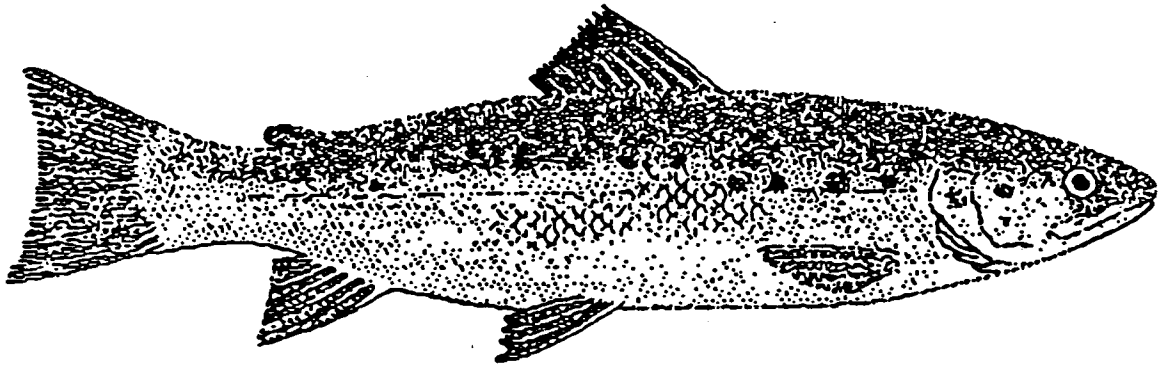


**Fishery Management Plan  
for**

**ATLANTIC SALMON**



**Incorporating an  
Environmental Assessment  
and  
Regulatory Impact Review /  
Initial Regulatory Flexibility Analysis**

**Prepared by the  
New England Fishery Management Council**

**October 1987**

COVER SHEET

RESPONSIBLE AGENCIES:

Assistant Administrator for Fisheries  
National Oceanic and Atmospheric Adm.  
U.S. Department of Commerce  
Washington, DC 20235

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PROPOSED ACTIONS:

Adoption, approval, and implementation of the Fishery Management Plan for Atlantic salmon.

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ABSTRACT:

The New England Fishery Management Council and the Assistant Administrator for Fisheries (NOAA) propose to adopt, approve and implement pursuant to the Magnuson Fishery Conservation and Management Act a Fishery Management Plan for Atlantic salmon.

This FMP is intended to establish explicit U.S. management authority over all Atlantic salmon (Salmo salar) of U.S. origin to complement State management programs in coastal and inland waters and Federal management authority over salmon on the high seas conferred as a signatory nation to the North Atlantic Salmon Conservation Organization (NASCO).

The FMP establishes a Federal management program which seeks to prevent the development of a fishery for Atlantic salmon in the EEZ through a prohibition on possession. By this action, the Federal government safeguards the very substantial investment embodied in the ongoing State/Federal stock restoration programs and strengthens its negotiating position with respect to U.S. proposals placed before NASCO.

This Environmental Assessment has been developed to address issues which arise as a consequence of establishment of a new management program for fishery resources not heretofore regulated under the authority of the Magnuson Act. The proposed management program will not have a negative impact on fishery resources, habitat, public health or safety, or endangered or threatened species.

DATE BY WHICH COMMENTS MUST BE RECEIVED: \_\_\_\_\_

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R	Key to the Regulatory Impact Review and the Regulatory Flexibility Analysis

## PART 1. INTRODUCTION

The New England Fishery Management Council (Council) and the Assistant Administrator for Fisheries (NOAA) propose to adopt a Fishery Management Plan (FMP) for Atlantic Salmon (Salmo salar). The FMP is needed to address a deficiency in the US management program for its Atlantic salmon resource to facilitate accomplishment of the long-term goals of salmon management as embodied within the cooperative State/Federal stock restoration programs in the Northeast. The Council proposes to establish a management program for Atlantic salmon in the EEZ to complement existing State management programs in inland and coastal waters and to complement Federal management authority over salmon of domestic origin on the high seas (beyond 12 miles) conferred to the US as a signatory nation to the North Atlantic Salmon Conservation Organization (NASCO).

### § 1.1 The Jurisdictional Environment in Atlantic Salmon Management

Management of the US Atlantic salmon resource, and the stock restoration programs come under the purview of the fish and wildlife agencies of the New England states plus the US Fish and Wildlife Service as well as a number of other state, federal, and international organizations, and commissions.

The Atlantic Sea-Run Salmon Commission, established through legislative act by the State of Maine in 1947, is comprised of five members; the Maine Commissioner of Inland Fisheries and Wildlife (permanent chairman), the Maine Commissioner of Marine Resources, and three appointed citizens of the State of Maine appointed by the Governor. The Commission has the authority to promulgate rules and regulations pertaining to the taking of Atlantic salmon from waters of the State of Maine and to institute remedial action where adverse conditions have been shown to exist and such action has been shown to be required.

Cooperative Agreement between the US Fish & Wildlife Service and the State of Maine By an agreement, entered into May 9, 1962 and most recently renewed October 1, 1987, a program of salmon hatchery production and fish stocking was initiated for the purpose of furthering stock restoration of Atlantic salmon in the state of Maine. To assist in technical matters and marshal scientific expertise for addressing appropriate research, a Technical Advisory Committee was established as part of the current Cooperative Agreement.

Inter-agency agreement for the Merrimack River basin (Statement of Intent) In 1969, the states of Massachusetts and New Hampshire, the US Fish and Wildlife Service, and the National Marine Fisheries Service entered into a compact to support a fisheries program for the Merrimack River Basin. The US Forest Service was included in the agreement in 1982. The goal of that program, with respect to Atlantic salmon, is to restore the Atlantic salmon resource to a level of optimum utilization of the existing habitat in the Merrimack River Basin for public benefit.

Atlantic salmon restoration program for the Pawcatuck River, Rhode Island The Rhode Island Division of Fish & Wildlife has been conducting a research and development program in the Pawcatuck River Basin using hatchery-reared stock. This work was initiated in 1981 with the preparation of a strategic

plan for stock restoration in cooperation with the US Fish & Wildlife Service. There are no existing formal interagency agreements concerned with the program, although it is expected that an interstate compact with Connecticut will be required to address the entire scope of the Pawcatuck River Basin.

The Connecticut River Atlantic Salmon Commission. Efforts relating to the restoration of Atlantic salmon in the Connecticut River Basin were initiated in 1967, through enactment of Public Law 98-138. The US Congress consented to an interstate compact creating the Connecticut River Atlantic Salmon Commission, such compact being entered into by the States of Connecticut, Massachusetts, New Hampshire, and Vermont and pursuant to the laws of these respective states. In April 1985, the Connecticut River Atlantic Salmon Commission formally adopted a Statement of Practices and Procedures and promulgated regulations governing Atlantic salmon on the main stem of the Connecticut River. Atlantic salmon in the tributaries of the Connecticut River are governed by regulations of the state in which the tributaries occur.

The North Atlantic Salmon Conservation Organization (NASCO) The US joined with other North Atlantic nations in 1982 to form NASCO for the purpose of managing salmon through a cooperative program of conservation, restoration and enhancement of North Atlantic stocks. The principal means for achieving those goals under NASCO is through a system for controlling the exploitation by one member nation of salmon which originated within the territory of another member nation.

#### § 1.2 Purpose and Need for Management

The Council embarked on the development of this FMP to address a deficiency existing within the United States management authority over its Atlantic salmon resource in the North Atlantic. The NASCO Convention of 1982 defines territorial seas as being the 0-12 mile zone contiguous to the coastline of the signatory nation (excepting the 0-40 mile zone for Greenland and a 0-200 mile zone in the case of the Faroe Islands). Contrastingly, the US recognizes only a 0-3 mile zone for its own territorial sea. By virtue of this disparity, the 3-12 mile zone off the US coastline is explicitly not under the management authority of NASCO nor is it under the explicit management authority of the coastal states of the US. Thus, all management programs for US-origin Atlantic salmon may be potentially compromised by unregulated exploitation of salmon resources within the zone. This deficiency in US management of Atlantic salmon poses a threat to the salmon restoration efforts in the New England and weakens the US position with regard to initiatives placed before NASCO and the US expectations for responsive salmon management under NASCO.

The US was instrumental in establishing NASCO for the purpose of controlling the exploitation of Atlantic salmon on the high seas. Under the terms of the NASCO Convention of 1982, salmon catches within the area of fisheries jurisdiction of a member nation of fish originating in the rivers of another member nation shall be minimized to promote the conservation, restoration, enhancement and rational management of salmon stocks in the North Atlantic. However, the lack of management regulations for domestic stocks of Atlantic salmon while resident in the 3-12 mile zone potentially jeopardizes

the efforts of the State-Federal partnership to conserve and restore those stocks and may compromise the US position with regard to initiatives placed before NASCO.

The United States is interested in curtailing interception fisheries of US origin fish to the extent that such fisheries may compromise the success of the very substantial long-term commitment on the part of the States and the Federal government to restore the Atlantic salmon stocks in New England. The establishment of NASCO largely resulted from US concerns with respect to this issue and with the need for creating an appropriate international forum for addressing salmon management in the North Atlantic. Accordingly, to place its own house in order to facilitate the accomplishment of its stock restoration goals, the US deems it appropriate to establish an explicit management program for Atlantic salmon throughout the entire EEZ.

### **§ 1.3 Management Objective**

The management objective for the Atlantic Salmon Fishery Management Plan shall be:

To complement restoration and management programs of the various Atlantic coastal states of the United States for Atlantic salmon (Salmo salar) and to complement the management and conservation program of the North Atlantic Salmon Conservation Organization (NASCO) and United States participation in NASCO.

### **§ 1.4 Management Unit**

The management unit for the Atlantic Salmon FMP is intended to encompass the entire range of the species of US origin while recognizing the jurisdictional authority of signatory nations to NASCO. Accordingly, the management unit for this FMP is:

All anadromous salmonids of U.S. origin in the North Atlantic area throughout their migratory ranges except while they are found within any foreign nation's territorial sea or fishery conservation zone (or the equivalent), to the extent that such sea or zone is recognized by the United States.

## PART 2. DESCRIPTION OF THE RESOURCE

### § 2.1 The Range and Abundance of the Stocks

§ 2.1.1 Original Condition In pre-colonial days, Atlantic salmon were known to be plentiful in many New England rivers. Early estimates place the number in excess of 300,000 fish entering at least 28 river systems (USFWS, 1984) (see Figure 2.1) to as many as 500,000 fish entering 34 rivers (Beland, 1984a).

By the early 1800s, the salmon resource had been severely reduced for a variety of reasons, all having to do with the activities of man. Early settlers utilized salmon for food and exported large quantities to Europe. As the areas around major watersheds became more urbanized, overfishing and deteriorating water quality vastly reduced salmon stocks in all natal New England rivers. Further development of the river basins during the Industrial Revolution created a profusion of dams which denied salmon access to spawning and nursery grounds. The decline was further complicated by lack of knowledge of the biology of Atlantic salmon. By 1865, salmon runs in southern New England had disappeared.

Early efforts to restore salmon to depleted rivers in southern New England, notably the Merrimack and Connecticut Rivers, met with only minimal success. By the 1890's, efforts were completely abandoned because of inadequate upstream fish passage facilities and the inability of states to regulate fishing.

§ 2.1.2 Present Condition Modern efforts to restore the Atlantic salmon resource date from 1947 when the Maine Atlantic Sea-Run Salmon Commission was established. In 1965, the United States Congress enacted the Anadromous Fish Conservation Act (P.L. 89-304) which expanded and accelerated efforts to restore Atlantic salmon. The Act enabled New England state fishery agencies to obtain Federal funding for restoration activities. In 1967, the Connecticut River Anadromous Fish Conservation Program became a cooperative Federal-State endeavor. Two years later (1969), a similar program was initiated for the Merrimack River.

Today, efforts to restore Atlantic salmon to the rivers of New England have grown into a highly coordinated initiative encompassing nine State and three Federal agencies as well as private sector groups. Atlantic salmon have gained a small foothold in several rivers. However, their long-term survival is not guaranteed.

Atlantic salmon now enter 16 river systems in New England. Salmon returning to the major river systems number less than 7,000 per year (USFWS, 1984). Of this total, about 1,000 are the direct result of wild smolt production and the remainder is from hatchery stock. Table 2.1 shows the annual returns of adult salmon to selected New England rivers for the years 1971-1986.

Seven rivers, all in the State of Maine, have relatively stable populations of Atlantic salmon. These are the Derrys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers. At least six other rivers (also in the State of Maine) support minor populations of Atlantic



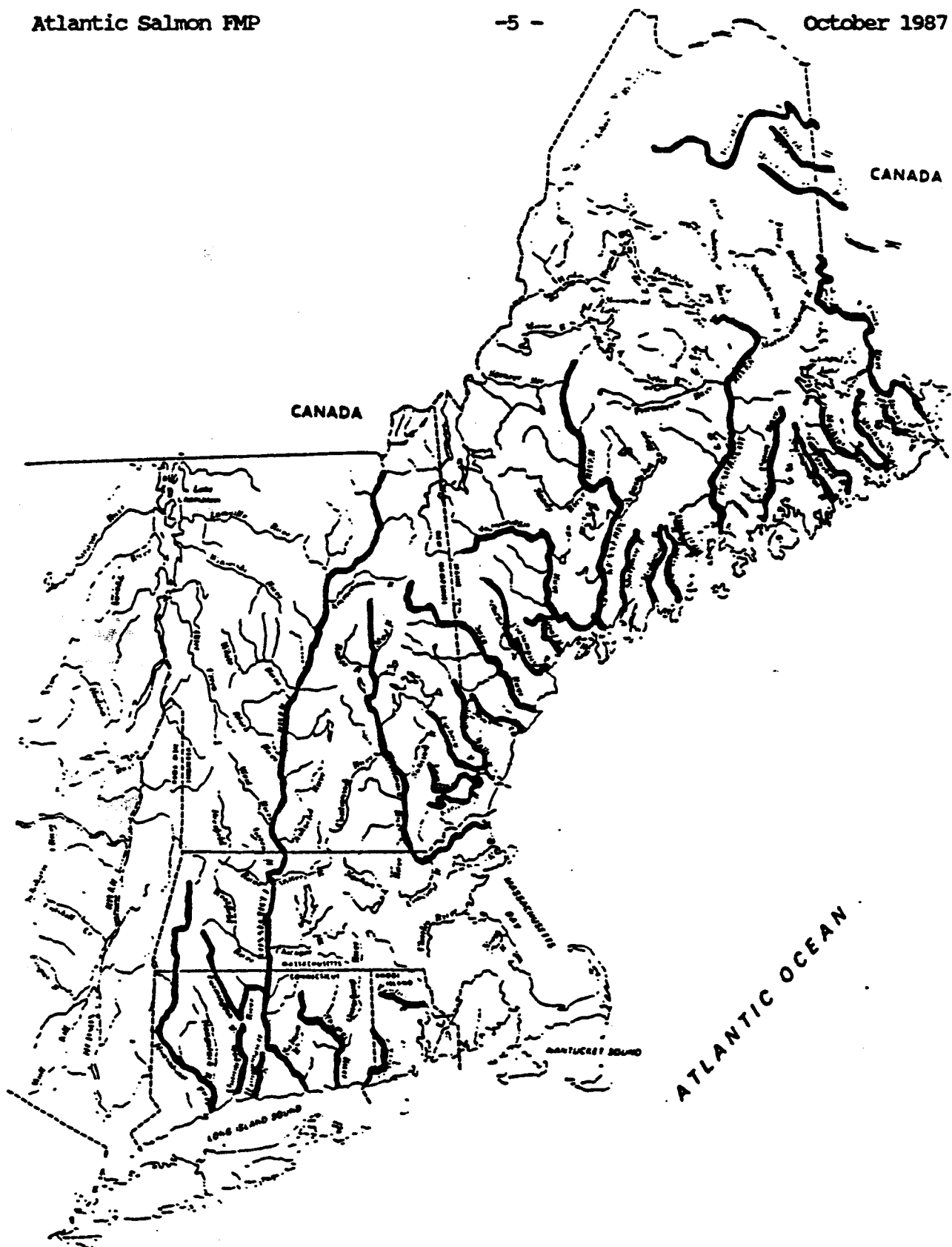


Figure 2.1. Original distribution of Atlantic salmon in New England (circa 1700)

Table 2.1. Numbers of Adult Atlantic Salmon Returning Annually to Selected New England Rivers, 1971-1986

<u>YEAR</u>	<u>PENOBSCOT</u>	<u>UNION</u>	<u>MERRIMACK</u>	<u>PAWCATUCK</u>	<u>CONNECTICUT</u>	<u>ST. CROIX</u>	<u>TOTAL</u>
1971	114	-	-	-	-	-	114
1972	337	-	-	-	-	-	337
1973	313	-	-	-	-	-	313
1974	584	20	-	-	-	-	604
1975	1,006	79	-	-	-	-	1,085
1976	673	249	-	-	-	-	922
1977	644	245	-	-	-	-	899
1978	1,824	164	-	-	93	-	2,081
1979	918	39	-	-	58	-	1,015
1980	3,327	238	-	-	175	-	3,740
1981	3,455	295	-	-	529	-	4,279
1982	4,161	156	23	38	70	-	4,448
1983	974	150	114	38	39	125	1,440
1984	1,845	39	104	26	92	244	2,350
1985	3,362	82	212	1	310	352	4,319
1986	4,529	55	103	0	318	320	5,323

Source: USFWS, 1987

salmon (Beland, 1984a). These 13 rivers contain a minimum of 19,700 production units of salmon rearing habitat (Beland, 1984a). One production unit is a hundred-square-yard area of potential salmon nursery habitat. Average wild smolt production potential for these rivers was estimated at 2.0 per production unit with the exception of the Dennys and Pleasant Rivers which are estimated at 3.0 per production unit (Beland, 1984b). Total potential wild smolt production from these rivers is estimated to be about 50,400 per year. Wild smolt production is assumed not to have occurred as yet in the Connecticut, Merrimack, Pawcatuck, and Penobscot Rivers.

Runs of Atlantic salmon in New England rivers consist primarily of two sea-winter (2SW) maiden spawners. Data collected from fishway trapping studies and angler catch surveys in the State of Maine indicate that 2SW salmon make up 90% or more of the maiden spawners (Baum and Jordan, 1982; Beland et al, 1982; Fletcher et al, 1982). Grilse and three sea-winter adults make up less than 10% of the maiden spawners. In Maine salmon rivers, repeat spawners account for a small proportion of returning adults, rarely exceeding 10% of the total population (Beland, 1984b).

Seven New England Atlantic salmon rivers permit closely regulated recreational fishing (the Dennys, East Machias, Machias, Narraguagus, Penobscot, Union, and Sheepscot Rivers). Annual exploitation rates through angler harvest range between 10 and 25 percent of the run size. Table 2.2 shows the exploitation rate for all US salmon rivers and the Penobscot River for the years 1984-1986. There is no known directed commercial fishery for Atlantic salmon in the United States.

§ 2.1.3 Stock Restoration Programs Restoration efforts on most rivers are guided by formal plans having long-range objectives. Strategic Plans guide salmon programs for rivers in the state of Maine, the Merrimack River (Massachusetts/New Hampshire), the Pawcatuck River (Connecticut/Rhode Island), and the Connecticut River (Connecticut, Massachusetts, New Hampshire, Vermont). Also, the Maine Atlantic Sea-Run Salmon Commission has developed river management reports for all of its important salmon rivers.

Restoration activities may include various combinations of five basic techniques:

- 1) Research: Conduct varied research projects to gain additional information on the biology of salmon.
- 2) Cultural: The hatching, rearing, and stocking of juvenile and adult salmon.
- 3) Fish Passage: Provide salmon access to sections of a river upstream from obstructions and, where necessary, a safe means for downstream migrating adults and juveniles to by-pass hazards.
- 4) Habitat Enhancement: Habitat manipulation to enhance wild salmon production capability.
- 5) Conservation Measures: Regulations to control the commercial and recreational harvests of salmon in home waters and the high seas.

State/Federal Hatchery Operations There are currently 17 fish cultural facilities involved in the New England Atlantic salmon program (ten hatcheries, two kelt reconditioning facilities, three smolt release facilities, and two sea-run adult holding facilities). Six of the hatcheries, one of the

Table 2.2. Exploitation Rates of Atlantic Salmon in US Rivers

<u>YEAR</u>	<u>TOTAL RUN</u>	<u>NUMBER HARVESTED</u>	<u>EXPLOITATION (%)</u>	<u>EXPLOITATION (%) IN PENOBSCOT R.</u>
1984	3,754	645	17.2	20.0
1985	5,737	584	10.2	10.0
1986	6,104	551	9.0	8.9

Note 1. All estimates of total run size in 1986 for Maine rivers that do not have traps are based on an exploitation rate of 20% and the reported angler catches from these rivers. For rivers which do have traps, the total run size is estimated as the trap count plus the angler harvest.

Note 2. Estimates of total run size and harvest for 1984 and 1985 are equal to those reported by Goodyear at the June 1986 NASCO meeting.

Note 3. Total run sizes for the Penobscot, Connecticut, and Merrimack Rivers are taken from reports supplied by the Maine Atlantic Sea-Run Salmon Commission and the US Fish & Wildlife Service.

kelt reconditioning facilities, and one of the smolt release facilities are operated by the U.S. Fish and Wildlife Service. The remaining facilities belong to state fishery agencies.

The fish culture program has a projected capacity to produce 5.675 million fish annually with current facilities. Approximately 74% of the fish reared would be released as fry (4.2 million) and the remaining 1.45 million as smolts (USFWS, 1984; Boreman and Almeida, 1984; Anthony and Lange, 1984). The total projected run size of spawning adult fish which could be expected to result with fish culture facilities operating at maximum capacity has been variously estimated to range from 28,000-43,000 fish (Anthony and Lange, 1984) to a high of 54,000 (USFWS, 1984). The predicted annual egg requirements are in excess of 10 million. The projected allocations of hatchery-produced fish, when the facilities are at full production, are shown in Table 2.3.

Rivers presently having self-sustaining wild runs (e.g., Sheepscot, Ducktrap, Pleasant, Narraguagus, Machias, East Machias, and Denny's River) would not normally receive allocations of hatchery-produced juvenile salmon and therefore are not included in the projections.

Production numbers and allocations are highly variable from year-to-year due to natural production success, variations in egg supplies, and other fish cultural contingencies. More than 10.5 million hatchery-reared smolts were released in US rivers during the period 1962-1986. An additional 9.8 million fry and parr were also released into nursery areas of numerous New England rivers (Table 2.4). A complete description and history of these programs may be found in Baum (1984) and Baum and Meister (1984a). The reader is referred to Appendix D for a complete record of recent stocking data. Rivers receiving these allocations are shown in Figure 2.2.

Wild smolt production in the United States is presently estimated to be approximately 50,400 fish per year (Beland, 1984b). With current levels of hatchery output, significant increases in numbers of adult salmon returning to home waters should occur. With continuing progress on programs restoring access to new spawning areas, future production of wild smolts in US rivers is expected to increase considerably. The Maine Atlantic Sea-Run Salmon Commission's objectives include salmon management on 18 rivers and streams having an estimated 410,000 smolt production units. The combined production potential of those waters is 997,000 smolts annually (Beland, 1984b). The USFWS (1984) projects the future annual wild smolt production for southern New England rivers to be 223,900-273,700 for the Connecticut, 81,900-100,100 for the Merrimack, and 7,200-8,800 for the Pawcatuck.

Research Programs Effective conservation, restoration, and enhancement of US Atlantic salmon stocks require the establishment and maintenance of a scientific information base and a better understanding of the mechanisms whereby natural factors and human interventions affect these stocks. NASCO has developed a comprehensive research program which requires broad cooperation and coordination among the scientific agencies within the US.

In 1984 the Northeast Fisheries Center of NMFS initiated an Atlantic salmon research program with sponsored research on stock discrimination and an analysis of historical Carlin tag returns.

Table 2.3 Projected Atlantic Salmon Hatchery  
Production Allocations

<u>RIVER</u>	<u>NO. OF FRY RELEASED</u>	<u>NO. OF SMOLTS RELEASED</u>
Connecticut River	1,750,000	550,000
Pawcatuck River	50,000	
Merrimack River	1,800,000	125,000
Penobscot River	300,000	600,000
Union River		50,000
St. Croix River	200,000	75,000 *
All other Maine rivers	100,000	75,000
	<u>4,200,000</u>	<u>1,475,000</u>

\* One half of the program needs, the other half to be contributed by Canada.

Table 2.4. Total Releases of Atlantic Salmon for all US Rivers

<u>YEAR</u>	<u>FRY</u>	<u>PARR</u>	<u>SMOLT</u>
1962	-	151,490	69,520
1963	-	11,280	101,180
1964	-	49,010	20,250
1965	-	46,970	220,185
1966	-	117,790	326,235
1967	-	12,640	208,915
1968	50,000	25,000	252,190
1969	-	25,000	102,505
1970	50,000	25,000	100,005
1971	75,000	15,800	116,815
1972	129,000	-	140,195
1973	15,000	-	198,675
1974	8,600	44,180	216,470
1975	48,500	36,780	248,135
1976	93,100	278,460	368,597
1977	122,000	700	519,793
1978	156,100	116,400	480,947
1979	159,350	207,780	593,878
1980	406,500	1,000	777,804
1981	431,500	413,230	441,643
1982	703,170	577,600	696,481
1983	259,000	354,850	861,982
1984	1,235,900	215,785	1,276,625
1985	1,167,440	292,452	1,204,846
1986	1,204,351	657,500	1,184,600



The NEFC stock discrimination projects include; 1) surveys of stock discrimination methodologies for potential application to Atlantic salmon, 2) image analysis techniques utilizing shape and texture of different calcareous body parts of salmon to separate nation of origin, 3) genetic studies based on biochemical analyses of different tissues to determine differences between stocks, and 4) investigations of internal tagging systems and natural tags or marks. A complete description of stock discrimination techniques can be found in Anthony and Neill (1984).

A prototype image analysis system, based on scale samples collected routinely from Canadian and Greenland salmon fisheries, was tested in 1986 by successfully separating US and Canadian Atlantic salmon stocks by scale shape characteristics. However, the prototype system was not suited for the production demands necessary to analyze samples from a foreign commercial fishery.

In 1986, based on the results of the prototype image analysis technique, the ICES North Atlantic Salmon Working Group estimated the harvest of US Atlantic salmon without the use of tag return data. These preliminary estimates were refined at the 1987 Working Group meeting and suggested that harvest may be underestimated by Carlin tag return data (Anon, 1987a). Scale image analysis offers a research approach to resolve this discrepancy by providing the means to classify salmon to their hatchery of origin. The NEFC is collecting the reference samples and developing the facilities necessary to carry out this research.

The United States has been an active member of the ICES North Atlantic Salmon Working Group in recent years. The NEFC, the USFWS, and the Maine Atlantic Sea-Run Salmon Commission (ASRSC) have sent scientists to the yearly meetings of the full Working Group and to special study group meetings (i.e., acid rain). The basic scientific advice on salmon management under the auspices of NASCO is developed at such meetings.

Scientists from the NEFC, the USFWS, and ASRSC also serve as advisors to the US Commissioners of NASCO and the US Section members on issues of salmon biology and management, conduct briefings on recent developments in the ICES Atlantic salmon forum and the domestic salmon program prior to NASCO deliberations, and develop briefing material to expand and clarify recent research developments.

Cooperative research programs, utilizing NEFC, State, and USFWS biologists, are engaged in the determination of the freshwater origin of returning adult salmon with identification of the specific stocking cohort. Such knowledge will enable biologists to calculate cohort-specific survival rates and accurately assess fry and parr stocking programs. The techniques being used in this stock discrimination research are the same being used in the analyses of the mixed stock fisheries in Canada and Greenland, and thus draw upon the same expertise and facilities at the NEFC. In addition, cooperative research projects on stock discrimination and population dynamics are being conducted with Canadian and Danish scientists relative to the interception fisheries off Canada and Greenland.

The US Fish and Wildlife Service is also conducting several independent research and development programs aimed primarily at improving survivability



of hatchery origin salmon and diversification of the gene pools in salmon stocks.

The Craig Brook National Fish Hatchery and the National Fish Health Laboratory have cooperated in research of various techniques to diversify the genetic pools of salmon stocks to maximize egg survival and to increase production of high quality smolts. Eggs are also being incubated at Craig Brook for use in various research programs at the National Fisheries Research and Development Laboratory and at the USFWS Northeast Fisheries Center (USFWS, 1987).

The North Attleboro National Fish Hatchery cooperated with the Lamar Fish Technology Center in studies on raceway density and with the Bozeman Fish Technology Center for work on gas supersaturation. Also, the North Attleboro NFH and the Rhode Island State Fish Hatchery contributed parr to the University of Rhode Island to monitor the physiological changes which occur during the smoltification process (USFWS, 1987).

Broodstock at the Sunderland National Salmon Station received oxolinic acid injections on an experimental basis to test its effectiveness in controlling furunculosis. Preliminary results indicate that the drug is effective in controlling this bacterial disease, but the USFWS is also investigating the side effects caused by oxolinic acid (USFWS, 1987).

The USFWS research laboratory in Wellsboro, PA is conducting a study of smolt physiology and migratory behavior using radio telemetry in the lower Merrimack River.

The USFWS is also involved in a number of cooperative studies to: 1) determine the extent of cormorant predation upon recently released hatchery smolts in the Penobscot River, 2) identify and map available nursery habitat for juvenile Atlantic salmon in tributaries of the Merrimack and Connecticut Rivers, and 3) determine the impact on salmon of construction projects on uplands adjacent to major salmon rivers.

There are numerous Federal aid projects administered by the USFWS and carried out by the New England states fishery agencies involving Atlantic salmon. Table 2.5 lists the Federal aid projects being conducted by the states.

Tagging Programs The Atlantic salmon stock restoration programs in the US are heavily dependent upon hatchery-reared fish. Tag and recapture data from these fish have provided major contributions to the assessment of hatchery stocks, determination of migration routes, and the assessment of rates of exploitation of US origin salmon in the foreign fisheries (Anthony and Lange, 1984; Bastien, 1984; Baum and Meister, 1984b; Boreman et al, 1984; Rideout, 1981).

Adult Atlantic salmon were first tagged and released in the State of Maine in 1962 and hatchery smolt tagging was begun in 1966. Also, tagged smolts were released in the Connecticut River during the period 1970-1978 and in 1984. The tag used in all of these studies was a modified version of the Carlin tag. For a description of the modified Carlin tag, see Baum (1984).

Table 2.5. Current Federal Aid Atlantic Salmon Projects Administered by the USFWS.

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<u>STATE</u>	<u>PROJECT NUMBER</u>	<u>TITLE</u>
ME	AFS-16-D	Union River Anadromous Fish Restoration
ME	AFS-22-R	Penobscot River Atlantic Salmon Restoration and Management Program
NH	F-50-R	New Hampshire Anadromous and Inland Fisheries Operational Management Investigations
NH	AFS-4-R	Connecticut River Basin Anadromous Fishery Study
NH	AFS-10-R	Anadromous Fish Restoration in the Merrimack River
VT	F-12-R	Inventory, Evaluation and Management of the Fisheries and Habitat of the Public Waters of Vermont
MA	F-45-R	Anadromous Fish Investigations
MA	AFS-4-R	Connecticut River Basin Anadromous Fishery Study
MA	AFS-10-R	Anadromous Fish Restoration in the Merrimack River
RI	F-26-R	Marine Sport Fishery Investigations
CT	F-50-D	Operation and Maintenance of Connecticut Fishways and Salmon Holding Facility
CT	F-57-R	Inland Fisheries Research and Management
CT	AFS-4-R	Connecticut River Basin Anadromous Fishery Study

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Over the period 1962-1965, the Maine Atlantic Sea-Run Salmon Commission (ASRSC) tagged a total of 788 adult salmon as they ascended the Narraguagus River to spawn (Cutting and Meister, 1967). Since 1966, approximately 1.65 million Atlantic salmon hatchery-reared smolts have been tagged and released into New England rivers. An additional 1.75 million have been tagged with coded wire microtags.

Baum and Meister (1984b) found that nearly one-half (49%) of all tag returns from salmon released in Maine between 1966 and 1982 and recovered during the period 1967-1983 were from distant water fisheries. Recoveries in West Greenland accounted for 52% of all foreign tag returns while 43% were returned from the fisheries off Labrador and Newfoundland (Table 2.6).

In 1984, the Maine Atlantic Sea-Run Salmon Commission began an analysis of the historical Carlin tag returns from Maine origin salmon. Although Carlin tag return data have been used extensively for stocking analysis, it had not been used in the past to calculate the harvest of US origin salmon stocks in foreign waters. The analysis of the tag data was completed in 1986 and was used for estimation of the interoception fisheries of US origin salmon for presentation before the ICES Working Group on North Atlantic Salmon.

In 1985, a unified tagging program was developed. The NEFC, USFWS, and state fishery agencies combined to organize a cooperative smolt tagging program for all salmon stocks involved in the restoration. A NMFS-USFWS interagency agreement was developed to facilitate the purchase, assembly, and application of tags. Two types of tagging systems, Carlin and coded wire micro tags (CWT), were selected for the study.

Carlin tags were applied to smolts in the Connecticut and Penobscot Rivers during 1985-1987 (Table 2.7). The Carlin tag is a small oval plastic disk marked with a reward message and an identity number which is attached to the back of salmon smolts prior to their release. Foreign fishermen who capture tagged salmon may return the tag for a reward (currently \$8.00 US). The tag return data are used in a mathematical model to estimate the harvest of US origin salmon in the respective fishery from which the tag originated. Despite a bias created by some fishermen reluctant to return tags, Carlin tagging remains an important and acceptable source of data on the migration and exploitation of US origin salmon.

Coded wire tags (CWT) were applied to smolts released in the Connecticut and Merrimack Rivers during 1985-1987 (Table 2.7). The CWT has been extensively used in mark and recapture experiments with Pacific salmonids and was recommended by the ICES North Atlantic Salmon Working Group as a technique to discriminate salmon stocks in the interoception fisheries (Anon, 1987a). CWTs are small cylindrical pieces of magnetized metal etched with country of origin codes which are implanted in the cranium of salmon smolts prior to their release. Smolts receiving CWTs have their adipose fin clipped for field identification. CWTs can later be detected in adult salmon with the aid of a magnetic field detector, thus allowing positive identification of the salmon's origin. Estimation of harvest from coded wire tags will be free of the "fishermen not reporting" source of bias associated with Carlin tags, but CWTs must be recovered directly from the fishery and thus requires development of a field tag recovery program.

Table 2.6. Distribution of Tag Returns From Smolts and Post-Kelts  
Released in Maine (1966-1982) and Recovered During 1967-1984.

<u>AREA OF RECOVERY</u>	<u>NUMBER OF TAG RETURNS BY AGE</u>			<u>TOTAL</u>
	<u>1SW</u>	<u>MSW</u>	<u>POST-KELT</u>	
W. Greenland	1,429	37	34	1,510
E. Greenland	7	0	0	7
Labrador/ Newfoundland	993	66	189	1,248
Nova Scotia	34	34	21	89
New Brunswick	14	12	2	28
-----				
TOTAL DISTANT FISHERIES	2,487 (91.6%)	149 (5.4%)	246 (53.2%)	2,882 (48%)
TOTAL HOMEWATERS	228 (8.4%)	2,585 (94.5%)	216 (46.8%)	3,029 (51%)
GRAND TOTALS	2,715 (100%)	2,734 (100%)	462 (100%)	5,911 (100%)

Source: Baum and Meister (1984a)

Table 2.7. Summary of Recent Releases of US Atlantic Salmon  
Tagged with Carlin and Coded Wire Tags (CWT)

<u>RIVER</u>	<u>TAG</u>	<u>YEAR OF RELEASE</u>		
		<u>1985</u>	<u>1986</u>	<u>1987</u>
Penobscot River	Carlin	100,000	100,000	100,000
	CWT	-	101,179	100,000
Connecticut River	Carlin	49,898	46,873	50,000
	CWT	50,078	210,754	365,000
Merrimack River	Carlin	-	-	-
	CWT	99,170	135,354	150,000
TOTAL	Carlin	149,898	146,873	150,000
	CWT	149,248	447,287	615,000

In 1986, tagging was increased from 1985 levels in both the numbers of CWT tagged smolts released and the river stocks involved. Also, for the first time, Maine origin salmon were tagged with CWTs.

US origin salmon tagged with CWTs were first available for recovery in non-USA fisheries during 1986. US scientists participated in a cooperative sampling effort in Greenland by joining an existing Canadian-Danish sampling program. In addition to collecting biological data, the sampling teams scanned commercial landings for CWTs. The Canadian salmon fishery in Newfoundland and Labrador posed greater sampling problems than the Greenland fishery since salmon are landed in many more ports and over a longer season. One sampling team was sent to Labrador in 1986, but the sampling was inadequate and indicated clearly the need for an expanded tag recovery program in Canada.

The NEFC plans to continue its participation in the Greenland tag recovery program and to quadruple the Canadian recovery program in 1987. Unlike the Greenland program where sampling teams travel to previously sampled ports, NEFC is sending sampling teams to Canadian ports that have not been sampled previously.

The NEFC sponsors an Atlantic salmon tag clearinghouse for the centralized coordination of tag returns and dissemination of tag return data to interested groups. Both Carlin and coded wire tags are returned to Woods Hole Facility for processing. The clearinghouse pays all rewards and responds to each fisherman who returns a tag. The tag return data from foreign fisheries is utilized primarily by the US Commissioners to NASCO for international deliberations, but is also valuable for evaluating the domestic program.

Fish Passage Facilities The disappearance of Atlantic salmon from New England Rivers during the nineteenth century is most often attributed to the loss of valuable spawning and nursery habitat upstream of impassable dams and barriers along migratory pathways. In Maine, only about 35% of the available habitat is presently accessible and the estimated cost of providing fish passage where needed will probably exceed \$40 million (Beland, 1984a).

A major objective of restoration programs is to provide access around dams and other barriers through the construction of fish passage facilities. The strategic plans that guide restoration efforts in New England waters address inadequacies in fish passage and establish goals for the completion of new facilities or renovation of existing structures. The location, cost and design of major fish passage facilities currently in place on New England rivers is presented in Table 2.8.

Significant progress has already been made in providing upstream passage for anadromous fish. In 1982, the entire main stem of the St. Croix River in Maine became accessible to anadromous fish with the completion of a fishway at the Milltown Dam (Beland, 1984a). In 1985, a fish passage complex was completed at the second mainstream dam on the Merrimack River, opening up the mainstem to the Amoskeag Dam in Manchester, New Hampshire. The Bellows Falls (VT) fish ladder on the mainstem of the Connecticut River began operation in 1984 and in July of 1986 an adult salmon was seen in the White River of Vermont. This marked the first time since 1798 that a salmon had successfully completed the 240 mile journey to the White River (USFWS, 1987).

Table 2.8. Location, Cost and Design of Major Fish Passage Facilities  
in New England, by Watershed.

RIVER	FISHWAY		TYPE OF FISHWAY	YEAR COMPLETED	APPROX	
	LOCATION	OWNER			COST (1)	HABITAT (2)
St. John River, Maine/N.B.						
Aroostook	Aroostook Falls	ME Pub.Ser.Co.	Pool/Weir	1936		impassable
	Caribou	ME Pub.Ser.Co.	Pool/Weir	1955		4,400,000
St. Croix River, Maine/N.B.						
St. Croix	St.Stephen	N.B. Power	Pool/Weir	1980	0.30	634,000
	Woodland	Georgia Pacific	Denil	1964	0.1	290,000
	Baileyville	Georgia Pacific	Denil	1965	0.10	2,682,000
	Vanceboro	Georgia Pacific	Vertical Slot	1965		30,000
Coastal Maine						
Sheepscot	Coopers Mill	State	Denil	1960	0.006	811
Union	Ellsworth	Bangor Hydro	Vertical Slot	1974	0.20	0
Karraguanus	Cherryville	US Army Corp.	Denil	1961		838,216
Pleasant	Columbia Falls	Pleasant R. Hydro	Vertical Slot	1983	0.024	6,508
	Saco Falls	State	Denil	1955		6,253
Dennys	Cathance	State	Steep-Pass	1985	0.005	80
Penobscot River, Maine						
Penobscot	Veazie	Bangor Hydro	Vertical Slot	1970	0.30	minor
	Old Town	Diamond Int'l Corp.	Denil (2)	1968	0.26	minor
	Milford	Bangor Hydro	Denil	1968	0.12	11,000
	W. Enfield	Bangor Hydro	Denil	1970	0.13	2,000
	Mattawankeag	Great North. Paper	Pool/Weir	1939		37,112
Piscataquis	Howland	Bangor Hydro	Denil	1965	0.52	6,630
	Dover/Foxcroft	Dover/Foxcroft	Denil	1973	0.20	16,723
	Guilford	Guilford Ind. Inc.	Denil	1972	0.76	6,630
Androscoggin River, Maine						
Androscoggin	Brunswick	Central Maine Power	Vertical Slot	1983	2.10	4.7
Saco River, Maine						
Saco	Biddeford	Saco Realty Co.	Pool/Weir	1950		16,300
	Dayton	Central Maine Power	Pool/Weir	1952		0

Table 2.8 (Continued)

RIVER	FISHWAY	OWNER	TYPE OF FISHWAY	YEAR COMPLETED	APPROX	
	LOCATION				COST	HABITAT
					(1)	(2)
Merrimack River, Maine/Massachusetts						
Merrimack	Lawrence	Consolidated Hydro	Fish Lift	1982	1.80	0
	Lowell	Consolidated Hydro	Fish Lift/ Vertical Slot	1986	4.50	8,200
Pawcatuck River, Rhode Island						
Pawcatuck	Potter Hill	State	Denil	1970	<0.001	30
	Bradford	State	Denil	1981	<0.001	250
Connecticut River, Connecticut/Massachusetts/Vermont/New Hampshire						
Salmon	E. Haddam	State (CT)	Denil	1980	1.40	3,856
Farmington	Windsor	State (CT)	Vertical Slot	1976	0.75	5,032
Connecticut	Holyoke	NE Utilities	Fish Lift	1973	2.50	6,500
	Montague	NE Utilities	Ice Harbor (2)	1980	15.00	16,000
	Vernon	NE Power Co.	Ice Harbor	1981	7.00	28,000
	Bellow Falls	NE Power Co.	Vertical Slot	1985	7.00	36,000
	Wilder	NE Power Co.	Vertical Slot	1987	7.00	21,000

(1) Millions of Dollars.

(2) Amount of habitat, measured in salmon production units (100 sq m), made accessible by the operation of the facility.



In 1987, the fish ladder at the Wilder Dam in Vermont became operational, marking the completion of the last fish passage facility currently scheduled for construction on the mainstem of the Connecticut River. This facility will allow salmon access to historic spawning grounds in the Ammonoosuc River in New Hampshire (USFWS, 1987).

The effectiveness of fish passage facilities is dependent on their design and location as well as prevailing river flows and water temperature (Stolte, 1982). It has been estimated that 85% to 95% of the salmon that reach a fishway will be able to pass it successfully (USFWS, 1984).

Goals and Expected Benefits of Stock Restoration Programs The purpose of the restoration programs is to restore Atlantic salmon runs to the extent that available spawning and nursery habitat is optimally utilized for the public benefit. Specific goals of the program are to: 1) restore Atlantic salmon to the Connecticut, Pawcatuck, Merrimack, and the rivers in Maine where salmon have historically occurred, 2) maintain the Atlantic salmon broodstock program in the Union River, and 3) maintain the existing wild salmon populations and fisheries in the Sheepscot, Ducktrap, Narraguagus, Pleasant, Machias, East Machias, and Dennys Rivers.

The USFWS (1984) expects this action to provide nearly an eight-fold increase in the existing New England salmon population in the restoration rivers. Projections are that the combined adult salmon population levels will reach a maximum of nearly 54,000 individuals during the next 25 years in a total of 18 river systems.

Continued salmon restoration, enhancement, and management efforts will result in several benefits. Sport fishing for salmon is expected to increase significantly. The USFWS (1984) estimates that the recreational harvest in the important rivers will increase from current levels of less than 1,000 fish yearly to approximately 13,000. The associated number of angler-days is also expected to rise from approximately 10,000 to as high as 145,000 annually. Consumptive and non-consumptive uses (e.g., salmon watching, and salmon hatchery and fish passage facility visitations) are expected to increase substantially and may provide additional benefits to local tourist industries.

Minimum flow requirements associated with salmon at identified dams will have a beneficial effect on all riverine aquatic fauna. Also, greater continuous discharges downstream from dams during low flow periods will likely improve water quality through higher dissolved oxygen levels and dilution and dispersal of pollutants.

Other anadromous fish species may be impacted beneficially as well. Fish passage facilities should result in expanded ranges and larger population sizes by providing access to new spawning and nursery habitat. This could lead to increased recreational fishing opportunities and increased harvests of commercially important species (USFWS, 1984).

The ambitious salmon program in the New England states has had a positive effect in the United States negotiations and deliberations at meetings of NASCO. Since the restoration effort is without equal elsewhere in the world, it has elevated the US to the leadership role among the other Parties to NASCO.

## § 2.2 Estimate of MSY

Since the aggressively ongoing US restoration program has the objective to utilize 100% of available spawning habitat, it would be inappropriate at this time to specify a maximum sustainable yield (MSY) within the EEZ. All available production from the limited populations of Atlantic salmon in the restoration rivers is needed to further that program, to the extent that 100% of available spawning habitat is utilized. At current population levels, there is no harvestable surplus production available. Therefore, MSY is zero.

## § 2.3 Probable Future Condition

The restoration of domestic stocks of Atlantic salmon will continue with or without implementation of this FMP. The U.S. Fish and Wildlife Service intends to proceed with the 25-year restoration program on 18 river systems in New England. In the restoration rivers, the results are expected to increase the adult returns eight-fold from the 1984 level of approximately 7,000 salmon to 54,000 fish (USFWS, 1984). This projection assumes no significant change from the current insignificant levels of US commercial harvest.

However, in the continued absence of explicit management authority over domestic Atlantic salmon in the 3-12 mile zone, the projected future condition of the resource may be jeopardized. Concentrations of salmon on their spawning runs off the mouths of natal rivers could stimulate the development of a directed commercial fishery which could rapidly dissipate the benefits of the restoration programs. The historic record is replete with previous examples of such an occurrence. Thus, the probable future condition of the resource, given implementation of the preferred alternative management program of this FMP, is that which is projected by USFWS (1984).

## PART 3. HABITAT

§ 3.1 Marine Habitat

Atlantic salmon begin the marine phase in their life cycle after undergoing a physiological adaptation which permits toleration of a wide range of salinities (a process called smoltification). Smolts leave the natal New England rivers during April through July once river temperatures reach 7°C to begin a migration to distant feeding grounds off Greenland. Surviving post-spawn adults (kelts) begin another oceanic migration in the late fall and spring when threshold temperatures reach approximately 4°C (Power, 1981). Smolts moving downstream through estuaries during the spring typically transit the area through passive drift in the tidal currents, exhibiting no evidence of diel periodicity in travel rate (Fried et al, 1978). The salmon grow and mature in the ocean and may return to the river of their origin as grilse after one sea-winter (1SW) at sea or as salmon after two or more sea-winters (MSW). All fish which return to their natal streams, regardless of age, do so as spawning adults.

As salmon of US origin migrate into Canadian waters, they may enter the Bay of Fundy but then leave the Gulf of Maine passing northerly off the coasts of Nova Scotia and Newfoundland. Tagging data indicate that fish of US origin typically pass seaward of Newfoundland although a few fish may utilize a migration route that passes up the west coast of Newfoundland through the Strait of Belle Isle (Meister, 1984). US salmon join fish of Canadian origin to pass through the Labrador Sea and continue into the Davis Strait where they co-mingle with fish of European origin, concentrating in coastal feeding areas, principally off West Greenland (although some US fish may penetrate East Greenland waters), from late July to early November (Christensen and Lear, 1980; Anon, 1985).

The return migration of US origin salmon is believed to be a direct route from the Greenland feeding grounds across the Labrador Sea to the northeast coast of Newfoundland. The fish then move easterly as far as the Flemish Cap to overwinter. In the spring, the salmon move inshore along the Avalon Peninsula or south across the Grand Banks. At this time it is assumed that many of the fish, in particular those destined to be multi-sea-winter (MSW) salmon, turn and follow the coast on a repeat sojourn north through Newfoundland and Labrador waters to the Greenland and Labrador Sea feeding grounds. Salmon destined to return to home waters on their spawning migration as two sea-winter fish turn south and move in a southwesterly direction to the south shore of Nova Scotia. From Cape Sable, US origin salmon move in a westerly direction on their return to home waters (see Figure 3.1).

Migrating salmon are typically located in the surface waters of the Atlantic. All fish sampled by Templeman (1968) off Newfoundland were taken in the upper 1.5 meters (5 ft) of the water column in an area where depths exceeded 1800 meters (about 1,000 fathoms). Most salmon taken in Canadian and Greenland commercial fisheries are from surface waters of 5 meters or less (16 ft or less). However, Atlantic salmon are occasionally found at depths greater than 300 meters (160 fms) (Lear, 1976; Hansen and Pethon, 1985). Movements of salmon to great depths may be a short term behavioral response to avoid perturbations in the surface layers caused by severe weather patterns.

May (1973) indicated that the optimum sea surface temperature for Atlantic

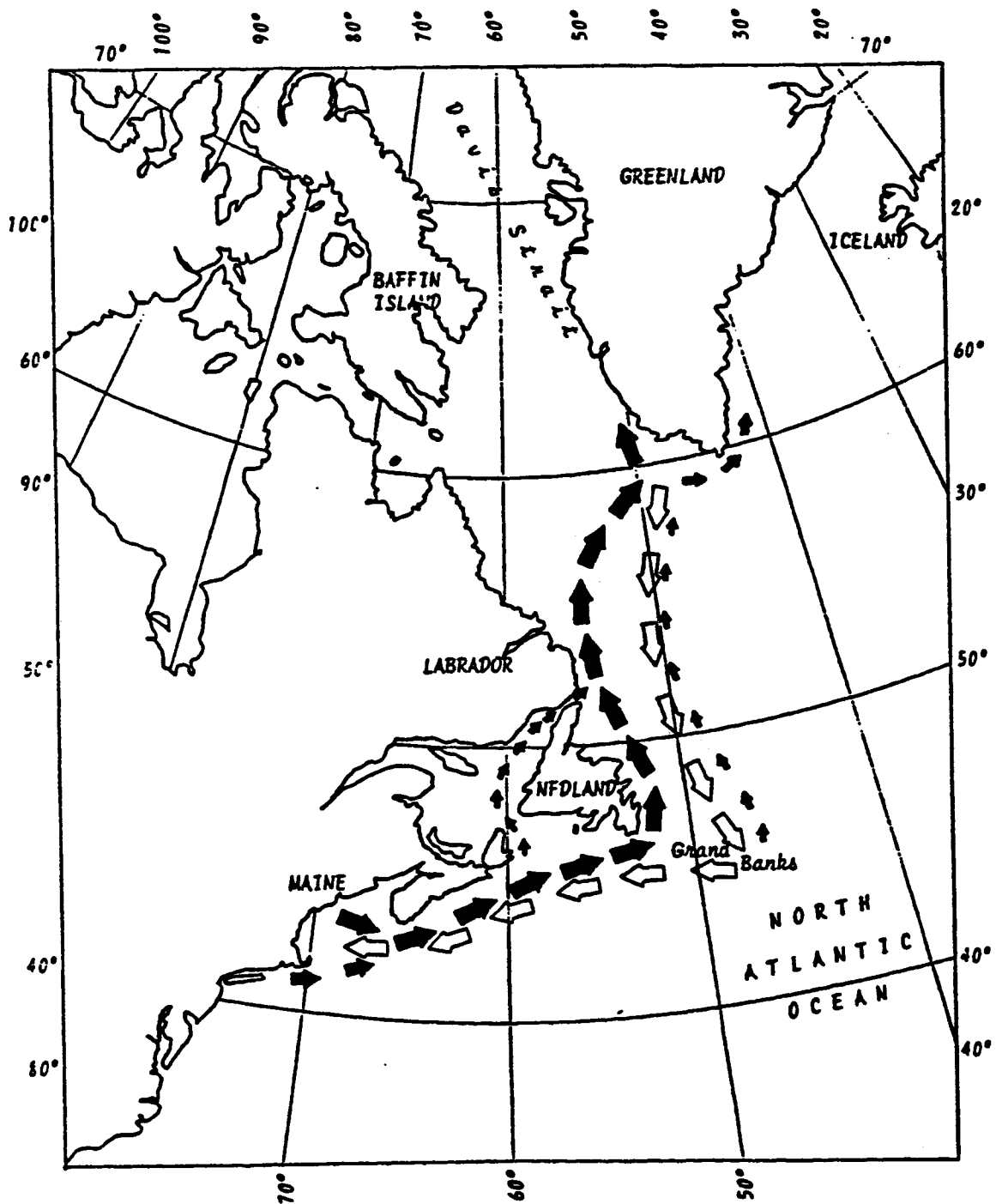


Figure 3.1. Diagrammatic representation of Atlantic salmon migratory routes. Northward (feeding) migrations are indicated with solid arrows, southerly (spawning) migrations with open arrows. See text for explanation.

salmon is between 3°C and 8°C. Salmon captured over the eastern Grand Banks in May of 1979 and 1980 were from surface waters of 3.8°C to 7.5°C (Reddin, 1985). Catch rates in 1980 were highest at locations where surface temperatures ranged 5.3°C to 7.5°C. Fish sampled by Templeman (1968) off Newfoundland between March and May were from surface waters of 3.7°C to 6.1°C. By contrast, no salmon were caught in gill nets set in an area adjacent to Templeman's sampling stations where the surface temperature was 9.2°C.

In the marine environment, salmon are likely to be opportunistic feeders, subsisting mainly on pelagic fish and invertebrates. Adult salmon are also likely to feed on deeper water prey during mesopelagic dives as suggested by Hansen and Pethon (1985). Lear (1972) found that adults captured in oceanic waters feed on capelin (Mallotus villosus), sand lance (Ammodytes spp.), sea herring (Clupea harengus), barracudina (Paralepis coregonoides), amphipods, and euphausiids. Templeman (1968) sampled salmon off the east and southeast coasts of Newfoundland, identifying P. coregonoides and lanternfish (Notoscopelus spp.) as the primary food items, whereas Arctic squid (Gonatus fabricii) was the main diet constituent of salmon captured in the Labrador Sea (Templeman, 1967). Salmon taken on the Grand Banks and eastward were feeding primarily on Ammodytes spp. and M. villosus, and to a lesser extent on shrimp larvae (Pandalidae), P. coregonoides, black smelt (Bathylagidae), and amphipods (Reddin, 1985).

Salmon captured in Disko Bay in West Greenland feed primarily on capelin, sand lance, amphipods, and euphausiids. Minor constituents include the fry of Greenland halibut (Reinhardtius hippoglossoides), daubed shanny (Lumpenus maculatus), the fry of striped wolffish (Anarhichas lupus), redfish fry (Sebastes marinus), polar sculpin (Ottunculus microps), and Arctic sculpin (Myoxcephalus scorpioides) (Lear, 1980). Jensen and Lear (1980) identified Paralepis spp. and squid (Branchioteuthis riisei) as primary food items of salmon captured in the Irminger Sea during July and August 1966, 1974, and 1975.

Carter (1979, 1980) hypothesized that the presence of certain prey species (e.g., capelin) is a primary factor limiting salmon distribution, growth, and ocean survival. Carscadden (1983), however, found no statistically significant relationship between salmon catches and the abundance of young capelin in the Northwest Atlantic. Moreover, Reddin (1985) examined the stomach contents of adult salmon captured on and east of the Grand Banks and suggested that prey abundance is not the primary factor limiting salmon distribution. Salmon were more abundant east of the Grand Banks even though feeding intensity among salmon was higher on the Bank. Hence, the availability of a specific prey species is unlikely to affect the long-term behavior of Atlantic salmon with its opportunistic feeding habits.

### § 3.2 Spawning and Nursery Habitat

Adult salmon may begin returning to the estuaries as early as February, though the majority of fish on their spawning runs typically enter US rivers between March and July. Water temperatures during this period range between 7°C and 25°C while salinities vary from fresh water to 20 ppt in the tidally influenced riverine habitat. Adults may remain in the estuaries for several months until optimal conditions of temperature and river flow occur prior to

moving upstream to spawning areas. Spawning salmon achieve upstream progress by drifting with the flood tide, stemming ebb currents, and actively swimming during slack water (Stasko, 1975).

Lear (1972) determined that returning adult salmon substantially reduce or cease feeding once entering the natal rivers to spawn. Salmon captured in the St. John and Miramichi River estuaries consumed little or nothing, based on stomach content analyses. Atlantic sea herring (Clupea harengus), smelt (Osmerus mordax), Atlantic mackerel (Scomber scombrus), and stickleback (Gasterosteus aculeatus) were the primary food items identified.

Although Atlantic salmon can reproduce under a variety of habitat conditions, resultant population size is influenced by the quality and quantity of habitat available during the riverine stages of the salmon's life cycle. Productive rivers possessing optimum conditions will produce larger populations per unit of area than rivers having less desirable conditions (USFWS, 1984).

Various chemical and physical factors can have a significant impact on the migratory behavior. Salmon are sensitive to temperature, flow rate, pH, dissolved oxygen concentration and levels of various pollutants (USFWS, 1984). Following release, hatchery-reared smolts must physiologically cope with a variety of environmental conditions in rivers and estuaries before their entrance into the sea. It has been shown that alterations of water chemistry can have a deleterious effect on smoltification and early marine survival (Wedemeyer et al, 1980).

Numerous pollution sources contribute to water quality problems. Point-source pollutants originate from piped or channeled discharges and include, bacterial contamination from inadequately treated municipal or domestic wastes, toxic materials and heavy metals from industrial wastes, thermal discharges from power plants, and high-organic pulp wastes discharged from paper processing plants. Pollutants also originate from non-point sources such as runoff from land surfaces contaminated with industrial, agricultural, logging, commercial or household wastes (Clark, 1977).

Rain water, acidified by emissions of sulfur dioxide and nitrogen oxides, is a pollutant of increasing concern in the Northeast. It has been concluded that low pH can contribute to mortality during several stages of the salmon's life cycle. Mortality can occur in parr and smolt, especially if the pH is rapidly reduced as occurs during snow melt in some areas (Anon, 1987b). Atlantic salmon loss attributable to the acidification of Nova Scotia rivers is in the vicinity of 23,000 adult fish per year (Anon, 1987b). More research and monitoring is necessary to fully understand the effects of acid rain on fisheries resources.

The effect of a pollutant depends on its pervasiveness and the ability of the ecosystem to flush or assimilate it. Impacts may be direct and highly visible such as fish kills caused by toxins or oxygen depletion. Most often, impacts are more subtle and long-term, ultimately degrading the ecosystem and reducing its carrying capacity (Clark, 1977).

### § 3.3 Sources of Habitat Degradation

Intensive modification of natural coastal and inland habitat is a direct result of considerable social and economic pressure to utilize those habitats for conflicting commercial, industrial, and private projects. Approximately 800 permit applications for marine construction projects from Maine to Connecticut are reviewed annually by the National Marine Fisheries Service. These activities may result in physical or chemical habitat alteration, imposing significant impact on marine biota. Most often, projects are small-scale, causing minor losses. The more benign may cause only temporary disruptions to organisms and habitat. Major projects, which may have very significant potential impacts on both the natural and human environment, are subjected to intensive public review. However, synergistic actions (those which have little apparent significance in and of themselves) are rarely examined for their cumulative impacts.

Construction or mining in and adjacent to waterways, which involves dredging, results in elevated suspended solids in the water column which adversely affects biological productivity. The effects of increased turbidity may be temporary or long-term depending on tides, currents, the substrate type and volume being dredged, and the mitigative measures implemented to reduce dispersion. Dredging and ocean disposal of dredged material further degrades habitat by resuspending toxic pollutants which may have been buried in the sediments.

Fossil fuel and nuclear power plants generate prodigious amounts of waste heat, discarded as heated effluents, which may adversely affect biological communities. Impingement and entrainment in cooling water structures can cause significant mortalities to local populations of marine and riverine biota.

The construction of impassable hydroelectric dams with absent or ineffective fishways is cited as being one of the major contributing factors for the decline of Atlantic salmon in the Northeast (Beland, 1984). Dams may physically prevent adequate numbers of salmon from reaching available spawning habitat or may seasonally result in inadequate flows downstream. The survival rates of salmon smolts may be directly affected by hydroelectric dams through physical injury in the turbines during downstream passage or by delaying the migration beyond that time when the probability of survival is optimal.

Outer continental shelf oil and gas exploration and/or production in the North Atlantic may degrade or destroy localized benthic habitat through the effects of discharged drilling muds, effluents, and cuttings. Dispersion of these toxicants through current action may threaten other areas of the ecosystem.

Demand is increasing for sand and gravel as a construction aggregate. Mining may be expected to expand from rivers and shallow coastal areas to deeper waters as economic conditions permit. Adverse effects associated with sand and gravel mining include disruption of benthic habitat, burial of benthic organisms by siltation, and altered sedimentation patterns. Coastal borrow pits created by mining are known to persist and accumulate very fine sediments which may cause anoxic or hypoxic conditions in bottom waters.

NOAA maintains a National Coastal Pollutant Discharge Inventory (NCPDI) which provides useful information for comparing the amounts of discharges among different coastal areas. Current NCPDI data indicate that the waters off major New England metropolitan centers (e.g., Massachusetts Bay and Narragansett Bay) consistently receive the highest amounts of pollutants and are those areas where habitat alteration problems are most severe. Sampling results also indicate trace metals in Penobscot Bay and Casco Bay sediments are at levels comparable to values identified in other industrialized New England areas (Pearce et al, 1985). Anthropogenic activity rather than natural phenomena are the major cause of high pollutant levels in these Maine waters. Significant increases in PCB sediment concentrations have been detected in Buzzards Bay in addition to the known PCB contamination of New Bedford Harbor.

#### § 3.4 Information and Research Needs

This FMP offers the opportunity to identify data needs and address issues requiring additional research to assess potential impacts on the Atlantic salmon resource and the habitat.

1. Previous discussion has demonstrated the destructive effects of acid rain on Canadian Atlantic salmon production areas. Additional research is needed to assess the impacts of acid rain on the US Atlantic salmon restoration programs. The early life stages of salmon may be directly affected by acidification of spawning and nursery areas, and the production potential of these areas may be affected through destruction of required forage species.
2. Recent years have seen a proliferation of Atlantic salmon fish farming enterprises in the Northeast utilizing cage-rearing techniques based on technology imported from Europe. Similar enterprises in Scotland and New Zealand have raised concerns over the threat of environmental damage from heavy local concentrations of fish food and droppings which are known to cause excessive organic enrichment of the seabed below fish cages. Other problems may arise from heavy use of antibiotics and cage preservatives. Little is known of these potential impacts. However, in view of the expectation that the number of fish-farming enterprises will continue to grow, the Council recommends that a research and monitoring program be conducted by appropriate agencies.
3. Although there is no directed commercial fishery for Atlantic salmon in US waters, previous discussion has frequently noted that by-catches occur. Unfortunately, the US Fisheries Statistics data base does not comprehensively document those catches. Maine has recently incorporated a system of tagging all commercially-caught salmon to improve catch data. The Council believes that similar efforts to improve the data base are badly needed.
4. Future scientific investigations on Atlantic salmon should examine the possible long-term, synergistic effects of combinations of environmental stresses. One focus of these investigations should be the consequences of chronic environmental loading of all types of pollutants (e.g., heavy metals, insecticides, herbicides, petroleum products, halogenated



hydrocarbons, other organics, etc.) in terms of early life and adult fish survival, reproductive capacity, and genetic effects. Another focus of needed studies is the cumulative impact of all projects involving habitat modification on the total production of the salmon resource.

### **§ 3.5 Recommendations for Habitat Conservation and Restoration**

The New England Fishery Management Council, under the authority of the Magnuson Fishery Conservation and Management Act, has the responsibility to prepare fishery management plans which address habitat requirements, describe potential threats to that habitat, and recommend measures to conserve and protect those habitats critical to the survival and continued optimal production of the species under management. The NMFS Habitat Conservation Policy establishes the basis for a partnership between NMFS and the Council to assess habitat issues specific to the resource being managed and allows the Council to make recommendations on habitat policy to all applicable Federal and State agencies. The following recommendations are made in light of this mandate.

1. All natural habitat for salmon stocks (as identified in restoration and management plans) should be preserved by encouraging management of conflicting uses to assure continued access by fish to essential habitat. High water quality standards should be maintained to protect migratory routes and spawning, rearing, and feeding areas. Spawning and nursery areas are essential to continued productivity of the salmon resource. Hydroelectric facilities on natal streams and rivers should incorporate facilities for continued and unimpeded access by spawning fish and salmon smolts. Sand and gravel extraction projects should be discouraged in spawning and nursery habitat.
2. Watersheds to natal river systems should be protected from significant adverse effects of domestic and industrial waste disposal. The selection of methods and sites for disposal of sewage sludge, contaminated dredged material, and other domestic and industrial waste should be based on a comprehensive scientific assessment of all options. Project proponents should be required to address the full range of impacts on salmon stocks, their habitat, food sources, and the value to recreational anglers of affected sites which may be associated with project implementation.
3. Alteration of wetlands and shallow water areas is discouraged. Coastal construction and dredging projects should employ best engineering and management practices (e.g. seasonal restrictions, dredging methods, disposal options, etc.). Such projects should be permitted only for water-dependent projects found to be in the public interest when no feasible alternatives are available. Project proponents should be required to address the full range of impacts on salmon stocks, their habitat, or food sources which may be associated with project implementation.
4. The best available technology should be utilized to control industrial wastewater discharges and in sewage treatment plants in areas important to the reproduction and survival of salmon. Dechlorination or effluent holding ponds should be used to reduce total residual chlorine to non-toxic levels in the mixing zones of sewage and power plants currently operating in salmon

migratory pathways and in spawning or nursery areas. The EPA's Water Quality Criteria Series should be used as guidelines for determining harmful concentration levels of toxic substances in wastewater discharges. Applications for Clean Water Act 301(h) waivers from secondary sewage treatment facilities should be reviewed on a case-by-case basis to prevent further degradation of water quality and additional accumulation of contaminants in areas important to salmon that frequent nearshore and riverine areas. Where possible, the siting of new sewage treatment facilities and power plants should be avoided in areas important to salmon.

5. Except in designated mixing zones, industrial and power generating facilities should not discharge thermal effluents that would raise ambient water temperatures to levels harmful to affected salmon stocks or their food supply. To minimize entrainment and impingement mortality, new facilities should not be located on important salmon restoration rivers, particularly in spawning or nursery areas. Power plants should avoid shut-down operations at times when significant induced mortality may result from reverse thermal shock. Potential dischargers should be required to address the expected impacts such projects will have on salmon habitat or food supply. Best management practices should be encouraged at existing facilities.

6. Important migratory pathways for salmon stocks should be protected from significant adverse impacts from offshore oil and gas and non-energy mineral exploration and development activities. Siting and regulation of these activities should be conducted with the view to prevent the disruption of normal migratory behavior of Atlantic salmon and to avoid injury or mortality, both as young fish on their first migration and as returning adults.

7. Dredge and fill permits issued by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and Section 10 of the River and Harbor Act should require that project proponents address the full range of impacts on existing or projected salmon stocks, their habitat, or food sources which may be associated with project implementation. In the planning phase of proposed projects, sufficient lead time should be provided for concerned resource agencies to properly evaluate impacts on natural habitats which may be associated with project implementation.

8. The U.S. Soil Conservation Service, U.S. Forest Service, and other concerned Federal and State agencies should evaluate present agricultural and forestry practices to develop standards for best management practices to prevent further degradation of salmon habitat by non-point source pollution. All options including vegetated buffer strips should be considered in agricultural and forested areas adjacent to salmon spawning or nursery areas to minimize pesticide, herbicide, fertilizer, and sediment loads to those areas important for salmon survival.

9. Agencies involved in permits to alter aquatic or benthic habitat for any Atlantic salmon life stage should consider the economic value of the salmon resource. The Council reserves the right, mandated under the MFCMA, to comment on a proposed action and to receive a detailed written response addressing all concerns.

## PART 4. DESCRIPTION OF THE FISHERY

§ 4.1 Domestic Commercial and Recreational Fishery

§ 4.1.1 History of Exploitation There are few data to document the history of Atlantic salmon exploitation in US waters. Information is most often anecdotal and speculative. The most complete accounts of historic salmon catches are from Maine, where self-sustaining salmon populations were once found in at least 34 rivers and streams along the coast (Beland, 1984a). As industrialization and urban development accelerated in the Northeast, salmon habitat was degraded, destroyed or made inaccessible through the construction of dams. By 1865, the salmon runs of southern New England had been eliminated and commercial fishing was profitable only in rivers of Maine from the Penobscot to the Canadian border (USFWS, 1984). Historic accounts of salmon fisheries for some of the major river systems will be discussed.

Penobscot River, ME: The Penobscot River once supported a productive commercial fishery for Atlantic salmon, accounting for most of the documented catches in the commercial fishery in Maine (Figure 4.1). It is reasonable to believe that the decline of the Penobscot fishery is representative of all other New England rivers (Beland, 1984a). Much of the harvest came from pound nets, of which there were nearly 200 in the estuary during 1872 (Stolte, 1981). The commercial fishery on the Penobscot River peaked in 1888 with a harvest of over 200,000 pounds (Beland, 1984a). Thereafter, the fishery declined rapidly. In 1948, the last year in which commercial salmon fishing was permitted, the catch in the Penobscot River was 40 fish. Inadequate fish passage was probably the major factor contributing to the demise of the Penobscot's salmon resource (Baum, 1983).

Prior to the 1880's the sport fishery for Atlantic salmon in New England was inconsequential. The first recorded recreational catch of salmon in New England was from the Bangor salmon pool in the Penobscot River in 1882. The recreational fishery developed rapidly and landings peaked in 1926 with a recorded catch of 354 salmon (Beland, 1984a). Historic angler catches for the Penobscot River by 10-year periods are presented in Table 4.1.

Sheepsfoot River, ME: Although not well documented, available information indicates that Atlantic salmon were once an abundant resource in the Sheepsfoot River. By the late 1800's, dams had obstructed upstream passage and salmon runs were severely depleted. Unpublished field notes from the 1870's state that nets and traps on the Sheepsfoot River caught 12 or 15 salmon - "a much larger number than usual." This decline continued, and by the late 1940's, salmon were nonexistent in the Sheepsfoot River (Meister, 1982).

Machias River, ME: Historic information on the Atlantic salmon fishery in the Machias River is also scarce. Unpublished field notes from the 1870's suggest that salmon were once abundant, reporting that dipnet fishermen caught up to 60 salmon per day. Most likely, these salmon were also subject to commercial harvest by weirs and gillnets operating at the mouth of the river (Fletcher et al, 1982).

No information is available on recreational fisheries for Atlantic salmon in the Machias River prior to early restoration efforts. Since the early 1950's, the river has supported an active sport fishery for Atlantic salmon.

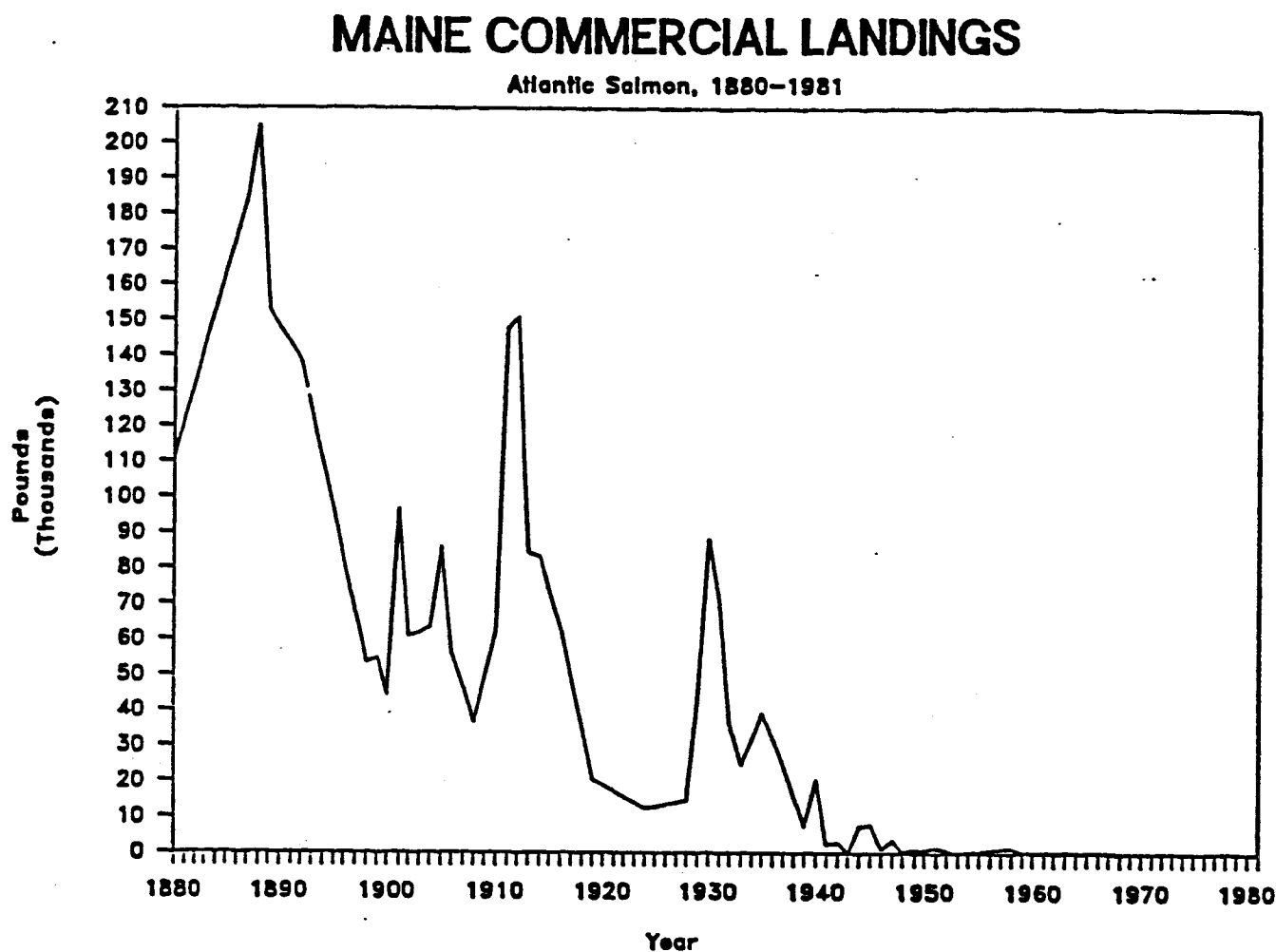


Figure 4.1 Maine commercial Atlantic salmon landings, 1880-1981

Source: Beland (1984a)

Table 4.1. Historic Atlantic Salmon Angler Catches (Numbers)  
From the Penobscot River

YEARS	TOTAL CATCH OVER PERIOD	ANNUAL RANGE	ANNUAL AVERAGE
1893-1899	538	51-124	76
1900-1909	808	37-120	81
1910-1919	903	50-153	90
1920-1929	1298	60-354	130
1930-1939	800	8-203	80
1940-1949	201	5- 48	20
1950-1959	72	0- 38	7
1960-1969	20	0- 13	2
1970-1979	855	1-360	86
TOTAL	5491	0-360	63

Source: Baum (1983).

Saco River, ME: The Saco River was said to be "abounding with salmon" in 1660 (Pearson, 1972) and supported a large run of salmon until the mid-1800s. Little is known about the river's historical fisheries but they were probably similar to those in the other Maine rivers. Kendall (1935) reported that a 10 pound salmon taken in a weir during 1875 was the last definite record in the river. Prior to that 4 salmon were caught in shad nets at the mouth of the Saco River from 1860 to 1873.

Small numbers of salmon currently enter the Saco River annually. These fish are probably the product of hatchery stockings or strays from other river systems (Norm Dube, MSRC, pers.comm.). A small, active sport fishery now exists below the lowermost dam.

Dennys River, ME: It appears that the Dennys River was noted for its sport fisheries and that commercial fisheries for salmon were relatively insignificant. The Dennys is the only Maine river where angling for Atlantic salmon preceded the erection of impassable dams (Beland et al, 1982).

While it is known that commercial salmon fisheries operated in the Dennys River, there are no records indicating the location of weirs within the estuary, the starting and ending dates for the fisheries, or day by day records of the catches (Beland et al, 1982).

Androscoggin River, ME: Commercial fishing was practiced as early as 1628 at the mouth of the Androscoggin River and later expanded with the development of commercial weirs (Beland, 1984a). No details of catches are available. The salmon run in the river was exterminated during the 1800s when dams were constructed. Salmon are being restored to the river through a program of fishway construction and hatchery stocking. A small recreational fishery currently exists.

Kennebec River, ME: Historic accounts indicate that "in its original condition, the Kennebec was scarcely surpassed by any salmon river in the country" (Kendall, 1935). The Kennebec once supported commercial salmon fisheries, with as many as 82 drift nets being fished at one time. Although there are no catch records, it is known that the river also supported set net and weir fisheries for salmon near it's mouth. The salmon fishery began to decline in the late 1800's when the dam construction preempted upstream passage (Kendall, 1935).

Merrimack River, MA, NH.: Stolte (1981) reviewed the status of historical runs and fisheries. He estimated the size of the annual adult salmon runs in the Merrimack at 9,000 to 27,000. Early fisheries were subsistence in nature and "each family living near the stream salted away about 100 salmon yearly". Fishing was pursued by spear (at bases of falls) and seines. Dipnets were used at the base of falls (Pearson, 1972). "In 1805, a good catch amounted to 20 salmon per day per fisherman" (Stolte, 1981). The estimated value of the salmon harvest in Lawrence, MA area was \$38,000 in 1789, \$9,500 in 1805, \$4,750 in 1835, and \$1.00 after 1850. Salmon were exterminated shortly after 1847.

During the late 1800s, a meager run of salmon was temporarily reestablished through the efforts of a restoration program. Illegal harvest by weirs and dynamite during this latter period were documented.

**Connecticut River:** The Connecticut River hosted some of the largest Atlantic salmon runs in North America (Pearson, 1972; Kendall, 1935). Early salmon fisheries were subsistence in nature and historical records are full of anecdotal accounts (for examples see, Goode, 1887; Pearson, 1972). The earliest fisheries were pursued by spearing at the base of falls. Nets came into use in the late 1600s. Primary gear types were seines, gill nets (fixed and drifting), and pound nets. Since the salmon runs in the river were eliminated at such an early date, there are no reliable estimates of early harvests.

The runs were exterminated after the construction of a dam across the mainstem river in 1798 (Stolte, 1980). An early attempt to restore salmon to the watershed, 1867-1880s, failed because of inadequate fishways and excessive harvest in the lower river. The pound nets in Connecticut were reported to have harvested and sold at least 800 salmon during this early restoration period (Stolte, 1980).

After the termination of this program, no significant numbers of salmon entered the river until the 1970s, when the current restoration program began producing adult returns. The taking of Atlantic salmon by any technique other than angling has been prohibited since the beginning of the restoration program. The taking of salmon by angling has also been prohibited in most areas of the watershed for several years.

**Thames River, CT:** As is the case of other New England River systems, historical information on Thames River salmon populations is scarce. It is clear that all anadromous fish species indigenous to Connecticut, including Atlantic salmon, once ascended the Thames in significant numbers (Minta, 1985). There were no salmon reported from the Thames after 1922 (Kendall, 1935).

**Pawcatuck River, RI, CT:** Although it is believed that salmon were once plentiful in the Pawcatuck River, there are no available records concerning their abundance (Kendall, 1935).

**§ 4.1.2 Domestic Commercial Fishery** It is generally acknowledged that there is no directed commercial fishery for Atlantic salmon in U.S. waters, although the incidental capture (by-catch) of salmon during commercial fishing operations for other species may be a significant source of mortality. Gillnets and trap nets (eg., pound nets and weirs) are the most likely mode of capture in inshore waters.

Recent statistics (Table 4.2) indicate that commercial by-catch of Atlantic salmon in state waters is generally low. Recent reported landings are highest in New York where salmon are taken as a by-catch in coastal trap net fisheries operating in Peconic, Gardiners, and Shinnecock Bays in eastern Long Island. A few salmon may also be taken by gillnetters, otter trawlers and hook and line fishermen (State of N.Y. - regulatory impact statement, 1987). In 1987, the state of New York adopted regulations that will prohibit the taking of Atlantic salmon in New York waters.

Table 4.2. Reported Commercial Landings (Pounds)  
of Atlantic Salmon, 1975-1986

Year	Maine	Mass.	R.I.	N.Y.
1975	269	-	-	-
1976	43	8	-	60
1977	70	-	-	-
1978	474	5	-	-
1979	20	-	-	-
1980	126	75	-	-
1981	30	-	-	-
1982	-	-	5	-
1983	-	-	2	-
1984	-	9	65	340
1985	29	10	-	305
1986	-	-	-	34

Source: NMFS Current Fisheries Statistics



§ 4.1.3 Domestic Recreational Fishery Recreational fishermen constitute the most significant source of exploitation to New England Atlantic salmon populations in homewaters. Although Atlantic salmon are occasionally taken by fishermen on the Merrimack River (since 1982, reported annual recreational catches of Atlantic salmon have not exceeded 9 fish), Maine is the only New England state with a viable recreational fishery for Atlantic salmon.

Based upon license sales, between 2,500 and 3,000 anglers fish for Atlantic salmon in Maine annually. The statewide effort was estimated to be around 30,000 angler-days. Approximately 80% of these license holders are Maine residents. Peak angling effort occurs during May and June, the bulk of this effort being concentrated within a few kilometers of tidewater (Anon, 1987a).

Atlantic salmon are found in 14 streams and rivers along the coast of Maine. Seven of these rivers (The Dennys, East Machias, Machias, Pleasant, Ducktrap, Narraguagus and Sheepscot) support wild, self-sustaining populations. All of these rivers have well-established sport fisheries for salmon. Because hatchery-reared salmon are stocked only to augment weak year-classes, wild salmon predominate in the sport catch (Anon, 1987a).

Atlantic salmon are also harvested recreationally from the Penobscot and St. Croix Rivers where populations are hatchery supported. About 90% of the sport catch from these rivers are of hatchery origin (Anon, 1987a). The Penobscot has the largest population of Atlantic salmon in Maine. Consequently, the sport catch on the Penobscot frequently exceeds that of all other Maine rivers combined.

Angler catches are reported on a voluntary basis and are believed to represent about 80% of the total recreational harvest. Recent reported annual recreational catches (since 1970) from Maine rivers have ranged from 136 to 1,400 fish (Table 4.3.). Beginning in the mid-1970s, the conservation effort of releasing caught fish by anglers has made steady headway. Of the 1,038 fish reported caught by sportfishermen in Maine rivers in 1986, 497 (48%) were released unharmed to provide a significant contribution to the broodstock.

The recreational salmon fishery primarily exploits first spawners (two-sea-winter adults). All other age groups make up less than 5% of the total catch in most rivers. Between 1971 and 1986, the exploitation rate of 2SW salmon on the Penobscot River ranged from 1.6% of the run in 1972 to 30% in 1981. More restrictive management measures imposed in 1985 reduced exploitation rates to an estimated 10.5% in 1986.

Table 4.3. Recreational Catches of Atlantic Salmon (in numbers)  
From Rivers in Maine, 1970-1986\*

<u>YEAR</u>	<u>RIVER</u>								<u>TOTAL KILLED</u> <u>TOTAL RELEASED</u>	
	D E N N Y S	E. M A C H I A S	M A C H I A S	P L E A S A N T	N A R R A G U A G U S	P E N O B S C O T	S H E E P S C O T	O t h e r  R i v e r s		
1970	49(0)	1(0)	45(0)	1(0)	58(0)	1(0)	6(0)	-	161	0
1971	19(0)	6(0)	45(0)	1(0)	32(0)	3(0)	30(0)	-	136	0
1972	61(0)	4(0)	65(0)	1(0)	139(0)	4(0)	20(0)	-	294	0
1973	41(0)	6(0)	35(0)	2(0)	75(0)	15(0)	20(0)	78(0)	272	0
1974	49(0)	2(0)	36(0)	30(0)	64(1)	26(0)	20(0)	26(0)	253	1
1975	40(0)	30(0)	51(0)	8(0)	111(2)	73(0)	11(0)	32(0)	356	2
1976	20(0)	20(0)	25(0)	1(0)	32(3)	55(0)	10(0)	35(0)	198	3
1977	26(0)	30(0)	25(0)	3(0)	124(10)	186(2)	24(0)	54(0)	472	12
1978	75(0)	59(1)	105(0)	16(0)	133(2)	322(38)	35(0)	35(0)	780	41
1979	38(0)	25(0)	64(1)	8(0)	58(0)	134(6)	8(0)	29(0)	364	6
1980	190(20)	62(0)	79(1)	5(0)	115(4)	810(33)	30(0)	51(0)	1342	58
1981	126(3)	85(0)	53(0)	23(0)	73(5)	720(6)	15(0)	44(0)	1139	14
1982	38(3)	37(0)	56(4)	20(0)	79(6)	936(3)	15(0)	34(0)	1215	16
1983	28(0)	8(0)	17(1)	-	90(5)	162(2)	12(3)	31(0)	348	11
1984	68(1)	47(0)	33(8)	1	68(3)	360(27)	22(0)	10(0)	609	39
1985	20(0)	30(1)	32(0)	-	57(4)	336(356)	6(0)	76(19)	557	380
1986	15(0)	11(2)	38(6)	closed	45(1)	403(416)	11(0)	18(72)	541	497

\* catch is reported as: killed(released)

Source: Anon. 1987

#### § 4.2 Foreign Interception Fisheries

After leaving natal rivers in the spring, Atlantic salmon smolts originating from New England undergo extensive feeding migrations while at sea. It is thought that salmon originating from New England rivers spend approximately eight weeks in Canadian waters during the spring and three weeks during the fall. In the interim, these salmon spend approximately eight weeks in Greenland waters during the summer. Consequently, US origin salmon are susceptible to harvest by Canadian fisheries during spring and fall and Greenland fisheries in the summer (Anon, 1987b) (Figure 4.2).

Since 1966, the Atlantic Sea-Run Salmon Commission of the state of Maine, in cooperation with the USFWS, has been tagging hatchery-reared smolts released into Maine rivers. Tag return data is used to estimate the total harvest of fish which leave US rivers as both wild and hatchery-reared smolts.

Approximately 1% of these tagged fish have been recovered. Of these recaptures, 49% have been recovered on their return to homewaters with the remaining 51% being recovered by fishermen off West Greenland (29%) and the eastern coast of Canada (22%) (Anthony and Lange, 1984). The highest proportion (91.6%) of returns from foreign fisheries have been from one-sea-winter fish (1SW), while the majority of returns from homewaters have been from two-sea-winter (2SW) fish (94.5%) (Anon, 1984).

Meister and Anthony (1986) reported that US origin salmon are also being harvested in East Greenland. From 1971-1985, 18 US tags have been returned from the Angmagssalik area from late August to early October. The lack of processing and freezing facilities in East Greenland has apparently kept this fishery from escalating. However, the use of shipboard processing facilities could alter this situation dramatically.

The major Canadian interception fisheries occur in Newfoundland, and to a lesser degree, Labrador. Based on tag returns, an average of 25% of the commercial catch on the east and south coasts of Newfoundland consists of intercepted fish from the Canadian mainland and fish of US origin. In Labrador, an estimated 6% of the commercial catch consists of Canadian mainland and US origin salmon (Boreman and Almeida, 1984).

The commercial salmon fishery in Canada is a limited entry fishery. Other effort controls include seasonal restrictions, gear restrictions and mesh size regulations. The principal gear used by commercial salmon fishermen is fixed gillnets. It is illegal to use drift nets or seines for Atlantic salmon (Anon, 1984). In Newfoundland and Labrador, about 3,400 licensed salmon fishermen used about 13,000 licensed gear units (1 unit = 50 fathoms of gill net) to fish for salmon in 1986 (Anon, 1987a).

The West Greenland commercial fishery for Atlantic salmon developed in the 1950's, although significant catches did not occur until the mid 1960's. Salmon are taken primarily by drift-nets. The mesh size in force is 140 mm. The types of vessels operating in the fishery range from small open boats to cutters up to 60 tons (Boreman and Almeida, 1984). In 1986, the Greenland fishery opened on August 15 and ended on December 1 (Anon, 1987a).

## CATCH OF MAINE 1SW ATLANTIC SALMON Total Interception Fisheries, 1967-1985

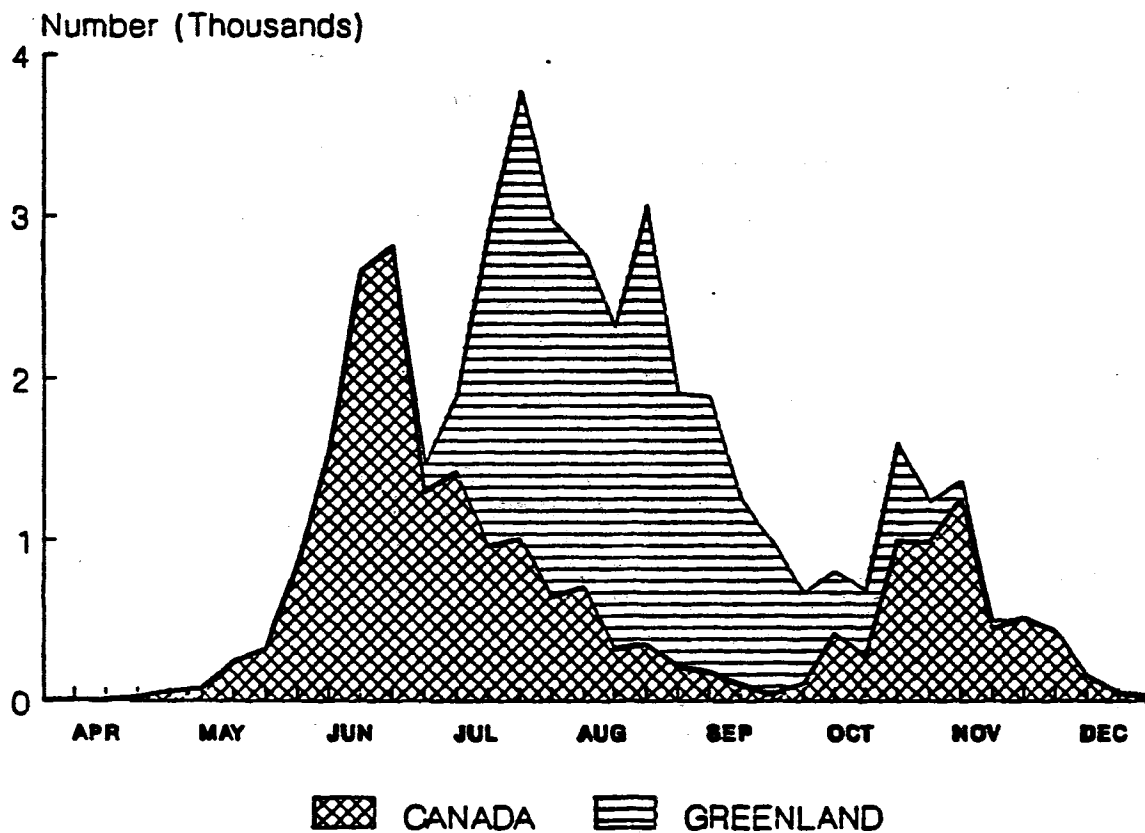


Figure 4.2. Annual distribution of catches of US-origin Atlantic salmon in the interception fisheries

Source: Anon. (1987b)

Table 4.4. Estimated Catch of Maine 1SW Atlantic Salmon  
in the Interception Fisheries  
With the Estimated Run Size of 2SW Fish in Home Waters  
(Numbers of Fish)

<u>YEAR</u>	<u>INTERCEPTION FISHERIES</u>			<u>RUN SIZE</u> <u>Following</u> <u>Year</u>
	<u>CANADA</u>	<u>GREENLAND</u>	<u>TOTAL</u>	
1967	240	230	470	662
1968	436		436	634
1969	327	643	970	787
1970	431	896	1327	637
1971	295	2504	2799	1331
1972	117	903	1020	1363
1973	200	1090	1290	1304
1974	830	2875	3705	2182
1975	1075	1356	2431	1222
1976	2518	1682	4200	1920
1977	1031	970	2001	3853
1978	330	1138	1468	1773
1979 *				5225
1980	4956	2236	7192	4724
1981	1172	1960	3132	5439
1982	1712	1374	3086	1788
1983	1826	524	2350	2792
1984	1382	729	2111	4319
1985	2305	1427	3732	4838

\* No estimates of interception catch available.

Source: Anon. (1987a).

Estimated Newfoundland/Labrador catches of Maine-origin salmon varied from 117 fish in 1972 to 4,956 fish in 1980 (Table 4.4). From 1981 to 1985, harvest estimates averaged about 1,700 fish and corresponding run sizes averaged about 3,800 fish. The estimated numbers of Maine-origin salmon taken in West Greenland fisheries varied from a low of 230 fish in 1967 to a high of 2,875 in 1974. Following the imposition of a quota in 1976, the catch has averaged about 1,300 fish (Anon, 1987b).

In 1987, the estimated number of 1SW Connecticut River origin salmon intercepted in the Newfoundland/Labrador fisheries was obtained. Based on the returns from the Carlin tag group of the 1984 smolt class, which returned to homewaters in 1986 (run size = 316), the estimated harvest was 649 salmon (Anon, 1987b).

Because salmon caught in interception fisheries have been at sea for 12-15 months at the time of their capture, most of the natural mortality that impacts a particular year-class of smolts would have occurred by this time. It is therefore generally accepted that the majority of salmon harvested by interception fisheries would have survived to return to their home waters had they not been captured (Beland, 1984b). Also, tag return data do not reflect losses that occur due to non-reporting of tags and "non-catch" mortality (mortality generated directly or indirectly by fishing which is not included in the reported catch) (Anon, 1987a).

The success of restoration efforts is dependent to a large degree on the level of harvest of US origin salmon in foreign fisheries. Regulations have recently been adopted in Canada to reduce interception of these fish. Since 1984, Canadian fishermen have been required to release all Atlantic salmon taken as by-catches; in 1985 the commercial fishing season was closed in New Brunswick, Nova Scotia and along the south shore and parts of the north shore of the Gulf of St. Lawrence in Quebec. Further restrictive management measures were implemented in the Canadian salmon fishery in 1986, including: closure of the commercial salmon fishery in Newfoundland on October 15, mandatory tagging of commercially harvested salmon, a limit of 15 fish per season for recreational fishermen, and a further reduction in licensed fishing effort (Anon, 1987a).

**PART 5. FISHERY MANAGEMENT PROGRAM****§ 5.1 Identification and Analysis of Alternative Management Programs**

**§ 5.1.1 Option 1: The "No Action" Alternative** This alternative action implies maintaining the status quo with respect to US management authority over Atlantic salmon of domestic origin. Thus, any Atlantic salmon of domestic origin which may exist within the 3-12 mile zone off the US coast and any fishery in that zone supported by such a resource would continue to be excluded from the specific management authority of the Federal government.

Although there are no regulations which specifically prohibit a directed commercial fishery for Atlantic salmon in the 3-12 mile zone off the US coast, there is no evidence that significant commercial catches, directed or incidental, occur within the zone which might constitute a threat to the continuing stock restoration efforts in New England. A preliminary evaluation of the magnitude of illegal catches of Atlantic salmon (ie., poaching) was unable to reach a definitive conclusion but it was felt that most poaching probably occurs within the river systems. The available by-catch statistics (which may include salmon actually taken by poachers) suggests catches of only about 2% of the Atlantic salmon which return to US waters after one or more winters at sea (Anon, 1986).

The States prohibit a directed commercial fishery for Atlantic salmon in the territorial sea complementing a similar prohibition on the high seas (beyond 12 miles from the US coastline) which is in effect under the auspices of NASCO. Recreational fisheries for Atlantic salmon are regulated by the States, utilizing fishing seasons, closed areas, minimum fish sizes, allowable gear, and bag limits (see Appendix B for a compendium of state regulations).

The apparent lack of a significant fishery for Atlantic salmon in near-shore waters of the US may be due to the current relative scarcity of salmon as compared to alternative marine species, coupled with the migratory habits of the fish which tend to limit their temporal availability to fishing activity in the near-shore marine environment. Atlantic salmon are transients in the 3-12 mile zone, first as postsmolts on their first migration to distant Arctic feeding grounds, and later as mature fish on spawning migrations to natal rivers. As indicated in Table 5.1, and depicted in Figure 5.1, returning mature fish on their spawning migrations begin to enter the natal rivers in late spring, quickly reaching their highest concentrations in the river systems within one to two months. Although all returning fish may begin to arrive in the coast-wide near-shore environment at about the same time, the evidence indicates that the major runs in the river systems occur earlier (later) in the more southerly (northerly) areas. For example, as shown in Figure 5.1, peak occurrence of Atlantic salmon in the Connecticut River is in late May whereas in excess of 80% of the run in the Penobscot River occurs during June and July. The Merrimack River may be intermediate, though the run resembles that of the Penobscot.

With continuation of the stock restoration programs which have been underway in 18 river systems in the Northeast, spawning runs of adult Atlantic salmon are expected to increase nearly eight-fold from the 1984 level of about 7,000 fish to nearly 54,000 fish over a 25-year planning horizon (USFWS, 1984).

Table 5.1. Mean Temporal Distribution of Adult Atlantic Salmon Trap Catches in the Penobscot (1969-1980), Merrimack (1983-1987), and Connecticut Rivers (1978-1981)

<u>MONTH</u>	<u>PENOBSCOT RIVER</u>	<u>MERRIMACK RIVER</u>	<u>CONNECTICUT RIVER</u>
May	0.8	22.0	56.8
Jun	41.1	50.0	37.5
Jul	31.5	24.0	3.0
Aug	10.0	0.0 *	0.0
Sep	11.3	2.0	0.1
Oct	5.1	2.0	0.9
Nov	0.2	-	0.9

Source: Baum (1983)  
Stolte pers. comm.  
Gephard pers. comm.

\* Fish-lift not in operation



### TIMING OF ANNUAL RUNS OF ATLANTIC SALMON For Selected River Systems

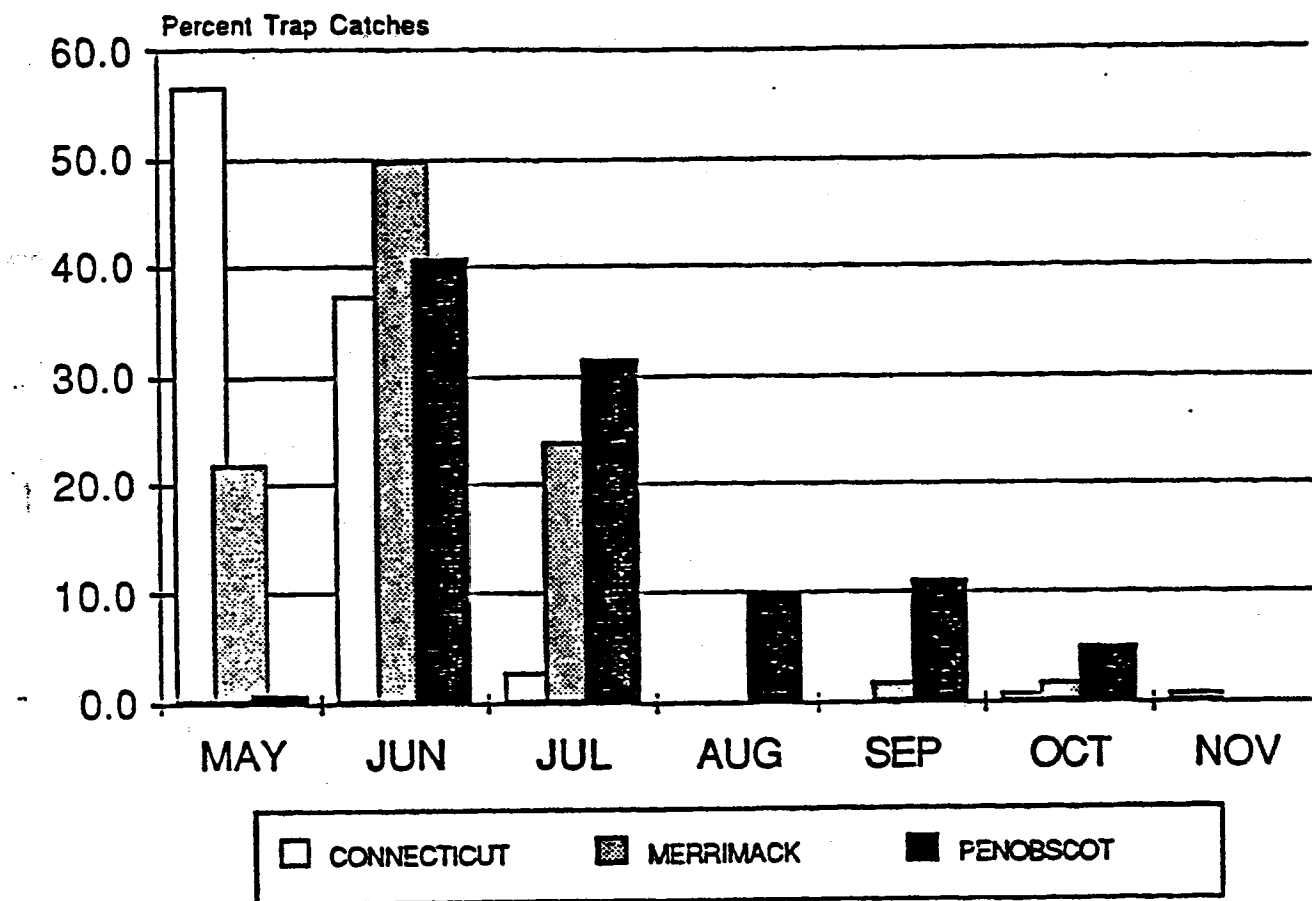


Figure 5.1. Temporal patterns in the annual run of Atlantic salmon

Whereas, the current abundance of US stocks of Atlantic salmon may potentially stimulate only very speculative directed commercial fishing effort, arguably the projected increased populations, when concentrated spatially and temporally during spawning runs off the mouths of the natal rivers, may represent an attractive alternative during periods of scarcity of other species. Thus, the continued absence of explicit management authority in the 3-12 mile zone may potentially encourage the development of an interception fishery within the zone.

**§ 5.1.2 Option 2: Establish Management Program Under Inter-State Compact** This alternative would codify management authority for the US Atlantic salmon resource within the jurisdiction of the States as an interstate compact, possibly under the auspices of the Atlantic States Marine Fisheries Commission (ASMFC). This sort of arrangement between the states of Maine, New Hampshire, Massachusetts, and Rhode Island is currently being used for management of the Western Gulf of Maine sea herring resource. With such a vehicle, US Atlantic salmon in waters beyond the territorial sea could be made subject to state laws and regulations governing landings, while the Council's role would be to encourage regional cooperation and uniformity. This alternative would obviate the necessity for preparation of an FMP at this time while preserving that option for possible future Council action.

The major weakness of this option is that a prohibition on possession of Atlantic salmon in the 3-12 mile zone would probably exceed the authority of any regulation promulgated by the states. Thus, it is likely that the intent of an interstate compact could be circumvented through the landing of commercial catches of Atlantic salmon in states not made a party to the compact or through over-the-side sales to processors. Whereas this may not necessarily constitute a credible possibility at current levels of stock abundance (commercial ventures specifically targetting Atlantic salmon may not be economically feasible at the present time), any commercial catch of salmon may pose a threat to the restoration efforts. Moreover, any such fishing activity could be expected to be intensified in the future, provided that the restoration programs begin to achieve the desired results. Thus, the long-term goals of stock restoration could be seriously compromised.

Finally, this option could hardly be viewed as a credible management program to control the domestic harvest of salmon of US origin. Article 9 of the NASCO Charter states that in exercising their function to propose regulatory measures for control of salmon fisheries of one member nation on fish originating from another member nation, the three Commissions of NASCO shall take into account (among other factors): "the efforts of States of origin to implement and enforce measures for the conservation, restoration, enhancement and rational management of salmon stocks in their rivers and areas of fisheries jurisdiction". (for further information on the NASCO Treaty, see Appendix C) Therefore, the US must demonstrate its serious intent to curtail domestic harvests in furtherance of the stock restoration programs if it wishes favorable consideration of initiatives placed before NASCO addressing the interception fisheries.

**§ 5.1.3 Option 3: Establish Federal Management Program (Preferred Alternative)** Specifically, it is recommended that there shall not be a commercial fishery for Atlantic salmon, directed or incidental, in Federal waters (3-200 miles) and that the possession of Atlantic salmon from Federal

waters shall be prohibited. It is intended that the Federal management program for Atlantic salmon within the EEZ shall complement the management regime under NASCO and the management programs of the States.

The establishment of a Federal regulatory regime for Atlantic salmon in the waters contiguous to the territorial sea will support the States' management efforts and close an existing loop hole. All of the New England states (Maine through Connecticut) and New York prohibit directed fishing for sea run Atlantic salmon with net gear in inland waters and the territorial sea.

Massachusetts and New Hampshire have for a number of years managed a stocking program for coho salmon (Onchorynchus kisutch) and other sea-run salmonids as a means of providing additional opportunities to recreational rod and reel fishermen in the rivers of both states. Most of the Massachusetts effort has been towards coho stocking in and near the North River. The sportfish catch in 1985 reached a confirmed catch of 632 coho salmon, nearly all of which were taken in the North River with a few taken in adjacent coastal waters (Personal communication, D.E. Pierce, 1986). These stocking programs affect only inland and near-coastal waters and are not expected to be impacted by management action in the area beyond 3 miles from shore.

The Atlantic salmon stock restoration programs in New England have begun to achieve significant increases in the number of fish returning to natal rivers to spawn. With continued success of these programs, however, the potential exists for the premature development of a commercial fishery, particularly during circumstances of reduced abundance of traditional commercial species of fish. This development, which has the potential to defeat the very substantial long-term investment embodied in the stock restoration programs, may be avoided through establishment of a management program in the US Exclusive Economic Zone (3-200 miles).

Currently, there is no directed commercial fishery for Atlantic salmon (although small by-catches have been recorded). With the prohibition under NASCO of a directed fishery on the high seas (beyond 12 miles), the only portion of the US Exclusive Economic Zone that a directed fishery is not explicitly prohibited is in the 3-12 mile area. The lack of significant historic commercial landings of Atlantic salmon indicates the absence of a significant legitimate historic interest in prosecuting a commercial fishery. Thus, the likelihood that the preferred alternative may impact any existing legitimate commercial fishing activity is remote.

## § 5.2 Assessment and Specification OY, DAH, ABC, DAP, JVP, and TALFF

The southern New England rivers are virtually closed to recreational fishing of Atlantic salmon and those Maine salmon rivers which are not closed to fishing are subject to very restrictive regulations. This is to allow for the maximum spawning escapement of returning adult salmon for broodstock purposes and/or natural reproduction of wild salmon. The objective is to achieve 100 percent utilization of available spawning habitat. To permit additional or unregulated exploitation of this resource at a time when most historical salmon producing rivers in the northeast are not capable of sustaining populations of salmon would be inexcusable. Therefore, pursuant to this FMP and to complement existing management measures, the designated optimum yield (OY), domestic annual harvest (DAH), and allowable biological catch (ABC) within the EEZ is zero.

TALFF It is arguable at this stage of the restoration program whether future sport fishing opportunities will be available for salmon on each restoration river. Therefore, to share with other countries a very limited resource in the EEZ of the United States, particularly at a time when salmon of US origin are being over-exploited in the Newfoundland/Labrador and West Greenland salmon fisheries, would be an inconsistent management practice and completely contrary to the intent of the international salmon treaty. In view of this, the total allowable level of foreign fishing (TALFF) is zero.

DAP and JVP Since the Atlantic salmon is an anadromous species whereby all natural reproduction would take place in the freshwater portion of natal rivers, there is not expected to be any domestic annual production (DAP) or joint venture production (JVP) within the 3-12 mile zone..

## § 5.3 Regulatory Impact Analysis

### Benefit - Cost Analysis

Option 1 This is the no-action alternative. Therefore, there would not be any regulatory impacts nor any costs or benefits associated with this alternative.

Option 2 Under this option, regulatory authority over Atlantic salmon from the 3-12 mile zone would be vested in the states. Hence there would be no need for Federal management authority over salmon in the 3-12 mile zone and there would be no new Federal regulatory impacts. Salmon seaward of 12 miles would continue to be managed under the auspices of the NASCO treaty agreement.

### Option 3

Costs No directed commercial fishing operations for Atlantic salmon are known to exist. Therefore, this option would not have a negative impact on commercial fishermen at this time. According to NMFS landings data, an average of 264 pounds of salmon were caught as a bycatch in commercial fisheries for other species over the past three years (1984-1986). Most of these fish were landed in New York and were caught in state waters. Commercial fishermen would not be disadvantaged in the future by being prohibited from possessing salmon since such a prohibition is needed to

restore salmon stocks. No directed commercial fishery may even be contemplated if the restoration program fails. Although projected annual runs of 54,000 fish (with success of the restoration programs) might encourage the development of a directed commercial fishery, it is unlikely that such a fishery could sustain itself in the long run.

Under the present restoration plan, all of the salmon returning to their natal rivers are needed for utilization of all available spawning habitat. A commercial fishery for Atlantic salmon at this time would jeopardize the restoration programs and substantially reduce the number of fish available to recreational fishermen.

There would be negligible enforcement costs associated with this alternative because prohibitions on landing Atlantic salmon from coastal waters caught with gear other than rod and reel are already enforced by Maine, New Hampshire, Massachusetts, Connecticut, and New York. Recreational catches of Atlantic salmon are allowed only in certain sections of the Merrimack River and in the states of Maine, New Hampshire, and Massachusetts. These fisheries are regulated through gear restrictions and bag limits.

Benefits Although all benefits of this option will probably be realized entirely within state waters due to the nature of the fishery, the proposed management program for Federal waters is needed to ensure that these benefits occur.

The value of recreationally caught Atlantic salmon far exceeds the value of those caught commercially. Kay, Brown and Allee (1987) estimated that the present value of the restoration program would be \$100.1 million by using a contingency valuation survey.

Other E.O. 12291 Requirements:

E.O. 12291 requires that the following issues be considered:

- a. Will the FMP have an annual effect on the economy of \$100 million or more?
- b. Will the FMP lead to an increase in the costs or prices for consumers, individual industries, Federal, state, or local government agencies or geographic regions?
- c. Will the FMP have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S. based enterprises to compete with foreign based enterprises in domestic or export markets?

The preferred alternative (Option 3) will have less than a \$100 million annual effect on the economy (\$100.1 million in estimated benefits are spread over a 50 year period). It will not lead to an increase in costs or prices for consumers, individual industries, Federal, state, or local government agencies or geographic regions because U.S. harvested Atlantic salmon is not commercially available at this time. Potential U.S. harvests of Atlantic salmon would be so small relative to other salmon supplies, that they would probably have no impact on salmon prices. This management measure is not expected to impose additional costs on Federal, state, or local government agencies or geographic regions.

Impacts of the FMP relative to the Regulatory Flexibility Act and the Paperwork Reduction Act of 1980:

The proposed action is not expected to have a significant effect on small entities in relation to the Regulatory Flexibility Act. There are no directed commercial fishing operations for Atlantic salmon and the annual incidental catch of Atlantic salmon by commercial fishermen is less than 300 pounds. The proposed measure is expected to have positive benefits of \$100.1 million for recreational fishermen and the recreational fishing industry.

There will be no new paperwork or record-keeping requirements under the proposed management plan.

§ 5.4 Consistency With National Standards, Other Management Programs, and Institutions

National Standards

1. Conservation and management measures shall prevent overfishing while achieving, on a continuous basis, the optimum yield from each fishery.

In view of the currently very limited population size of US salmon stocks, it is necessary to maintain strict conservation of adult salmon for broodstock to utilize 100% of available spawning habitat so as to meet the long-term objectives for stock restoration. As a consequence, MSY has been determined to be zero; optimum yield is also zero and overfishing is thereby avoided.

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

The best and most recent scientific information available to the Council has been utilized in the preparation of this FMP. The management program does not require any new mechanisms for data collection or recordkeeping beyond that which is already in place as part of the regional data collection program.

3. 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 management unit of this FMP is the entire range of US stocks of Atlantic salmon except as they may be found within the jurisdiction of foreign nations, as recognized by the US.

4. Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

This FMP does not discriminate between residents of any state nor does it propose any allocations of fishing privileges.

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

The proposed management program represents the most efficient utilization of the resource in light of the current very low size of the stocks. A uniform prohibition on directed or incidental catches of Atlantic salmon from the EEZ is needed to assure 100% utilization of the available spawning habitat for attainment of the stock restoration goals. No measures have been proposed which have economic allocation as their sole purpose.

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

The Council believes that wise use of the Atlantic salmon resource for the foreseeable future is embodied in the management program which complements the State/Federal restoration program and conservation and management of North Atlantic salmon under NASCO. Therefore, this FMP takes into account variations and contingencies to the extent that such are addressed by these other bodies.

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

This FMP does not propose any measures which are inconsistent with state regulations or which conflict with US interests before NASCO. The purpose of the management program is to complement, without duplication, the management programs of the states and of the North Atlantic Salmon Conservation Organization.

#### Other Fishery Management Plans

Fisheries in the area covered by this plan which are currently under regulation by other FMPs include Northeast Multi-Species, Squid/Mackerel/Butterfish, American Lobster, Surf Clam/Ocean Quahog, and Atlantic Sea Scallops. In addition, the Secretary of Commerce has established Preliminary Management Plans (PMP) for red and silver hake and for finfish caught incidental to the trawl fisheries of the NW Atlantic. Fishermen operating in any of these other fisheries may be subject to the provisions of this plan to the extent that their activities may result in capture of Atlantic salmon.

### Marine Mammals and Endangered Species

The proposed management program is not believed to have any adverse effect on the marine mammals that occur in waters of the Northeast. See Appendix E for additional discussion on the subject. The proposed rule will not constitute an action that may affect endangered or threatened species or critical habitat within the meaning of the regulations implementing Section 7 of the Endangered Species Act of 1973. Thus, consultation procedures under Section 7 will not be necessary.

### Flood Plains or Wetlands

The proposed rule would not adversely affect flood plains or wetlands, and trails and rivers listed or eligible for listing on the National Trails and Nationwide Inventory of Rivers.

### State Regulations

Atlantic salmon occur within inland and territorial waters of the Northeast as well as the EEZ and beyond. The management unit is considered to include all Atlantic salmon as they occur within state's waters, the EEZ, and the high seas. The management policies, measures and recommendations contained in this plan are appropriate and consistent with state regulations. Recreational fisheries for Atlantic salmon are regulated by the States, utilizing seasonal restrictions, gear restrictions, area restrictions, bag limits and minimum fish sizes. Table 5.2 presents a brief overview of Atlantic salmon regulations by state/river system. For a more detailed compilation of all relevant regulations, the reader is referred to Appendix B.

The states regulate the commercial harvest of Atlantic salmon within their inland waters and the territorial sea. It is generally understood that directed commercial fishing for Atlantic salmon is prohibited in New England state waters although by-catch may occur in some states.

In Maine, it is unlawful to take Atlantic salmon from inland waters by means other than fly fishing. Except as otherwise provided (see appendix B), it is unlawful to take Atlantic salmon from coastal waters by means other than rod and line. Commercial by catches are permitted but fishermen are limited to five (5) Atlantic salmon per year. Commercial catches must be reported to the Atlantic Sea-Run Salmon Commission within 24 hours after capture. In an effort to control the commercial by-catch of Atlantic salmon, the Atlantic Sea-Run Salmon Commission has implemented time and area restrictions for commercial gear in designated rivers (see Appendix B).

While New Hampshire does not have a specific regulation that prohibits the sale of Atlantic salmon caught in marine waters, the taking of all species of salmon by netting in any form is prohibited.

In Massachusetts, the creeling, harvesting, taking or possession of Atlantic salmon from designated inland and coastal waters of the Merrimack River is prohibited (Appendix B). Only salmon greater than fifteen (15) inches may be taken from coastal waters and the taking of salmon by snagging, snatching or hooking is prohibited.



Table 5.2. Synopsis of Existing State Recreational Fishing Regulations for Atlantic Salmon.

## GENERAL STATE REGULATIONS

## MAINE

Open Seasons	
Inland waters . . . . .	May 1 - September 15 *
Coastal waters . . . . .	May 1 - October 15
Closed Areas . . . . .	see individual river systems
Minimum Length . . . . .	14 inches
Gear Regulations	
Inland waters	
and designated	
coastal waters . . . . .	Fly fishing only
Coastal waters . . . . .	Rod and line only
Bag Limits (inland and coastal)	
Daily . . . . .	1 Atlantic salmon
Possession . . . . .	2 Atlantic salmon
Season . . . . .	5 Atlantic salmon

## NEW HAMPSHIRE

Open Season	
Inland and	
Marine waters . . . . .	April 1 - September 30 *
Closed Areas . . . . .	Pemigewasset River and it's tributaries north of Ayers Island Dam (Bristol)
Minimum Size . . . . .	15 inches
Gear Regulations	
Inland waters . . . . .	Fly fishing and single hook artificial lures only
Marine waters . . . . .	Angling only, snagging and foul hooking is prohibited
Bag Limits (for salmon and lake trout)	
Daily . . . . .	Two (whether two of one species or one of each species)

## MASSACHUSETTS

Open Season . . . . .	No closed season *
Closed Areas . . . . .	The Merrimack River downstream from the base of the Essex Dam in Lawrence, MA Tributaries to the Connecticut River are closed by emergency action on an annual basis
Minimum Size . . . . .	15 inches
Gear Regulations . . . . .	Snagging, snatching or hooking is prohibited
Bag Limits	
Daily . . . . .	One Atlantic salmon

## CONNECTICUT

Open Season . . . . .	The taking of Atlantic salmon is prohibited. An open season may be declared by the Commissioner of the DEP, allowing the taking of salmon during a specified period, in specified areas. Upon declaration of open season the following regulations would apply. *
Minimum Size . . . . .	9 inches
Gear Regulations . . . . .	Fly fishing only
Bag Limits	
Daily . . . . .	One Atlantic salmon

## RHODE ISLAND

The taking of Atlantic salmon is prohibited in inland waters.

\* Except as designated in statutes and regulations pertaining to individual waters (see Appendix B).

Table 5.2. (continued)

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STATUTES AND REGULATIONS PERTAINING TO INDIVIDUAL RIVER SYSTEMS	
Connecticut River - Main Stem (Tributaries regulated by respective states)	
Open Season . . . . .	Not in existence - Open season may be declared by the Connecticut River Atlantic Salmon Commission. In the event of an open season the following regulations would apply:
Closed Areas . . . . .	No Atlantic salmon may be taken within 250 ft. of any dam or fishway.
Minimum Size . . . . .	15 inches
Fishing Gear . . . . .	Fly fishing only
Bag Limits . . . . .	Determined by the Commission upon declaration of open season
License Requirements . . . . .	A Connecticut River Basin Atlantic salmon license is required for the river mainstem and all tributaries.
Merrimack River - Main Stem (Tributaries regulated by respective states)	
Ocean to Essex Dam (Lawrence, MA)	
Prohibit all taking of Atlantic salmon	
Essex Dam (Lawrence, MA) to Ayers Island Dam (Bristol, NH)	
Permit taking of one Atlantic salmon daily by fly fishing and single hook artificial lures only.	
Ayers Island Dam (Bristol, NH) to headwaters	
Prohibit all taking of Atlantic salmon in main stem and tributaries	
Maine Rivers	
Open seasons, gear regulations, length limits and bag limits vary by river system. Refer to Appendix B for specific statutes and regulations pertaining to individual waters.	

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Regulations in the state of Rhode Island prohibit the taking of Atlantic salmon in freshwater areas, and other statutes prohibit the possession of salmon while gillnetting for bait in designated coastal waters (Appendix B). Additionally, recent action by the Rhode Island Marine Fisheries Council will prohibit the possession of Atlantic salmon from all waters of the state.

The taking of Atlantic salmon in waters of Connecticut's marine district is prohibited by state regulation. The taking of salmon in inland waters is also prohibited except that the Commissioner of the Department of Environmental Protection may declare an open season when in his judgement it will not endanger the Atlantic salmon restoration and management program. In the event of an open season, Atlantic salmon may be taken only by flyfishing and cannot be sold, bartered, exchanged or offered for sale, barter or exchange.

#### Coastal Zone Management Programs

The proposed rule will be conducted in a manner consistent with the Coastal Management Programs within the meaning of Section 307 of the Coastal Zone Management Act of 1972 and its implementing regulations. A determination that this action is consistent with the approved State coastal zone management programs has been prepared by the New England Fishery Management Council and submitted for review to the coastal zone management agencies of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York.

#### Vessel Safety

Legislative amendments in P.L. 99-659 (1986) to the Magnuson Fishery Conservation and Management Act requires that FMPs must consider and may provide for temporary adjustments addressing matters of vessel safety. After consultation with the Coast Guard and with vessel operators, FMPs may provide for vessels otherwise prevented from operating in the fishery because of inclement weather or other ocean conditions affecting the safety of fishing vessels.

The management measures proposed in this FMP are intended to prevent the development of a new fishery for Atlantic salmon in the EEZ and to prohibit any by-catch fishery in Federal waters. Since no vessels are to be permitted to operate in any fishery for Atlantic salmon, no temporary adjustments for reasons of vessel safety are necessary.

#### § 5.5 International Implications

The Convention for the Conservation of Salmon in the North Atlantic Ocean (the international salmon treaty) provides an effective forum for salmon producing nations and salmon harvesting nations to work together cooperatively in resolving critical salmon conservation and management problems in the Atlantic region. It focuses attention on worldwide Atlantic salmon conservation and management programs and augments current domestic and international efforts to restore Atlantic salmon stocks.

To enable the US to present a strong case before NASCO for reducing the exploitation of US origin Atlantic salmon in the interception fisheries, the US must demonstrate that management measures are already in place in home waters. The course of action the US decides to take with respect to both in-river and ocean management will, to a large degree, contribute to the strength or weakness of the American position before this international body.

The international salmon treaty clearly recognizes this issue under Article 9(c): "A Commission in exercising its functions shall take into account the efforts of States of origin to implement and enforce measures for the conservation, restoration, enhancement and rational management of salmon stocks in their rivers and areas of fisheries jurisdiction." The treaty also requires that "each year each Party shall notify the Council [of NASCO] of the adoption or repeal since its last notification of laws, regulations and programs relating to the conservation, restoration, enhancement and rational management of salmon stocks subject to this Convention in its rivers and area of fisheries jurisdiction." Thus, each Party to NASCO is held accountable for their actions (see Appendix C).

Because of the positive actions taken in the past by the US to restore Atlantic salmon to New England rivers, the US has maintained a leadership role before NASCO. The US restoration effort is without parallel anywhere in the world. In excess of \$80 million has been expended on restoration programs. But, the US must continue to manage salmon in home waters and reduce interceptions in foreign fisheries or it stands to lose a substantial investment.

With NASCO now in operation to offer the mechanism to reduce foreign exploitation of US origin salmon, the only gap remaining in the management regime is the lack of protection within the 3 to 12 mile zone which could potentially compromise the restoration programs.

#### § 5.6 Finding of No Significant Environmental Impact

For the reasons discussed above, it is hereby determined that neither approval and implementation of the rule nor any of the alternatives to that action would affect significantly the quality of the human environment, and that the preparation of an Environmental Impact Statement on the rule is not required by Section 102(2)(c) of the National Environmental Policy Act nor its implementing regulations.

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Assistant Administrator for Fisheries, NOAA

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Date

**PART 6. LIST OF PERSONS AND AGENCIES CONSULTED  
IN FORMULATING THE PROPOSED ACTION**

**A. Federal Agencies:**

U.S. Environmental Protection Agency (Regions I, II, III)  
Department of State  
U.S. Coast Guard  
National Marine Fisheries Service  
Department of Interior  
    Fish and Wildlife Service  
    Bureau of Indian Affairs  
U.S. Army Corps of Engineers  
Marine Mammal Commission  
Mid-Atlantic Fishery Management Council  
South Atlantic Fishery Management Council  
Atlantic States Marine Fisheries Commission

**B. State Agencies:**

Maine Department of Marine Resources  
Maine State Planning Office  
New Hampshire Dept. of Fish and Game  
Massachusetts Division of Marine Fisheries  
Massachusetts Office of Coastal Zone Management  
Rhode Island Dept. of Environmental Management  
Rhode Island Statewide Planning Program  
Connecticut Dept. of Environmental Protection  
New York Division of Marine and Coastal Resources  
New Jersey Division of Fish, Game and Shellfisheries  
Pennsylvania Fish Commission  
Maryland Department of Natural Resources  
Virginia Marine Resources Commission  
Delaware Division of Fish and Wildlife  
North Carolina Division of Commercial and Sport Fisheries

**C. Individuals:**

Henry Lyman  
Frank Grimaldi

**PART 7. LIST OF PREPARERS FOR ENVIRONMENTAL ASSESSMENT  
AND FISHERY MANAGEMENT PLAN**

The Atlantic Salmon Fishery Management Plan (FMP) was prepared by a team of fishery managers and scientists with special expertise in the Atlantic salmon resource.

Atlantic Salmon Oversight Committee

Robert Jones, Chairman  
Ted Spurr  
William Brennan  
Philip Coates  
Steven Parry

Assisting the Committee

Howard Russell, NEFMC Staff  
Linda Gurn Alexander, CIDEF Staff  
Stephen Gephart, CIDEF Staff  
Arthur Neill, NMFS/NEFC

## PART 8. RESPONSE TO PUBLIC COMMENTS

All comments on the draft Atlantic Salmon FMP received from the public have been favorable. In particular, there has been unanimous support for Option 3, to establish a Federal management program for Atlantic salmon (the preferred alternative). The specific comments received at the public hearing held on September 24, 1987 at the Ramada Hotel in East Boston were as follows:

Mr. Lester Smith stated that, as a member of the New England Fishery Management Council and as a representative of the National Coalition for Marine Conservation and the National Wildlife Federation, he supported the draft FMP and, in particular, Option 3 (the Preferred Alternative).

Mr. Robert Jones stated for the record that the FMP, with Option 3, has the support of the State of Connecticut and of the Connecticut River Atlantic Salmon Commission.

Mr. Steven Parry stated that the U.S. Fish and Wildlife Service supports Option 3. He noted that the Plan serves to unite management efforts by the States and the USFWS as well as the Federal involvement in NASCO. He recommended that the New England Fishery Management Council adopt the FMP.

Mr. Charles Thoits stated that the New Hampshire Department of Fish and Game supports the Plan and Option 3.

Mr. Arthur Neill, from the Northeast Fisheries Center, stated that the National Marine Fisheries Service supports the FMP and Option 3.

In addition to the oral comments received at the public hearing, written comments received include letters from the following:

Mr. Richard A. Buck, Chairman of Restoration of Atlantic Salmon in America, Inc. and one of the U.S. Commissioners to NASCO has expressed approval of the draft FMP.

Mr. Henry Lyman, of the Atlantic Salmon Federation and member of the U.S. Section to NASCO, and Mr. William D. Hubbard, Executive Committee Chairman of Friends of the Merrimack and member of the U.S. Section to NASCO, both express support for the FMP and urge adoption of Option 3.

Mr. David F. Egan, President of the Connecticut River Salmon Association and member of the U.S. Section to NASCO, has advised that the Association fully supports Option 3 of the FMP.

Mr. Howard N. Larsen, Regional Director of the U.S. Fish and Wildlife Service and a member of the U.S. Section to NASCO, indicates that the USFWS supports the draft FMP and the preferred alternative to establish Federal management authority over U.S. Atlantic salmon in the EEZ (Option 3).

Copies of written comments received are attached to this document.

October 1987

# Salt Water SPORTSMAN

186 Lincoln Street, Boston, MA 02111 (617) 426-4074

SEP 23 1987  
R E C E I V E D

September 22, 1987.

Mr. Douglas G. Marshall, Executive Director  
New England Fishery Management Council  
Suntaug Office Park  
5 Broadway (Route 1)  
Saugus, MA 01906

Dear Doug:

For the record, in my capacity as a Director and Executive Committee member of the Atlantic Salmon Federation, this letter is to support strongly the draft Fishery Management Plan for Atlantic Salmon as prepared by the New England Fishery Management Council. The draft is a good job well done.

Unfortunately I am unable to attend the public hearing on the draft, but my presence really is not needed since I have been following this project since its inception as you know.

If you have not done so already, I would appreciate it if you would send a copy of the draft and summary to:

Dr. Wilfred M. Carter, Executive Director  
Atlantic Salmon Federation  
P.O. Box 429  
St. Andrews, N.B.  
Canada E0G 2X0

Thanks, and all the best.

Cordially,



Henry Lyman  
Publisher Emeritus

HL/bk



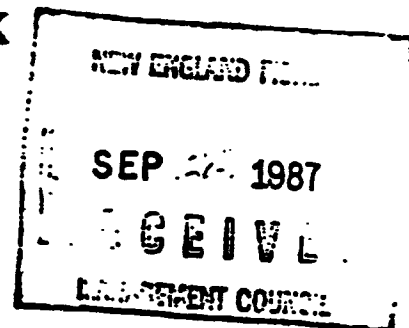
October 1987

## FRIENDS OF THE MERRIMACK

Post Office Box 236  
Hooksett, New Hampshire 03106

September 22, 1987

Mr. Douglas G. Marshall, Exec. Director  
N.E. Fishery Management Council  
5 Broadway, Suntaug Office Park  
Saugus, Mass., 01906



Re: Atlantic Salmon fishery Management Plan

Dear Mr. Marshall:

We welcome this opportunity to comment on the Atlantic Salmon Fishery Management Plan(FMP). We are responding to your recent solicitation of comments from Merrimack Atlantic Salmon Association; one of our affiliates. Please correct your mailing list to show the latter's address as P.O. Box 236, Hooksett, N.H., 03106.

Friends Of The Merrimack is a coalition of environmental and sportsmens organizations and individuals from the Merrimack Valley in Massachusetts and New Hampshire. One of our foremost goals is support for the ongoing cooperative federal-state effort to restore Atlantic salmon to the Merrimack river system.

On behalf of our affiliates, we wish to urge adoption of Option 3 of the plans now under review and assessment. That is establishment of a Federal Management Program for Atlantic salmon stocks occurring and traversing the waters from 3-12 miles off the continental United States. It is imperative that a management plan(FMP) be established for those waters not now under the jurisdiction of either the coastal states(within the 3 mile limit or by NASCO on the high seas(beyond 12 miles).

The coastal states are engaged, in cooperation with the federal government in an imaginative and popular restoration of Atlantic salmon to New England's rivers. NASCO, in its brief life as a high seas Atlantic salmon conservation treaty organization, has made great strides in conserving salmon stocks in both eastern and western Atlantic waters. It is inexcusable that the United States and the coastal states should continue to ignore the potential for exploitation of these stocks while in the waters 3-12 miles from our coastline. Not only will a continuance of the status quo peril the salmon in those waters; it will inevitably lead to a delay in successful restoration within our coastal rivers.

We thank you for this opportunity to comment on the FMP and again urge adoption and implementation of the Federal Management Program.

Sincerely,

*Wm. D. Hubbard*  
William D. Hubbard, Chairman  
Executive Committee

*Take Pride In The Merrimack*

October 1987

## RESTORATION OF ATLANTIC SALMON IN AMERICA, INC.

BOX 164, HANCOCK, NEW HAMPSHIRE 03449

TELEPHONE: 603-563-8051

SEP 21 1987

RECEIVED

September 20, 1987

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Mr. Douglas G. Marshall, Executive Director  
New England Fishery Management Council  
Suntaug Office Park  
5 Broadway (Route 1)  
Saugus, Massachusetts 01906

Dear Mr. Marshall:

COORDINATING  
COMMITTEE

PAUL O. BOFINGER

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DAVID CLARKE

WALTER L. DICKSON

DAVID F. EGAN

DAVID GOULET

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MARTIN M. SELDON

JANE P. SMITH

PATRICK W. WILLS

Our organization is writing to inform the New England Fishery Management Council of its approval of the draft Atlantic Salmon Fishery Management Plan, the draft Environmental Assessment and draft Regulatory Impact Review.

We also approve of the regulations to implement the Fishery Management Plan.

Sincerely,

*Richard A. Buck*

Richard A. Buck  
Chairman

SPECIAL  
PROJECTS

CHARLES E. FERREE JR.  
Director

lgk

SPECIAL  
ADVISERS

CONRAD CHAPMAN

JACK W. HANKS

ANTHONY NETEY

NATHANIEL P. REED

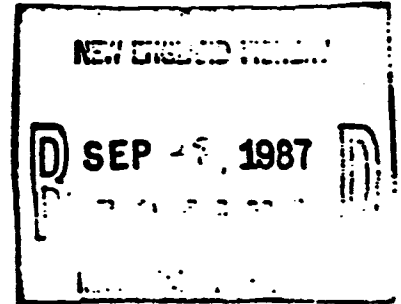
PETER V. STROM

PETER THOMPSON

TED W. L. AYS

***The Connecticut River  
Salmon Association***

September 25, 1987




Mr. Douglas G. Marshall  
Executive Director  
New England Fishery Management Council  
Suntaug Office Park  
5 Broadway  
Saugus, MA 01906

Dear Mr. Marshall:

Please be advised that The Connecticut River Salmon Association fully supports the creation of a federal management program (option 3) within the three to twelve mile zone of U.S. coastal waters.

Very truly yours,

  
David F. Egan  
Attorney at Law  
President

DFE/c

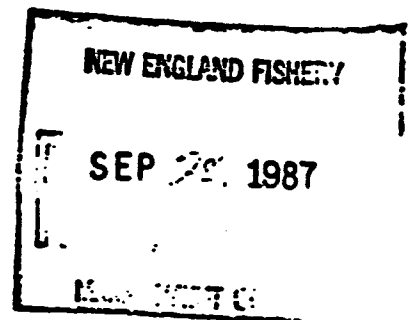
October 1987



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
ONE GATEWAY CENTER, SUITE 700  
NEWTON CORNER, MASSACHUSETTS 02158

SEP 24 1987



Mr. Douglas C. Marshall, Executive Director  
New England Fishery Management Council  
Suntaug Office Park  
5 Broadway (Route 1)  
Saugus, Massachusetts 01906

Dear Doug:

The U.S. Fish and Wildlife Service supports the New England Fishery Management Council's Draft Atlantic Salmon Fishery Management Plan (FMP) and its preferred alternative to establish a Federal management program for U.S. Atlantic salmon in the Exclusive Economic Zone (EEZ).

This plan promotes the conservation and enhancement of Atlantic salmon between three and twelve miles off shore, thereby uniting the management efforts of the States and Federal government, under the North Atlantic Salmon Conservation Organization (NASCO). Joint Atlantic salmon restoration efforts between the States and Fish and Wildlife Service are planned or currently underway in 14 river systems in New England.

The draft plan specifically prohibits any commercial fishing for Atlantic salmon, directed or incidental, and any possession from Federal waters (3-12 miles). Such a restriction will not impact commercial or recreational fishing since no directed commercial operations for Atlantic salmon are known to exist and State prohibitions already exist on recreational catches in coastal waters. These restrictions will support the Atlantic salmon restoration program because all salmon returning to their natal rivers are needed to begin using all available spawning habitat.

Sincerely yours,

A handwritten signature, "Howard M. Lora", is written in cursive below the "Sincerely yours," text.

Regional Director