

New England Fishery Management Council

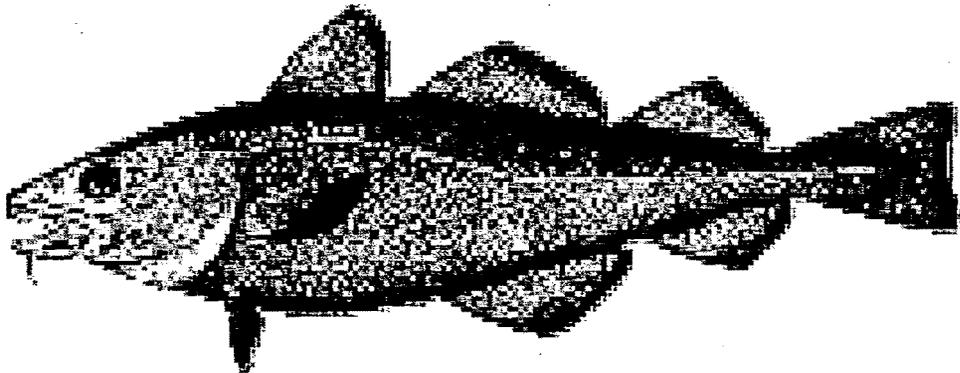
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FRAMEWORK ADJUSTMENT 26

to the

NORTHEAST MULTISPECIES FISHERY MANAGEMENT PLAN

To reduce mortality and preserve spawning potential of cod



Prepared in consultation with the National Marine Fisheries Service and the Mid-Atlantic Fishery Management Council

Initial framework meeting: October 28, 1998
Final framework meeting: December 10, 1998
Submitted by NEFMC: December 18, 1998

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2.0 INTRODUCTION

2.1 Background

2.1.1 Amendment 7

Amendment 7 to the Multispecies FMP established a rebuilding program for Georges Bank and Gulf of Maine cod, Georges Bank haddock, and Georges Bank and Southern New England yellowtail flounder stocks based primarily on days-at-sea controls, area closures and minimum mesh size. Among the management measures implemented by Amendment 7, the most notable were an acceleration of the day-at-sea allocation schedule to reduce days by 50 percent in two years (beginning May 1, 1997), year around closure of Closed Areas I and II and the Nantucket Lightship Area. As early as 1995, during the development of the amendment, the Council recognized issues that would have to be addressed after implementation and as the plan evolved. Foremost of these, as noted in the Final Supplemental Environmental Impact Statement (FSEIS) was the potential for effort shifts between areas or fisheries in response to restrictive days-at-sea allocations and closures of prime fishing grounds on Georges Bank. A second issue recognized by the Council was the relative lack of control of fishing effort of some fleet sectors, particularly gillnet vessels and day boats, which had either been exempt from restrictions, or were not effectively managed under Amendment 5.

Subsequent Council actions, implemented by framework adjustments, tightened the restrictions on fishing sectors that had not been addressed in Amendment 7. These actions were needed because stocks that were targeted by large vessels (primarily on Georges Bank and in Southern New England) had seen significant drops in mortality, while stocks that were fished by inshore fleets did not. Related to the proposed management adjustments in this framework action, the most relevant actions after Amendment 7 are Frameworks 20, 24, and 25.

2.1.2 Framework 20

Framework 20 was the first to specifically address the high fishing mortality rate for Gulf of Maine cod, after mortality on the other four Georges Bank and Southern New England stocks had declined to below the rebuilding targets ($F_{0.1}$). During the first annual plan review, for the 1996 fishing year, the Council learned that fishing mortality on four of the five principal groundfish stocks (except Gulf of Maine cod) had declined but that mortality on Gulf of Maine cod remained well above the rebuilding target (F_{max}) set by Amendment 7 and the maximum fishing mortality rate ($F_{20\%}$) set by Amendment 5. The report by the Multispecies Monitoring Committee resulted in Framework 20, which established a gillnet gear/effort control program, a Gulf of Maine cod trip limit, incentives to shift effort to other fisheries in the form of an increased haddock trip limit, and established several exempted fisheries (non-days-at-sea fisheries with very low groundfish bycatch levels).

Framework 20 also established a "running clock" procedure to allow vessels that inadvertently exceeded the daily trip limit (1,500 or 1,000 lbs./day-at-sea) to land their catch rather than discard the overage. If a vessel exceeded the daily limit, the vessel had to report its landings by telephone and not call-in to end the trip until sufficient time had elapsed on the day-at-sea clock to account for the overage. With the day-at-sea clock continuing to run, however, the vessel could return to fishing, since it was not required to remain in port. A vessel landing 5,000 pounds of cod on a four-day trip, for example, would have five days counted against its annual day-at-sea allocation. This measure was intended to reduce the incentive to target cod and allow vessels to use their days-at-sea allocations to target other species of groundfish.

2.1.3 Framework 24

Following the implementation of Framework 20, the Council learned that the Gulf of Maine cod trip limit was not working as effectively as intended. Reportedly, vessels were landing higher amounts of cod, keeping their days-at-sea clock running (as required by Framework 20) and then sailing to fish for species other than cod (possibly discarding cod in the process). While this practice was legal, it did not prevent vessels from targeting cod as much as anticipated and reduced the cod trip limit's effectiveness for controlling fishing mortality.

In response, the Council developed and submitted Framework 24 which requires vessels that exceed the per day limit of Gulf of Maine cod to remain in port until sufficient days-at-sea time had elapsed to account for the excess landings. This system allows vessels to land the excess cod (thus avoiding discards), but was meant to retain the effectiveness of the effort control system.

2.1.4 SAW 24 Advice and the 1997 Multispecies Monitoring Committee Report

SAW 24 updated the assessment on all five primary groundfish stocks through the 1996 calendar year, eight months into the first day-at-sea reduction and year-around area closures implemented by Amendment 7. For four of the five stocks, fishing mortality was at or below the rebuilding targets and initial signs (biomass increase due to survival of existing spawning stock) of recovery were evident. Fishing mortality for Gulf of Maine cod, on the other hand, remained stubbornly high and spawning stock biomass remained very low. SAW 24 characterized the Gulf of Maine cod stock as follows:

"This stock continues to be over-exploited and biomass remains at a very low level. Two successive year classes (1994 and 1995) which recruited to the fishery in 1996 and 1997 are the lowest ever observed. Fishing mortality has been very high (in excess of $F=0.88$ or 54% exploitation) since 1983, while spawning stock biomass continues to decline to new record lows . . . the 1996 F lies between 0.79 (50% exploitation) and 1.41 (70% exploitation). This further implies a 90% probability that the 1996 F was greater than 0.79 (50% exploitation), or about two times greater than the overfishing definition ($F_{20\%} = 0.37$ or 28% exploitation) and almost three times the rebuilding level ($F_{max} = 0.29$ or 23% exploitation)."

SAW 24 also gave the following management advice:

"The combined effects of low spawning stock biomass, high fishing mortality, record low incoming recruitment, and record low survival of pre-recruit fish indicate that the stock is on the verge of collapse. If the fishing mortality rate in 1997 continues at the 1996 level, the spawning biomass is expected to decline to an unprecedented low level in 1998. An immediate reduction in fishing mortality to a level approaching zero is required to halt the declining trend in spawning stock biomass and to rebuild at the maximum rate possible. Measures should be enacted immediately to minimize all directed fishing and bycatch on this stock."

2.1.5 Framework 25

Framework 25 was an annual adjustment of multispecies management measures that took effect on May 1, 1998. The purpose of the adjustment was to meet the plan objectives established by Amendment 7. To address the concerns raised by SAW 24, the objectives of Framework 25 included reducing mortality on Gulf of Maine cod to below F_{max} ($F_{max}=0.29$), a 63 percent reduction from the 1996 fishing mortality rate ($F_{1996}=0.78$). Among other actions to achieve the Amendment 7 objectives were sequential one-month "rolling closures" to reduce mortality on Gulf of Maine cod and protect spawning. The following table summarizes the inshore cod spawning closures and their relationship to the previous area closures that remain in place. Specific closed area boundaries are shown in Figure 1.

Table 1. Schematic illustration of the relationship between current closed areas to conserve groundfish and protect harbor porpoise. Refer to Figure 1 for precise boundaries of closed areas.

Closed area name	¼-degree Blocks ¹	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year-around closures													
Area I	80, 97, 98	■											
Area II	92, 93, 94, 108, 109, 118	■											
Nantucket Shoals	81, 82, 83 and some areas south	■											
Western Gulf of Maine	123, 124, 131, 132, 138, 139	■											
Inshore (cod spawning) closures – implemented in Framework Adjustment 25													
Inshore I	124, 125			■									
Inshore II	131, 132, 133				■								
Inshore III	138, 139, 140					■							
Inshore IV	145, 146, 147, 152						■						
Cashes Ledge	129						■						
Other closures													
Mass. Bay ²	124, 125			■									

¹ Boldfaced blocks are completely within the closed area

² Closed March 1 to March 30, inclusive; area also is closed to gillnet fishing to protect harbor porpoise.

Closed area name	¼-degree Blocks ¹	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northeast closure ³	144, 148, 149, 150, 151, 152, 153												
Closures to protect harbor porpoise – applies to gillnets only⁴													
Cape Cod South ⁵	84, 85, 86, 101, 102, 103												
Mid-Coast ⁶	132, 133, 137, 138, 139, 140, 145, 146, 147												

Of the options analyzed by the MSMC, Option 2 came closest to the measures that were ultimately adopted under Framework 25. Assuming that the Gulf of Maine cod trip limit would be 400 pounds per day-at-sea year around, these area closures were anticipated to produce a 65 percent reduction in catch, relative to the status quo. This analysis assumed, however, that no fishing effort that occurred within the proposed closed area would be displaced to open areas or would shift over time. An alternative “two-bin” model estimated effort displacement and predicted catches that were 15-16 percent higher than the “no effort displacement” model for similar options⁷.

2.1.6 SAW 27 Advice

SAW 27 updated the Gulf of Maine cod assessment through calendar year 1997. Based on the assessment, fishing mortality remained well over F_{max} and spawning stock biomass declined further to a new low. SAW 27 gave the following advice:

“The stock continues to be over exploited, and biomass has declined to an extremely low level. . . . Fishing mortality has been very high (in excess of $F=0.88$ or 54 % exploitation) between 1983 and 1996), while spawning stock biomass has declined to a new record low in 1997. There is a 90% probability that the 1997 F [$F=0.75$ or 48% exploitation] was greater than 0.57 (40% exploitation), or about 1.5 times greater than the overfishing definition ($F_{20\%} = 0.41$ or 31% exploitation) and twice the rebuilding level ($F_{max} = 0.29$ or 23% exploitation).

The SARC recommends an immediate reduction in fishing mortality to near zero. Measures should be implemented immediately to cease all directed fishing and minimize bycatch on this stock. Measures implemented in 1998 were only intended to achieve F_{max} . Reductions to F_{max} will be insufficient to promote rebuilding from record low spawning stock biomass. The combined effects of low spawning stock biomass, high fishing mortality, record low recruitment, and record low survival of pre-recruit fish indicate that the stock is collapsing [emphasis added].”

³ Closed August 15 to September 13, inclusive; area also is closed to gillnet fishing to protect harbor porpoise

⁴ Vessels have been allowed to fish in an experimental fishery if their gillnets are equipped with pingers.

⁵ Closed March 1 to March 30, inclusive.

⁶ Closed March 25 to April 25, inclusive.

⁷ Option 2 was not analyzed with the “two-bin” model.

2.1.7 Amendment 9 and Landings through July 1998

The Council submitted Amendment 9 to the Multispecies FMP during October 1998. In response to new Sustainable Fisheries Act requirements, the Council adopted new overfishing definitions that include a biomass target, a minimum biomass threshold, a control rule⁸, and a 5 to 10-year rebuilding schedule for Gulf of Maine cod. Considering the SFA requirements and the new overfishing definition, SAW 27 gave the following advice:

"The current (1997) total stock biomass of 9,200 mt is less than one-third of the proposed B_{MSY} of 33,000 mt and is projected to decrease further in 1998 (7,900 mt) to less than the proposed minimum biomass threshold of $\frac{1}{4}B_{MSY}$ (8,300 mt). Total stock biomass is projected to increase to about 8,900 mt in 1999, but this increase is predicated on the assumed recruitment for 1998 and 1999, which is higher than that observed in the last several years. The current overfishing definition in Amendment 7 is inconsistent with the requirements of the SFA. According to the proposed control rule for this stock based on SFA requirements, fishing mortality should be reduced to near zero."

The MSMC is currently evaluating the stock status in 1998 to determine whether the biomass of Gulf of Maine cod has fallen below the minimum biomass threshold in the overfishing definition. If the stock biomass has fallen below this level, the control rule would require the Council to reduce mortality to as close to zero as practicable, consistent with the new overfishing definition and SAW27 advice. If it hasn't fallen below the minimum biomass threshold, mortality would still have to decline to a level that would promote rebuilding in 5 to 10 years. This rebuilding target could require mortality to be no higher than $F_{0.1}$, or 0.16.

The in-season landings data, however, gives some indication of the effectiveness of the measures that were implemented during 1998. The major regulatory changes that affected the cod fishery were new area closures in the Western Gulf of Maine (year around), Massachusetts Bay (March 1998), Inshore Area III (May 1998), Inshore Area IV (June 1998), Cashes Ledge (June 1998), requiring vessels to tie up when using the running clock to account for landings that exceed the trip limit (April 1998), and adjustment of the cod trip limit (May 1998). NMFS implemented the original running clock procedure⁹ in May 1997. Although the pro-ration of landings in the Northeast Multispecies Preliminary Fisheries Statistics data is slightly different than the proration of landings used to assess Gulf of Maine cod, the Northeast Regional Office monthly report gives an early indication of changes in the fishery. The tables below compare monthly landings of Gulf of Maine cod during 1997 and 1998 to detect if there were any reductions in catch that might have been caused by the 1998 regulations. The reductions in landings have been adjusted to account for the changes in exploitable stock biomass between January 1997 and January 1998.

⁸ A control rule is a set of target and threshold mortality rates that define overfishing and trigger action to rebuild stock biomass and/or reduce mortality.

⁹ The original running clock procedure did not require vessels to tie up to the dock until their days-at-sea accounted for the cod landings that exceeded the trip limit. Vessels were able to land their cod, deduct multispecies days-at-sea to account for the overage and then fish for other multispecies under a the vessel's remaining days-at-sea.

Table 2. Prorated Gulf of Maine cod landings for 1997. Source: Northeast Regional Office – Monthly landings of the ten multispecies (groundfish species) by stock area and gear.

Gear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Trawl	330,431	672,570	549,648	983,874	1,072,521	966,608	345,789	148,505	181,918	332,190	561,425	426,657	6,572,136
Gillnet	115,903	250,086	229,563	450,822	346,019	494,858	499,876	405,499	469,311	596,981	483,614	242,202	4,584,734
Hook Other Gear	201,999	151,628	82,159	75,661	15,359	1,964	8,336	20,567	18,472	20,428	42,436	223,774	862,783
	18,995	23,032	36,717	54,750	6,007	14,295	10,562	10,863	4,108	3,538	9,191	11,622	203,680
Total	667,328	1,097,316	898,087	1,565,107	1,439,906	1,477,725	864,563	585,434	673,809	953,137	1,096,666	904,255	12,223,333

Table 3. Prorated Gulf of Maine cod landings for 1998. Source: Northeast Regional Office – Monthly landings of the ten multispecies (groundfish species) by stock area and gear. Shaded cells are projected landings based on the harvest pattern by gear and month during 1997.

Gear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Trawl	451,821	510,264	650,280	732,271	997,098	760,000	163,000	128,689	157,643	287,863	486,510	369,725	5,695,164
Gillnet	112,003	68,164	177,597	361,189	313,546	397,000	250,000	285,295	330,191	420,015	340,254	170,405	3,225,658
Hook Other Gear	134,966	107,779	64,455	71,700	24,411	7,000	12,000	16,171	14,524	16,062	33,366	175,947	678,381
	19,899	75,676	68,505	70,792	30,564	18,000	19,000	19,989	7,559	6,510	16,912	21,386	374,793
Total	718,689	761,883	960,837	1,235,952	1,365,619	1,182,000	444,000	450,144	509,917	730,450	877,042	737,462	9,973,996

Table 4. Nominal change in landings between 1997 and 1998. Shaded cells include the projection of Aug-Dec 1998 landings.

Gear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Trawl	37%	-24%	18%	-26%	-7%	-21%	-53%	-13%	-37%	-37%	-37%	-37%	-13%
Gillnet	-3%	-73%	-23%	-20%	-9%	-20%	-50%	-30%	-30%	-30%	-30%	-30%	-30%
Hook	-33%	-29%	-22%	-5%	59%	256%	44%	-21%	-21%	-21%	-21%	-21%	-21%
Other Gear	5%	229%	87%	29%	409%	26%	80%	84%	84%	84%	84%	84%	84%
Total	8%	-31%	7%	-21%	-5%	-20%	-49%	-23%	-24%	-23%	-20%	-18%	-18%

Table 5. Change in landings between 1997 and 1998, accounting for a 31-percent decline in exploitable biomass from Jan. 1, 1997 and Jan. 1, 1998. Estimates of exploitable biomass based on the SAW 27 assessment results (NEFSC 1998).

Gear	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Trawl	99%	10%	72%	8%	35%	14%	32%	26%	26%	26%	26%	26%	26%
Gillnet	40%	31%	12%	16%	32%	17%	-27%	2%	2%	2%	2%	2%	2%
Hook	14%	3%	14%	38%	131%	418%	109%	14%	14%	14%	14%	14%	14%
Other Gear	52%	377%	171%	88%	639%	83%	161%	167%	167%	167%	167%	167%	167%
Total	56%	1%	55%	15%	38%	16%	-25%	12%	10%	11%	16%	18%	19%

As of early October, preliminary landings for 1998 were compiled and assigned to stock area from Vessel Trip Reports through July 1998. The monthly landings by gear for 1997 and 1998 are shown in Table 2 and Table 3, respectively, along with projected landings for August to December. The MSMC is also updating this data with slightly different methods, so these projected numbers are preliminary and subject to change.

Simply comparing the change in landing between the last two years indicates that there is a measurable reduction in landings in 1998. For the entire year, landings of Gulf of Maine cod would decline by 18 percent (Table 4), provided that the proportion of annual catch during August to December is the same as it was during the same months in 1997. Within months, the change in landings of course varies and may be attributable to some of the management measures that NMFS implemented in early 1998. July shows a 49 percent decline, but this may be due to unavailable late landings in the most recent month. The next largest decline (31 percent) appears in February, but this precedes many of the management measures that were implemented in May 1998. May saw a five percent decline in landings while June experienced a 20 percent decline. Landings from vessels using gillnets appear to have had the largest decline, about 30 percent between 1997 and 1998 (Table 4). Landings from vessels using trawls, on the other hand show a 13 percent decline in landings, again if the seasonal landings pattern in August to December are characteristic of the 1997 pattern.

For landings by gear type within a month, a bit of a pattern emerges, especially for trawl and gillnet gears. For both gear, landings show the biggest declines in February, April, and June. It is hard to attribute these changes to any one factor, but perhaps the area closures during these months were more effective than in others. Another factor that could have played a part is the start of the fishing year on May 1 with a new allocation of days-at-sea and the change in the running clock procedure. Since few vessels use all of their days-at-sea allocations (MSMC 1997), it is hard to attribute the drop in April landings to having few days-at-sea available. On the other hand, the low landings change in May could be attributable to the beginning of a new fishing season and a new allocation of days-at-sea. Alternatively, the change in landings may have more to do with the availability and price of cod and other species than any changes in management measure.

It is comforting to observe a landings reduction for an overfished stock, following the implementation of more restrictive management measures . . . until the change in stock biomass is taken into account. Between January 1, 1997 and January 1, 1998, Gulf of Maine cod had a 31 percent decline in exploitable biomass according to the SAW 27 assessment (NEFSC 1998). Exploitable biomass is the total biomass of fish at each age times the percent of fish that are vulnerable to capture by the fishery. This estimated decline in exploitable biomass isn't precise, because it does not take into account any seasonal differences in exploitation patterns or differences in size selection that may have occurred. The VPA stock size estimate in 1998 does, however, gives a pretty good indication of the biomass of fish that is available to the fishery in 1998.

Taking the change in exploitable biomass into account, however, the landings reductions are less significant and could imply only small reductions in fishing mortality during 1998 (Table 5). During January to June, there are only two cells showing reductions in landings that exceed the reduction in exploitable biomass. The landings by vessels using hook gear in January fell by 3 percent and the landings by vessels using gillnets in February fell by 60 percent. Trawl landings of cod are actually up in every month, when the change in exploitable biomass is accounted for. July shows reductions in landings for trawl and gillnet vessels, but it is too early to tell if this is simply due to unavailable late data.

2.1.8 Summary of Existing Closures

2.1.8.1 Multispecies closed areas

The following sections describe what gears are allowed in the closed areas (exemptions) and the boundaries for the areas summarized in Table 1 and Figure 1.

Year Round Closed Areas

Western GOM Area Closure - Exceptions to the closure are vessels fishing with or using pot gear designed to take lobsters or hagfish, pelagic hook or longline gear, harpoon gear, and mid-water trawl gear.

Table 6. Points of N latitude and W longitude describing the boundary of the Western Gulf of Maine Area Closure.

Point	Latitude	Longitude
WGM1	42°15'	70°15'
WGM2	42°15'	69°55'
WGM3	43°15'	69°55'
WGM4	43°15'	70°15'
WGM5	42°15'	70°15'

Closed Area I - Exceptions to the closure are vessels fishing with or using pot gear designed to take lobsters or hagfish, pelagic hook or longhne gear, harpoon gear, and mid-water trawl gear.

Table 7. Points of N latitude and W longitude describing the boundary of Closed Area I.

Point	Latitude	Longitude
	41°30'	69°23'
	40°45'	68°45'
	40°45'	68°30'
	41°30'	68°30'
	41°30'	69°23'

Closed Area II – Exceptions to the closure are vessels fishing with or using pot gear designed to take lobsters or hagfish, pelagic hook or longhne gear, harpoon gear, and mid-water trawl gear.

Table 8. Points of N latitude and W longitude describing the boundary of Closed Area II.

Point	Latitude	Longitude
	41°00'	67°20'
	41°00'	66°35.8'
	41°18.6'	(10)
	42°22'	(10)
	41°00'	67°20'

(1) The U.S. – Canada maritime boundary

Nantucket Lightship Closed Area – Exceptions to the closure are vessels fishing with or using pot gear designed to take lobsters or hagfish, pelagic hook or longtime gear, harpoon gear, mid-water trawl gear, surf clam/quahog dredge gear and charter, party or recreational vessels. Charter and party vessels must have a letter of authorization from the Regional Administrator to enter or fish in this area.

Table 9. Points of N latitude and W longitude describing the boundary of the Nantucket Lightship Closed Area.

Point	Latitude	Longitude
	40°50'	69°00'
	40°20'	69°00'
	40°20'	70°20'
	40°50'	70°20'
	40°50'	69°00'

Seasonal Multispecies Closure Areas

Exemptions to the seasonal multispecies closures are: vessels that do not have a Federal multispecies permit and are fishing exclusively in state waters; charter, party or recreational vessels, and vessels fishing with spears, rake, diving gear, cast nets, tongs, harpoons, weirs. Dip nets, stop nets, pound nets, pots and traps, purse seines, mid-water trawl, surf clam/quahog dredge gear, pelagic hook or longlines, pelagic gillnets, and shrimp trawls (with properly configured grates). The areas are as follows:

Inshore Closure Area I – Closed March 1 through March 31:

Table 10. Points of N latitude and W longitude describing the boundary of the Inshore Closure Area I.

Point	Latitude	Longitude
GM1	42°00'	(1)
GM2	42°00'	(2)
GM3	42°00'	(3)
GM4	42°00'	70°00'
GM5	42°30'	70°00'
GM6	42°30'	(1)

(2) Massachusetts shoreline
 (3) Cape Cod shoreline on Cape Cod Bay
 (4) Cape Cod on the Atlantic Ocean

Inshore Closed Area II – Closed April 1 through April 30:

Table 11. Points of N latitude and W longitude describing the boundary of the Inshore Closure Area II.

Point	Latitude	Longitude
GM6	42°30'	(4)
GM7	42°30'	69°30'
GM8	43°00'	69°30'
GM9	43°00'	(5)

(5) Massachusetts shoreline

(6) New Hampshire shoreline

Inshore Closure Area III - Closed May 1 through May 31:

Table 12. Points of N latitude and W longitude describing the boundary of the Inshore Closure Area III.

Point	Latitude	Longitude
GM9	43°00'	(7)
GM8	43°00'	69°30'
GM10	43°30'	69°30'
GM11	43°30'	(6)

(7) Massachusetts shoreline

(8) New Hampshire shoreline

Inshore Closure Area IV - Closed June 1 through June 30:

Table 13. Points of N latitude and W longitude describing the boundary of the Inshore Closure Area IV.

Point	Latitude	Longitude
GM11	43°30'	(8)
GM12	43°30'	69°00'
GM13	(8)	69°00'

(9) Maine shoreline

Cashes Ledge Closure Area - Closed June 1 through June 30:

Table 14. Points of N latitude and W longitude describing the boundary of the Cashes Ledge Closure Area.

Point	Latitude	Longitude
GM14	42°30'	69°00'
GM15	42°30'	68°30'
GM6	43°00'	68°30'
GM17	43°00'	69°00'
GM14	42°30'	69°00'

Northeast Closure Area – This area is closed August 15 through September 13

Table 15. Points of N latitude and W longitude describing the boundary of the Northeast Closure Area.

Point	Latitude	Longitude
	(9)	68°55.0'
	43°29.6'	68°55.0'
	44°04.4'	67°48.7'
	44°06.9'	67°52.8'
	44°31.2'	67°02.7'
	(9)	67°02.7'

(10) Maine shoreline

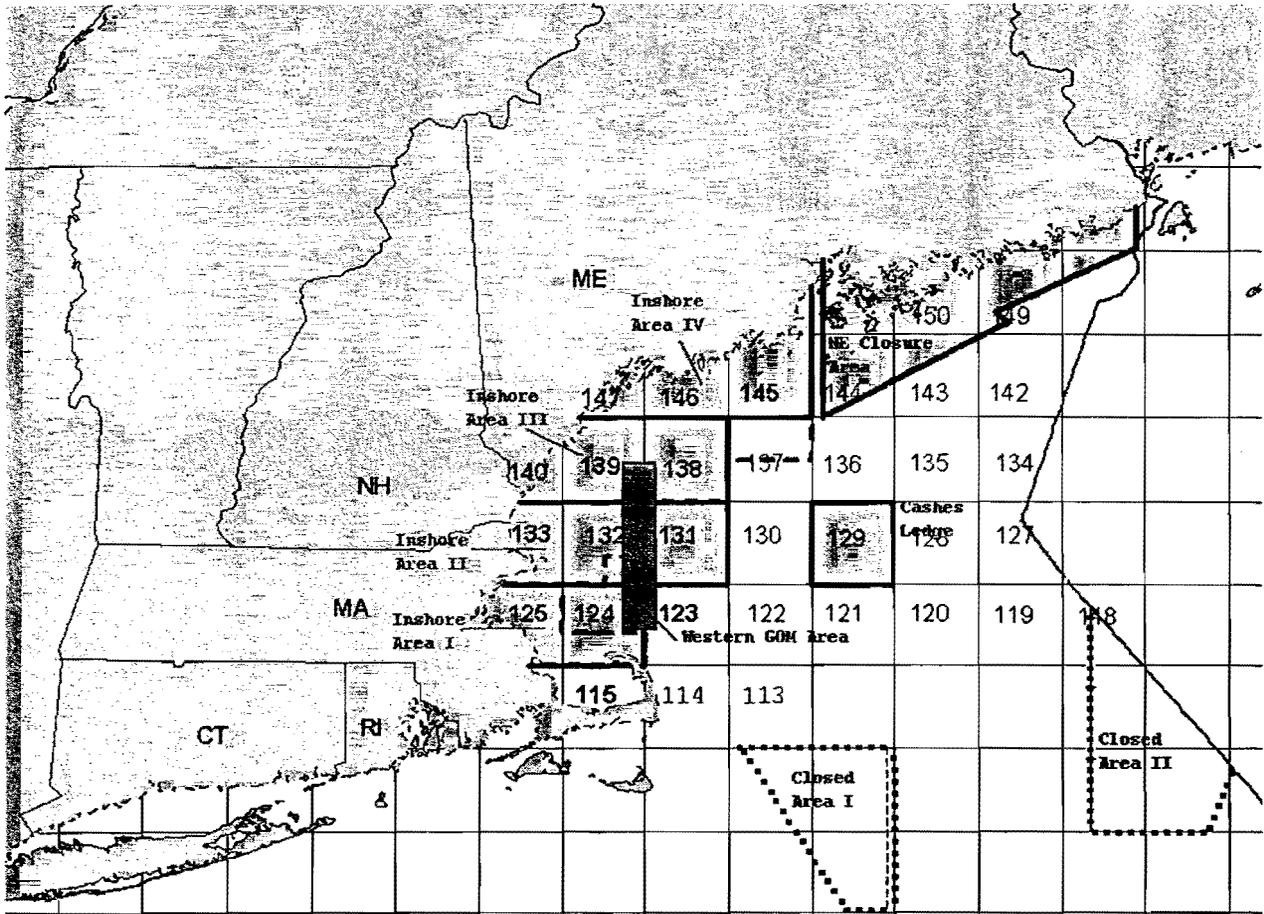


Figure 1. Boundaries of existing Multispecies FMP area closures. Quarter-degree square blocks are numbered sequentially to describe and evaluate proposed area closures. Shaded blocks represent the Gulf of Maine Inshore Closure Areas, the Cashes Ledge Closure Area, and the Northeast Closure Area. Dashed lines in the Gulf of Maine indicate the boundaries of the Massachusetts Bay and Mid-Coast Closure Areas.

2.1.8.2 Marine mammal closures affecting sink gillnets

The following outline summarizes the area closures in the Multispecies FMP that the Council implemented to protect harbor porpoise and other marine mammals. It also gives a brief history of when the area closures took effect and what rules applied.

Northeast Closure Area: August 15 - September 13, closed.

- Implemented in 1994.
- Area was closed for groundfish conservation beginning in 1996.

Mid-coast Closure Area: September 15 - December 31

- Implemented in 1994. Initial closure did not include the Jeffreys Ledge Band and was closed for November only. During the closure period an experiment was conducted to evaluate the use of acoustic deterrents.
- In 1995, both time and area were expanded to include the month of December and the Jeffreys Ledge (or Z) Band. An experimental fishery was allowed to evaluate the use of acoustic deterrents only in the Band.
- In 1996, the closure period was extended to include the period September 15 - October 31. Experimental fisheries were conducted during this period in 1996 and 1997. At the same time the use of acoustic devices became a requirement for fishing in the area during November and December, rather than a condition for participation in an experimental fishery.
- The closure for groundfish conservation, scheduled for implementation in 1996, was moved to the spring. This was accomplished under Framework Adjustment 19 to the Northeast Multispecies FMP. Blocks 132 and 139 were closed from May 1 - May 31, 1997. The same action would have closed the entire Mid-coast Area from May 10 - May 30 in 1998. Before the closure went into effect, Framework 25, with its "rolling closure" program for groundfish, superseded the Framework 19 closure.

Mid-Coast Closure Area: March 25 - April 25

- Implemented in 1996. An experimental fishery was allowed to evaluate the operational use of acoustic devices during the closure period.
- In 1997, a formal experiment was conducted to determine the effectiveness of acoustic devices during the closure period.

Mass Bay Closure Area: March 1 - 31, closed

- Implemented in 1994, but the first closure did not occur until 1995.
- An experimental fishery was allowed in 1996 to evaluate the operational use of acoustic devices during the closure period.
- Area was closed for groundfish conservation in beginning 1997.

Cape Cod South Area: March 1 - 31

- Implemented on March 8, 1996. An experimental fishery was allowed to evaluate the operational use of acoustic devices during the closure period.
- No experimental fishery was requested in 1997.

Right Whale Critical Habitat/Cape Cod Bay (fed. waters portion): January 1 - May 15

- Closed unless gear or alternative practices are developed that reduce the likelihood of entanglement or reduce the chances that entanglements will result in serious injury or mortality.

Right Whale Critical Habitat/Great South Channel (NMFS action): April 1 - June 30

- Closed unless gear or alternative practices are developed that reduce the likelihood of entanglement or reduce the chances that entanglements will result in serious injury or mortality.

3.0 PURPOSE AND NEED

The Council wants to take additional action to protect cod during the 1999 spawning season which starts in February. Scientific advice on Gulf of Maine cod indicates that the stock is collapsing, and immediate action is necessary to reduce catches and protect the spawning stock. Georges Bank cod is only in the initial stages of rebuilding and additional measures are needed to protect the spawning potential of that stock to continue recovery to sustainable levels.

The Gulf of Maine cod stock is in a state of collapse (NEFSC 1998) and rapid action is needed to avert excessive catches when cod become vulnerable to fishing during the February to June spawning season. Georges Bank cod is also overfished and only in the initial stages of rebuilding. Quick action will prevent the cod spawning potential from falling below currently low levels and improve the chance for recovery if environmental conditions for recruitment are favorable. The annual framework adjustment will however not be implemented until the start of the next fishing year on May 1, 1999.

According to the most recent assessment, the total stock biomass in 1997 was 9,200 mt and was projected to decline below or approach the minimum biomass threshold of 8,300 mt ($\frac{1}{4}B_{MSY}$) if fishing mortality in 1998 remained at the 1997 level. This prediction also assumed that the exploitation pattern would not improve and that the age 2 estimate in 1997 is accurate.

If the Council can keep the stock biomass from falling below the minimum biomass threshold ($\frac{1}{4}B_{MSY}$), rebuilding to B_{MSY} could occur within the 5-year rebuilding time period selected by the Council by reducing mortality to a range between 0.15 to 0.20. This policy would be analogous to the rebuilding strategy (holding mortality below $F_{0.1}$) for the other primary groundfish stocks and could allow some incidental catches of cod in a multispecies fishery.

If total stock biomass falls below the minimum biomass threshold, however, the Council must take steps to reduce mortality to as close to zero as practicable, according to the control rule set by Amendment 9 for Gulf of Maine cod. Even below the minimum biomass threshold, Gulf of Maine cod may be able to rebuild to B_{MSY} in less than five years (the Council's maximum rebuilding period), but there is a greater risk of recruitment failure at lower biomass levels. For this reason, the Council has determined to promote rebuilding at the maximum rate possible by decreasing fishing mortality as close to zero as possible.

Since the landings in 1998 appear to be exceeding the TAC by a considerable margin, action during this fishing year by the Council may avert the need to take even more drastic action to rebuild Gulf of Maine cod. Also, recruitment appears to be at very low levels and preservation of spawning stock biomass is needed to avert a stock collapse caused by poor recruitment.

Although Emergency Action could be justified to address this issue, an in-season framework adjustment could be implemented by March 15, at the latest, and also allow the opportunity for public comment during the framework process.

Excess catch and discard of small cod also contributes to the overfished condition. New recruitment should be protected from discarding to promote rebuilding when spawning stock biomass is very low. Discard also contributes to the overfished status of other species commonly caught by hook gear (pollock, hake, spiny dogfish, monkfish, etc.) and is a waste for healthy (not overfished) stocks as well. For these reasons, National Standard 9 requires the Council to minimize bycatch mortality.

Timing

The action will be limited to the months of February through April, 1999. The Council will develop a follow-up framework adjustment (Framework 27) to implement the annual adjustment of management measures to take effect on May 1, the start of the fishing year covering the entire multispecies fishery.

At the December meeting, in addition to approval of Framework 26, the Council will review the Multispecies Monitoring Committee report and initiate the annual adjustment, Framework 27. The Multispecies Monitoring Committee is currently analyzing action taken in the Gulf of Maine during 1998, which include area closures and a cod trip limit of 400 pounds per day. It is also considering updated stock assessments of other fish in the multispecies complex. The results of that analysis will form the basis for the management plan for the 1999 fishing year.

However, since 85 percent of the target allowable catch of the Gulf of Maine cod stock had been landed by the end of September, the Council is gravely concerned that current measures are not sufficient to prevent further stock decline, and seeks to put additional protection for cod in place before the annual adjustment. By limiting the scope of Framework 26 to protect cod in February through April, 1999, the Council is minimizing the workload for preparing and reviewing the documents, and therefore minimizing the potential for any delay in implementation.

4.0 PREFERRED AND REJECTED ALTERNATIVES and QUALITATIVE IMPACTS

Background

This framework adjustment will not achieve the Amendment 7 targets by itself, but is only intended to quickly reduce fishing mortality from currently high levels, before more permanent measures can be implemented via Framework 27, the annual framework adjustment that will take effect on May 1, 1999.

The Council considered area closure alternatives that build on existing closures designed to protect spawning aggregations of cod by extending the time or area covered under those closures. Alternatives include:

- Modifying current one-month inshore closures for March and April to two-months, beginning as early as February.
- A proposal by an industry group that would expand the inshore closure areas closed during March and April seaward across the Gulf of Maine to the Hague Line.
- Extending the expanded inshore closure areas for an overlapping two-month period from February to April.
- Expanding the current closed areas in February, March, and April to include other blocks that have the highest CPUE for cod.

The area closure alternatives are intended to be a transition management strategy that will have many of the same properties that a larger closed area system would have in the annual framework adjustment (Framework 27), effective May 1, 1999. It is too early to know what the final outcome of Framework 26 will be, but the Council intended to avoid closing areas in Framework 26, only to see them remain closed when Framework 27 becomes effective. There are two strategies that the Council considered: choosing Framework 26 options that most closely resemble the alternatives in Framework 27, or delaying implementation of some Framework 27 area closures to avoid a continuous closure of the same area under both frameworks.

The area closures would apply to all fishing capable of catching groundfish as defined in the multispecies regulations including scallop dredges. The economic impacts of excluding scallop dredges and trawls are estimated in Section 5.2.7.

Issues to be addressed

Over the short term, the proposed extension and expansion of the inshore closure areas is intended to delay fishing mortality on mature, spawning cod until the annual framework adjustment can be implemented at the start of the fishing year on May 1, 1999. Some of the measures in the annual framework adjustment may replace or augment the management adjustments proposed by this framework. This short-term strategy for preserving spawning cod is important in 1999, because it will occur before implementation of the annual management adjustment on May 1, 1999.

The Council may, on the other hand, continue some or all of the management specifications in this framework as part of its long-term strategy for reducing mortality and rebuilding Gulf of Maine cod. Area closures can effectively reduce fishing mortality if they occur during times and within areas where cod are more available to the fishing fleet. To the extent that cod aggregate in inshore waters to spawn

(e.g. Bigelow and Schroeder 1953), the fish may become more vulnerable to fishing gear. If the area closure causes fishermen to target other species or to fish for cod when they are less available, the closure may translate into reduced mortality for cod. This effect is doubly important if the closure protects mature cod. On the other hand, fishermen may respond by fishing immediately outside the area or by fishing harder during other times, partially or completely negating the benefits attributable to a closed area. Larger closed areas, a greater proportion of simultaneous closures, or longer closures tend to be more effective at reducing mortality for the species they are designed to protect than smaller closures that last for a short period.

The Council considered three types of extensions of the existing inshore area closures. The original inshore area closures were intended to “roll” and follow the peak in cod spawning activity. At present, none of the four inshore area closures occur simultaneously. On one hand, the one-month “rolling” closures maximize the fishing industry’s flexibility to target cod in other areas and adapt to the closures. On the other, the potential effort shift reduces the effectiveness of the closed areas to protect spawning codfish [since codfish have a protracted spawning period that lasts two to three months within a particular spawning area (Bigelow and Schroeder, 1953)].

An additional inshore closure near Cape Cod and an area offshore were also considered in order to provide additional conservation of Georges Bank cod and to accommodate variability of Gulf of Maine cod spawning that could extend further south than the static boundary in the assessment. More protection for Georges Bank cod is needed because fishing mortality is 0.26, higher than the 0.18 rebuilding mortality target.

4.1 Preferred Alternative (Alternative 3) - Doubling of the number of area-month blocks to be closed, selected on the basis of the highest CPUE

Based on rankings of blocks and months by cod landings per day-at-sea (Table 19), The preferred alternative will double the number of closed block-month combinations during the February to April period and add one additional block to conserve Georges Bank cod. This strategy adds seven block-month combinations to the closures. Table 19 lists the block-month combinations and ranks them according to cod CPUE. The existing closures are shaded.

Selection of blocks and months in this manner indicate that blocks 119, 124, and 125 would close during February (Figure 2). There are currently no February closures, but this choice would effectively close Inshore Closure Area I for February and March. Block 119 is on the north side of Georges Bank, so it would add conservation for Georges Bank cod. This option would affect 73 mt of cod landings above the status quo.

Selection of the highest block-month combinations would have added block 114 during the existing March closure (Figure 2). Thus, Inshore Closure Area I and the block immediately east of Cape Cod would close during March. This closure would have affected 18 mt of landings. Due to uncertainty at the final framework meeting about the contribution of this block/month combination and the negative impact on the scallop industry, the Council chose not to close block 114 during March as part of the preferred alternative.

This selection method also adds blocks 123, 124, and 130 during the existing April closure (Figure 2). Thus, Inshore Closure Area II and the areas immediately to the east and southeast will close at the same time. Area 123 affords additional conservation for Georges Bank cod, since it falls partially within the Georges Bank cod stock area. Area 124 would therefore close during February through April. Also proposed for closure is area 125 during April, since although the CPUE ranking did not qualify it

within the top seven areas (defined by block and month) it would be likely to receive the lion's share of the effort shift caused by the new closures in this alternative. Including keeping area 125 closed during April, the new April closures would affect 288 mt of cod landings.

In summary, by selecting the top five open block-month combinations that would reduce mortality on Gulf of Maine cod plus the two top blocks that would reduce mortality on Georges Bank cod would close blocks 119, 124, and 125 during February, and blocks 123, 124, 125, and 130 during April. The quantitative estimates of cod landing reductions and economic impacts are given in Sections 5.2.6 and 5.2.7, respectively.

The following tables identify the boundaries of the new closed areas, i.e. blocks 119 (February), 123 (April), and 130 (April). Other closures in Alternative 3 are extensions in time of existing closed areas.

Table 16. Points of N latitude and W longitude describing the boundary of the block 119.

Point	Latitude	Longitude
GM18	42°00'	67°30'
GM19	42°00'	68°00'
GM20	42°30'	68°00'
GM21	42°30'	67°30'
GM18	42°00'	67°30'

Table 17. Points of N latitude and W longitude describing the boundary of the block 123.

Point	Latitude	Longitude
GM22	42°00'	69°30'
GM23	42°00'	70°00'
GM24	42°30'	70°00'
GM25	42°30'	69°30'
GM22	42°00'	69°30'

Table 18. Points of N latitude and W longitude describing the boundary of the block 130.

Point	Latitude	Longitude
GM26	42°30'	69°00'
GM27	42°30'	69°30'
GM28	43°00'	69°30'
GM29	43°00'	69°00'
GM26	42°30'	69°00'

Rationale: The preferred alternative (Alternative 3) closes blocks during months with the highest landings-per-unit-effort (LPUE). Assuming that the economic value of a multispecies day-at-sea is equal, but the species composition (and therefore cod catches) differ between areas, this approach maximizes the conservation of cod with the least economic impact on gross fleet revenue. Without taking into account transition costs for a vessel to fish in other areas (possibly with different gear), this strategy maximizes the benefit-cost ratio.

The strategy in preferred alternative is to reduce the vulnerability of cod to fishing, independent of spawning activity. While it fails to include as many offshore blocks or blocks within the Georges Bank cod stock area as Alternatives 2a and 2b, it does not close all the blocks in the same areas as the existing inshore closure areas. Because of the high LPUE for all months in February to April, however, Alternative 3 will close blocks 124 and 125 in all three months under consideration.

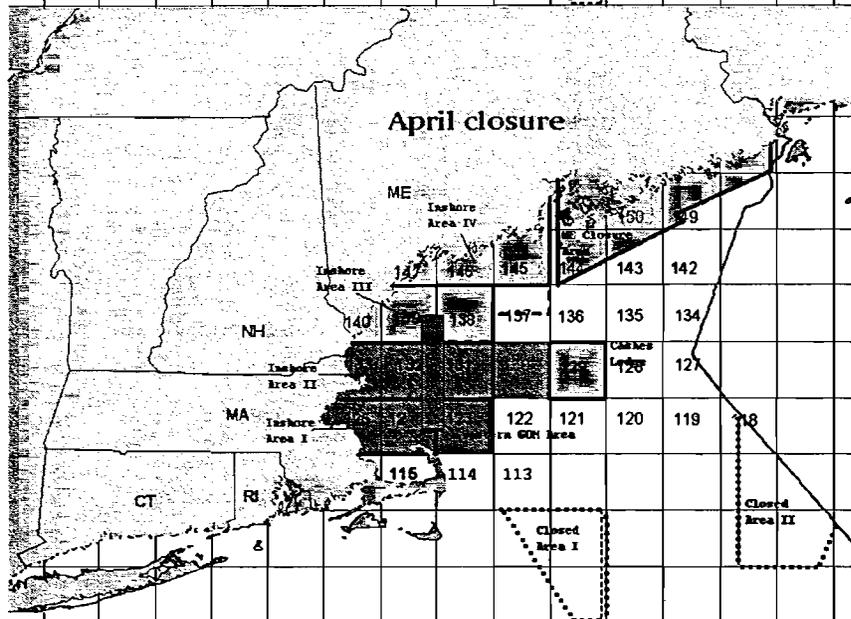
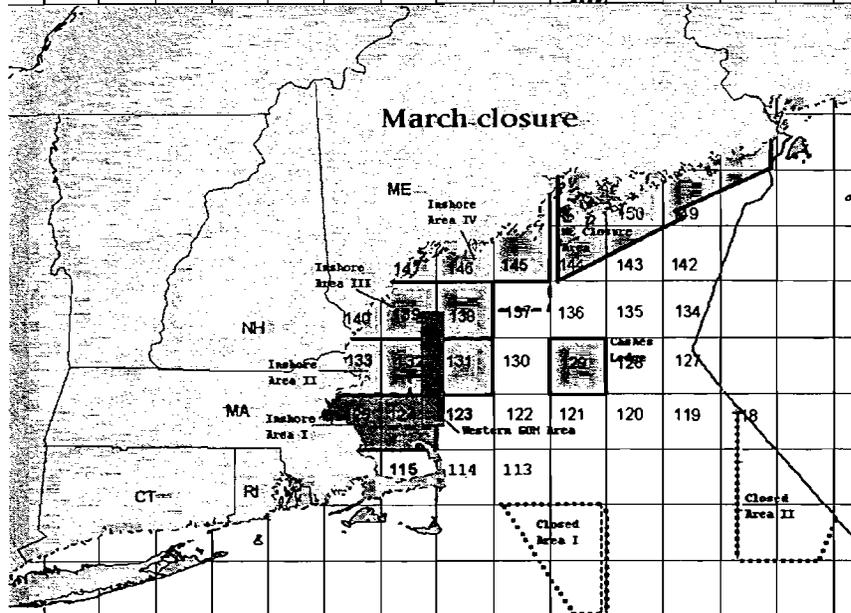
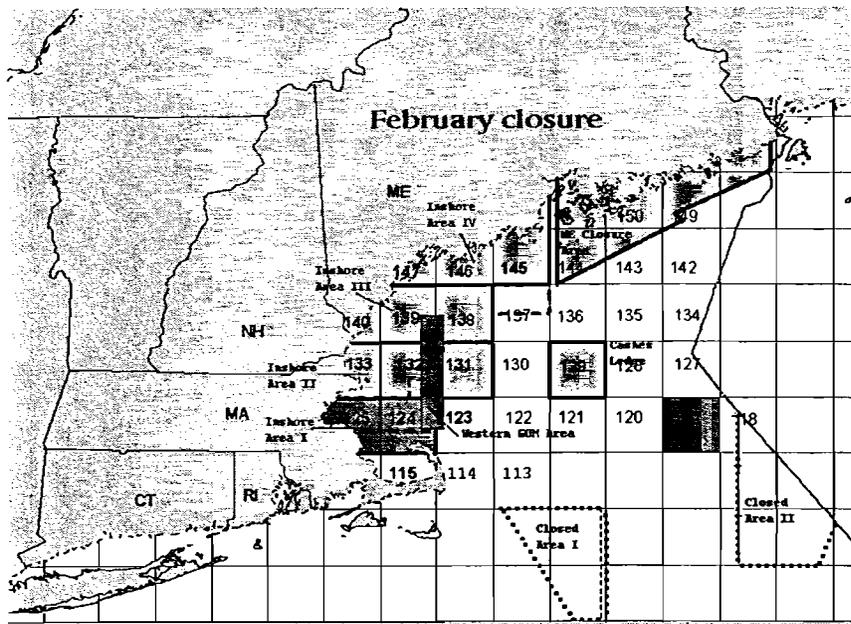
Table 19. Highest 50 quarter-degree square (block) – month combinations, ranked by landings-per-unit-effort (LPUE) by trawls and gillnets during February – April 1997. New block and month combinations in Alternative 3 are numbered in column 1. Existing areas that are closed for one month during February – April are shaded.

New area closures	Block number	Month (1-12)	Days Absent	Cod stock	Landings per day-at-sea	Total cod landings (mt) ¹⁰
	144	4	2	GM	5.608727	5.6
1	123	4	109	GB/GM	4.772949	75.3
	131	4	17	GM	3.298671	4.8
2	130	4	103	GM	3.251183	15.1
	115	3	1	GB/GM	3.09081	3.1
3	124	4	309	GM	2.592397	197.9
4	119	2	182	GB/GM	2.015458	73.2
	114	3	310	GB	1.913018	18.3
	114	4	180	GB	1.762175	51.7
	119	4	130	GB/GM	1.640908	113.0
	119	3	98	GB/GM	1.619032	56.4
5	124	2	208	GM	1.608439	111.3
6	125	2	133	GM	1.548494	49.2
	114	2	74	GB	1.50185	20.5
	132	4	258	GM	1.411993	108.4
	123	3	118	GB/GM	1.342257	38.5
	124	3	161	GM	1.319457	78.5
	132	3	174	GM	1.259364	43.8
	131	2	105	GM	1.24918	16.8
	133	4	183	GM	1.235837	105.2
7	125	4	169	GM	1.1446	65.8
	130	2	102	GM	1.062802	11.6
	137	2	52	GM	0.94689	18.7
	127	2	20	GM	0.941702	8.0
	133	2	132	GM	0.939651	22.1
	132	2	124	GM	0.909503	37.3
	127	4	45	GM	0.898104	22.6

¹⁰ All gears.

New area closures	Block number	Month (1-12)	Days Absent	Cod stock	Landings per day-at-sea	Total cod landings (mt) ¹⁰
	113	2	75	GB	0.804871	15.4
	136	2	22	GM	0.796718	3.3
	123	2	68	GB/GM	0.775577	18.4
	131	3	130	GM	0.764002	14.4
	136	4	56	GM	0.704898	36.7
	129	3	68	GM	0.687979	18.8
	120	3	114	GB/GM	0.66223	32.8
	137	4	213	GM	0.553663	6.5
	125	3	41	GM	0.546499	2.5
	122	2	80	GB/GM	0.533385	43.8
	122	3	64	GB/GM	0.519298	34.1
	120	2	48	GB/GM	0.51557	28.7
	133	3	68	GM	0.506959	2.6
	115	2	1	GB/GM	0.503039	0.5
	121	4	8	GB/GM	0.482174	6.5
	118	2	60	GB	0.41454	15.7
	128	3	24	GM	0.407892	1.5
	129	2	30	GM	0.406479	4.0
	135	3	71	GM	0.383776	9.0
	143	4	12	GM	0.373805	0.4
	121	2	70	GB/GM	0.362366	10.4
	113	3	89	GB	0.328335	37.0
	128	2	18	GM	0.316399	1.3

Figure 2. Alternative 3 – Blocks and months ranked by highest landings per day-at-sea for cod (both stocks). Shaded cells represent the proposed area closure for the indicated month. Gradient-filled areas represent areas that are seasonally closed to fishing for multispecies during other months. Closed areas I and II remain closed year around to conserve Georges Bank cod, haddock and yellowtail flounder.



4.2 Alternatives Considered and Rejected

4.2.1 Area Closures

4.2.1.1 Status Quo

The status quo would continue the current inshore area closures as listed in Section 2.1.8.1 and Table 1. Fishing mortality might be lower prior to May 1, 1998 than it was in 1997, because the Inshore Areas I and II would be closed to fishing for the first time in 1999. These inshore area closures were proposed in Framework 25, the annual adjustment for 1998, and implemented on May 1, 1998.

This Council rejected this alternative because the status quo will not reduce cod mortality to the required levels. Gulf of Maine cod landings in 1998 are projected to be 4,075 mt, well above the 1998 TAC associated with the Amendment 7 target, F_{max} . It is furthermore evident that recruitment during the last several years has been low for Gulf of Maine cod and the stock is in danger of falling below $\frac{1}{4}B_{MSY}$, a minimum biomass threshold in the new overfishing definition. Fishing mortality for Georges Bank cod is also above the Amendment 7 target and the status quo alternative will not offer any additional conservation for this stock.

4.2.1.2 Alternative 1 - Extension of Inshore Closure Areas I and II to a two-month closure and add a new closure east of Cape Cod during February and March

The Council's intention is to achieve the greatest reduction in mortality possible for Gulf of Maine cod through a two-month closure of existing areas. Examination of the 1997 VTR data indicates that the arrangement of closure extensions in Table 22 will affect the greatest amount of landings during February, March, and April.

This arrangement is a slight variation to option 4.1.3.1. in the initial meeting document. Inshore Closure Area IA is the new closure east of Cape Cod and the closure time would be the same as in the initial document. This closure would affect 75 mt of cod landings.

The new closed areas would partially close blocks 113, 114, and 123 (Figure 3) between February 1 and March 31 (Table 21). This area is to the east of Cape Cod and the offshore boundary approximates the 100-fm contour. The boundaries for this area would be the coordinates listed in the following table.

Table 20. Proposed boundaries of Inshore Closure Area IA.

Point	Latitude	Longitude
GM18	(11)	70°00'
GM19	41°30'	70°00'
GM20	41°30'	69°10'
GM21	41°45'	69°20'
GM22	41°45'	69°30'
WGM2	42°15'	69°55'
GM23	42°15'	70°00'
GM24	(12)	70°00'

(11) The MA shoreline at Monomoy Point

(12) The MA shoreline at Wellfleet

Rationale: More protection for Georges Bank cod is needed because fishing mortality is 0.26, higher than the 0.18 rebuilding mortality target. Rebuilding for Georges Bank cod has occurred due to increased survival of existing year classes. SAW 27 (NEFSC 1998), however, did not anticipate continuing rebuilding until recruitment increases from the higher spawning stock biomass. If recent low recruitment continues, the current mortality rate is expected to cause stock declines in 2000 without new action to reduce mortality. Reducing mortality to the rebuilding target ($F_{0.1} = 0.18$) would hold spawning stock biomass near current levels until recruitment improves.

This additional inshore closure would also accommodate interannual variation in spawning activity that sometimes begins earlier in a more-southerly staging area. Fishermen report that cod often migrate through this proposed area during the early spring in preparation for spawning. Closure of the area during this time when cod are vulnerable to fishing would reduce mortality prior to the critical spawning season.

The new closed area would also address the perceived inequity caused by fishermen targeting cod south of Inshore Closure Area I without trip limits. North of the dividing line between the Gulf of Maine and Georges Bank stock areas, fishermen targeting cod face much heavier restrictions (trip limits and closed areas). In the Gulf of Maine, the cod trip limit is 700 lbs./day-at-sea until 75 percent of the annual TAC is taken and then 400 lbs./day-at-sea thereafter. For the inshore areas to the west of Georges Bank, there are no cod trip limits but Area I is closed to fishing for multispecies year around.

Extension of existing inshore closure areas

Inshore Closure Area I would be closed to gear capable of catching multispecies during February and March (Figure 3; Table 21), affecting 164 mt of cod landed by the fleet during 1997.

Inshore Closure Area II would during the same time period as it would have under all options in the initial meeting document, March and April (Figure 3; Table 21). This extended closure would affect 61 mt of cod landings.

Inshore Closure Area III would close during April and May (Figure 3; Table 21), the only two-month extension made possible by the fixed time period for Framework 26. This is the same closure time period as in option 4.1.3.3 of the initial meeting document and would affect 14 mt of cod landings. Inshore Closure Area IV and the Cashes Ledge Closure Area would be unaffected by Framework 26, because the potential two-month extension cannot be in February, March, or April.

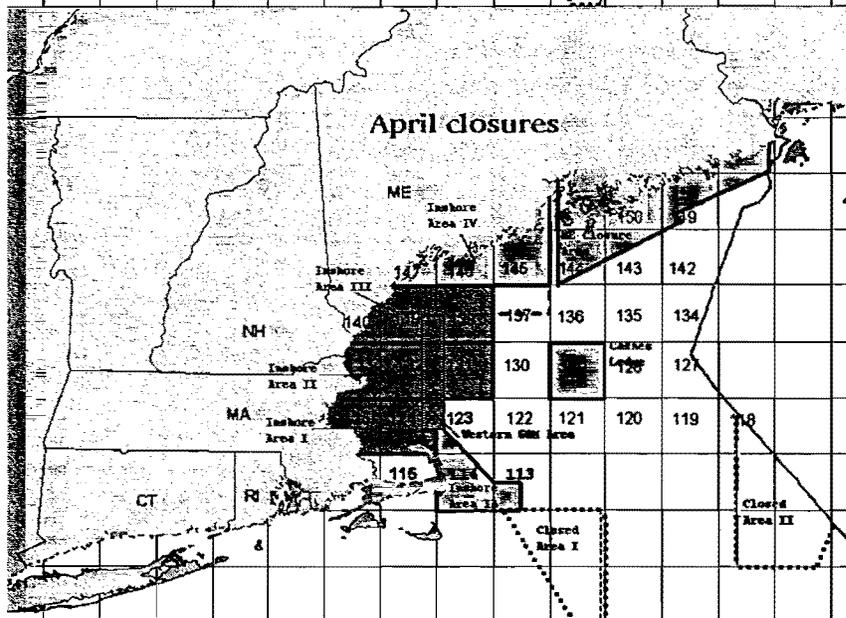
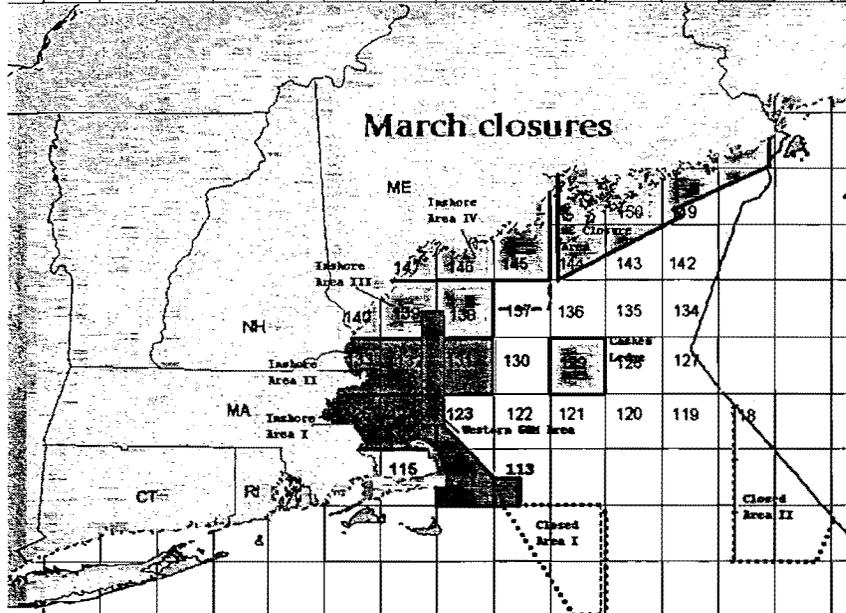
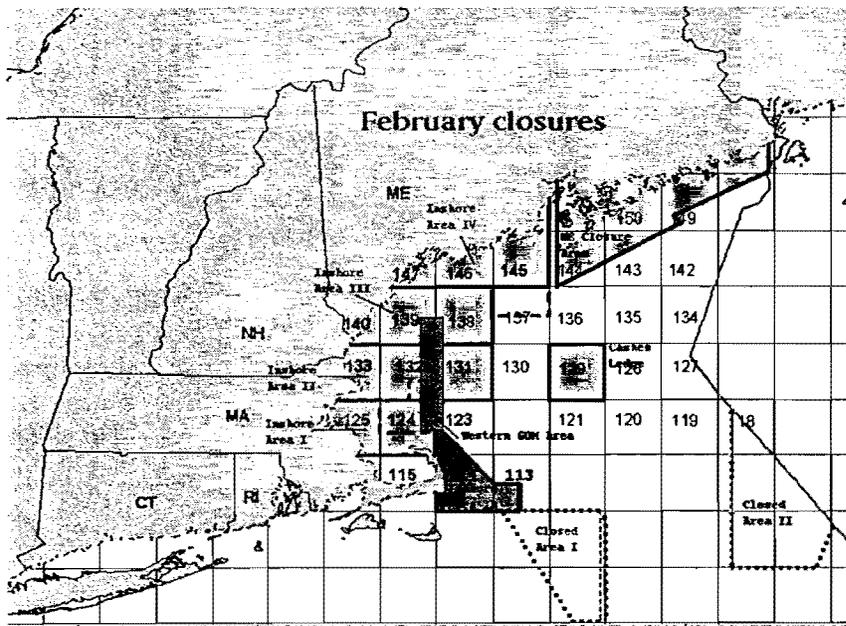
Table 21. Schematic diagram of proposed inshore closure areas that would maximize the overlapping closure of adjacent areas. Dark squares represent the proposed management adjustment, while light gray squares represent existing closures.

Closed area name	¼-degree Blocks ¹¹	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inshore (cod spawning) closures – implemented in Framework Adjustment 25													
Inshore IA	113, 114, 123		■	■									
Inshore I	124, 125			■	■								
Inshore II	131, 132, 133			■	■								
Inshore III	138, 139, 140				■	■							
Inshore IV	145, 146, 147, 152							■	■				
Cashes Ledge	129							■	■				

Reason for rejecting Alternative 1: Alternative 1 conserved fewer cod than any other alternative (Table 27), assuming no effort displacement and the cod conservation was the most costly (Table 26). Cod conservation for alternative 1 and its cost was better than Alternatives 2a and 2b when effort displacement was incorporated in the model. Even with this assumption, however, Alternative 1 had less benefits and higher costs than Alternative 3.

¹¹ Boldfaced blocks are completely within the closed area

Figure 3. Alternative 1 – Two month rolling inshore closure areas plus new Inshore Closure Area 1A. Shaded cells represent the proposed area closure for the indicated month. Gradient-filled areas represent areas that are seasonally closed to fishing for multispecies during other months. Closed areas I and II remain closed year around to conserve Georges Bank cod, haddock and yellowtail flounder.



4.2.1.3 Alternative 2a - Expansion of Inshore Closure Areas I and II eastward to the Hague Line for a one-month closure

This alternative is the Gulf of Maine Fishermen's Alliance proposal offered at the initial framework meeting. According to this proposal, the Inshore Closure Area I closure (blocks 124 and 125) would also encompass blocks 118 to 123 (Figure 4) and contribute additional conservation for Georges Bank cod, since some of these blocks fall within the Georges Bank cod stock area. For a one-month closure, this option would close these blocks to fishing during March and would affect 174 mt of cod landings.

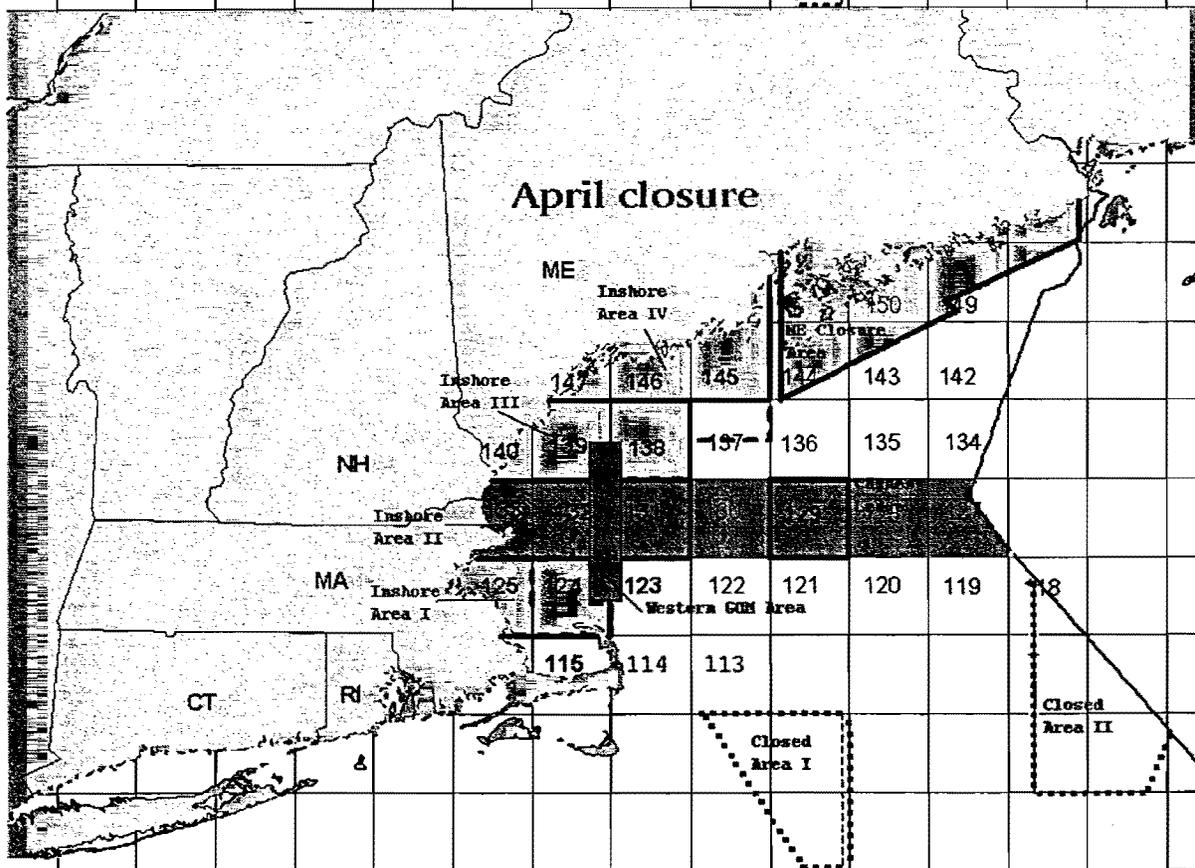
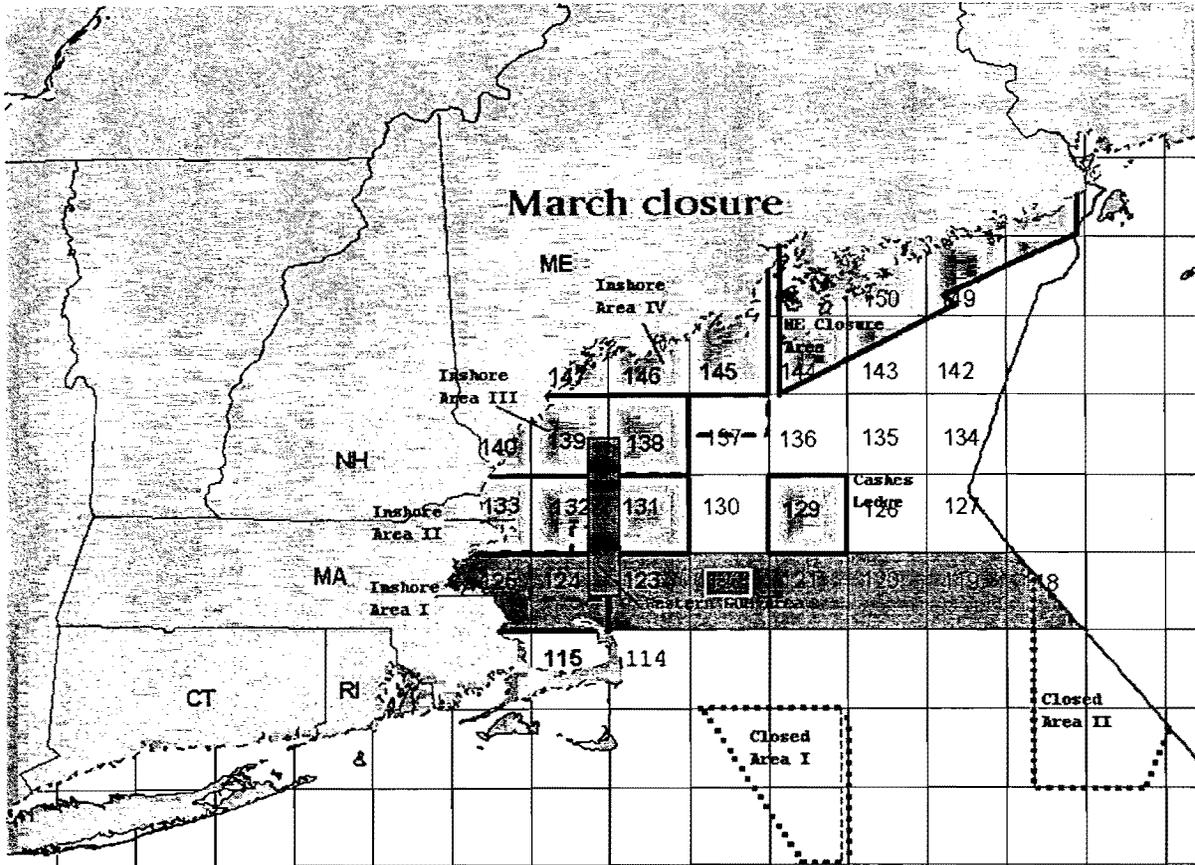
Inshore Closure Area II (blocks 131-133) would also include blocks 127-130 (Figure 4) and close during April. Since block 129 is also the Cashes Ledge Closure Area, it would mean that this block would be closed during April and June. During the one-month April closure, this option would affect 46 mt of landings.

In summary, implementation of this alternative would close blocks 118-125 during March and blocks 127-133 during April.

Rationale: Alternative 2a, offered by the Gulf of Maine Fishermen's Alliance, is intended to more equitably distribute the cost across fleet sectors, from small boats fishing inshore to large boats fishing offshore, and from vessels fishing with trawls to vessels fishing with gillnets. Unlike Alternative 1, there are fewer closures inshore and this alternative is not intended to protect spawning cod. Spawning in the areas that this alternative proposes to close occurs much later in the season. Instead, the alternative is intended to reduce mortality prior to spawning and the enhanced survival of mature fish will increase the spawning potential compared to the status quo. All of the closed areas in Alternative 1 are in inshore waters near Cape Cod and in the Gulf of Maine and therefore is thought to have a greater impact on small vessels and those using gillnets to target multispecies. Each alternative's impacts by gear sector are described in Section 5.2.7.3.

Reason for rejecting Alternative 2a: Although more effective than Alternative 1 if there is no effort displacement, Alternative 2a conserved fewer cod than any Alternatives 2b and 3 (Table 27), and the cod conservation was more costly (Table 26). When the model allowed for effort displacement, Alternative 2a is expected to conserve a maximum of 109 mt (Table 27), only one-fourth of the cod conserved by Alternative 3 under equivalent assumptions about effort displacement. If 100 percent of the effort in the proposed closed areas is displaced to other areas or seasons, no conservation of cod is anticipated. Even with this assumption, however, Alternative 2a had less benefits and higher costs than Alternative 3.

Figure 4. Alternative 2a – Industry Alliance proposal to extend Inshore Closed Areas I and II offshore to the US-Canada boundary. Shaded cells represent the proposed area closure for the indicated month. Gradient-filled areas represent areas that are seasonally closed to fishing for multispecies during other months. Closed areas I and II remain closed year around to conserve Georges Bank cod, haddock and yellowtail flounder.



4.2.1.4 Alternative 2b - Expansion of Inshore Closure Areas I and II eastward to the Hague Line for a two-month closure

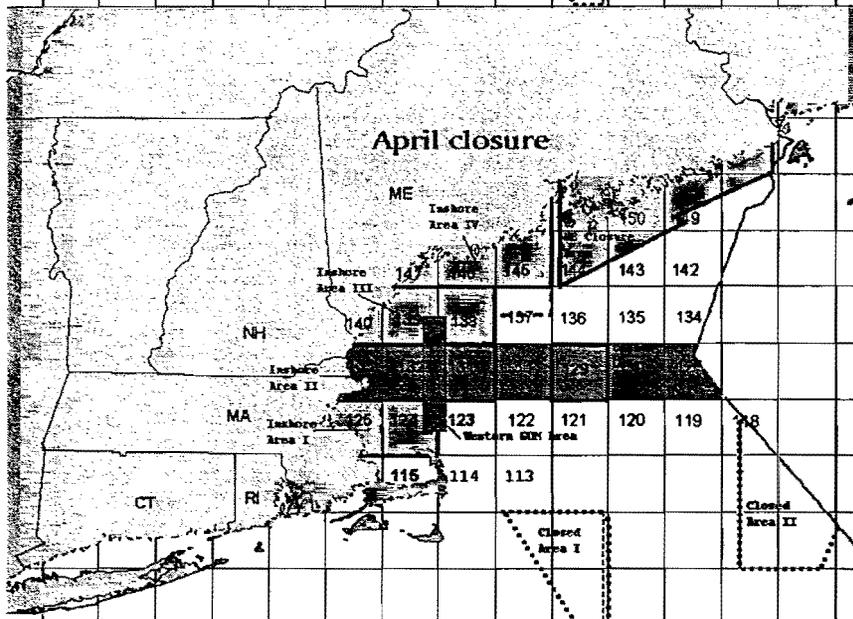
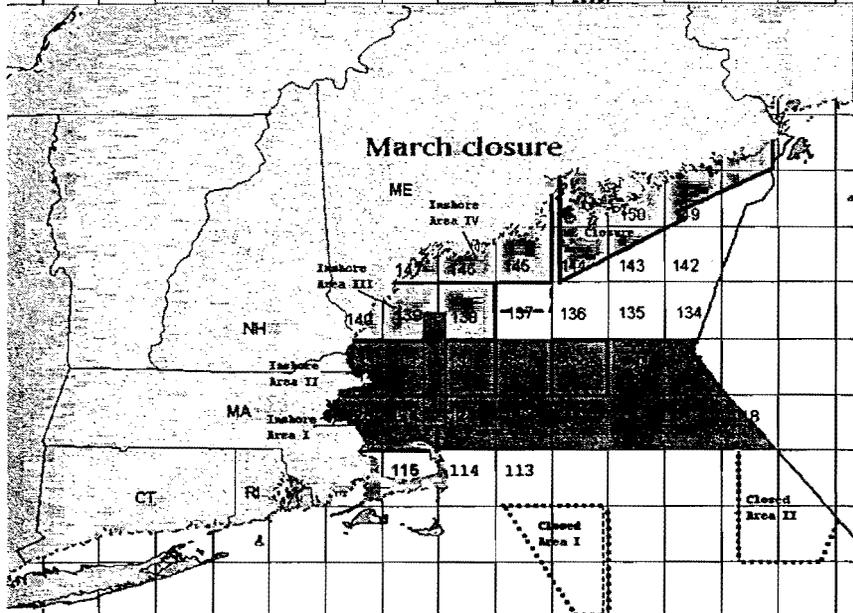
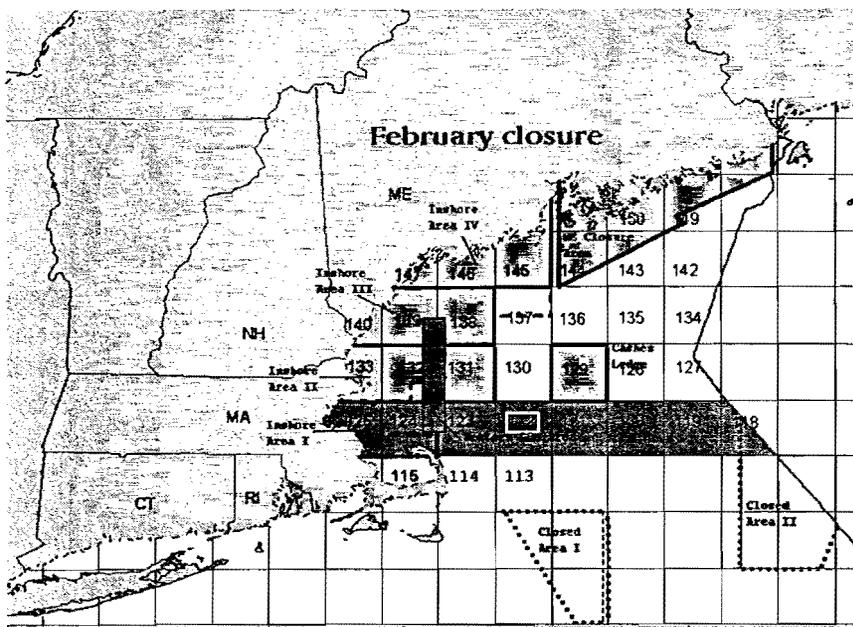
Unlike Alternative 2a, this alternative would close blocks 118-125 during February and March, and would close blocks 127-133 during March and April. The darkly shaded regions in Figure 5 illustrate the area closures that would occur under Alternative 2b.

A February-March closure of the blocks within and to the east of Inshore Closure Area I would affect 213 mt of cod landings vs. 97 mt for a March-April closure. Without accounting for the predictable effort shift, it appears that a February-March Closure of the blocks within and to the east of Inshore Closure Area I is preferable. Under this option the blocks within and to the east of Inshore Closure Area II would close during March and April, the only choice allowed during the time period addressed by Framework 26.

Rationale: The Council decided to extend the Gulf of Maine Fishermen's Alliance proposal to two months, consistent with Alternative 1's strategy of extending the inshore area closures for two months. At face value, Alternative 2b is the most conservative of the alternatives for Gulf of Maine cod, because it both expands the inshore closure areas and extends their timing for two months. The additional closed blocks along the northern edge of Georges Bank would replace the proposed Inshore Closure Area 1A in Alternative 1.

Reason for rejecting Alternative 2b: Alternative 2b is expected to conserve more cod than Alternative 3, if there is no effort displacement (Table 27). Since more of the proposed closures fall within the Georges Bank cod stock area, the affect landings of Georges Bank cod are nearly double that for Alternative 3. The costs of these closures in terms of foregone revenue, however, are much greater than for Alternative 3, because of the impacts on catches of other species in the multispecies fishery. Per pound of cod conserved by Alternative 2b (Table 26), the costs are 37 percent higher for Georges Bank cod and 58 percent higher for Gulf of Maine cod, compared to Alternative 3. When effort displacement is factored into the two-bin model for Gulf of Maine cod (Table 27), Alternative 3 outperformed Alternative 2b by a significant margin.

Figure 5. Alternative 2b – Industry Alliance proposal to extend Inshore Closed Areas I and II offshore to the US-Canada boundary, extended to two-month closures. Shaded cells represent the proposed area closure for the indicated month. Gradient-filled areas represent areas that are seasonally closed to fishing for multispecies during other months. Closed areas I and II remain closed year around to conserve Georges Bank cod, haddock and yellowtail flounder.



4.2.1.5 Extension of Cod Spawning Closures

The Council, at the initial framework meeting, chose to limit the scope of Framework 26 to only February to April of 1999, prior to when more permanent and comprehensive measures can be implemented via the annual framework adjustment process. Because of this decision, all three alternatives described below have few meaningful differences between them. As a consequence, the three alternatives for extending the existing inshore closure areas were combined into one alternative (Section 4.2.1.2) in the proposed action. This combined alternative was included as one during the final framework meeting, but the Council favored Alternative 3 because of the greater cod conservation with less cost to the industry. This simplification of the measures for the final meeting was necessary to reduce the number of alternatives to be analyzed, saving preparation and review time, avoiding unnecessary confusion, and ignoring inconsequential differences between the previous options when only the February to April period is considered.

4.2.1.5.1 Maximize overlapping closures – Inshore Closure Area Option 1

This option would minimize the opportunity for targeting cod in adjacent areas by increasing the overlapping closures. The two southern inshore closure areas (Table 22) would simultaneously close during March 1 to April 30. The two northern inshore closure areas and the Cashes Ledge Closure Area, on the other hand, would close simultaneously during May 1 to June 30.

While this option provides less flexibility for industry, it could produce more cod mortality reduction than the other options would if effort shifts are mitigating the effectiveness of area closures. On the other hand, this option may provide less protection for mature cod if they are more vulnerable to fishing during spawning in February in Inshore Closure Area I and May in Inshore Closure Area II. The MSMC is quantitatively assessing, as part of the annual review process, the potential mortality reduction of various area closures. This information will be available at or prior to the second Framework meeting scheduled for December 9-10, 1998

Table 22. Schematic diagram of proposed inshore closure areas that would maximize the overlapping closure of adjacent areas. Dark squares represent the proposed management adjustment, while light gray squares represent existing closures.

Closed area name	¼-degree Blocks ¹²	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inshore (cod spawning) closures – implemented in Framework Adjustment 25													
Inshore I	124, 125			■	■								
Inshore II	131, 132, 133			■	■								
Inshore III	138, 139, 140					■	■						
Inshore IV	145, 146, 147, 152					■	■						
Cashes Ledge	129					■	■						

¹² Boldfaced blocks are completely within the closed area

4.2.1.5.2 Minimize overlapping closures – Inshore Closure Area Option 2

This option would create a two-month rolling closure over the longest possible interval of time and encompass early spawning during February in the most southern portion, Inshore Closure Area I. This option would also spread out the timing of the proposed area closures and maximize the opportunity for the fishing industry to target cod and other species.

The two southern inshore closure areas would close earlier than at present. Inshore Closure Area I would close between February 1 and March 31 (Table 23). Inshore Closure Area II, extending from about Cape Ann to southern Jeffreys Ledge (Figure 1) would be closed between March 1 and April 30. The two northern inshore closure areas closure would be extended by a month from the present timing. Inshore Closure Area III would be closed from May 1 to June 30 and the rolling closure would close later. Inshore Closure Area IV and the Cashes Ledge Closure Area would be closed between June 1 to July 30.

This option would spread out the timing of the closures, possibly including the spawning activity at both ends of the season. According to Bigelow and Schroeder (1953), cod spawn as early as November near Plymouth, MA and as late as June near Cape Ann, MA. Near Mt. Desert Island, ME cod eggs were observed as late as July 19, although these eggs may have been haddock or they may be from cod spawning farther to the north and east.

This strategy would protect cod over a longer season and could accommodate annual variations in cod spawning and migration. On the other hand, there would only be two areas closed during the April-May peak spawning period. Compared to the other options in Framework 26, there would be less area closed during this period.

To assess the importance of interannual variability, the models that the MSMC uses to predict mortality reduction would have to include data from at least several years. The MSMC is quantitatively assessing, as part of the annual review process, the potential mortality reduction of various area closures. This information will be available at or prior to the second Framework meeting scheduled for December 9-10, 1998.

Table 23. Schematic diagram of proposed inshore closure areas that would minimize the overlapping closure of adjacent areas. Dark squares represent the proposed management adjustment, while light gray squares represent existing closures.

Closed area name	¼-degree Blocks ¹³	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inshore (cod spawning) closures – implemented in Framework Adjustment 25													
Inshore I	124, 125		■	■									
Inshore II	131, 132, 133			■	■								
Inshore III	138, 139, 140					■	■	■					
Inshore IV	145, 146, 147, 152						■	■	■				
Cashes Ledge	129						■	■					

¹³ Boldfaced blocks are completely within the closed area
 Framework 26
 Multispecies FMP

4.2.1.5.3 Start all closures one month early – Inshore Closure Area Option 3

This option has the same area closure features as Draft Framework Option 1 that the Council considered during the development of Framework 25. The timing of the inshore closure areas would begin one-month earlier than they currently do. The first area, Inshore Closure Area I, would close between February 1 and March 31 (Table 24). Areas further north would close sequentially one-month later, until Inshore Closure Area IV and the Cashes Ledge Closure Area closed between June 1 and July 31

During the development of Framework 25, the MSMC calculated that this option would reduce landings by 62 percent, assuming that there would be no effort displacement. With a “two-bin” model that allowed for effort displacement, the MSMC estimated that the option would produce a 46 percent reduction in landings. Other management measures have changed since that initial estimate, so a re-estimate of the probable effects by the MSMC is needed. This information will be available at or prior to the second Framework meeting scheduled for December 9-10, 1998.

Although this measure was predicted to achieve greater mortality reductions and was initially designed to encompass peak spawning activity in each inshore closure area, the Council rejected it primarily because of negative public comment about the impact of two-month closures on inshore, small-boat fleets and associated shoreside infrastructure. In January 1998, the Industry Advisory Panel supported a modified version of the Draft Framework Option 1, but a minority view opposed two-month closures of inshore grounds.

Table 24. Schematic diagram of proposed, overlapping inshore closure areas. Dark squares represent the proposed management adjustment, while light gray squares represent existing closures

Closed area name	¼-degree Blocks ¹⁴	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inshore (cod spawning) closures – implemented in Framework Adjustment 25													
Inshore I	124, 125		■	■									
Inshore II	131, 132, 133			■	■								
Inshore III	138, 139, 140				■	■							
Inshore IV	145, 146, 147, 152					■	■						
Cashes Ledge	129					■	■						

4.2.1.5.4 Status quo – Inshore Closure Area Option 3

The status quo would retain the present one-month closures in Inshore Closure Areas I to IV. This option would provide no additional protection for Gulf of Maine cod.

¹⁴ Boldfaced blocks are completely within the closed area
 Framework 26
 Multispecies FMP

4.2.1.6 Expansion of Cod Spawning Closures

4.2.1.6.1 Cape Cod spawning closure

This management adjustment was described as a separate alternative in the initial meeting document. The Council combined this alternative with the extension of the inshore closure areas and included it in Section 4.2.1.2. Alternative 3 was chosen by the Council over Alternative 1, because of the greater cod conservation with less cost to the industry. Inshore Area IA, part of Alternative 1 during the final framework meeting, was therefore rejected.

4.2.1.6.2 Status quo

The status quo would have no area closure for inshore areas near Cape Cod. This could allow increased fishing pressure in this area by small boats that could be negatively impacted by the proposed extended closed seasons to the north. The status quo option for this management measure could, therefore, increase fishing mortality on Georges Bank cod. Since the fishing mortality rate is already over the rebuilding target ($F_{0.1} = 0.18$), this increase could slow or jeopardize rebuilding for Georges Bank cod.

The status quo would create no additional inshore closure area, but the status quo alternative for the Cape Cod spawning closure is included in Alternatives 2a, 2b, and 3 because they do not create a new Cape Cod closed area. The status quo is also of course part of the status quo for area closures, described in Section 4.2.1.1.

4.2.1.7 Modification of Existing Closures

4.2.1.7.1 Move closed season of the Northeast Closure Area to coincide with cod spawning

Originally, the Northeast Closure Area was established to protect harbor porpoise that are common in late August and early September. Amendment 7 to the Multispecies FMP applied the Northeast Closure Area to all gear to gain some additional mortality reduction for overfished groundfish species in the Gulf of Maine. The proposed 50 percent reduction in days-at-sea allocations was not anticipated to produce the needed mortality reductions by itself and applying the harbor porpoise closures to all gears was intended to partially make up the difference. At that time, the models that scientists used to predict the effectiveness of area closures to reduce landings were not yet developed, so there were no quantitative estimates of the effect that the August 15 to September 13 closure to all gear types would have on groundfish mortality.

The Council believes that an earlier closed season for the Northeast Closure Area that coincides with cod spawning would help achieve the mortality reduction needed for Gulf of Maine cod. The Council is therefore considering closing the Northeast Closure Area to all gears between June 1 and July 31 (Table 25). The area boundaries (Table 15) would not change and are shown in Figure 1. The new closed season would apply to all gears to protect mature cod, but the existing closed season (August 15 to September 13, inclusive) for gillnets would continue. As such, there would be a 14-day "window" for vessels to fish with gillnets in early August.

The proposed closed season is one-month later than the proposed closed season for Inshore Closure Area IV, in central Maine, and coincides with late cod spawning at the northern end of the range. According to Bigelow and Schroeder (1953), cod spawning was observed as far north as Mount Desert Island. Eggs were observed near Mount Desert Island on July 19, in Penobscot Bay on August 6, and

near Cape Elizabeth on September 13. These gadoid eggs, however, may have been haddock and their origins were unknown. In Sheepscot Bay, ME, Perkins et al. (1997) documented cod freely emitting milt or eggs as late as July 15 between 1978 and 1983. More recently, Ames (1997) documented ripe cod in the area of Casco Bay to Saco Bay, but not farther north within the Northeast Closure Area.

What is important to rebuilding biomass and increasing spawning success, however, is improving the survival of mature cod. Area closures can effectively reduce fishing mortality if they reduce availability to the fishery and are not mitigated by shift or increases in fishing effort.

Since the Council limited the scope of Framework 26 to February – April 1999, modification of the timing of the Northeast Closure Area is no longer germane. Framework 27 will include a comprehensive range of alternatives and solutions that could affect the Northeast Closure Area.

Table 25. Proposed modification of the closure dates for the Northeast closure area. Dark squares represent the proposed management adjustment, while light gray squares represent existing closures. The existing closure during August 15 to September 13, inclusive, for the Northeast closure area would apply to vessels using gillnets. The new closure during June and July would apply to all vessels.

Closed area name	¼-degree Blocks ¹⁵	Approximate closure dates – shaded blocks											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Other closures													
Northeast closure ¹⁶	144, 148, 149, 150, 151, 152, 153												

4.2.1.7.2 Status quo

The status quo would maintain the current Northeast Closure Area closed season (August 15 to September 13, inclusive). Since this timing also overlaps the closed season to protect harbor porpoise, the status quo option would have the least impact on vessels using gillnets to target multispecies. The relative mortality reduction for the status quo versus a closure in June and July has not been estimated, but will be evaluated by the MSMC during the 1998 annual review.

By default, the status quo for modifying the Northeast Closure Area is included in Alternatives 1, 2a, 2b, and 3.

4.2.2 Modifications To The Gulf Of Maine Cod Trip Limit System

The current Gulf of Maine cod trip limit system allows vessels to land cod exceeding the daily limit (currently 400 pounds per day), as long as the vessel remains in port and does not call-out to end the trip until sufficient time has elapsed to account for the overage. While the purpose of this provision is to minimize discards on vessels that land cod as a bycatch while fishing for other groundfish species, some vessels are reportedly using it to target cod. Letting the clock run, in effect maximizes the cod per allocated day-at-sea. A vessel with 88 allocated day-at-sea, for example, could land 35,200 pounds of cod

¹⁵ Boldfaced blocks are completely within the closed area

¹⁶ Closed August 15 to September 13, inclusive; area also is closed to gillnet fishing to protect harbor porpoise

on a directed trip. To prevent this type of activity, the Council is considering capping the total amount of Gulf of Maine cod a vessel could possess, thereby reducing the incentive to direct on cod and keeping the landings, and potentially catch, at bycatch levels.

At the final framework meeting, the Council decided to postpone taking action on the Gulf of Maine cod trip limit system. During the Council meeting associated with the final framework action, the Multispecies Monitoring Committee indicated that an 80 percent reduction in mortality was needed to rebuild Gulf of Maine cod. Since it may be necessary for large changes in the cod trip limits to achieve this goal, the Council may review the status of the running clock during its deliberation of Framework 27, instead of making an adjustment now that may be unnecessary in a few months.

4.2.2.1 Issue to be addressed

Even though Framework 24 intended to reduce targeting of Gulf of Maine cod, there are still a considerable number of vessels that continue to target cod, exceed the daily trip limits, and tie up to the dock until their clock accounts for the excess landings. This response is not what the Council intended and less directed fishing for Gulf of Maine cod is needed to achieve the mortality objective ($F_{max} = 0.29$). Another mechanism is needed to allow the trip limits to have the desired effect and help reduce fishing mortality.

The Council rejected all alternatives except a straight possession limit that is more than the running clock cod trip limit. During the initial meeting, it was suggested that the possession limit should be 4,000 pounds per trip, or the current limit for a 10-day trip. Since this choice is unlikely to show any tangible benefits according to the VTR data, the proposed adjustment to the cod trip limit system includes a range of possession limits from 400 to 4,000 pounds. While the 400 pounds per day-at-sea cod limit is in effect, a 400 pound limit would effectively eliminate the running clock for all trips, while the 4,000 pound limit would affect very few. A similar possession limit would be effective when a 700-pound cod trip limit is in effect, ranging from 700 to 7,000 pounds per trip.

Four alternatives were evaluated at the initial framework meeting to address this concern. Discontinuing the running clock (Section 4.2.2.3) will make it illegal to land cod that exceed the daily limits. A higher backup possession limit (Section 4.2.2.2) will have a similar effect, but the existing daily trip limits would apply so that the landings that exceed the current daily limits could be accommodated without forcing vessels to discard cod. The third alternative would increase the penalty (Section 4.2.2.4) for exceeding the trip limit from one day-at-sea per every 700 or 400 pounds of cod over the limit. If a vessel exceeds the daily control date trip limit, the clock could run at double the rate. In other words, a day-at-sea would be accumulated for every 350 or 200 pounds over the daily limit. The status quo alternative (Section 4.2.2.6) would continue the current trip limit system.

4.2.2.2 Backup possession limit without running clock

The current trip limits and running clock would continue, but a higher possession limit would be implemented to limit the amount of cod that could be landed. A backup possession limit places an upper limit for cod overages that could be landed under the current rules. The proposed action for the cod trip limit has 10 options, ranging from a possession limit that is equivalent to the daily cod limit to a possession limit that is equal to the daily cod limit on a ten-day trip. Examples of these options are given below and a quantitative estimate of the anticipated landings benefits are discussed in Sections 5.2.6 and 5.2.7.

The strategy that the Council is considering is to implement a straight possession limit, independent of trip length. The possession limit would range from 700 to 7,000 pounds, when the daily cod limit is 700 pounds per day-at-sea. If a 2,000 lb. possession limit was implemented, for example, a vessel that had taken a 4-day trip and landed 1,800 lbs. would accumulate 4.5 days-at-sea, but it could not land more than 2,000 lbs. of cod. Obviously, this alternative strategy would affect boats taking longer trips more than day-boats, since the daily limit could exceed the backup possession limit on long trips.

A backup possession limit could limit the number of days-at-sea that is used to target cod. In other words, fewer days would be used to account for cod landings that exceed the trip limit. It could therefore work to decrease the incentive to target cod, without causing the discard and safety at sea concerns associated with having no running clock.

Rationale: A possession limit, independent of trip length, is the most straightforward and uncomplicated system possible while retaining some of the benefits (minimizing discards and promoting safety at sea and efficiency) associated with the running clock system. It would reduce the attractiveness of targeting cod and landing large volumes of cod on short trips, perhaps increasing compliance and easing monitoring costs.

4.2.2.3 Discontinue running clock

The Council rejected this alternative over concerns about discarding, safety of human life at sea, and efficiency. These factors are discussed in Section 5.2.6.2.4.

Discontinuing the running clock would prohibit vessels from landing cod that exceed the daily limit. A vessel that had taken a 4-day trip when the 400 lb. trip limit is in effect, for example, could land no more than 1,600 lbs. of cod.

A vessel that had more than the daily limit would have to extend the trip and fish for other species, or discard cod. In the first response, the option could create safety concerns in violation of National Standard 10. In the latter response, this option could increase discards in violation of National Standard 9. Without the running clock, vessels would have less incentive to target cod and land large amounts of cod on short trips.

4.2.2.4 Increase the penalty for exceeding running clock trip limit

The Council rejected this alternative because it was too complicated and could negatively impact vessels that could target multispecies besides cod with the allotted days-at-sea.

The present running clock system accumulates one day-at-sea or any part of a day-at-sea to account for the excess landings, as if the vessel remained fishing for a period of time that would have otherwise allowed it to land its cod. The Council could increase this penalty as a disincentive to target cod and exceed the cod trip limit. Increasing the penalty for exceeding the daily limit could be accomplished in at least three ways. One way to revise the running clock is to count overages against the day-at-sea clock in whole day increments, rather than counting one minute for the final day of the trip. The following examples use this procedure, rather than the current one, as the basis for describing the other options.

Instead of accumulating an equal number of days to account for the excess landings, days could accumulate at a higher rate after the boat called out of the fishery (i.e. returned to port) and reported its haul weight of cod. The Council is considering increasing the days-at-sea accumulation under the running clock at 1.5 to 4.0 days for cod landings that exceed the daily limit. The vessel would also have to remain tied to the dock until the running clock accumulated enough days to account for the overage.

A vessel on a 4-day trip that lands 1,800 lbs. of cod while the 400 lbs./day-at-sea limit is in effect would presently accumulate 4.5 days-at-sea. If the penalty to account for the excess landings increased to a 2:1 ratio, for example, 5.0 days would accumulate. The vessel, in this case, would have to remain in port until 5 days after the start of the trip had elapsed. If the same vessel landed 3,200 lbs. of cod (1,600 lbs. over the limit) and days accumulate at a 3:1 ratio, 16 days would accumulate and the vessel would have to remain in port for 16 days after the start of the trip (4 days for the trip and 12 days (1,600/4 x 3) for the excess landings).

A third approach for increasing the penalty for excess cod landings may be simpler to understand and administer. The same thing could be accomplished by reducing the allowance for excess landings to a fraction of the daily limit. In practice, this procedure (example in the next paragraph) may be simpler to understand and administer than the previous example. The Council is considering a running clock poundage ratio that is $\frac{2}{3}$ to $\frac{1}{4}$ of the actual daily limit (300 to 100 lbs./day-at-sea for the running clock when the daily trip limit is 400 lbs.)

To achieve a 2:1 ratio for days-at-sea accumulation, the vessel would continue the running clock until it accounted for a daily limit that is one-half of the actual daily limit while the vessel is at sea. If the 400 lb. daily limit is in effect, the running clock days would accumulate as if there were a 200 lb. daily cod limit. A vessel landing 1,800 lbs. of cod from a 4-day trip, would continue the running clock for 1.0 days [(1,800 / 1,600) / 200] and would remain in port until the running clock expires. If the vessel lands 3,200 lbs. on a 4-day trip, 12 days would accumulate (4 days for the trip and 8 days for the excess landings with a 200 lb./day-at-sea running clock limit).

Increasing the penalty for exceeding the daily limit has the same benefits and costs associated with discontinuing the running clock (Section 4.2.2.3), except that vessels might not discard cod or stay at sea as frequently as it would without the running clock. An increased penalty by increasing the day-at-sea accumulation under the running clock would however reduce the incentive to target cod.

4.2.2.5 Implement a cod landings limit as a percentage of the total weight of fish onboard

The Council eliminated this alternative from consideration, because of the difficulty enforcing a possession limit where the fraction is a significant proportion of the total catch. Rules would have to be imposed that only allowed landing the catch at a single point of offloading. Since it would be impossible for vessels to segregate a large volume of their catch, enforcement at sea would be impossible.

Establishing a cod possession limit that is a percentage of the total weight of fish onboard would eliminate the need for a running clock. Percentages are used in other fisheries to keep bycatch at a low level. As proposed in the Monkfish FMP, for example, some vessels can land up to five percent of the total weight of fish onboard. In order for this type of possession limit to be enforceable, the cod limit would have to be in a range from one to ten percent. Higher limits are difficult to monitor and enforce, especially if trip or possession limits for other species also apply.

A possession limit based on the percent of total weight of fish onboard would, however, discourage vessels from targeting cod. As with the other running clock options in Sections 4.2.2.3 to 4.2.2.4, vessels could target cod, although there would be a significant disincentive to do so. With this option, vessels could fish on other species and selectively target cod until the vessel caught its cod allowance before returning to port.

4.2.2.6 Status Quo

The Council rejected the status quo alternative, because the current system has not prevented vessels from targeting cod, originally the intention of the daily cod trip limit system.

The status quo would continue the current running clock system. The Council originally proposed to administer a daily trip limit with a running clock to minimize discards and not cause vessels to remain at sea under potentially bad conditions. If the current running clock system remains in place, however, other management measures would be adjusted to reduce targeting and lower cod mortality. Although not proposed in this framework, other alternatives include reducing the cod trip limit, closing more areas where fishermen target Gulf of Maine cod, or reducing the number of days available to target cod.

4.2.3 Fair Lead Roller Gear

Discussion and comment at the initial meeting focused on setting a minimum spacing between fair lead rollers to reduce the ability to dislodge undersized fish in a manner detrimental to survival. Thus the Council included in the proposed action to set a minimum spacing of four or more inches between the rollers, rather than prohibit the gear entirely.

At the final framework meeting, the Council decided to postpone taking action on fair-lead rollers. Hard data were lacking about the prevalence of using fair-lead rollers to discard fish and the impact on survivability compared to other methods of hook removal. Given the controversial nature of the primary action in Framework 26 and the absence of hard data about discard survival with hook gear, the Council may take up this issue in a future action, as new information becomes available.

4.2.3.1 Issue to be addressed

The Council believes that fishermen targeting cod and other groundfish with longline gear may increase discard mortality by using fair lead rollers to dislodge hooks on undersized and unmarketable fish. The Sustainable Fisheries Act, passed by Congress in 1996, requires the Fishery Management Councils to “minimize the mortality of such bycatch”. National Standard 9 reads:

“Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.”

Often, fair lead rollers, sometimes referred to as "crucifier" gear, is described as a pair of steel rollers or bars near the rail of the boat that the ground line and leader can pass through, but hooked fish cannot. De-hooking fish by this means is reported to cause considerable damage to the jaw and gills of discarded fish and probably decreases the fish's survivability.

4.2.3.2 Minimum spacing between fair lead rollers – Four inches.

The Council is considering a requirement that the spacing of fair-lead rollers on hook boats be not less than four inches on hook boats to minimize the potential for discard mortality of sub-legal sized cod. Fair-lead rollers are vertical steel bars mounted on the rail of the boat through which the trawl line (to which the hooks are attached) passes when the gear is being brought back on the boat. As the fisherman observes the catch coming up, undersized fish are discarded by simply not lifting them over the rollers, and allowing the hook to be pulled out mechanically. The extent of this practice is uncertain, but with the support of hook fishermen, the Council is taking a precautionary action to reduce the opportunity for this practice aboard fishing vessels.

Rationale: By requiring a minimum spacing between the rollers, the Council believes that the effectiveness of the rollers to mechanically de-hook the fish will be significantly reduced. Increased survivability of discarded sub-legal sized fish will contribute to increasing stock biomass. To the extent that those survivors, particularly the ones just under the minimum size, contribute to spawning stock biomass, the Council expects that this measure will contribute to achieving the goals of Framework 26.

4.2.3.3 Prohibit fair lead rollers onboard vessels fishing during a multispecies day-at-sea

Fishermen would be prohibited from using fair lead rollers on their vessels. A fair lead roller would be defined, as a constriction in the path of hauled longline gear that is intended to forcibly de-hook unwanted catch prior to discarding. Undersized and unmarketable fish may have a better chance of surviving after release if the rollers are not used to de-hook the fish.

The added time that would be required to remove hooks from fish could slow the hauling operation and make the vessels less efficient, but fishermen may adopt other means of hook removal to compensate for the new requirement. Other methods of hook removal could be equally as damaging to discarded fish. Regulations would also be difficult to enforce because fishermen might develop slightly different equipment that had the same effect, but would still be legal.

4.2.3.4 Status Quo

Fishermen would be able to continue using fair lead rollers in their current configuration.. No change in discard mortality or cost is anticipated under the status quo. The Council rejected the status quo alternative because there is sufficient evidence that this practice is a problem, at least for some species.

5.0 APPLICABLE LAW

The sections that follow will be completed prior to submission of the framework, when the Council has obtained comments about the initial proposal and has selected a preferred alternative.

5.1 *Magnuson-Stevens Fishery Conservation and Management Act - Consistency with National Standards*

Section 301 of the Magnuson-Stevens Act requires that regulations implementing any fishery management plan or amendment be consistent with the ten national standards listed below.

5.1.1 National Standard 1 – Optimum Yield

“Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry.”

This action is a continuation of the stock-rebuilding program initiated by the Council with Amendment 7 to the FMP. The Council’s overall goal in Amendment 7 is to rebuild stocks above minimum acceptable levels to achieve optimum yield on a sustainable basis. This action is consistent with and moreover specifically addresses the revised standards of the Sustainable Fisheries Act to stop overfishing *and* rebuild overfished stocks.

Although this framework adjustment is not intended to achieve a specific mortality rate or stop overfishing on Gulf of Maine and Georges Bank cod, the intent is to reduce mortality during and prior to spawning, especially important for Gulf of Maine cod. Framework 27 is the annual adjustment that will meet the mortality goals of Amendment 7. Continued fishing mortality at current rates until Framework 27 becomes effective, however, will further depress Gulf of Maine cod spawning stock biomass to record lows during the current fishing year, threatening the prospects for good recruitment.

The measures in Framework 26 will significantly decrease fishing mortality during February to April, and will be replaced by the annual adjustment in Framework 27 to achieve the Amendment 7 mortality targets. The Framework 26 adjustment will reduce mortality to below the estimated amounts for the 1998 fishing year and allow more spawning potential than currently estimated in 1999. Thus, Framework 26 is an initial step to keep Gulf of Maine cod from falling below a minimum biomass threshold and to enhance recruitment in 1999.

5.1.2 National Standard 2 – Scientific Information

“Conservation and management measures shall be based upon the best scientific information available.”

The information used to develop this action is the best scientific information available. The data used to support Framework 26 comes from the results of the 1998 annual review by the Multispecies Monitoring Committee and also from the most recent stock assessment for cod (NEFSC 1998). The analysis of the area closure options and cod trip limits are based on the 1997 vessel trip report data, a significant update of the 1993 data previously used to assess the impact of area closure options.

5.1.3 National Standard 3 – Management Units

“To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.”

The Multispecies FMP manages the 10 large mesh species (cod, haddock, yellowtail flounder, pollock, redfish, white hake, witch flounder, American plaice, winter flounder, and windowpane flounder) as a unit throughout the range with a broad set of rules that apply to vessels that fish in any subset of fisheries that make up the multispecies fishery. The fishery management plan and the stock rebuilding plan for cod are based on a combination of measures which apply to all regulated species, such as days-at-sea and gear restrictions.

Since individual stocks within the multispecies complex are at different levels relative to their respective overfishing definitions or rebuilding targets, the Council has, to the extent practicable, developed measures designed to address specific stock needs. These stock-specific management measures help control mortality on a stock while allowing vessels to participate in other fisheries within the multispecies fishery resource. Examples of management measures that apply to individual stocks include trip limits and area closures. These stock-specific management measures control the mortality on the most critical elements of the multispecies complex, while limiting the negative impact on other fisheries in the management unit.

5.1.4 National Standard 4 – Allocations

“Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation shall be:

- 1) Fair and equitable to all such fishermen*
- 2) Reasonably calculated to promote conservation.*

Carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.”

The measures in this framework adjustment do not discriminate between residents of different states, although states will be differentially affected by the measures, especially those bordering the Gulf of Maine. It also will have a greater impact on fisheries and industry sectors that rely more heavily on the catches of cod.

Out of the areas that remain open to fishing, the ones that have the highest catches of cod occur near shore, where cod aggregate to spawn in the spring and early summer. As a result, this framework adjustment will have an unavoidably greater impact on smaller vessels in the multispecies fishery than on larger ones that fish offshore for other species. Thus, although the burdens are not spread equally, the proposed measures are fair and equitable, because the impacts of the adjustment will fall more heavily on vessels that rely on the stock that needs conservation. Since cod recruitment will be enhanced by this action and rebuilding would occur more quickly than it would under no action, the smaller, inshore vessels (and the communities that depend on them) will also be the primary beneficiaries of this action. This framework adjustment also includes a February closure of offshore block 119 that has high catches of cod. Closure of this block will reduce mortality on Gulf of Maine and Georges Bank cod, both with mortality rates that exceed Amendment 7 targets.

5.1.5 National Standard 5 – Efficiency

“Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.”

The Council considered efficiency in the utilization of fishery resources by selecting the alternative that provides the greatest opportunity for vessels to continue fishing on stocks other than those in immediate need of conservation. Since Gulf of Maine cod are concentrated in inshore waters, the measures designed to significantly reduce effort on that stock will necessarily affect the ability of inshore vessels to fish in their traditional manner.

The Council chose the proposed action from a range of area closure alternatives, in large part because it provided the most opportunity for those vessels to seek alternative fisheries. Unlike the others, alternative 3 had the greatest conservation benefit for cod compared to the cost of foregone revenues in other multispecies fisheries.

5.1.6 National Standard 6 – Variations and Contingencies

“Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.”

The management measures in the Multispecies FMP recognize and allow for variations in fisheries, fishery resources, and catches by seeking the optimal combination of measures (days-at-sea, trip limits, and area closures) that maximize flexibility and opportunity, while achieving the conservation goals of the FMP. The FMP also contains exemptions for gears and fisheries that do not significantly affect the target stocks of the plan or that do not compromise the enforceability of the regulations. This framework adjustment conserves cod by reducing fishing mortality and complements the primary management measures in the Multispecies FMP. Since the preferred alternative has the least impact on foregone revenues from species other than cod, it also allows a greater flexibility for the industry to respond to variations and contingencies that it encounters.

5.1.7 National Standard 7 – Costs and Benefits

“Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.”

The management measures in Framework 26 are extensions in time or expansions in area of existing closure, so pose no added costs for administration and enforcement. The Council chose the preferred alternative specifically because it maximized the benefits (reducing mortality for cod) while minimizing the costs in terms of foregone revenues from the landings of other species in the multispecies complex.

5.1.8 National Standard 8 – Communities

“Conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to:

- 1) *Provide for the sustained participation of such communities; and*
- 2) *To the extent practicable, minimize adverse economic impacts on such communities.*

Although the proposed action will have negative short-term impacts, the Council is taking this action to meet the National Standard 1 requirements for managing the Gulf of Maine cod stock. In taking this action, the Council has chosen the alternative that has the lowest impact on other fishing per ton of cod conserved. Additionally, the Council believes that the long-term social impacts resulting from a rebuilt stock and a healthy fishery will be positive.

5.1.9 National Standard 9 – Bycatch

“Conservation and management measures shall, to the extent practicable:

- 1) *Minimize bycatch; and*
- 2) *To the extent bycatch cannot be avoided, minimize the mortality of such bycatch.*

The combination of area closures and cod trip limits reduce cod catches, while at the same time minimizing discards. The area closures cover times of the highest cod catches; thereby reducing the potential for discarding associated with the existing trip limits. The expanded area closures proposed by Framework 26 build on the approach that was initially adopted for the 1998 annual adjustment, Framework 25. The additional area closures will therefore make it even less likely that vessels will discard cod because they exceed the cod trip limit.

A more thorough discussion is given in Amendment 9 to the Multispecies FMP of bycatch issues and data deficiencies for the multispecies fisheries. Although discards occur, many multispecies fishermen are keenly aware of the high long-term cost of discard mortality and often make on-site changes to gear or fishing location to avoid catching groundfish that they cannot land. Many management measures in the Multispecies FMP help to reduce discards by limiting where (area closures), when (days-at-sea), and how (gear restrictions) vessels can fish. Since Framework 26 expands the area closures and vessels cannot fish where cod are most concentrated, this action minimizes discarding that might be caused by other measures that would achieve the same cod mortality reductions.

5.1.10 National Standard 10 – Safety of Life at Sea

“Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.”

Framework 26 closes inshore fishing areas for only a short, but important time of the year when cod are most concentrated. Although these areas occur inshore where small vessels usually fish, the proposed action allows these vessels to fish inshore during the remaining nine months. No fishing area or block is closed for more than three months under the proposed action, except for permanent year-around closures that are closed under current regulations. Some vessels may respond by fishing offshore of these closed areas, but the Council notes that the proposed action does not require fishermen to operate in an unsafe manner. Most small vessels have fleet permits and are allocated only 88 days (plus a 10-day carry over of unused days from the prior year). Under this allocation of days, there is no reason why inshore fishing vessels would be forced

farther offshore unless the economic benefits of fishing offshore outweigh the returns from fishing inshore during different seasons. This problem is however faced everyday by fishermen that balance the cost of fishing in more productive areas and the sea worthiness of his vessel compared to the returns the vessel might see by fishing in other locations.

5.2 National Environmental Policy Act (NEPA) - Environmental Assessment

The Council conducted an analysis of the environmental impacts of the stock rebuilding plan under Amendment 7. The Final Environmental Impact Statement (FSEIS) indicated that the impacts of Amendment 7 would be significant, particularly the positive biological and long-term economic impacts of rebuilding the stocks. Since the proposed action in Framework 26 makes adjustments to achieve Amendment 7 objectives and falls within the scope of potential management actions envisioned by the FMP, the Council finds that the proposed action will have no significant impact on the environment.

5.2.1 Purpose and Need for the Proposed Action

The purpose and need for the proposed action is described in Section 3.0.

5.2.2 Description of the Proposed and Alternative Actions

The proposed action and alternatives that have been considered by the Council are described in Section 4.1 and 4.2, respectively.

5.2.3 Description of the Physical Environment

A comprehensive description of the physical environment is presented in Amendment 7 to the Multispecies Fishery Management Plan.

5.2.4 Description of the Biological Environment

A comprehensive description of the biological environment is presented in Amendment 7 to the Multispecies Fishery Management Plan.

5.2.5 Description of the Human Environment

A comprehensive description of the human environment is presented in Amendment 7 to the Multispecies Fishery Management Plan.

5.2.6 Biological Impacts

5.2.6.1 Area Closures

5.2.6.1.1 Summary

The greatest landings reduction for the four alternatives would be produced by Alternative 2b (715 mt). For Gulf of Maine cod, however, Alternative 3 would produce the greatest cod landings

reduction (364 mt, assuming a 50 percent effort redistribution) vs. 247 mt for Alternative 2b. Both alternatives would benefit Georges Bank cod, but Alternative 2b appears to be twice as effective for that stock. It was impossible to estimate the effectiveness for Georges Bank cod assuming effort displacement, because of insufficient data.

Area closures, however, affect the ability of the multispecies fleet to target other species managed by the FMP. The estimated revenue loss is estimated and summarized in Section 5.2.7. Combining the biological and economic results helps to measure the relative benefits and costs associated with each alternative. One way of looking at this problem is to estimate the loss in economic revenue per ton of cod landings conserved (Table 26).

For Gulf of Maine cod alone, Alternative 3 produces the least economic impact while producing the greatest reduction in cod landings, regardless of the amount of effort displacement that is assumed (Table 26). For no effort displacement, the gross revenue forgone for each metric ton of cod landings conserved is \$6,816, forty-six percent better than the closest alternative. If 50 percent of the effort in the new closed areas is redistributed evenly among the remaining open areas, the revenue loss would fall to \$5,575 per metric ton of cod conserved, 50 percent better than the next best choice. If as a result of the effort displacement, CPUE is cut in half in the remaining open areas, Alternative 3 would still produce the best result, \$3,876 of revenue loss per metric ton of cod conserved, or 43 percent better than the next best choice.

These results, however, overstate the costs of conserving cod because they do not include the Georges Bank cod landings reductions. For both stocks together (Table 26), only a no effort displacement analysis is possible. For both cod stocks, the foregone revenue to conserve cod is lowest for Alternative 3 (\$5,935/mt of cod), or 32 percent better than the next choice (Alternative 2b = \$8,765/mt of cod). Alternative 1 appears to be the most costly at \$12,122/mt of cod.

Table 26. Estimated annual revenue reduction per metric ton of cod conserved for the area closure alternatives.

<i>Stock</i>	<i>All cod</i>		<i>Gulf of Maine cod</i>					
	<i>Assumed catch rate</i>	<i>Landings (1997)</i>	<i>Landings (1997)</i>	<i>No change</i>	<i>50% LPUE</i>			
<i>Effort displacement</i>	<i>No Displacement</i>	<i>No Displacement</i>	<i>50% Displacement</i>	<i>50% Displacement</i>				
<i>Alternative 1</i>	\$	12,122	\$	13,832	\$	11,139	\$	6,827
<i>Alternative 2a</i>	\$	9,371	\$	15,007	\$	16,222	\$	18,844
<i>Alternative 2b</i>	\$	8,765	\$	12,507	\$	12,622	\$	12,854
<i>Alternative 3</i>	\$	5,935	\$	6,816	\$	5,575	\$	3,876

5.2.6.1.2 Georges Bank cod

Reductions in landing for Georges Bank cod range from 49 mt for Alternative 1 to 214 mt for Alternative 2b (Table 27), compared to the status quo area closures implemented on May 1, 1998 by Framework Adjustment 25. Alternative 2b closes the greatest portion of Georges Bank for the longest period of time compared to the other alternatives. Alternative 2b would close blocks 118-123 for two months, two-thirds of these two blocks falls within the Georges Bank cod stock area. This result assumes

no effort displacement occurs as a result of the new closures, i.e. fishing effort in the new closed areas is not replaced by increases in fishing effort in the remaining open areas and times. Other assumptions about effort displacement were impossible because of insufficient data.

Table 27. Change in landings compared to status quo.

Stock	Georges Bank cod		Gulf of Maine cod			
	Assumed catch rate	Landings (1997)	Landings (1997)	No change 100% Displacement	No change 50% Displacement	50% LPUE 50% Displacement
Effort displacement	No Displacement	No Displacement	No Displacement	No Displacement	No Displacement	No Displacement
Alternative 1	(49)	(348)	(87)	(217)	(283)	
Alternative 2a	(90)	(149)	13	(68)	(109)	
Alternative 2b	(214)	(501)	7	(247)	(374)	
Alternative 3	(74)	(499)	(229)	(364)	(431)	

5.2.6.1.3 Gulf of Maine cod

For Gulf of Maine cod, Alternative 2b produces the largest reduction in landings (501 mt) followed closely by Alternative 3 (499 mt) (Table 27). Alternative 2a produces the lowest reduction in cod landings, 149 mt.

Due to the amount of days that are currently fished in the proposed closed areas and the relative catch per unit effort (CPUE), these rankings change when effort displacement is assumed in the model. If there is 100 percent displacement, i.e. all of the days absent within the proposed closed areas would shift to the remaining open areas, then the highest Gulf of Maine cod landings reduction is expected for Alternative 3 (229 mt). Alternative 2b, on the other hand, produces much less reduction in Gulf of Maine cod landings than do the results assuming no effort displacement. Cod landing reduction falls from 501 mt assuming no effort displacement to an increase of 7 mt relative to the status quo area closures, assuming complete effort displacement (Table 27).

Assuming that only half of the fishing effort in the closed areas is redistributed in the remaining open areas maintains nearly the same ranking as for 100 percent effort displacement and the results are somewhat more encouraging for Alternative 2b. With ½ of the fishing effort being displaced to the remaining open areas, the expected landings reduction for Gulf of Maine cod is 364 mt for Alternative 3 and 247 mt for Alternative 2b (Table 27). Alternative 2a is estimated to produce the lowest landings reduction for Gulf of Maine cod, only 68 mt.

When effort shifts to new areas, the CPUE for the vessels that remain fishing in that area often declines as a function of the amount of total effort. This occurs because in the short term, the abundance or biomass of fish in the open areas remains constant. A 50 percent decline in CPUE may be somewhat pessimistic, giving overly optimistic landings reductions. Under this assumption, however, Alternative 3 still is estimated to produce the highest net landings reduction (431 mt), relative to the status quo area closures. The cod mortality benefits are followed closely by Alternative 2b with an estimated 374 mt of Gulf of Maine cod landings reduction. Again, the poorest result is for Alternative 2a with a net cod landings reduction of 109 mt.

5.2.6.1.4 Aggregate landings reduction

The net landings reduction for Georges Bank cod is for Alternative 2b, about seven percent of current landings. Coupled with the expected decline in fishing effort during 1998, this could reduce mortality a significant fraction of the needed reduction (current $F = 0.26$, $F_{0.1} = 0.18$). Assuming no effort displacement, landings for the four alternatives ranges between 2,645 mt and 2,823 mt (Table 28).

For Gulf of Maine cod, on the other hand, the best case (no effort displacement) for Alternative 2b is estimated to produce a net reduction of 12 percent. This reduction is far short of the 80 percent mortality reduction that has been recommended by the Multispecies Monitoring Committee. Expected landings (Table 28) range from 3,801 mt for Alternative 2b to 4,181 mt for Alternative 2a. If ½ of the fishing effort in closed areas is redistributed equally among the remaining open areas, however, the expected landings range between 4,328 mt for Alternative 3 to 4,647 mt for Alternative 2a, a proportional reduction from the status quo of between one and eight percent.

Combining both stocks, Alternative 2b would produce the greatest landings reduction (715 mt), assuming no effort displacement. This is followed by Alternative 3 (573 mt), and then by Alternative 1 (397 mt) and Alternative 2a (239 mt).

Table 28. Expected cod landings after closures.

Stock	Georges Bank cod		Gulf of Maine cod		
	Assumed catch rate	Landings (1997)	Landings (1997)	No change 100%	No change 50% Displacement
Effort displacement	No Displacement	No Displacement	Displacement	50% Displacement	Displacement
Alternative 1	2,823	3,966	5,006	4,486	4,226
Alternative 2a	2,779	4,181	5,114	4,647	4,414
Alternative 2b	2,645	3,801	5,107	4,454	4,128
Alternative 3	2,766	3,804	4,852	4,328	4,066
Status Quo	2,876	4,342	5,100	4,721	4,532

5.2.6.1.5 Methods

The efficacy of various area closures results from a mixture of the relative CPUE in open and closed areas, the amount of fishing effort that would be excluded from an area had it been closed to fishing, and the amount and type of fishing effort that will be redistributed in open areas and season once an area is closed. Although estimating the last factor requires a very detailed analysis of vessel characteristics, certain assumptions can be made to bound the problem. The first two factors can be calculated and used to approximate the landings reduction that might occur with various area closure options. This is the basis for the "two-bin" model used here.

Since other trips are irrelevant to estimating the landings reduction for cod, only trips by multispecies vessels that landed one or more pounds of cod were selected. The total days-at-sea reported by these vessels was 42,696 days (Table 29). This total is about 85 percent of total days used by vessels with multispecies permits, due primarily to the pervasiveness of cod catches on Georges Bank and the Gulf of Maine. Under status quo area closures, 39,000 days were taken by trips fishing in the open areas during 1997. Conversely, nearly 4,000 days were taken by trips fishing in the closed areas during 1997 (many of the status quo area closures did not become effective until May 1, 1998).

Alternative 2b affects the greatest amount of fishing effort, 2,568 days more in closed areas than for 1997 fishing effort in the closed areas for the status quo (Table 29). The next highest is Alternative 1 (2,158 days), followed by Alternative 3 (1,401 days) and Alternative 2a (812 days).

On the other hand, the difference between the 1997 cod catch rates (CPUE/DAS) was greatest for Alternative 3 (2.63), followed by Alternative 2a (1.99), Alternative 2b (1.94) and lastly Alternative 1 (1.68). These catch rates are for all cod, not just Gulf of Maine cod since the intent of Framework 26 is to use area closures to reduce fishing pressure on both stocks.

Combining these two variables and making some assumptions about effort displacement gives the results in Table 27. Since both the amount of affected effort and the CPUE is high for closed areas in Alternatives 2b and 3, they produce the greatest landings reductions with no effort displacement. This data was also compared to the affected revenue by all vessels fishing in the quarter degree square blocks on Georges Bank and the Gulf of Maine.

Table 29. Affected 1997 cod landings in closed and open areas for Framework 26 area closure alternatives and for the status quo area closures in fishing year 1998.

		Cod landings 1997		Total DAY-AT-SEA (97) on cod trips	CPUE – Cod per DA
		Georges Bank	Gulf of Maine		
Alternative 1	closed areas	75	1,798	6,007	0.3118
	open areas	2,823	3,966	36,689	0.1851
Alternative 2a	closed areas	98	1,603	4,661	0.3648
	open areas	2,779	4,181	38,035	0.1830
Alternative 2b	closed areas	231	1,982	6,417	0.3449
	open areas	2,645	3,801	36,279	0.1777
Alternative 3	closed areas	74	1,980	5,250	0.4160
	open areas	2,766	3,804	37,446	0.1581
Status Quo	closed areas	-	1,441	3,849	0.3745
	open areas	2,876	4,342	38,847	0.1858
	total	2,876	5,784	42,696	0.2028

5.2.6.2 Impacts of Possession Limit

The biological and economic impact from the various possession limit options is expected to decrease landings and revenue by the amount of cod landed on trips exceeding the limit (Table 30 and Table 31). Eliminating the running clock entirely (i.e. the daily cod limit would become a possession limit that varies by trip length) would reduce landings up to 22 percent when a 700 pound daily limit is in effect and up to 16 percent when a 400 pound daily limit is in effect. These benefits may be different in unanalyzed seasons when catch per day-at-sea is higher or lower than the time period (May 1 to August 31) examined below.

These results may overestimate the benefits and economic impacts if fishermen respond by discarding more cod or increasing the number of trips in a fishing year. Conversely, a possession limit

may cause fishermen to target other species instead of cod, because the cost of continuing to target cod is too high. This framework also proposes to extend or expand closed areas that also will have influence on where, when, and what species that fishermen will fish under the Multispecies FMP provisions.

5.2.6.2.1 Estimated Impacts on Landings and Revenue

The following quantitative analysis makes no assumptions about discarding caused by the possession limit or about changes in fishing behavior (i.e. increasing the number or frequency of trips). These and other factors are qualitatively described in Sections 5.2.6.2.3 and 5.2.6.2.4.

During the last year, there are only two periods when the 700 pound per day-at-sea and the 400 pound per day-at-sea daily cod limits were in effect. These limits are the ones implemented by current regulations. The 700-pound daily cod limit is in effect at the beginning of the fishing year and continues until NMFS determines that 50 percent of the annual TAC had been taken. During the 1998 fishing year, this threshold was exceeded on June 24, 1998. After the 50 percent threshold is exceeded the daily cod limit falls to 400 pounds per day-at-sea until the end of the fishing year. Thus, during 1998, there are data applicable to the 400-pound daily cod limit from June 25 to the last available trip data, August 31.

Applying the proposed possession limits to different seasons during previous years would be inappropriate because of the significant change in fishing behavior (number of trips over the daily limit) has noticeably changed, comparing the activity under the 700 pound limit vs. the 400 pound daily cod limit. During 1997, the cod limit was 1,000 pounds per day-at-sea throughout the fishing year. Secondly, the exploitable biomass for Gulf of Maine cod has also fallen by 31 percent from January 1, 1997 to January 1, 1998 (derived from NMFS 1998). There is therefore no comparable period to estimate the efficacy and impacts of cod possession limits for September to April. In lieu of this information, the effects observed during July and August were assumed for the proportion of annual cod landings that occur during September to April.

While a 700 pounds per day-at-sea limit was in effect (May 1 to June 24, 1998), possession limits would have prevented zero to 22.1 percent of cod from being landed (Table 30). While 1,647 thousand pounds were landed during this period, up to 383 thousand pounds of landings would have been avoided had a 700 pound possession limit been in place. With a 700-pound possession limit, 354 or twelve percent of trips landing cod would be affected by the most restrictive possession limit.

The cod conservation benefits decline rapidly as the possession limit increases. In fact, there is only one trip landing 6,617 pounds that would be impacted with a 6,300-pound possession limit. Since the vessel could still land up to 6,300 pounds with this option, the landings reduction would only be 617 pounds (**Figure 6**) if it fished like the vessel in the last category that was consistent with the proposed limit (see methods described below). A 7,000-pound possession limit would have no impact (Table 30). Even with a 2,800 pound cod possession limit, equivalent to the daily cod limit for a four-day trip, cod landings would be reduced by 40,919 pounds or 4.4 percent of the Gulf of Maine cod landings that occurred between May 1 and June 24, 1998 (Table 30).

As the possession limit increases, it obviously impacts fewer and fewer trips of short duration (**Figure 6**). Not only do the number of trips that would be affected by an increasing possession limit declines, but the proportion of long trips would become disproportionately impacted by a straight possession limit. Since the Council's goal is to reduce the opportunity for vessels to make short trips, catch lots of cod, and tie up to the dock until the running clock has satisfied the daily limit requirement, this result is somewhat contradictory to the objective.

While a 400-pound daily cod limit was in effect, a possession limit would have fewer benefits than the case when the 700-pound daily limit was in effect. During June 25 to August 31, only 106 trips or 7.5 percent of all trips landing Gulf of Maine cod were over the daily limit (Table 31). This compares

to 354 trips or 12 percent of the total during May 1 to June 24, 1998 (Table 30). This may be due to changes in fishing behavior induced by the higher costs (more day-at-sea taken under a running clock) associated with the same amount of cod landings. This result also may be due to seasonal patterns in catch per day-at-sea and a possession limit may be more effective during other portions of the year when cod are more available to the fishery.

Possession limits ranging from 400 to 4,000 pounds per trip would prevent cod landings ranging from 15.8 percent down to 1.4 percent, respectively (Table 31). Elimination of the running clock by implementing a 400-pound possession limit would have prevented the landings of 73,540 pounds of cod, compared to the 337,000 pounds that were landed. This impact rapidly declines and at 2,000 pounds per trip, only would affect 17 trips (one percent) and prevent the landings of 18,000 pounds (four percent). At the limit associated with a 10-day daily limit, only four trips would be affected and it would prevent 6,372 pounds (1.4 percent) of cod landings (Table 31).

The same distributional pattern over trip length occurs as that for a possession limit when a 700-pound daily cod limit was in effect. As the possession limit increases, a disproportionate share of long trips would be affected by a cod possession limit (Figure 7). To the extent that large vessels tend to take longer trips, a straight possession limit would have an unequal and inequitable effect on different fleet sectors. It is no more inequitable, however, than a straight trip limit that applies for other species of fish.

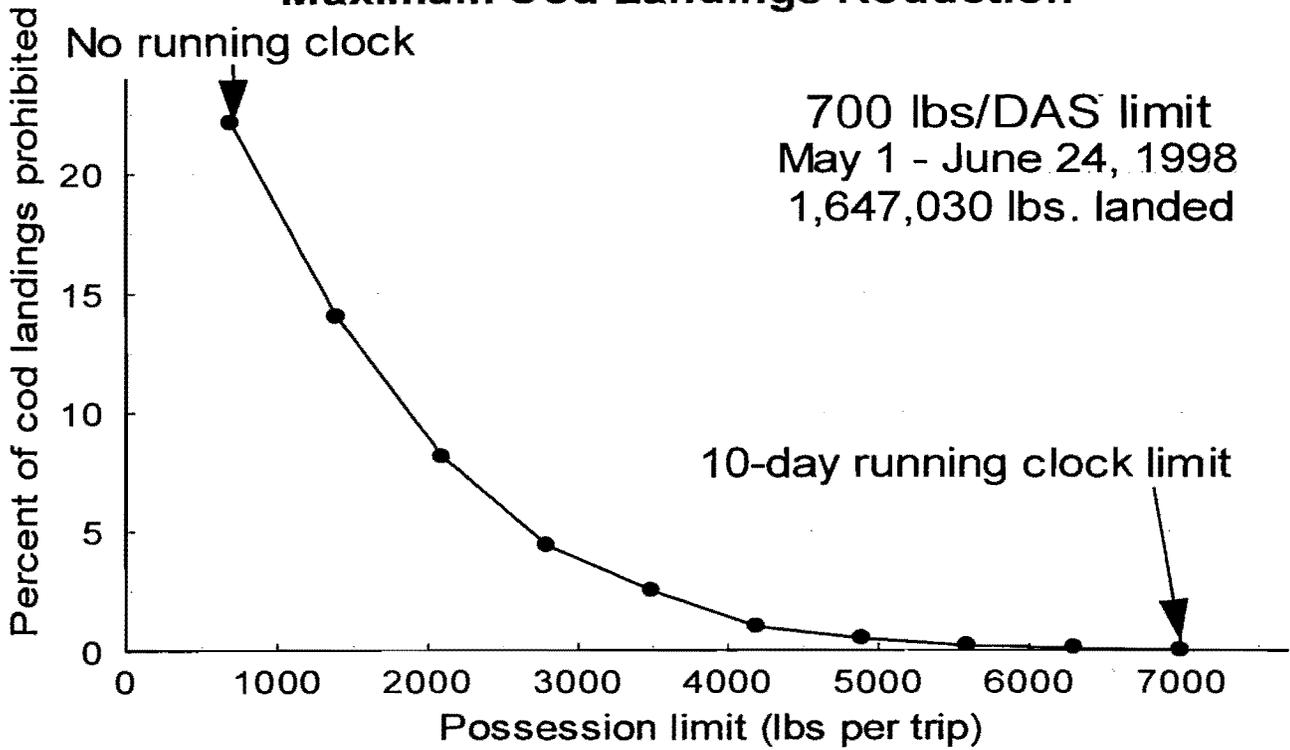
Table 31 Cod Trips and Cod Landings in the Gulf of Maine by Vessels Greater than 30' in Length using All Gear, June 25th through August, 1998 with the Trips Grouped into 400 Lb Categories. Cell shading indicates trips which exceeded an average of 400 lbs. per day and accumulating days-at-sea via a running clock. Darkly shaded cells with bold text indicate trips that would exceed a 2,000 pound possession limit and would be prohibited if the Council adopts that option. The tables on the bottom indicate the expected effect during the analyzed season with a 400 pound daily limit and alternative possession limit options.

COD LANDING (LBS.)	TRIP DURATION (24 Hour Days)															TOTAL								
	0-1		>1-2		>2-3		>3-4		>4-5		>5-6		>6-7		>7-8			>8-9		>9-10		>10		
	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS	TRIPS	LBS
0-100	547	20,289	35	1,920	24	1,103	21	1,211	19	1,088	10	595	4	252	2	188	-	-	1	35	-	-	663	25,839
>100-400	397	102,583	31	8,251	18	4,013	8	1,845	24	4,488	19	4,427	6	1,818	2	498	-	-	3	1,057	-	-	506	128,575
>400-800	62	37,518	15	8,819	10	4,884	11	5,531	10	5,507	3	1,590	5	3,115	1	817	-	-	-	-	1	610	118	69,189
>800-1,200	3	8,417	7	7,368	8	8,487	6	6,121	4	4,180	3	2,900	2	1,983	-	-	1	1,200	-	-	-	-	40	41,616
>1,200-1,600	2	2,810	1	1,247	-	-	4	5,515	3	4,692	5	7,301	3	4,345	1	1,800	-	-	-	-	1	1,600	20	29,105
>1,600-2,000	2	2,500	-	-	4	31,473	-	-	4	7,715	4	7,784	2	3,970	2	3,924	-	-	-	-	1	1,700	21	40,064
>2,000-2,400	2	4,880	-	-	-	-	-	2,200	7	15,928	3	6,829	1	2,385	-	-	-	-	-	-	1	2,020	18	40,258
>2,400-2,800	1	2,600	-	-	-	-	-	2,500	-	-	-	-	8	18,098	-	-	-	-	-	-	-	-	9	23,686
>2,800-3,200	-	-	-	-	-	-	-	2,911	-	-	-	-	3,040	4	12,051	-	-	-	-	-	-	-	7	21,003
>3,200-3,600	-	-	-	-	-	-	-	3,216	-	-	-	-	-	-	-	-	3	10,800	-	-	-	-	4	13,827
>3,600-4,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	11,727	
>4,000-4,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,505	-	-	-	-	-	-	1	4,505
>4,800-5,600	-	-	-	-	-	-	-	-	6,000	-	-	-	-	-	-	5,075	-	-	-	-	-	-	2	10,375
>5,600-6,400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,128	-	-	-	-	-	-	1	7,128
>6,400-8,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
TOTAL	1,023	185,978	92	32,728	64	29,938	54	31,852	68	34,848	51	40,525	32	41,025	15	31,121	5	18,937	4	1,092	7	17,657	1,413	485,697
Under Daily Limit	944	122,872	81	18,990	58	18,487	50	21,023	64	27,648	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,307	337,309
Over Daily Limit	79	63,104	11	15,738	6	11,471	4	10,829	2	7,200	0	-	1	3,040	2	9,880	1	7,128	0	-	0	-	106	128,388

Source: NMFS VTR Database

400 lbs. possession limit																Percent									
Under Possession Limit	944	122,872	81	18,990	58	18,487	50	21,023	64	27,648	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,307	337,309	72.4%
Over Possession Limit	79	63,104	11	15,738	6	11,471	4	10,829	2	7,200	0	-	1	3,040	2	9,880	1	7,128	0	-	0	-	106	128,388	15.8%
800 lbs. possession limit																Percent									
Under Possession Limit	1,006	180,388	81	18,990	58	18,487	50	21,023	64	27,648	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,369	374,825	90.5%
Over Possession Limit	17	15,301	11	9,259	6	5,121	4	5,314	2	3,343	-	-	1	357	2	3,855	1	3,592	-	-	-	-	44	46,151	9.0%
1,200 lbs. possession limit																Percent									
Under Possession Limit	1,018	189,805	86	24,356	58	18,487	50	21,023	64	27,648	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,385	391,810	84.1%
Over Possession Limit	8	7,800	4	4,158	8	5,121	4	5,314	2	3,343	-	-	1	357	2	3,855	1	3,592	-	-	-	-	28	33,539	7.2%
1,600 lbs. possession limit																Percent									
Under Possession Limit	1,017	172,315	89	25,900	58	18,487	50	21,023	64	27,648	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,388	395,682	85.0%
Over Possession Limit	6	6,131	3	2,400	6	2,740	4	5,314	2	3,343	-	-	1	357	2	3,855	1	3,592	-	-	-	-	25	27,531	5.9%
2,000 lbs. possession limit																Percent									
Under Possession Limit	1,019	175,815	89	25,900	64	29,938	50	21,023	64	27,648	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,398	410,833	88.2%
Over Possession Limit	4	3,181	3	1,103	-	-	4	3,198	2	3,343	-	-	1	357	2	3,855	1	3,592	-	-	-	-	17	18,807	4.0%
2,400 lbs. possession limit																Percent									
Under Possession Limit	1,021	180,375	91	30,238	64	29,938	51	23,223	65	29,848	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,402	423,929	91.0%
Over Possession Limit	2	1,041	1	322	-	-	3	2,029	1	2,800	-	-	1	357	2	3,855	1	3,592	-	-	-	-	11	13,998	3.0%
2,800 lbs. possession limit																Percent									
Under Possession Limit	1,022	182,975	92	32,728	64	29,938	52	25,723	65	29,848	51	40,525	31	37,985	13	21,241	4	11,809	4	1,092	7	17,657	1,405	431,519	92.7%
Over Possession Limit	1	401	-	-	-	-	2	1,129	1	2,388	-	-	1	357	2	3,855	1	3,592	-	-	-	-	8	11,702	2.5%
3,200 lbs. possession limit																Percent									
Under Possession Limit	1,023	185,978	92	32,728	64	29,938	53	28,834	65	29,848	51	40,525	32	41,025	13	21,241	4	11,809	4	1,092	7	17,657	1,408	440,471	94.6%
Over Possession Limit	-	-	-	-	-	-	1	307	1	2,000	-	-	-	-	2	3,855	1	3,592	-	-	-	-	5	9,753	2.1%
3,600 lbs. possession limit																Percent									
Under Possession Limit	1,023	185,978	92	32,728	64	29,938	54	31,852	65	29,848	51	40,525	32	41,025	13	21,241	4	11,809	4	1,092	7	17,657	1,409	443,689	95.3%
Over Possession Limit	-	-	-	-	-	-	-	-	1	1,543	-	-	-	-	2	2,967	1	3,592	-	-	-	-	4	8,101	1.7%
4,000 lbs. possession limit																Percent									
Under Possession Limit	1,023	185,978	92	32,728	64	29,938	54	31,852	65	29,848	51	40,525	32	41,025	13	21,241	4	11,809	4	1,092	7	17,657	1,409	443,689	95.3%
Over Possession Limit	-	-	-	-	-	-	-	-	1	1,091	-	-	-	-	2	2,062	1	3,210	-	-	-	-	4	6,372	1.4%

Maximum Cod Landings Reduction



Number of Affected Trips

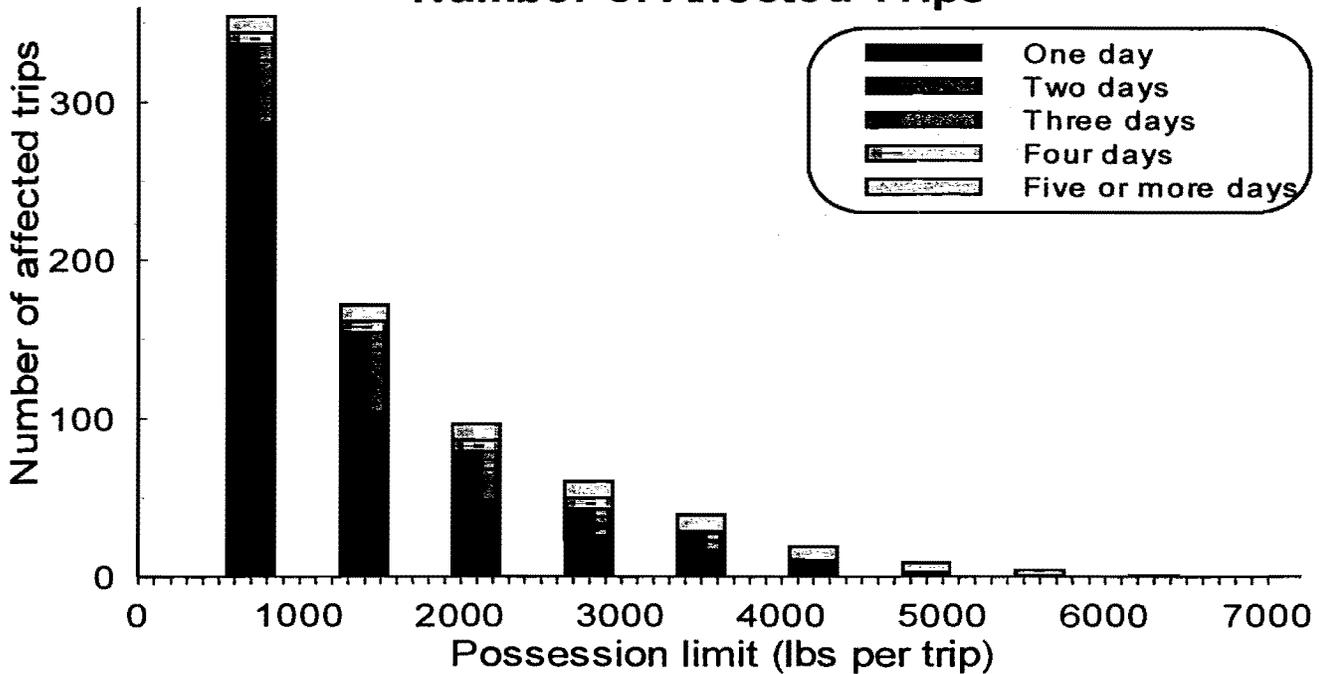


Figure 6. Estimated cod landings reduction (upper) and number of affected trips by trip duration (lower) that would result from a possession limit ranging from the daily limit to a possession limit that equals the total daily limit for a 10-day trip. The estimates reflect the fishing practices and cod landings per trip during 1998 for the 700 lbs/DAS limit.

5.2.6.2.2 Methods

The impact analysis contained in this section considers a range of options that encompasses elimination of the running clock to a possession limit that is equal to the amount of cod captured in the Gulf of Maine and could be landed on a 10-day trip. Thus, while a 700 pound trip limit was in effect, the possession limit options range from 700 pounds per trip (thus no running clock would apply) to 7,000 pounds per trip (Table 30). Similarly, when a 400 pound daily limit is in effect, the possession limit options range between 400 pounds per trip (no running clock) and 4,000 pounds per trip.

In this case, the interaction between a straight possession limit, as proposed in this framework, and a running clock is somewhat complicated. In no case was it assumed that the possession limit would be less than the daily cod limit that applied to a given trip. For example, the cells in Table 30 with the darkest shading illustrates the effect of a 2,800 pound possession limit. For trips less than four days long, vessels would be able to exceed the daily limit of 700 pounds per day-at-sea, but could not land more than 2,800 pounds. On two day trips and for trips landing between 1,400 and 2,800 pounds, the analysis assumed that there would be no reduction in landings because the vessel would employ the running clock procedure to account for the trip's cod landings. On the other hand, there were 12 trips landing 44,042 pounds that had landings above the 2,800 pound cod possession limit. The analysis assumed that these trips would fish like the eight trips that landed between 2,100 and 2,800 trips (mean landings per trip equaled 2,504 pounds) and would thus utilize the running clock for some proportion of their landings. The net reduction in landings would therefore be 13,990 of the 44,042 pounds landed on these 12 trips.

When applied to all trips of any duration, the net landings reduction for the 60 trips over the 2,800 pound cod possession limit is 73,087 pounds (Table 30), or 4.4 percent of the 1,647 thousand pounds landed during May 1 to June 24, 1998. Of the 1,647 thousand pounds, 1,405 thousand pounds, or 85.3 percent, would be unaffected by a 2,800 pound cod possession limit. The difference (10.3 percent) between these values and 100 percent is the landings that would have occurred on the affected trips with the possession limit option that was analyzed.

The analysis may overestimate the landings reduction, because the analysis also assumed that the total number of trips would remain the same. In response to a possession limit, some vessels may increase the frequency and number of trips targeting cod to make up for the inability to use the running clock to account for higher landings of cod. Alternatively, the possession limit may cause vessels to utilize the multispecies days-at-sea to target other species besides cod, because the cost of targeting cod is too high.

5.2.6.2.3 Qualitative impacts - positive effects

5.2.6.2.3.1 *Improved compliance*

The proposed action would close the loophole and also could improve compliance with the cod trip limit. Fishermen who exceed the current daily cod trip limit are required to call in a hail weight on returning from sea and let their clock continue to run until sufficient time had elapsed to account for their cod landings. Many fishermen and others have noticed that some boats take advantage of this procedure to target cod on short trips, and let the clock run to account for their overages. This is defeating the purpose of the cod trip limit. Under present rules, it is up to fishermen to call in their hail weight and let the clock run for the proper period.

Maximum Cod Landings Reduction

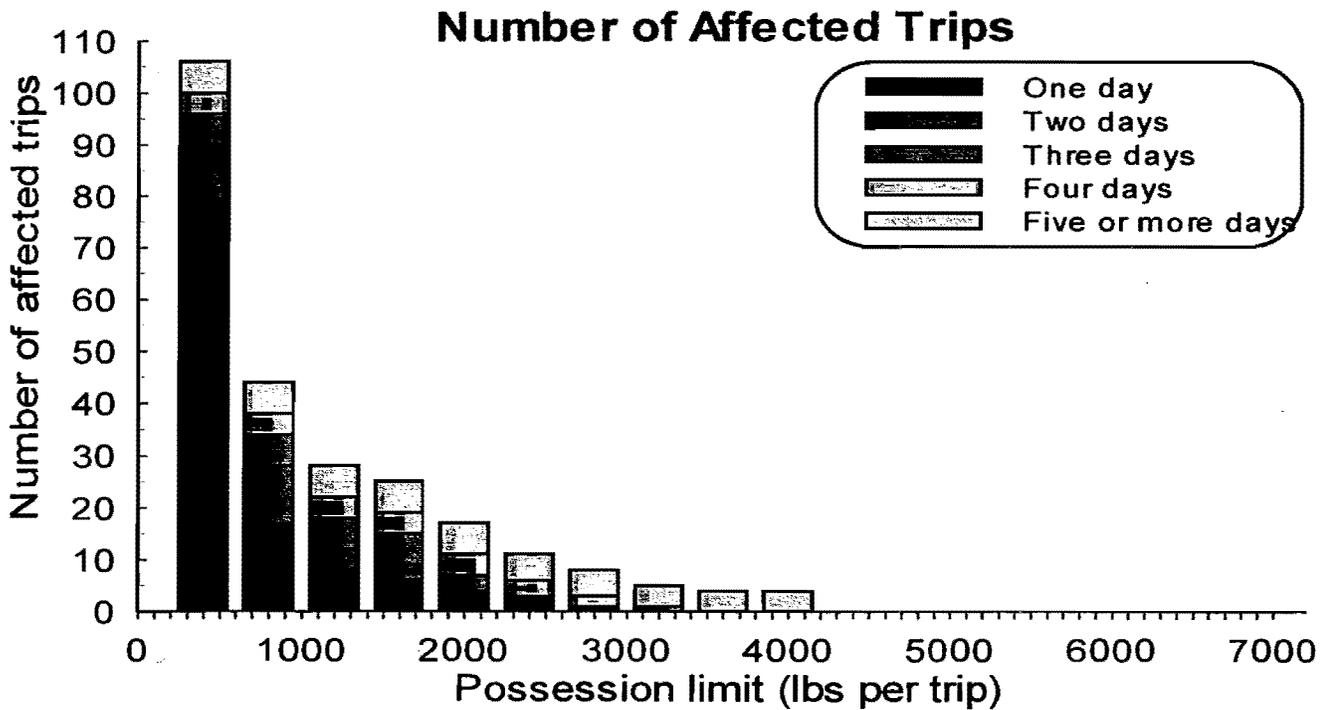
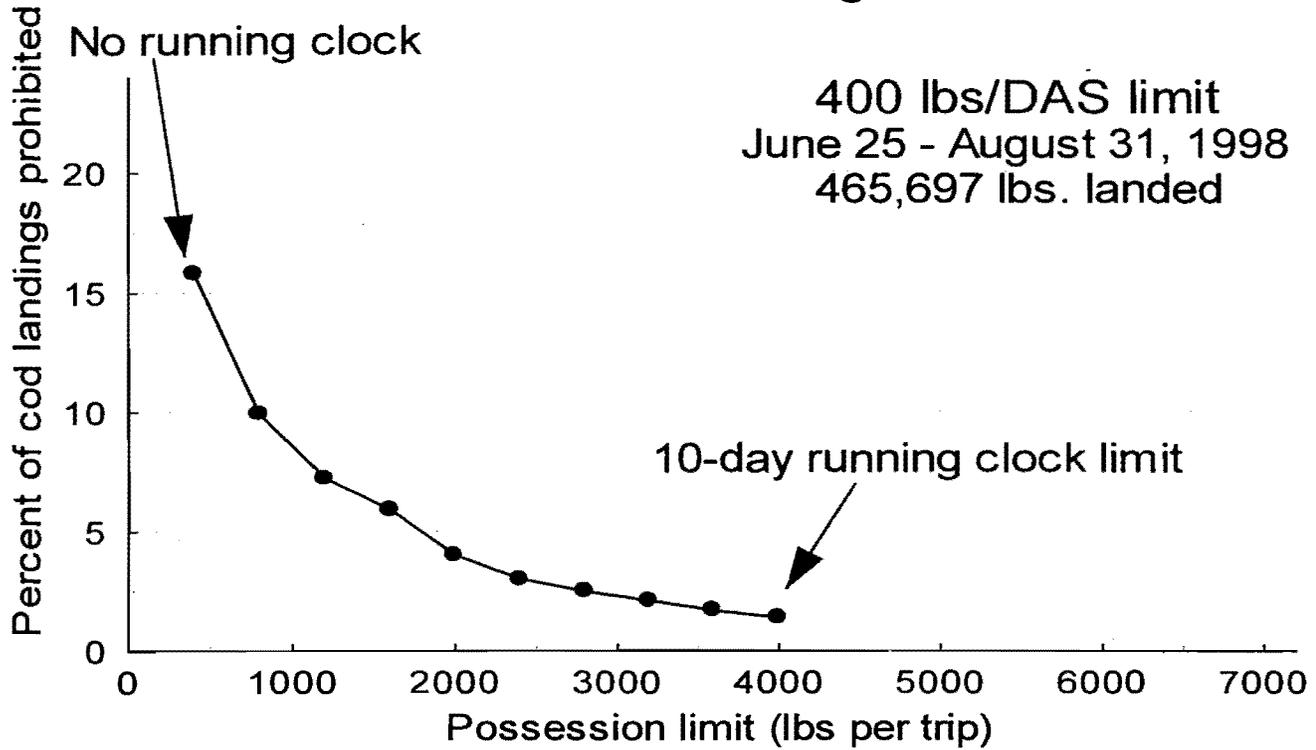


Figure 7. Estimated cod landings reduction (upper) and number of affected trips by trip duration (lower) that would result from a possession limit ranging from the daily limit to a possession limit that equals the total daily limit for a 10-day trip. The estimates reflect the fishing practices and cod landings per trip during 1998 for the 400 lbs/DAS limit.

Poor compliance also might be a problem. Since this program is designed as a self-administered system, it is uncertain how well fishermen are complying with the rules. No cases for failure to account for cod overages by allowing the day-at-sea clock to run have been made to date (U.S.C.G., pers. comm.). In cases where there is little law enforcement and some people are thought to be bending the rules, it can be tempting to others to do the same. Therefore, although there are only eight to twelve percent of trips landing cod that employ the running clock, the total that actually should use the clock could be considerably higher.

A possession limit is more difficult to evade, therefore, a possession limit could augment the running clock and help prevent fishermen from targeting cod and landing large amounts. Compliance with the cod trip limits is therefore likely to improve.

5.2.6.2.3.2 Reduced enforcement burden

Similarly, enforcement of the running clock is very difficult and involves tracking trips, calls into and out of the fishery, and landings possibly unloaded on different days at different dealers. Unless there are egregious violations, the high cost of enforcing the running clock procedure may outweigh the benefits of ensuring compliance.

Out of any type of trip limit, a simple, constant possession limit is easiest to enforce. While it is difficult to enforce high trip limits at sea, it is possible to meet a returning vessel at the dock and requiring it to unload fish. Also, it is somewhat easier to check receipts for violations of a possession limit as well.

On the other hand, a daily possession limit is impossible to enforce at sea, because the amount of allowable catch depends on the length of an incomplete trip. Even when the vessel returns to port, there is no violation until the vessel stops its clock or returns to sea before allowing the necessary time to account for a cod overage. Not only does each vessel have a different trip limit, but no violation can occur until the vessel has called out of the day-at-sea program.

The proposed possession limit system (backup possession limit) is a combination of the two extremes described above. While it does not replace the running clock system and trip limits still vary with trip duration, there is less incentive to land large volumes of cod and it would be somewhat easier to enforce at the time the vessel returns to port. There would be no requirement to wait until the vessel called out of the fishery to determine compliance as long as it called out when returning to port. Depending on what possession limit is implemented, the proposed system could work like a simple possession limit that changes with trip duration, for most trips where the possession limit equals the daily limit. In this case, vessels would be unable to use the running clock on long trips. If the possession limit equals the daily possession limit, the running clock procedure would not be available to any vessel.

5.2.6.2.4 Qualitative impacts - negative effects

5.2.6.2.4.1 Discarding

The primary purpose of the running clock was to prevent low trip limits from causing frequent discarding. Under the present system, there is no compelling reason to discard cod catches that exceed the daily limit. If the vessel returns to port, it only has to call in a haul weight of cod and wait to call out of the fishery until sufficient time had elapsed to account for the trip's cod landings. To some extent, the proposed possession limit would reduce the flexibility offered by the running clock.

It is impossible to accurately predict how much discarding would occur with a certain possession limit, without also analyzing the amount of revenue generated by other species on the trip and what are the operating costs of the vessel. Unfortunately, this type of data is not available at this time. The intent of the possession limit is to change fishing behavior and therefore it cannot be assumed that all of the current landings above a proposed possession limit would be discarded. This data does, however, provide a pessimistic bound on the amount of discarding that might be expected.

On an annual basis (Table 36), the amount of Gulf of Maine cod landings that is above the proposed limits ranges from 26.6 to 472 mt, or 0.7 to 11.6 percent of the 1997 landings. Estimates of foregone revenue, based on the average 1997 ex-vessel price for all cod, ranges from \$50,000 to \$891,000. The highest amounts would occur when the possession limit equals the daily cod limit (400 and 700 pounds per day-at-sea), i.e. the possession limit replaces the running clock procedure.

The Council believes that the actual amount of increased cod discards will be much lower than these maximum values, however, since the intent of the backup possession limit is to alter fishing behavior and the choice of target species. In addition, trips that currently target cod discard fish that are less than the existing size limit. Discarding cod also could decrease if the possession limit successfully discourages targeting and fishermen avoid concentrations of cod, where small cod may be more abundant. The actual result, therefore, depends on the amount of change in fishing behavior and the catch per unit effort experienced by fishermen in the areas they choose to fish. The interaction between area closures to protect cod and the proposed possession limits is discussed in the section below.

5.2.6.2.4.2 Safety of life at sea

The other major reason the Council developed the running clock to administer the daily cod limit was to give vessels more flexibility. If during a trip, a vessel possessed more cod than the daily cod limit, fishermen would have two choices without the running clock procedure: 1) discard the excess cod at sea, or 2) extend the trip and fish for other species. The second response is discussed here.

When the possession limit equals the existing daily cod limit (this occurs for more vessels at lower possession limits, see Tables 30 and 31), vessels could continue the trip and fish in other areas where cod are less abundant, or continue fishing and discard all cod caught from that point forward. Extending trips unnecessarily can create a safety hazard due to changing weather conditions, crew fatigue, and/or the need for routine maintenance that can be overlooked at sea.

With a higher possession limit, it would only equal the daily cod limit for the longest trips. Not only are there fewer vessels that make long trips in the Gulf of Maine, but these vessels also have more flexibility to avoid cod, fishing instead in deeper water for flatfish and other species. Smaller vessels that fish predominately inshore, however, may not be seaworthy enough to move where cod are less abundant or to stay at sea for longer periods. Due to these considerations, the choice of a possession limit to restrict the opportunity to target cod with a running clock is a balance between the efficacy of the possession limit in reducing cod targeting, the amount of discarding that might be caused, and the ability of vessels of various categories to avoid unsafe conditions.

5.2.6.2.4.3 Equity among fleet sectors

Simple possession limits often impact larger vessels that take longer trips more than smaller vessels taking short trips. This occurs because a simple possession limit is not adjusted for trip length. The only way for fishermen taking long trips to compensate is to fish in areas with lower catch rates for

that species or to take shorter trips. The latter response could be incompatible with the design of the vessel or the amount of fixed costs associated with a larger vessel.

The above problem was one reason why the Council devised a daily cod limit in the first place. That approach recognized the differences in the fleet relative to their catches of cod. Other possession limit systems besides the one proposed by this framework adjustment would however add complication to an already complicated program.

The strategies that the Council did not consider for this reason include making the possession limit a multiple of the daily cod limit that would apply for that trip. When the daily cod limit is 400 pounds per day-at-sea, for example, the possession limit could be 800 pounds (2 x 400 x 1) for a one day trip and 4,000 pounds (2 x 400 x 5) for a five day trip. This strategy would mean that each trip would have a different possession limit, depending on the length of the trip and it would double the same enforcement costs that pertain to the daily cod limit.

Another strategy would be to establish a possession limit that is a function of vessel size (loosely related to average trip duration). Here again groups of vessels would have different possession limits, while their daily cod limit would be based on trip limit. Obviously, this strategy to equalize the impacts would be hopelessly complicated.

5.2.6.2.4.4 *Efficiency*

In response to not being able to use the running clock to account for cod landings, fishermen may compensate by taking more trips. The current system allows a permitted vessel to fish for multispecies until it has used its entire allotted annual day-at-sea. If the vessel lands more cod than the daily limit, the vessel is required to call out of the fishery only when sufficient time has passed to account for the landed cod. Once it has returned to port and reported its cod haul weight, the vessel must remain at the dock until it has called out of the fishery. The outcome of this is to reduce the number of days that the vessel can actually fish as a penalty for landing too much cod.

If there is less opportunity to use the running clock procedure because of a possession limit, it makes more days available for the vessel to actually fish. Depending on the response to the new management measure, this could cause the vessel to discard cod (losing revenue in the process), or make more trips to achieve the same gross stock (increasing variable costs). Either response decreases the fleet's efficiency. Overall economic efficiency of the fleet, however, will increase as cod stocks are restored and total catch is brought in line with target TACs.

5.2.6.2.5 Synergistic impacts with expansion of the inshore closed areas

Also included in this framework adjustment are proposals to close additional areas or extend the duration of existing closed areas. The intent of the area closures is to reduce cod catches in areas and times with high catch per unit effort (CPUE) of cod. The impacts of the closed area proposals and the CPUE in closed vs. open areas is discussed in Section 5.2.6.1.4.

As the high catch-rate areas and seasons become unavailable to the fishery, the catch per day-at-sea should decline. When this occurs, vessels would use the running clock less frequently and there would be fewer times when they would catch more than the possession limit. On one hand, this additional effect reduces the need for a possession limit to reduce cod targeting with a running clock. On the other, it reduces the potential discarding from a possession limit. These factors cannot be estimated without a detailed analysis of cod catches by individual vessel and for various area closure options. Data

is not readily available to provide a detailed analysis at this time. Currently available data are furthermore aggregated by categories of landings amounts, making it impossible to adjust a discrete distribution of trips (see Tables 30 and 31) with a continuous variable (CPUE) and compare the result with various possession limit options.

5.2.6.3 Fair-Lead Rollers

There is very little hard data about the prevalence of fair lead rollers or its impact on discard mortality, so the Council will rely heavily on public comment and industry advice about this practice. Removal of undesirable catch is accomplished via two primary methods. King and McKiernan (1995) describe the discarding process for longline vessels as follows:

“Discards of all species in this [groundfish longline] fishery are typically not brought on board. To release undersized or unwanted catch, the hauling operation is stopped temporarily so fish can be unhooked manually with a deft turn of the hook with a gaff or unhooked by hand and dropped back into the water. The alternative is for the hauling operation to continue, and fish (to be discarded) are unhooked forcibly by a “crucifier”, a pair of steel rollers mounted vertically on the vessel’s rail. Fish are stopped by the rollers as the main line is brought aboard the vessel and the hook is ripped from the fishes’ mouth, allowing fish to fall back into the water.”

Although discard rates were relatively low on five sampled trips southeast of Cape Cod, King and McKiernan (1995) recognized that there could be higher discard mortality induced by the fair lead rollers. They conclude that:

“Discard survival appeared to be high. Under conditions fished for these five trips, undersized cod could be unhooked and released in apparently good condition. When carefully unhooked, fish showed little external injury and in most cases swam out of sight when returned to the water.

“Discard rates of cod were fairly consistent among trips ranging from 101 lbs. to 346 lbs. per trip. Chances of survival for discarded cod appeared good but might be lowered by “crucifier”-induced damage to fishes’ mouths. A definitive discard survival study is warranted.”

Fishermen report that fair lead rollers are not very prevalent in the cod fishery, but they are used more extensively to target monkfish and spiny dogfish. This evidence is not verified with observer data, however.

5.2.7 Economic Impacts

5.2.7.1 Introduction

The Council proposes this framework to achieve the plan objectives of Amendment 7 and the overall economic impacts of this action fall within the range of impacts discussed in the FSEIS for that Amendment. This section presents a quantitative and a qualitative analysis of Framework 26 proposed action subject to availability of data, and relative to taking no action to modify current measures.

The proposed action will directly affect cod landings and revenues, but will also produce indirect impacts on the landings of and revenues from other species. The impacts of the proposed closure options on cod landings, revenues and total revenues are analyzed using various models of effort displacement because it is not possible to know how effort will be displaced:

1. No effort displacement
2. Total effort displacement
3. Total and partial effort displacement
 - at the same catch per unit effort
 - at a reduced catch per unit effort

The first model assumes that the vessels do not fish in other areas and/or increase their fishing effort in the closure areas in other months so that all catch from a closed block-month is conserved. The second model assumes that there will be no reduction in total effort with closures and distributes effort from a closed area uniformly throughout the remaining open areas using a two-bin approach (for a further discussion of these models see Section 5.2.6.1.5). The actual impacts are expected to be between the range of impacts of these two scenarios. The scenarios with partial effort displacement provide some examples of the likely impacts if only 50 percent of the effort from the closed areas was directed to the open areas.

The Framework 26 measures also include various cod possession limit options. These possession limits vary as a function of the daily Gulf of Maine cod limit. For the 1998 fishing year the daily limit was 700 pounds per day-at-sea from May to June, and 400 pounds per day-at-sea from June 25 to the end of the year. The impacts of these options on cod revenues are analyzed separately in the following sections.

5.2.7.2 Economic impacts of the proposed closures

Framework 26 proposes a combination of measures including time-area closures and trip limits to directly reduce the Gulf of Maine cod mortality. These measures will also indirectly impact the landings and revenues of other species depending on the degree of effort displacement and revenue recovery from other areas and species. The following economic impact analysis shows the impacts on total revenues of the fishing vessels that will be impacted by the proposed closures. The impacts are examined separately for each type of gear in Table 33. The Table does not include, however, the impacts of the proposed trip limits (See Table 36 and Table 35 for the impacts of trip limits).

Table 32 and Table 33 show the potential impacts of the area closures on cod landings, and revenues, and total revenues using the information on landings, revenues, and effort in 1997 in the proposed closure areas under the various assumptions regarding effort displacement. The 1997 figures for revenues are adjusted downwards to reflect the 7.4 percent reduction in total effort projected to occur in 1998 fishing year.

Table 32. No displacement and two-bin model estimates of changes in Gulf of Maine cod landings and revenues for Framework 26 alternatives.

	Georges Bank	Gulf Of Maine	Total of GB and Gulf of Maine No Displacement	Gulf of Maine Cod only	
				Scenario 1: 50% LPUE* 50% Displacement	Scenario 2: No change in LPUE* 50% Displacement
Alternative 1					
Change in landings (mt)	-49	-348	-397	-283	-217
Change in revenues (1000 \$)	-93	-657	-750	-534	-410
Alternative 2a					
Change in landings (mt)	-90	-149	-239	-109	-68
Change in revenues (1000 \$)	-170	-282	-452	-205	-129
Alternative 2b					
Change in landings (mt)	-214	-501	-715	-374	-247
Change in revenues (1000 \$)	-404	-946	-1350	-706	-466
Alternative 3					
Change in landings (mt)	-74	-499	-573	-431	-364
Change in revenues (1000 \$)	-140	-941	-1081	-814	-687

*LPUE: Landings per DAS

Table 33. No effort displacement and two-bin model estimates of changes in total fleet revenue by gear for Framework 26 alternatives (U.S. dollars).

Alternatives	Gear	No Effort Displacement	Partial Effort Replacement	
			Scenario 1: 50% Displacement at 50% of RPUE*	Scenario 2: 50% Displacement at the same of RPUE*
Alternative 1	dredge	-1,563,648	-1,037,590	-511,533
	gillnet	-502,302	-359,172	-216,043
	hook	-168,963	-20,852	127,259
	trawl	-2,578,510	-1,730,996	-883,482
	Total impacts including dredges	-4,813,423	-3,148,610	-1,483,798
	Total impacts excluding dredges	-3,249,775	-2,111,020	-972,266
Alternative 2a	dredge	-321,961	-277,311	-232,661
	gillnet	-268,145	-174,052	-79,959
	hook	-28,480	-13,705	1,071
	trawl	-1,622,904	-1,299,559	-976,215
	Total impacts including dredges	-2,241,490	-1,764,627	-1,287,764
	Total impacts without dredges	-1,919,529	-1,487,316	-1,055,103
Alternative 2b	dredge	-831,288	-594,567	-357,846
	gillnet	-680,894	-475,763	-270,633
	hook	-103,364	9,626	122,615
	trawl	-4,650,894	-3,659,515	-2,668,135
	Total impacts including dredges	-6,266,440	-4,720,219	-3,173,998
	Total impacts without dredges	-5,435,152	-4,125,652	-2,816,153
Alternative 3	dredge	-634,118	-435,487	-236,856
	gillnet	-741,828	-562,071	-382,314
	hook	-62,601	43,705	150,012
	trawl	-1,959,266	-1,450,432	-941,597
	Total impacts including dredges	-3,397,815	-2,404,396	-1,410,755
	Total impacts without dredges	-2,763,696	-1,968,797	-1,173,899

*RPUE=Total revenue per unit effort, i.e., per DAS.

No Effort Displacement

The impacts of the area closure options on Georges Bank and Gulf of Maine cod landings and revenues are shown in Table 32. If the vessels are not able to recover their losses by shifting effort to other times or areas, the reduction in total cod landings from Gulf of Maine and Georges Bank areas would range from 239 metric tons (Alternative 2a) to 715 metric tons. Similarly, the reduction in cod revenues will range between \$452,000 (Alternative 2a) to \$1,350,000 (Alternative 2b). The magnitude of

impacts under Alternative 3 is closer to the impacts of two-month closures under Alternative 2b, whereas the impacts of Alternative 1 be between the impacts of Alternatives 2a and 3. The area closures will, however, not only have impacts on cod landings and revenues, but will also reduce the revenues from other species if the vessels cannot recover their losses by fishing in other areas. In fact, the comparison of the impacts on cod revenues with the total revenue impacts indicates that the proposed closures have a larger impact on the revenues from species other than cod.

Table 33 shows that, under no effort displacement, the total revenues of the affected vessels would decline by \$2.3 to \$ 6.3 million depending on the alternative under consideration. Alternative 2b produces the largest impact, a \$6.3 million loss, because of the extension of closures to two-months beginning as early as February. The impacts on net revenues (i.e., revenues minus costs), however, will be less than these levels since the operating costs will also decline as effort is reduced by the closures under the no effort-displacement scenario.

Although the assumption of no effort displacement results in an unrealistically high estimate of the negative impacts, it is employed here to show the potential maximum loss in revenues from the proposed closures. The figures shown do not represent, however, the maximum loss from this framework since the application of possession limits are expected to further reduce GOM cod landings and revenues when combined with the proposed closures as discussed below.

The closures would have the largest revenue impacts on the trawl fleet, ranging from \$1.6 million total revenue loss under Alternative 2a for a one-month closure to \$4.6 million under Alternative 2b for a two-month closure (Table 33, No Effort Displacement). The impacts of Alternatives 1 and 3 be within this range of impacts, Alternative 1 producing the second largest, and Alternative 3 the third largest impact on cod landings, cod revenues as well as on revenues from other species.

The impacts on the gillnet and hook sectors will be smaller with an annual loss in fleet revenues from all species by \$ 268,000 and \$ 28,500 respectively under Alternative 2a. For gillnets, however, Alternative 3 produces the largest impacts with a \$741,828 loss, and Alternative 1 results in the largest negative impacts for the hook fishery by a \$169,000 loss.

The impacts on total revenues are estimated by assuming that the dredges would also be prohibited from fishing in the closure areas. The majority of the dredges fishing in these areas are scallop dredges, therefore, the closures will have negative impacts on scallop revenues. Among these alternatives, Alternative 1 would have the largest negative impact on dredges with a \$1.6 million expected reduction in their total revenues, followed by Alternative 3 with an \$1.1 revenue loss. These numbers represent maximum revenue reduction for the scallop fleet since the possession limits for cod will not impact these vessels (vessels on a scallop day-at-sea cannot land regulated multispecies).

If the dredges are exempted from the proposed closures, the total revenue impacts will range between \$1.9 million (Alternative 2a) and \$5.4 million (Alternative 2b) loss (see Table 34, for total impacts with and without dredges).

These results should be interpreted with caution for the following reasons:

- Ex-vessel prices of fish are assumed to stay constant after the closures.
- The variable cost savings associated with the reduced effort are not taken into account.
- The estimates only reflect the maximum revenue and landings losses under the proposed closures with no effort displacement to other areas and months.

- When the impacts of the possession limits are taken into account, the total decline in landings and revenues will be larger than the estimated impacts of the area closures alone as will be discussed below.

Effort displacement

The closures and the cod trip limits will probably induce vessels to change their fishing behavior somewhat to target other species rather than take large losses by not shifting effort. In this way, it will be possible for vessels to partly recover their losses in revenues from other species by fishing in the open areas and months.

The impacts of the effort displacement to other areas/months are estimated based on two assumptions regarding revenue per unit effort in those areas:

- a) Total revenue per day-at-sea declines as more fishing takes place in an area. Specifically, it is assumed here that the vessels can derive only half as much revenue per day-at-sea when they shift the extra effort to the open areas (**Scenario 1**).
- b) Total revenue per day-at-sea is independent of the total effort applied to an area, and is constant at the estimated 1997 level (**Scenario 2**).

Based on these two assumptions, the revenue recovered from the open areas was estimated by multiplying the displaced effort (total day-at-sea in the closed areas by gear) with the average revenue per day-at-sea (by gear) at the reduced rate under scenario 1, and at the constant rate under scenario 2.

If all the vessels could shift their effort to open areas and if their landings and revenues per day-at-sea average the same level prior to the closures, then the proposed closures would have no impact on their revenues. It is highly unlikely, however, for vessels to recover the revenue loss from the closed areas by fishing in the open areas. First of all, the size and horse power of some vessels may restrict their ability to fish in distant off-shore areas, so that not all effort can actually shift to open areas. In addition, the crowding-out impacts of many vessels fishing in the open areas would reduce the catch per unit effort from these areas. For these reasons, the results of the scenario with total displacement at the constant revenue per day-at-sea are not shown in Table 32 and Table 34. Instead, it is assumed that under the assumption of total effort displacement at a constant revenue per day-at-sea, the closures would have no impacts on vessel revenues.

A more realistic scenario with the effort displacement is to assume that the vessels may be able to shift their effort to other areas/periods only partially. Table 32 provides a range of impacts assuming that only 50 percent of the displaced effort may shift to other areas/times. Scenario-1, shows the impacts of proposed closures on the revenues from all species assuming extra effort can generate only half as much revenue per day-at-sea, and scenario-2 shows the impacts assuming that the revenue per day-at-sea stays constant at the level prior to the closures.

Scenario 1 appears to portray a more realistic outcome in terms of the impacts of the proposed closures. Under this scenario, the revenue losses for the fleet as a whole could reach \$4.7 million under Alternative 2b if scallop dredges are prohibited to fish in the closed areas as well, and \$4.2 million if they are not excluded from these areas. Again, scenario 2a results in the least impacts in terms of revenue losses, followed by Alternatives 3 and 1. Scenario-2, on the other hand, represents a highly optimistic case, under which vessels can recover at least half of their revenue losses from closed areas by fishing in the open areas. Even under this scenario, the net losses could reach \$3.2 million under Alternative 2b, and about \$1.2 to \$1.5 million under the other alternatives with the impacts on dredges included. The impacts on net revenues, however, will be less since the operating costs will decline with only 50 percent of the effort displaced to other areas/months.

5.2.7.3 Comparison of the Impacts under Alternative Closures

Under all assumptions regarding the effort displacement, Alternative 2b would have the largest impacts on revenues ranging from \$6.3 million loss with no effort shift to \$3.2 million loss under scenario 2 with partial effort shift at the constant revenue per day-at-sea in the open areas (including the impacts on dredges). The negative impacts would be the least under Alternative 2a with a \$2.2 million loss if there is no effort displacement, and with \$1.3 million loss in revenues under Scenario 2 with partial effort displacement. The impacts of Alternatives 1 and 3 are similar in magnitude and be within the range of impacts of Alternatives 2a and 2b. The proposed closures have, however, differential impacts on different gear types. Alternative 1 results in the largest negative impacts on dredges and hook vessels. Alternative 2b would have the largest impacts on trawls as compared to other alternatives under all scenarios, whereas Alternative 3 would have the largest impacts on gillnets.

Another way of comparing the alternatives would be to compare their revenue impacts per unit of cod conserved. Column 2 of Table 34 shows the total revenue loss from all species under each alternative per metric ton of cod conserved from both the Gulf of Maine and Georges Bank areas under the no-displacement scenario. The comparative revenue loss is largest, \$12,000 per metric ton of cod conserved, under Alternative 1 and smallest under Alternative 3 (\$6,000 per metric ton of cod conserved). Although Alternative 1 leads to a reduction in cod landings by only 397 metric tons (Table 32), it results in a higher revenue loss, \$4.8 million, compared to Alternative 3 which reduces cod landings by 573 metric tons (Table 32), and the total revenues by \$3.9 million (Table 34). Alternatives 2a and 2b result in similar values for revenue reduction per metric ton of cod conserved.

The ranking of the alternatives could change, however, if there is effort displacement to other areas. The data is not available to estimate the change in Georges Bank cod landings with effort displacement. For this reason, the columns 3 to 5 of Table 34 show the revenue impacts for only per metric ton of Gulf of Maine cod conserved. Again, under all scenarios with effort displacement, Alternative 3 minimizes the revenue reduction per unit of Gulf of Maine cod conserved in comparison to Alternatives 1, 2a and 2b. This time, however, Alternative 2a has the highest revenue loss, \$15,000 to \$18,844 per metric ton of Gulf of Maine cod conserved under all scenarios. Under the assumption of no-effort displacement, the second best alternative in terms of the minimum revenue impacts is Alternative 2b (column 3). With partial effort displacement scenarios, the ranking of alternatives from best to worst does not change, Alternative 3 being the best one for minimizing revenue losses per unit of cod conserved, followed by Alternative 1.

Table 34. Expected annual revenue reduction per metric ton of cod conserved under various closure options (Impacts for dredges included).

	Gulf of Maine and GB Cod		Gulf of Maine cod only	
	No Effort Displacement	No Effort Displacement	Scenario1: 50% LPUE* 50% Displacement	Scenario 2: No change in LPUE* 50% Displacement
Alternative 1	12,122	13,832	11,139	6,827
Alternative 2a	9,371	15,007	16,222	18,884
Alternative 2b	8,765	12,507	12,622	12,854
Alternative 3	5,935	6,816	5,475	3,876

* LPUE: Landings per unit DAS

5.2.7.4 Impacts of Possession Limits

The Framework 26 measures also include various cod possession limit options, which place an upper limit for cod overages that could be landed under the current rules. These trip limit alternatives are shown in Table 36 for a possession limit 700 per day-at-sea for May and June, and for 400 per day-at-sea for July and August.

To estimate the annual economic impact of the possession limit options, the available data pertinent to the conditions with a 700-pound and 400-pound limit were extrapolated to other seasons in the fishing year. The following analysis assumes that the trigger reducing the daily cod limit occurs at the same time (June 25) as it did during the 1998 fishing year. Due to the categorical nature of the available data (Tables 30 and 31), it also assumes that CPUE in September to April equals the observed CPUE in July – August, 1998. Higher cod CPUE in September to April implies an underestimate of the true impacts, and vice versa.

As described in Section 5.2.6.2.1, data were available for May 1 to August 31, 1998 to evaluate the efficacy and impacts of a possession limit that would operate in tandem with a 400- and 700-pound daily cod limit and running clock. Observed landings from dealer reports were 3.3 million pounds during May – August (Table 36). Seasonal projected landings estimated by the Multispecies Monitoring Committee predict landings of 8.9 million pounds for the 1998 fishing year, a difference of 5.6 million pounds or 7.2 times the landings that occurred in July and August.

The prediction of annual revenue reductions (Table 36) multiplies this factor by the estimated landings reduction in July and August for each possession limit option. These three estimates (landings reduction for May-June, July-August, and September-April) were summed to give the estimated reduction in annual cod landings. The average price per pound for all cod landed in the Northeast Region (\$0.86) was applied to these summed landings reductions to estimate the annual reduction in gross revenue, assuming that prices do not change in response to lower landings (i.e. prices are inelastic).

Assuming that price is inelastic and fishermen do not recover these revenue reductions by fishing for other species, the maximum reduction in gross revenue ranges from \$50,000 for the highest

possession limits that are considered to \$891,000 for the lowest possession limits and elimination of the running clock procedure (Table 36). In the last case, there would be some cost savings associated with removing the requirement to comply with and enforce the running clock procedure. The negative impacts on revenues will decline, however, as the upper bounds on trip limits increase.

Table 35 provides a qualitative analysis of the short-term impacts of the possession limits on prices, revenues, consumer and producer surpluses, and net benefits.

Table 35. Economic costs of benefits of Framework 26.

SHORT TERM ECONOMIC COSTS AND BENEFITS OF FRAMEWORK 26								
	Effort Displacement	Impact on prices	Impact on Landings	Impact on Gross Revenues	Impact on Consumer Surplus	Impact on Operating Expenses	Impact on Producer Surplus	Net Benefits
Cod trip limit		Increase	Decrease	Decrease	Decrease	Increase	Negative	Short-term Negative
Area Closures	Zero or partial Displacement of Effort	Increase	Decrease	Decrease	Decrease	Decrease	Negative	Short-term Negative
Area Closures	Displacement of Effort fully to other areas/months.	No or negligible impacts	No or negligible impacts Decrease	No or negligible impacts Decrease	No or negligible impacts Decrease	Increase or negligible	Negative or negligible	Short-term Negative or negligible

Table 36. Expected annual landings reduction and economic impacts of various cod possession limit options.

Number of DAS for Running Clock	700 lbs		400 lbs			Landings reduction			Revenue @ \$ 0.86 Thousand Dollars
	May & June		July & August		Sept - April	Annual			
	Possession limit	Landings reduction (lbs)	Possession limit	Landings reduction (lbs)	Landings reduction (lbs)	Thousand pounds	Percent of total landings	MT	
1	700	363,475	400	73,540	602,921	1,040	11.6%	471.71	\$ 891
2	1400	229,793	800	46,151	378,368	654	7.3%	296.79	\$ 560
3	2100	132,990	1200	33,539	274,968	441	4.9%	200.26	\$ 378
4	2800	73,087	1600	27,531	225,709	326	3.6%	148.02	\$ 279
5	3500	40,919	2000	18,607	152,553	212	2.4%	96.20	\$ 182
6	4200	16,466	2400	13,996	114,742	145	1.6%	65.86	\$ 124
7	4900	8,911	2800	11,702	95,937	117	1.3%	52.87	\$ 100
8	5600	2,599	3200	9,753	79,958	92	1.0%	41.87	\$ 79
9	6300	617	3600	8,101	66,420	75	0.8%	34.08	\$ 64
10	7000	-	4000	6,372	52,241	59	0.7%	26.59	\$ 50
Total GM cod landings from VTR in period		1,647			466				
Recorded GM cod landings (thousand pounds)		2,548			785				
Projected GM cod landings (May - April, thousand pounds)¹⁷						8,984			

¹⁷ Projection from 1998 Multispecies Monitoring Committee report.

5.2.7.5 Net Economic Impacts

Combining the maximum possible impacts of the proposed closures on total revenues with the maximum loss in cod revenues due to the possession limit (\$891,00) results in approximately \$7 million reduction in total revenues under Alternative 2b if the dredges were prohibited to fish in closed areas as well. The negative impacts will be smaller under other alternatives, and the least under Alternative 2a, with about \$3 million reduction in total fleet revenues. It should be pointed out, however that, although Alternative 2a produces minimum revenue losses in absolute terms, it does not achieve the same level of benefits as Alternative 3 in minimizing the losses per unit of cod conserved (see Table 34 and the discussion above).

In summary, if the vessels are not able to shift their effort to other areas/months, the maximum revenue losses will range between \$3 to \$7 million. With a partial displacement of effort, the negative impacts will be smaller under scenario 2 ranging from \$2 million to \$4 million including maximum possible impacts from the possession limits. Again, the impacts of Alternatives 1 and 3 will be within the range of impacts produced under Alternatives 2a and 2b. Alternative 3 is the second best option in terms of minimizing the revenue loss (in absolute value) in all effort-displacement scenarios, but the best, in terms of minimizing the losses per unit (metric ton) of cod conserved.

The actual losses under all the alternatives, however, will probably lower than these for the following reasons:

- The results are based on the 1997 prices that may change in year 1999. The reduction in landings will probably increase the price of cod and other species affected by the area closures. The increase in prices will partly offset the revenue loss from the reduced landings depending on the price elasticity of the demand for fish, availability of imports and the availability of other substitutes.
- The impacts on net revenues and the producer surplus will also be less than these estimates because of the cost savings from reduced effort under the No-displacement and partial displacement models. The change in producer surplus is measured by the change in revenues and the corresponding change in variable costs under the proposed measures compared to taking no action. Non-wage variable costs include operating expenses such as fuel, ice and oil, which will decrease if the vessels are tied up at the dock. As an example, if it is assumed that these non-wage variable costs comprise about 28 percent of the gross revenues, the savings in operating expenses would be around \$2 million under Alternative 2b with no effort displacement.¹⁸ Combining this with the \$7 million revenue loss, the reduction in producer surplus would be around \$ 5 million under the No-displacement model and two-month closure with Alternative 2b.
- Similarly, the net losses under all alternatives will be less than shown in Table 33 if these cost savings are taken into account under various assumptions of effort displacement. For example, under Alternative 2b, the net loss will decline to \$2.2 million if only 50 percent of the displaced effort is shifted (Scenario 2) to the other areas because of the savings in operating expenses (about a \$1 million) with reduced effort. The short-term decrease in the consumer and the producer surpluses will also be minimized if vessels can recover their losses by fishing in other areas during the months of closure.

¹⁸ See FEIS, Amendments 5 and 7. Half-of repairs are also included in the operating costs.

These figures, it should be emphasized, represent only short-term losses and Table 35 provides a qualitative analysis of these short-term impacts on prices, consumer and producer surpluses and net economic benefits. As stated in FSEIS of Amendment 7, the rebuilding measures will have negative impacts on revenues, producer and consumer surpluses in the short-term, but will increase fleet profits, crew shares, and consumer benefits over the long-term by increasing the stock size and therefore, landings of the regulated species.

5.2.8 Social Impacts

National Standard 8 requires the Council to consider the importance of fishery resources to affected communities and provide those communities with continuing access to fishery resources, but *not* at the expense of compromising the conservation objectives of management measures. "Sustained participation" is interpreted as continued access to the fishery within the constraints of the condition of the resource. The long-term conservation and rebuilding of stocks often require that limits be placed on particular gears and/or the harvest of specific stocks. Thus, National Standard 8 is interpreted to apply only to a consideration of continued overall access to fishery resources and is not a guarantee that fishermen will be able to use a particular gear type, harvest a particular species of fish, fish in a particular area, or fish during a certain time of the year.

A description of the affected human environment (multispecies fishermen and fishing communities) as well as an assessment of the social impacts of the multispecies rebuilding program are presented in Amendments 5, 7, and 9. Management measures implemented through Framework 26, as with all framework adjustments, are intended to fall within the scope of the rebuilding program initiated by Amendment 7. Therefore, while there may be short-term social consequences resulting from the Framework 26 actions, the long-term social impacts of this framework adjustment are consistent with the Amendment 7 assessment.

The measures proposed for Framework 26 include inshore (seasonal) area closures to protect the spawning stock of Gulf of Maine cod during the months of February, March, and April. Measures implemented by the Council in Framework Adjustment 25 to the Multispecies FMP during 1998 include seasonal "rolling" closures in the western Gulf of Maine in order to achieve the same objective, and Framework 26 closures build on existing Framework 25 closures. The social and community impacts of Framework 26 are likely to be similar to those predicted for Framework 25; any additional impacts directly relating to Framework 26 measures will result from additional inshore area closures during the months of February and April (March closures remain the same as those implemented in Framework 25).

In general, two categories of fishing vessels will be most affected by the additional Framework 26 area closures during February and April: (1) vessels from fishing communities directly bordering the proposed inshore area closures, and (2) vessels from other fishing communities that have traditionally accessed the proposed closed areas to fish. Affected vessels from both categories include not only those vessels that fish for Gulf of Maine cod, but also those vessels that fish for other species like flatfish or scallops.

The vessels in Category (1) will be the most directly affected by Framework 26 actions because the area closures border on the coastlines of their communities and, in some cases, extend up to 80 or 100 miles offshore. These vessels are primarily based in the communities of Gloucester, Newburyport, and Boston, Massachusetts as well as most communities along the New Hampshire coastline. Within this category of affected vessels, smaller vessels (less than 51 GRT) will be at a greater disadvantage to adjust to the new regulations because of their inability to travel beyond the area closures to fish for multispecies between February and April. Medium and larger-sized vessels will undoubtedly be constrained and

inconvenienced, but the physical characteristics of these vessels may allow them to sustain some level of offshore fishing activity during this time period. A majority of the vessels in question, especially those from Gloucester and communities in New Hampshire, are smaller-sized vessels and may be forced to seek alternatives to fishing for multispecies between February and April. Commercial fishing alternatives between February and April are limited for these small vessels. The communities in which these vessels conduct their fishing activities are likely to demonstrate the greatest short-term social impacts resulting from Framework 26 actions.

The second category of affected vessels is comprised of vessels that have accessed the inshore closed areas to fish for a variety of species and are now facing a closure of these fishing grounds. Although some of the affected vessels in this category include those from fishing communities bordering the area closures (see Category (1) above), others may come from communities in Maine and other New England and Mid-Atlantic states. These vessels, while inconvenienced and limited in terms of their flexibility, may still have the opportunity to fish in other parts of the Gulf of Maine as well as in other regions. Most vessels that have the capability to travel from their home communities to the proposed closure areas will be able to travel to alternative areas to fish. Thus, affected vessels in Category (2) but not in Category (1) are more likely to shift their effort into other areas (and perhaps onto other species) and should have the opportunity to maintain an overall level of fishing closer to their historic levels. The communities in which these vessels conduct their fishing activities (Portland, Maine and Chatham, Massachusetts, for example) are less likely to experience short-term social impacts resulting from Framework 26 actions.

There are other sectors of the Gulf of Maine groundfish industry that are likely to be affected by the Framework 26 area closures. Shoreside facilities that supply bait, ice, fishing gear, and other supplies may suffer from a decrease in fishing activity in their communities between February and April. In particular, some gear suppliers have already purchased their products for the spring fishing season: trawl nets, flounder twine for gillnets, etc. There is concern that these businesses may lose a substantial portion of their annual income during 1999 as vessels that cannot fish beyond the area closures do not purchase these supplies. The greater dependence on fishing for groundfishing in communities like Gloucester could ultimately lead to a greater potential for community economic dislocation resulting from the Gulf of Maine cod situation. According to recent information from the U.S. Census Bureau, Essex County (Gloucester, MA) employs close to 6,000 persons in fishing related businesses (processing, seafood markets, vessel repair, etc.). Support infrastructure in communities such as Gloucester is estimated to be at a premium, and very little additional infrastructure could be lost without having a major impact in the ability of the fleets in these communities to operate (Aguirre International, 1996).

Negative social consequences of management actions usually result from the following:

- Loss of income,
- Changes in the structure of the fishery,
- Displacement from the fishery,
- Negative impacts on job satisfaction levels resulting from the above, and
- Perceptions of the rules as "bad" or "unfair" in terms of their potential impacts (Pollnac and Littlefield, 1983).

Loss of income, changes in the structure of the fishery, and displacement from the fishery are likely to result in the short-term from Framework 26 closures. Fishermen who have traditionally focused on Gulf of Maine cod will likely face a decrease in their income unless they can quickly and effectively shift to other species. Loss of income often results in a request for community economic assistance. Many fishermen from Gloucester and neighboring communities have already expressed this concern with regard to the Framework 26 closures. The need for financial assistance, when combined with the perception of

lowered social status resulting from decreased income, can often result in lowered self-esteem and negative impacts on job satisfaction. These social impacts are often consequences of any management plan directed at reducing exploitation.

Inshore closures like those contained in Framework 26 may require that vessels find new fishing grounds and/or travel farther to fish. The potential need to spend more time at sea as a result of Framework 26 area closures may produce negative short-term social consequences. In fact, length of time at sea has been cited as an important characteristic affecting job satisfaction because of the amount of time fishermen are required to spend away from their families and communities and because of the potential for owners of smaller vessels to compromise their own safety to maintain income during the closure time (Pollnac and Littlefield, 1983). While these consequences may result in the short-term, no long-term consequences, such as changes in ownership patterns resulting from a necessity to increase vessel size, are predicted to result from the additional Framework 26 closures during February and April.

The Council acknowledges and understands the potential short-term social ramifications of the additional inshore area closures included in Framework 26. When determining that Alternative 3 would be the closure alternative included in Framework 26, the Council considered the potential socioeconomic effects of the additional closures on communities, especially those neighboring the closure areas, but recognized that action must be taken in order to protect the spawning biomass of a cod stock facing collapse. The Council endeavored to maximize the protection of cod while minimizing the economic impact on gross fleet revenue. Quite often, minimizing negative economic impacts serves as a means to minimize social impacts resulting from regulations. Of the alternatives under consideration, Alternative 3 produces the least economic impact while producing the greatest reduction in cod landings, regardless of the amount of effort displacement that is assumed (see Table 23). In fact, when assuming no effort displacement, Alternative 3 resulted in a 50% smaller reduction in annual revenue per metric ton of cod (Gulf of Maine and Georges Bank) conserved than Alternative 1, about 30% smaller than Alternative 2a, and about 25% smaller than Alternative 2b. For Gulf of Maine cod alone, the differences in revenue reduction resulting from the alternatives is even greater. If, as a result of effort displacement, catch-per-unit-effort is reduced by 50% in the remaining open areas, Alternative 3 still produces the best economic result, about 40% better than the second choice. The Council determined that any closures implemented through Framework 26 will produce negative short-term consequences for affected communities but that the closures are critical to achieving conservation and management objectives for Gulf of Maine cod. In turn, the Council chose to minimize short-term adverse impacts on fishermen, their families, and their communities by selecting the option that should minimize economic dislocation resulting from the closures.

In summary, the additional inshore area closures proposed in Framework 26 will require fishermen and their respective communities to adjust to the increase in regulations aimed at rebuilding a critical commercial groundfish stock. How these adjustments will affect individuals, their families, and their communities varies with a number of factors, such as their dependence on Gulf of Maine cod and their ability to increase the value of a reduced catch or to shift effort to other fisheries in order to maintain a stream of revenues. These impacts, however large or small, must be compared to the potential impacts of maintaining the status quo. Taking no action to protect Gulf of Maine cod at this time could quickly result in stock biomass falling below the minimum biomass threshold as well as the potential for significant recruitment failure. According to the Amendment 9 control rule, when the stock biomass falls below the minimum biomass threshold, the Council is required to reduce mortality to as close to zero as practicable. If the Gulf of Maine cod stock were to continue to decline, the Council would be required to take additional management action, the social consequences of which are likely to be more severe and much larger in scale. In addition, further declines in stock levels would lengthen recovery periods and, therefore, the period over which the greatest negative social impacts are felt by affected communities.

5.2.9 Impacts on Protected Species

This action will have no adverse impacts on protected species and its impacts fall within the range of those analyzed in Amendment 7 to the Northeast Multispecies FMP.

5.2.10 Impacts on Habitat

A comprehensive description of the physical environment and assessment of the impacts to habitat resulting from fishing practices is presented in Amendment 11 to the Multispecies Fishery Management Plan. The actions taken in this framework adjustment will not increase any adverse impacts on essential fish habitat (EFH) resulting from fishing activity. The increase in areas temporarily closed to bottom-tending mobile fishing gear and other fishing gear capable of catching groundfish will reduce any adverse impacts associated with those fishing gears within the boundaries of the areas closed to fishing. While surrounding areas may see an increase in fishing activity due to effort displacement, insufficient data prevent a quantitative analysis of the habitat impacts of effort displacement associated with the actions taken in this framework adjustment.

If a fraction of the fishing effort within the proposed closed areas is not displaced to other areas or seasons, this action may decrease the impact on habitat, especially that preferred by cod. A more detailed description of the potential impact on habitat is given in Section 4.11 of Amendment 11 (NEFMC 1998), which specifically discusses the effects of effort displacement. It is also possible that concentrating fishing effort into smaller areas that remain open may have the unintended effect of increasing impacts on EFH for other species.

5.2.11 Finding of No Significant Impact (FONSI)

NOAA Administrative Order 216-6 provides guidance for the determination of significance of the impacts of fishery management plans and amendments. The five criteria to be considered are addressed below.

1. *Can the proposed action be reasonably expected to jeopardize the long-term productive capability of any stocks that may be affected by the action?*

The proposed action is part of an ongoing stock rebuilding program established by Amendment 7 that is based on reducing overall fishing mortality, by limiting fishing effort, prohibiting effort in select locations and seasons, and controlling fishing technology. More specifically, this action focuses on rebuilding Gulf of Maine and Georges Bank cod stocks which will enhance their long-term productivity.

2. *Can the proposed action be reasonably expected to allow substantial damage to the ocean and coastal habitats?*

A major part of the proposed action would make areas off limits to fishing when cod are particularly vulnerable. The cessation of fishing and the limits on fishing effort in open areas will have a beneficial impact on fish habitat, allowing the bottom time to recover from whatever disturbance fishing has caused. The issues relative to essential fish habitat (EFH) are addressed in Amendment 8 to the Northeast Multispecies FMP. The proposed action in Framework 26 is consistent with the

identification of essential fish habitat.

3. *Can the proposed action be reasonably expected to have an adverse impact on public health or safety?*

Since the management measures in the Multispecies FMP provide flexibility and continuous opportunity to fish within the constraints of the conservation needs of the plan, the Council expects that the proposed measures will not negatively impact safety. The measures do not require vessels to take risks that compromise safety of the vessel and crew.

The proposed action in Framework 26 includes a possession limit that could cause some fishermen to change their fishing practices. Some trips might need to be lengthened to avoid discarding cod or landing them illegally. The intent of this measure, however, is to cause fishermen to target other species, rather than change their fishing practices to continue targeting cod. The Council therefore believes that the proposed action will not meaningfully alter fishing practices that will endanger life or human health.

Some of the area closure alternatives have different impacts on small, inshore vessels that often take day trips. Alternatives that close the greater amount of area near shore, therefore, have a greater potential for harming public health and safety. Since the total amount of time that vessels may fish for regulated multispecies is only 98 days (for fleet vessels with 10 carry over days), there is ample opportunity to fish close to shore during other times of the year. The Council believes that fishermen with small boats that are negatively affected by the closed areas will fish during the remaining 10 months of the year when the Inshore Closure Area is open to fishing, rather than relocating offshore, possibly exceeding the seaworthiness of the vessel. Weather in the remaining 10 months of the year, on average, tends to be less adverse than during the two months proposed for closure.

4. *Can the proposed action be reasonably expected to have an adverse effect on endangered, threatened species or a marine population?*

The Council does not expect the proposed action to have an adverse effect on marine mammals or other protected species. In fact the proposed area closures may enhance marine mammal protection measures currently in place.

5. *Can the proposed action be reasonably expected to result in the cumulative adverse effects that could have a substantial effect on the target resource species or any related stocks that may be affected?*

The measures in this framework are management adjustments to achieve the stock rebuilding program established under Amendment 7. For this reason, the Council does not expect the action to have any cumulative adverse effect on the target resource. In Amendment 7, the Council recognized that effort shifts could occur that may have an adverse impact on other stocks, although the direction and magnitude of that impact could not be predicted. The proposed measures do not substantially change the effect of the stock rebuilding plan on any related stocks nor result in any cumulative adverse effect.

Based on the preceding criteria and analysis, the Council proposes a finding of no significant impact.

FONSI STATEMENT: In view of the analysis presented in this document and in the FSEIS for Amendment 7 to the Northeast Multispecies Fishery Management Plan, the proposed action will not significantly affect the quality of the human environment with specific reference to the criteria contained in NAO 216-6 implementing the National Environmental Policy Act. Accordingly, the preparation of a Supplemental Environmental Impact Statement for this proposed action is not necessary.

ASSISTANT ADMINISTRATOR DATE

5.3 Regulatory Impact Review (Executive Order 12866)

This section provides the information necessary for the Secretary of Commerce to address the requirements of Executive Order 12866. The purpose and need for management (statement of the problem) is described in Section 3.0. The alternative management measures to the proposed regulatory action are described in section 4.2. The economic impacts are described in Section 5.2.7 and summarized below under the discussion of how the proposed action is characterized under Executive order 12866.

5.3.1 Executive Order 12866

The proposed action does not constitute a significant regulatory action under Executive Order 12866 for the following reasons:

- (1) The management proposals will not have a significantly different impact on the landings and revenues of the existing fishery as compared to the levels anticipated in Amendment 7. The proposed area closures coupled with the possession limits will reduce the revenues in the short-term at a maximum of \$7 million under Alternative 2b, and less under other alternatives.
- (2) The overall economic impact of these measures, while they cannot be assessed quantitatively, falls within the range of impacts discussed in the FSEIS of Amendment 7. The short term impacts will probably be somewhere between a maximum revenue loss of \$ 7 million under a no-effort displacement scenario under Alternative 2b, and a \$1.5 million loss under Alternative 3 if a part of the loss is recovered by shifting effort to other areas and periods (partial effort displacement-scenario 2, Table 33). The net impact on the economy will, however, be positive over the long term as predicted in the FSEIS of Amendment 7. The proposed action will not have an annual effect on the economy of more than \$100 million given the fact that even under Amendment 7 regulations, annual effect on the economy is not expected to reach \$100 million despite the dramatic reductions in the overall fishing effort planned by this amendment.
- (3) The proposed measures contained in this framework are designed to achieve the biological objectives of Amendment 7, and to provide economic relief to the industry whenever possible without compromising the conservation goals. The area closures and cod trip limits will reduce the landings and revenues in the short-term, but will contribute to stock rebuilding, and therefore, will increase the net economic benefits in the long term. For these reasons, the

proposed action will not adversely affect in a material way the economy, productivity, competition and jobs in the long term.

- (4) For the same reasons as above, the proposed action will not significantly affect competition, jobs, the environment, or state, local or tribal governments and communities. The area closures and trip limits will not affect safety or public health.
- (5) The proposed action will not create an inconsistency or otherwise interfere with an action taken or planned by another agency. No other agency has indicated that it plans an action that will impact the same areas and the fisheries.
- (6) The proposed action will not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of their recipients.
- (7) The proposed action does not raise novel legal or policy issues. Regulations regarding area closures and trip limits have already been used to manage fisheries in the Northeast.

5.4 Regulatory Flexibility Act (RFA)

The RFA applies to any rule or regulation that must undergo “notice and comment” under the Administrative Procedures Act (APA), specifically those rules published as proposed. Since this action is submitted as a final rule, not subject to further notice and comment under the APA, and the effects of the regulations fall within the scope of Amendment 7, the RFA requirements do not apply.

The purpose of the RFA is to reduce the impact of burdensome regulations and record-keeping requirements on small entities (small businesses, organizations, or governments). When the RFA applies, the Council must assess the effects of the regulations to determine if they will have a “significant economic impact on a substantial number of small entities.” The Council must then either provide an explanation that there is not a significant impact (as described in the guidelines to the RFA), or prepare an initial regulatory flexibility analysis (IRFA).

5.5 Endangered Species Act (ESA)

Pursuant to Section 7 of the Endangered Species Act, the impacts of fishing under the Northeast Multispecies FMP, and gillnet fishing specifically, were considered in formal consultations conducted for Amendment 5 in 1993 and on Amendment 7 in 1996. Both Biological Opinions concluded that existing fishing activities and related management measures proposed under Amendments 5 and 7 might affect, but would not likely jeopardize, the continued existence of any endangered or threatened species under NMFS jurisdiction. Framework 26 to the FMP should not change that determination.

5.6 Marine Mammal Protection Act (MMPA)

The New England Fishery Management Council has reviewed the impacts of Framework Adjustment 26 on marine mammals and concludes that this management action is consistent with the provisions of the MMPA and will not alter existing measures to protect the species likely to inhabit the management unit. Overall, positive benefits may accrue to species inhabiting the areas affected by the measures proposed. See Section 5.2.9 for a discussion of these impacts.

5.7 Coastal Zone Management Act (CZMA)

Upon submission of Amendment 7, the Council conducted a review of the FMP for its consistency with the coastal zone management plans of the affected states. All the states concurred with the Council's consistency determinations. See Section 8.5, Volume II of Amendment 7 for the Council's consistency determinations. The response letters of the states are on file at the Council office. The Council has determined that the proposed action is within the scope of measures already reviewed for consistency with states' CZM plans and is, therefore, consistent with those plans. The Council has notified potentially affected states of this action and of its determination that the action is consistent with its earlier determination.

5.8 Paperwork Reduction Act (PRA)

The proposed action contains no additional collection of information requirements and does not change the existing reporting burden. No analysis of costs is therefore required under the Paperwork Reduction Act.

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