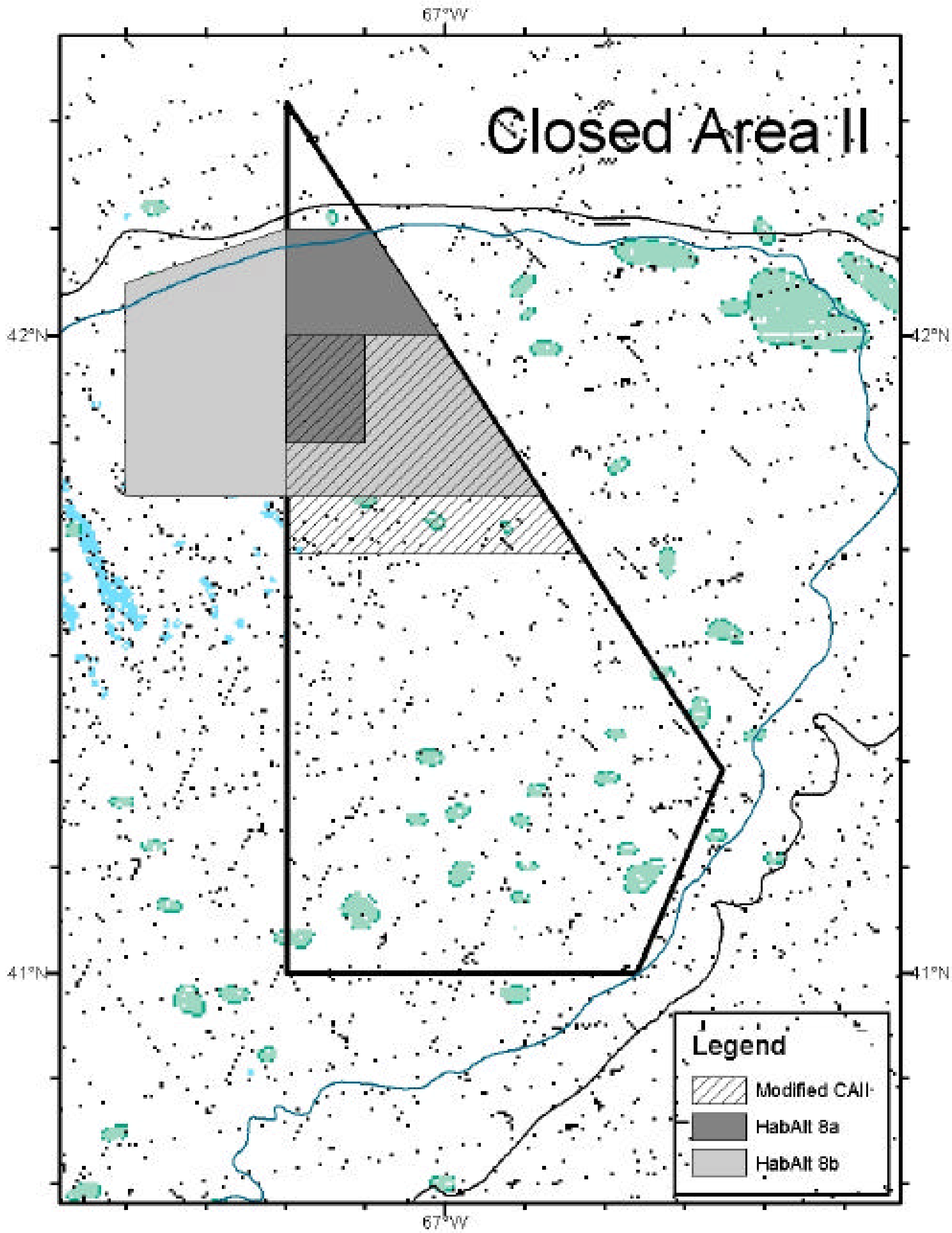


Figure 1 - Chart of Closed Area II with suggested modification from the Joint Advisors Meeting

- **JAR 2 - Recommend that the existing Western Gulf of Maine (WGOM) closure remain as it is currently configured, or that the Habitat Technical Team examine the impacts of a modification to it's eastern boundary.**

Advisor Rationale: After identifying the habitat types and species that live in different parts of the WGOM closure, the group came up with several overall recommendations. Overall, the majority of the group supports leaving the boundaries the way they are. The new boundaries proposed in some of the habitat alternatives seem hard to enforce, and the industry would not gain much from the areas that would open. One suggestion was to modify the proposed habitat closure for the WGOM by removing the proposed "bulge" to the west and modifying the eastern boundary to come straight down the 70°W line instead of the irregular boundary proposed in habitat alternatives 3a, 3b, and 4 (See Figure 2). The main rational behind this modification is that the closed area would be easier to enforce and there are resources in the eastern portion of the closure that should be available to fishermen. Furthermore, the important areas for habitat are along the western boundary. Enforcement individuals present urged the group to identify how critical enforcement of the area is, and if enforcement of the closure is a high priority then VMS should be required for all fishing vessels in the region. The group recommends that this modification should be a Level 4 closure to permit existing activities such as lobster, hagfish, herring and shrimp fishing. There is a substantial amount of lobster gear in this area, and the group was concerned about where that effort would shift if the WGOM became a Level 1 closure.

There was one suggestion that the bulge out could be closed to mobile gear only, but some industry members in the audience felt that was socially unfair, and stationary nets can catch significant amount of juvenile fish. One fisherman pointed out that the closed areas we have today were selected for a reason, and the most important areas to close have been identified already. The "bulge" is the last place with hard bottom available that gillnetters can go to avoid cod discards. If all the deep areas are closed to fishing then there is nowhere to go to avoid cod bycatch. It was also pointed out that this area is close to Gloucester, and this port depends on this area heavily. On the other hand, one researcher in the audience pointed out the "bulge" does provide a lot of opportunity for research, and this should be kept in mind when discussing where to identify areas for habitat research. One member of the Groundfish Advisory panel suggested that maybe the "sliver" within the WGOM closure should be identified as a Level 1 closure for research purposes. However, there was not full support of this idea among the group.

This modification could potentially impact habitat alternatives 3a, 3b, and 4.

- **JAR 3 - Recommend that the Habitat Technical Team look at the Multi-beam research in more detail to determine if the WGOM closure should be defined more accurately to contain only the sensitive habitat types intended for closure.**

This group also supported the need for more multi-beam mapping of the ocean floor, perhaps starting with the Stellwagen Bank Area.

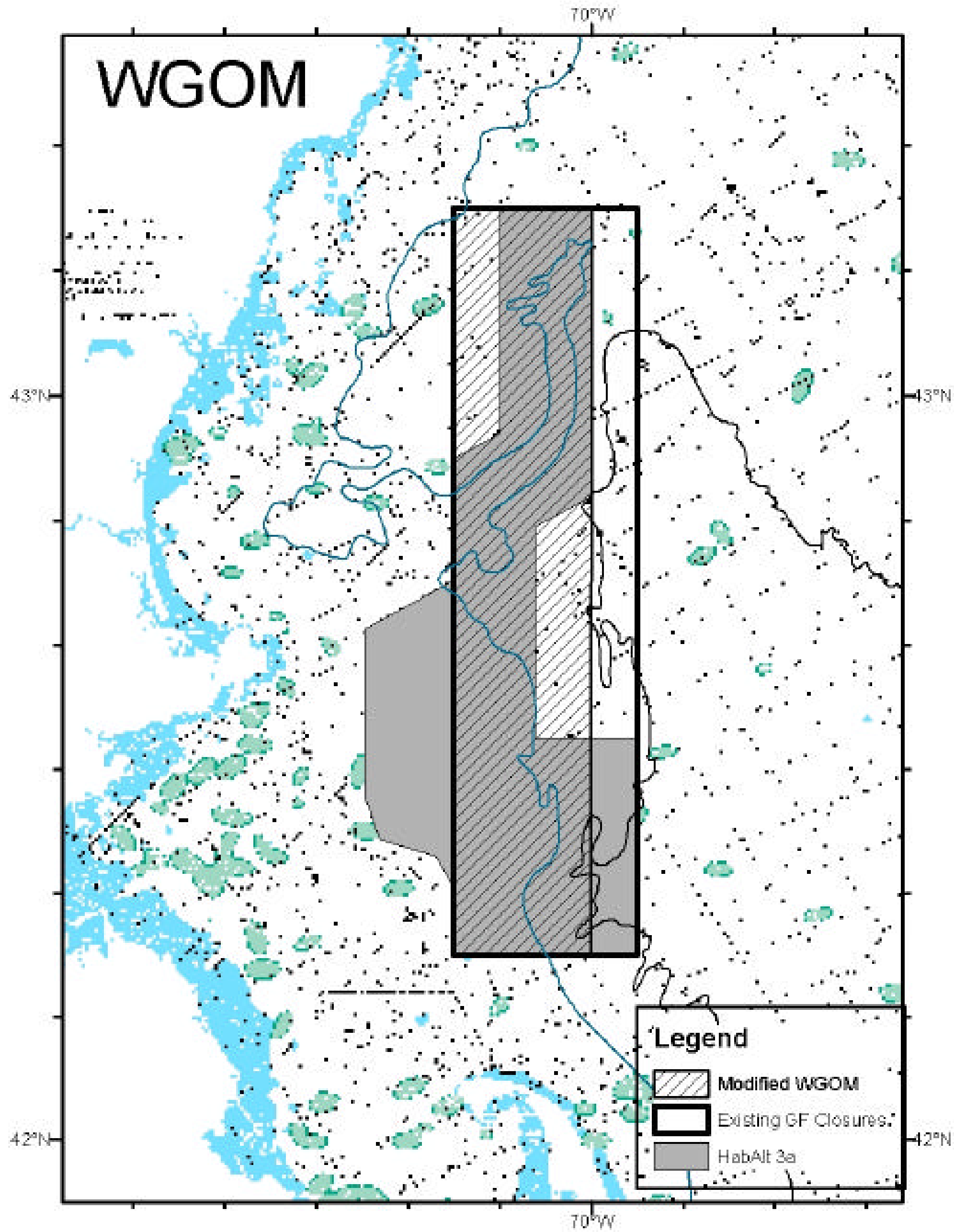


Figure 2 - Western Gulf of Maine closure with suggested modification from the Joint Advisors Meeting

- **JAR 4 - Recommend that the Habitat Technical Team analyze a modification to the Cashes Ledge habitat closure and include a closure proposed for Jeffrey's Bank.**

Advisor Rationale: Within the habitat closed area alternatives there are several alternatives that propose a specific habitat closure on Cashes Ledge and Jeffrey's Bank (Alternatives 3a, 3b, and 4). The group agreed that the closure on Jeffrey's should remain, but it should be a Level 4 closure. The habitat types in this area were identified to be mixed rock and mud, no sand. The majority of the group agreed that herring and shrimp activities in this area should be permitted to continue. It was pointed out that if this area was deemed a Level 4, then the habitat Technical Team will have to evaluate the gears used in that area, and determine whether they are adversely impacting the bottom or not. The group recommended that the gears that are permitted there now should be permitted access to the Jeffrey's Bank closure. The group agreed that there should be a Level 1 closure on Cashes to protect the rare kelp beds that are found in that area, but the closure should be modified to the 42°45W line. The southern boundary should be moved up, because the deeper area to the south does not contain kelp and should be assessable for fishing. Figure 3 below depicts the modified closure option

This modification could potentially impact habitat alternatives 3a, 3b, and 4.

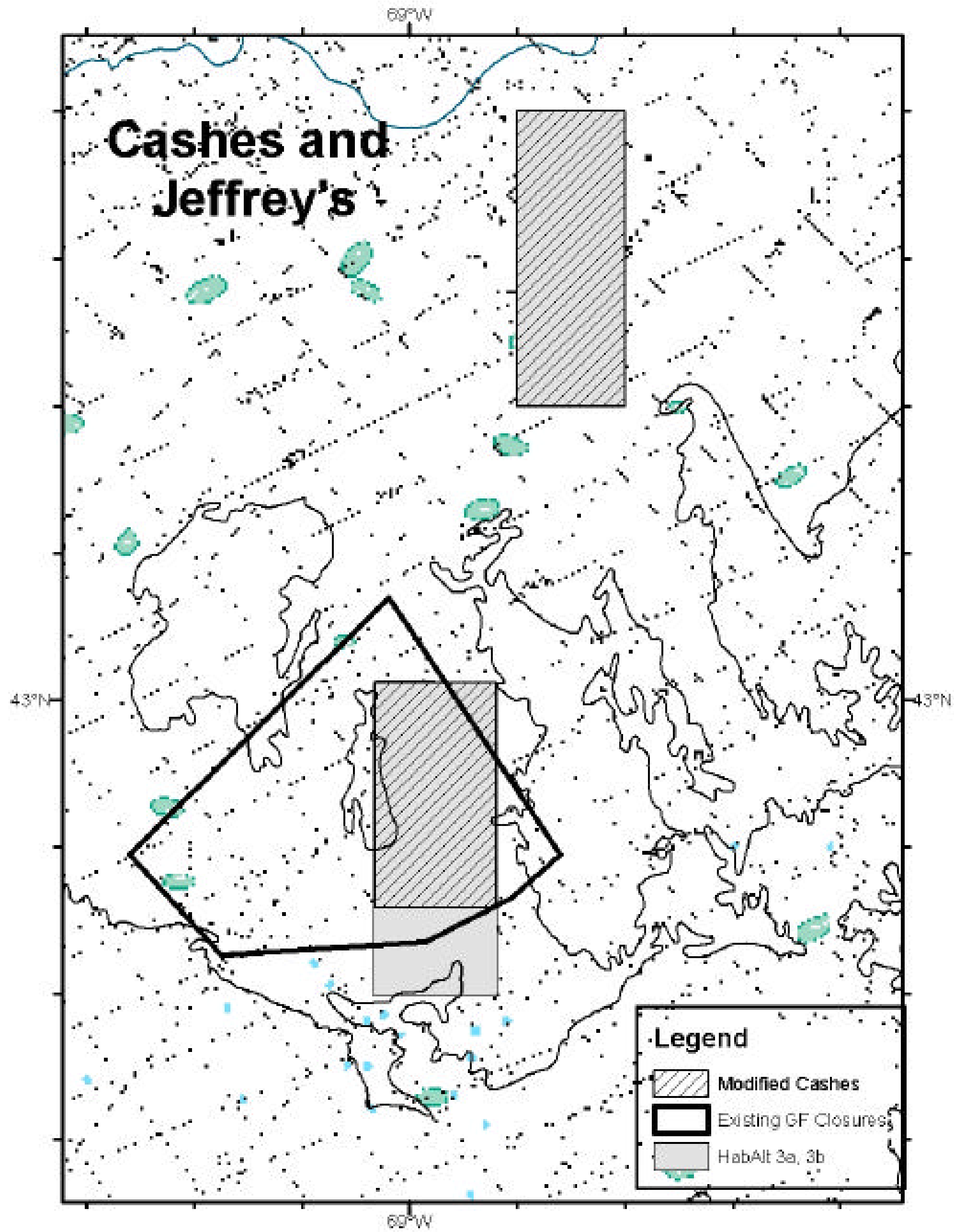


Figure 3 – Suggested modifications to the Cashes Ledge closure and inclusion of a habitat closure on Jeffrey's Bank

- **JAR 5 - Recommend that the Habitat Technical Team analyze a modification to the Nantucket Lightship closed area.**

Advisor Rationale: There is a problem with identifying a habitat area in the Nantucket Shoals area because there is no data for this area. The bottom is very complex, so most surveys and fishermen stay out of this area. But the majority of the audience agreed that this area has diverse sediment types and is important for the protection of small fish. An area was suggested just north of the Nantucket Lightship closed area to be closed primarily to protect the habitats that small fish depend on. As a modification to the existing Nantucket Lightship closed area, the group suggested the area shaded in Figure 4. A benthos map completed roughly in the 1960s showed that most of the concentrations of benthos in this area was contained in the central portion of the Nantucket Lightship area. Although this area is mostly sand, it contains many species. It was also suggested that the area be extended below the existing boundary of the Nantucket Lightship area to help protect tilefish and monkfish EFH. If all three components of this closure (the new portion to the north, the middle of the Nantucket Lightship area, and the proposed area to the south) were included, it would contain a diversity of sediments and species. The group felt that since the Mid-Atlantic Council has not identified closed areas as necessary for protection of tilefish EFH, then this closure might be unnecessary. It was also suggested that this area could be a multi-level closure; for example the top portion could be closed to different gear types than the southern portion. Overall, the area to the south did not get widespread support, so the other two recommended areas for analysis are shown in Figure 4. There was not consensus about the level of closure for this area because there is significant hook gear that works in this area, and it has been argued that this gear does not adversely impact the bottom.

This modification could potentially impact habitat alternatives 3a, 3b, and 4.

- **JAR 6 - Recommend that the Council recognize that the Great South Channel is an important "hot spot" for a variety of species and sediment types, but also that this area is very important to numerous fishing industries and should not be closed.**

Advisor Rationale: There was agreement among the fishermen at the meeting that the proposed habitat closure between Closed Area I and the Nantucket Lightship Area was unacceptable. They commented that this is a major fishing area for a variety of species, and would displace effort to even more sensitive habitats. A representative from the scallop industry explained that the majority of scallops that are not locked up in the existing closed areas are in this area, and if more of the channel area was closed to the scallop fleet, the industry may as well shut down. One Advisor pointed out that the Habitat Technical Team was originally charged to identify alternatives that would better protect habitat by closing areas near or adjacent to existing areas. This was identified as the wrong approach to take, and that these alternatives are arbitrary because the closed areas were based on where you should look, and not where the most important habitat areas are. He went on further to explain that this irregular shaped area, which is part of Alternative 3a, 3b, and 4, may have been identified because it is in between two existing closures, and may not provide the best habitat protection. The area is too large and the sediment types in this area are not that fragile. In addition, it was pointed out that there is a lot of ocean upwelling and strong tides in the channel that impact habitat irrespective of fishing gear. Many people in the room would prefer to look at area closures that are more "habitat driven", but recognize that it is late in the process to do that and difficult to do when we have existing closed areas for mortality.

This modification could potentially impact habitat alternatives 3a, 3b, 4, and 7.

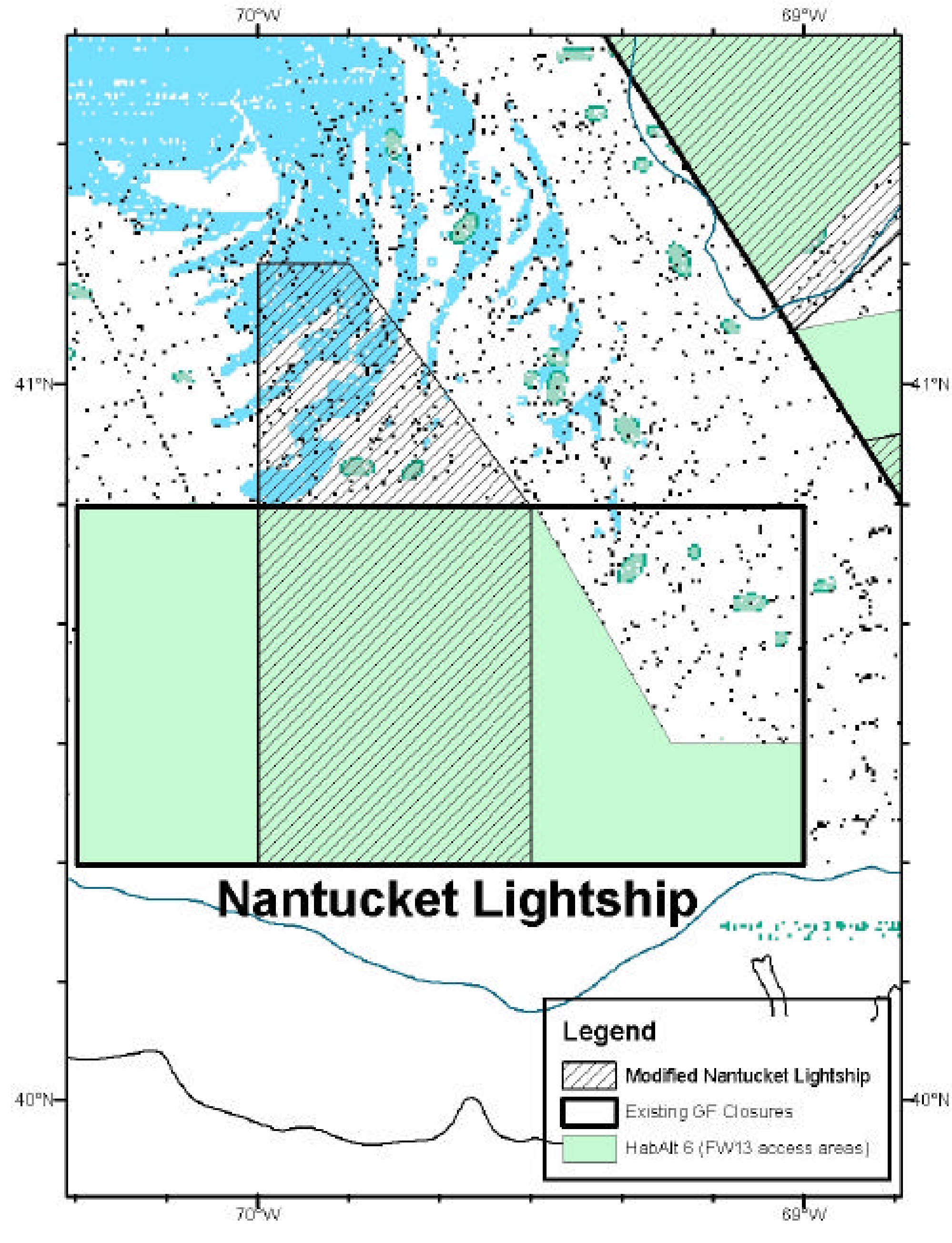


Figure 4 – Nantucket Lightship closure with suggested modification from the Joint Advisors Meeting

- **JAR 7 - Recommend that the Habitat Technical Team analyze a modification to Closed Area I**

Advisor Rationale: It was reported that Closed Area I does a lot for haddock, and is the primary reason haddock are recovering today. In general, it was concluded that CAI does not provide much benefit for cod. The group identified that a lot of CAI is sand, but there are diverse sediment types scattered within the area. The northwestern portion was identified as an important spawning area for cod in February in the deeper parts of that section. The "hambone", and areas around it in the southeastern portion of CAI was identified to contain the most complex bottom in the closed area. The scallop industry explained that they area able to catch scallops with a relatively low bycatch in the central portion of CAI from October to February. Industry members explained that when Closed Area I was implemented, fishing activity was displaced to the west, and if that area is now closed for habitat, fishing will be displaced again to the west, which is actually on even harder bottom. Most fishermen would prefer to fish on less complex bottom, but sometimes those areas are not accessible to them.

There was support for Habitat Alternative 6, but the group did have a suggestion of how to modify this closed area to better protect cod spawning areas. It was identified that the northern part of the Framework 13 scallop access area in the middle of CAI has important habitat for cod spawning. Therefore, if the Framework 13 scallop access area was shifted downward, then the cod could gain protection in the north for spawning, and the scallop industry could still gain access into the closed area. Figure 5 below shows the shift that the group recommends.

This modification could potentially impact habitat alternatives 3a, 3b, and 4.

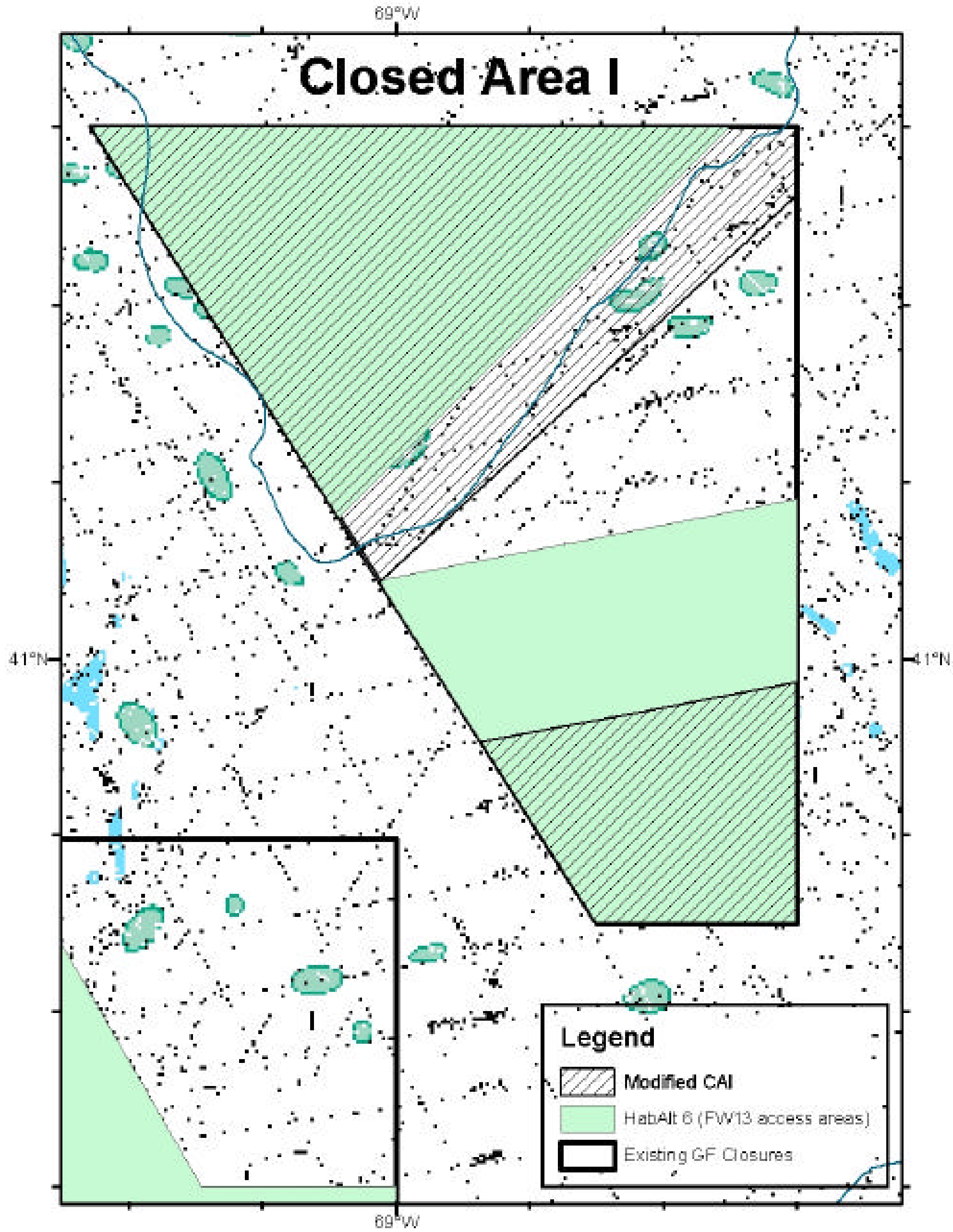


Figure 5 – Closed Area I with suggested modification from the Joint Advisors Meeting

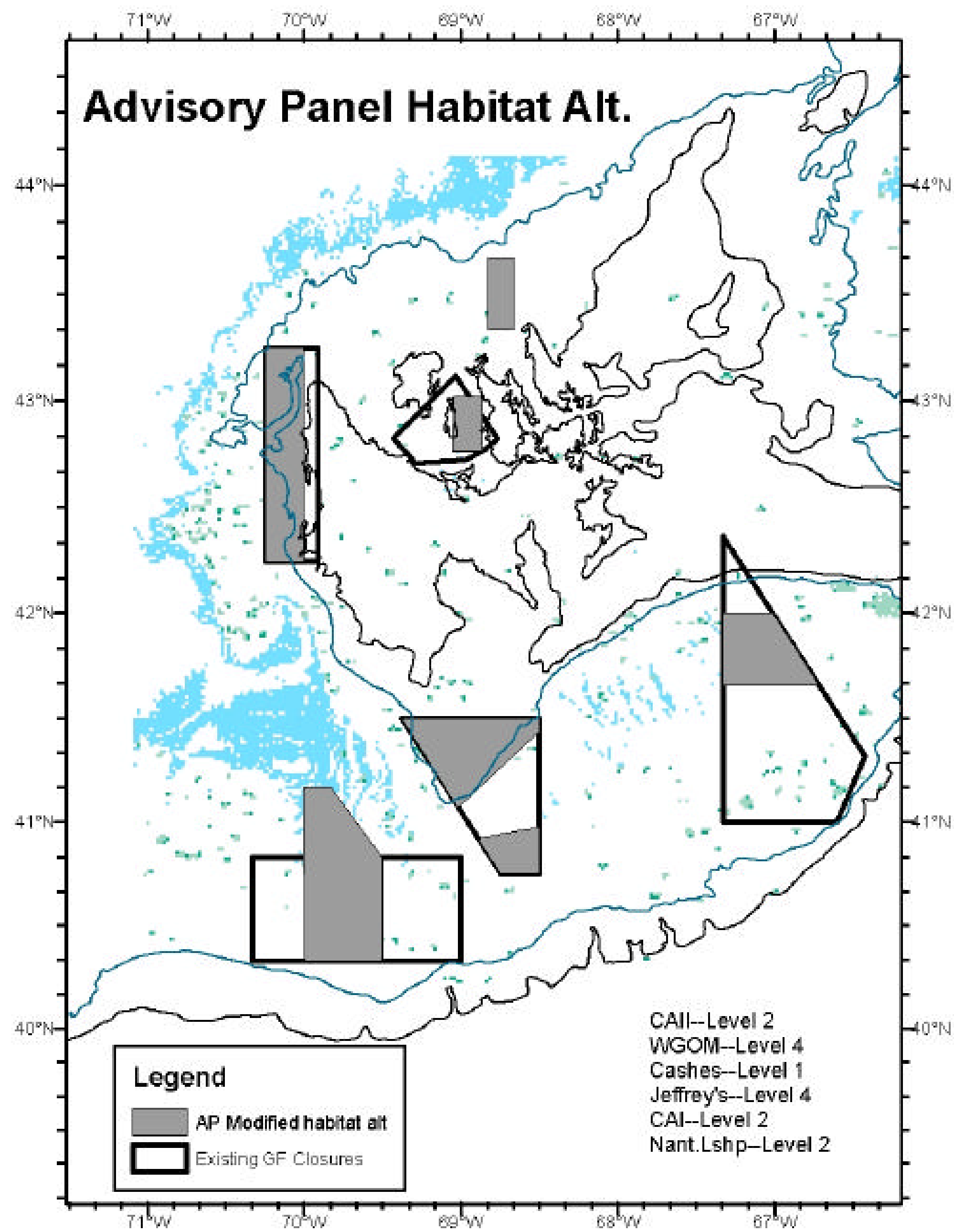


Figure 6 – Combination of all the suggested modifications from the Joint Advisors Meeting. It was not the intent of this group to combine all the recommendations into one alternative.

- **JAR 8 - Recommend that if the Council approves to implement a habitat closed area, it should have a sunset period of no longer than ten years. After that date, the habitat closure should expire, unless the review suggests that the area should remain closed for habitat purposes.**

Advisor Rationale: There was general support for the idea that any habitat closed area should be reviewed, and not be implemented as a permanent closure. The range of 5-10 years was suggested as a reasonable amount of time to go back and evaluate the habitat benefits of an area, and make modifications to the area if necessary. One Advisor brought up that there is nothing currently in the regulations of Amendment 10 and Amendment 13 that suggests that the closures are permanent, "we need to focus on "minimizing" impacts only; that is what we are required to do". In general, the group would prefer if the areas automatically opened after a certain amount of time, unless research showed that keeping them closed was necessary. However, there was strong opposition to automatically opening these areas from a few Advisors present. One Advisor suggested that to be precautionary, the areas should remain closed unless a review shows that they should be opened or adjusted.

- **JAR 9 - Recommend that the Council seriously consider a VMS requirement for the entire fleet if that would help implement smaller, more refined closed areas for mortality and habitat protection.**

Advisor Rationale: The requirement of VMS on all fishing vessels was discussed at length. The group recognized the high cost to the industry, but it was also pointed out that if VMS could mean smaller habitat and mortality closed areas, then the majority of the group would support a VMS requirement for all vessels in the region. One industry member pointed out that in the long-term it might be better for fishermen to bear the cost of having VMS rather than having such large closed areas. It was pointed out however, that if VMS were required for all vessels, than the enforcement resources to process all that information would increase dramatically. Overall, most people in the room would support 100% VMS coverage in an effort to fine tune closures. One fisherman commented that, "the long-term economic benefit for an individual is better if they get more rational access, and uniform enforcement on all vessels in the area is a good idea." A few individuals in the audience have already begun working with new power systems that are cheaper, and commented that, "If VMS is required, fishermen will quickly figure out a way to run the devices more efficiently."