AMENDMENT #1 TO THE FISHERY MANAGEMENT PLAN FOR THE SUMMER FLOUNDER FISHERY

September 1990

Mid-Atlantic Fishery Management Council

in cooperation with the

National Marine Fisheries Service,

the

New England Fishery Management Council,

and the

South Atlantic Fishery Management Council

Draft adopted by MAFMC: 20 September 1990
Final adopted by MAFMC: 31 October 1990
Final approved by NOAA:

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2. SUMMARY

This Amendment 1 to the Fishery Management Plan for the Summer Flounder Fishery (FMP), prepared by the Mid-Atlantic Fishery Management Council (Council) in cooperation with the New England and South Atlantic Fishery Management Councils, is intended to protect small summer flounder (under 13") from the 1989 and 1990 year classes. In the absence of the measures proposed in this Amendment, the spawners necessary for future year classes are in jeopardy.

Currently, a very large segment of the population is comprised of three year classes. Therefore, it is essential that we protect the 1989 and 1990 year classes from destruction through discarding to provide a spawning biomass.

This Amendment was prepared when it was learned the Council could not expect the National Marine Fisheries Service (NMFS) to enact emergency regulations to protect those year classes without further Council action. The principal reason given for not implementing emergency action at that time was that regulations of such a nature are likely to be extremely controversial and, therefore, there was a great reluctance to implementing them without either extraordinarily strong documentation of emergency need and relationship between such proposed relief and the emergency action requested as well as an opportunity for public comment on the proposal. The Council prepared a hearing draft of this Amendment, held hearings, received written comments, and revised the Amendment significantly based on those comments.

The changes made by the Council in the final version of Amendment 1 should satisfy most of the commentors. The requirement for the entire net to meet the minimum mesh size beginning with the second year of implementation has been dropped from this Amendment. Exemptions have been included for the northeast offshore fishery and the fly net fishery. The northeast offshore exemption is to be implemented through a readily enforceable permit election system.

This Amendment will be superceded by Amendment 2, which is under preparation by the Council, the New England and South Atlantic Councils, and the Atlantic States Marine Fisheries Commission (ASMFC). Amendment 2 will address the total stock problem and contain measures to prevent overfishing. Amendment 2 is scheduled for completion in May 1991.

The Amendment will manage the summer flounder (*Paralichthys dentatus*) fishery pursuant to the Magnuson Fishery Conservation and Management Act of 1976, as amended (MFCMA). The management unit remains unchanged and is summer flounder in US waters in the western Atlantic Ocean from the southern border of North Carolina northward to the US - Canadian border. The objectives of the FMP continue to be:

1. reduce fishing mortality on immature summer flounder;
2. increase the yield from the fishery;
3. promote compatible management regulations between the Territorial Sea and the EEZ; and
4. minimize regulations to achieve the management objectives recognized above.

The management measures for this Amendment are:

1. Only otter trawl vessels with 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh), inside measure, applied throughout the cod end for at least 75 continuous meshes forward of the terminus of the net may retain more than 500 lbs of summer flounder. If the fish are landed in a State that has a larger minimum net mesh size, the State limit would prevail. There are two exceptions to this rule:

   a. Vessels fishing seaward of the line described below may obtain a special permit from NMFS in advance of doing so. Vessels with this special permit are exempted from the minimum net mesh regulations, but are prohibited from fishing west (landward) of the line. NMFS is authorized to establish procedural rules necessary to process applications for and cancellation of these special permits in order to facilitate enforcement.

      The line follows 71°30' west longitude south to its intersection with Loran C 8860-Y-43750, thence northeasterly along Loran C 8860-Y-43750 to 41°00.0'N, 70°49.5'W, thence easterly to 41°00.0'N, 70°30.0'W, thence southerly to 40°50.0'N, 70°30.0'W, thence easterly to 40°50.0'N, 69°40.0'W, thence southerly to 40°33.5'N, 69°40.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°26.5'N, 70°40.0'W, thence northerly to 40°40.5'N, 70°40.0'W, thence southwesterly along Loran C 9960-Y-43600 to 40°30.0'N, 72°00.0'W, thence southerly to 40°17.8'N, 72°00.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°15.5'N, 72°20.0'W, thence southerly along 72°20.0'W, to the southern limit of the management unit (Figure 17).

b. Vessels fishing in the fly net fishery are exempt from the minimum mesh size requirement. A fly net is a two seam otter trawl with the following configuration:

(1) The net has large mesh webbing in the wings with a stretch mesh measure of 8" to 64".

(2) The first body (belly) section of the net consists of 35 meshes or more of 8" (stretch mesh) webbing or greater.

(3) In the body section of the net the stretch mesh decreases in size relative to the wings and continues to decrease throughout the extensions to the cod end, which generally has a webbing of 2" (stretch mesh).

Vessels fishing with a fly net may catch no more than 50 lbs of summer flounder in any haul back of the fly net. This is necessary to assure that the exemption is not abused.

If the Regional Director determines after a review of annual data that the summer flounder catch in the fly net fishery exceeds 1% of the total catch in the fly net fishery, he may rescind the exemption.

2. Otter trawl vessels retaining more than 500 lbs of summer flounder and subject to the 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh) regulation may not have available for immediate use any net, or any piece of net not meeting the mesh size requirements, or mesh that is choked off. A net that conforms to one of the four following specifications and which cannot be shown to have been in recent use is considered to be "not available for immediate use":

a. nets stowed below deck; or

b. nets stowed and lashed down on deck; or

c. nets which are on reels and are covered and secured with the cod end removed; or

d. nets which are secured in a manner approved by the Regional Director. After review and approval, the Regional Director may specify alternative manner(s) of securing nets by notice in the Federal Register.

A net is considered to be stowed below deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck of the vessel. Towing wires (any wires including the "leg" wires), must be detached from the net.

A net is considered to be stowed and lashed down on deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck or the rail of the vessel. The towing wires (any wires including the "leg" wires), must also be detached from the net.

A net on a reel is considered to be "stowed and lashed down on deck" only if the entire surface of the net on the reel is covered with canvas or similar material which is securely bound, the towing wires (any wires including the "leg" wires), must also be detached from the net, and the cod end is removed from the net and stored below deck.

3. A fishing vessel may not use any means or device which would obstruct the meshes on the top of the regulated portion of a trawl net, except that one net strengthener may be attached (only at its outside edges) to the top of the regulated portion of a trawl net, if such net strengthener consists of mesh material similar to the material of the regulated portion of the net and has a mesh size of at least twice the authorized minimum mesh size. "Top of the regulated portion of the net" means the 50% of the entire regulated portion of the net which (in a hypothetical situation) would not be in contact with the ocean bottom during a tow if the regulated portion of the net were laid flat on the ocean floor.

4. States with minimum mesh regulations larger than those established in this FMP are encouraged to maintain them.

5. Since it will be difficult to detect a violation of the minimum mesh net regulation, the penalty for individuals detected of such a violation must be sufficient to provide an adequate deterrent. Therefore, it is recommended that penalty for the first offense be a six month loss of permit and the penalty for a second offense be a one year loss of permit. After imposition and expiration of such a penalty, if the individual fishes without penalty for three consecutive years, the earlier offenses are expunged from the record.

The Amendment also defines overfishing for summer flounder as fishing in excess of the F_{max} level.

The provisions of the existing FMP [for example, 13" minimum size limit as well as annual permits for commercial vessels and vessels for hire in the recreational fishery (party and charter boats)] continue in effect unchanged.

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4. INTRODUCTION

4.1 DEVELOPMENT OF THE PLAN

The Council first considered the development of a fishery management plan for summer flounder in late 1977. During the early discussions, the fact that a significant portion of the catch was taken from State waters was considered. As a result, on 17 March 1978 a questionnaire was sent by the Council to east coast State fishery administrators seeking comment on whether the plan should be prepared by the Council or by the States acting through the Atlantic States Marine Fisheries Commission (ASMFC).

It was decided that the initial plan would be prepared by ASMFC. The Council arranged for NMFS to make some of the Council's programmatic grant funds available to finance preparation of the ASMFC plan. New Jersey was designated as the State with lead responsibility for the plan. The State/Federal draft was adopted by the Atlantic States Marine Fisheries Commission at its annual meeting in October 1982. The original Council FMP (MAFMC 1988) was based on the ASMFC management plan.

The Council adopted the original FMP for public hearings on 29 October 1987. The public hearings were held in January 1988 in Fairhaven, MA; Galilee, RI; Riverhead, NY; Rockville Center, NY; Wall, NJ; Cape May Court House, NJ; Lewes, DE; Annapolis, MD; Norfolk, VA; Morehead City, NC; and Manteo, NC.

Following public hearings, the original FMP was adopted by the Mid-Atlantic Council on 16 April 1988. The South Atlantic Fishery Management Council endorsed the FMP on 28 April 1988 (Joseph pers. comm.). The New England Council, also in April 1988, adopted a motion supporting a 13" minimum fish size and no mesh size initially, with an automatic minimum size limit increase to 14" at the end of three years, rather than the framework measure adopted by the Mid-Atlantic and South Atlantic Councils (Marshall pers. comm.).

NMFS approved the original FMP on 19 September 1988.

4.2. PROBLEM ADDRESSED BY THE FMP

Summer flounder are over exploited. The best currently published indicators, on which the Amendment is based, show that instantaneous fishing mortality (F) is at least 1.0, while the rate which maximizes the harvest (F_{max}) is 0.35. Thus, fishing mortality is triple the rate which would produce the maximum yield per recruit. Preliminary analyses from an October 1990 workshop indicate that the summer flounder resource could be in much worse condition. A minimum fishing mortality estimate of 1.4 was developed and fishing mortality could be as high as 2.1. A reanalysis of the F_{max} level produced an estimate of 0.23 as opposed to the previous 0.35 estimate. Thus, the difference between the fishing rate which produces the maximum yield and the current level of harvest is at least 6 fold, rather than 3 fold. The instantaneous fishing mortality rate is easily translated into an annual survival estimate. With a fishing mortality rate of 1.4, only about 20% of all summer flounder that are alive now will be alive one year later. An annual survival estimate that corresponds to a fishing mortality rate of 2.1 is only 10%. The level that corresponds to the F_{max} rate is 65%. Obviously, gains in long term yield from the fishery and increases in stock size could be realized by significantly reducing fishing mortality from current levels. Overfishing id defined in this Amendment as fishing in excess of the F_{max} level.

Long term trends in abundance and recruitment of summer flounder were derived from several local and coastwide surveys at the October 1990 workshop. In general, these indices indicated that summer flounder were approximately 5 times more abundant in the mid to late 1970's than in the late 1980's. These surveys also indicated that the 1988 year class was poor and the 1989 and 1990 year classes "no better than average". In addition, the coastwide NEFC survey did not collect any summer flounder older than age 3 in the 1990 survey, although a decade ago summer flounder as old as 10 years were collected.

Spawning biomass per recruit declines markedly with increasing fishing mortality on females (Figure 11). An Fmax level (0.35) of fishing corresponds to a spawning stock biomass per recruit level of 20%. Maximum spawning stock biomass per recruit levels of 30% and 40% would correspond roughly with F levels of 0.25 and 0.20. Current levels of F (1.0) would be equivalent to a spawning stock biomass per recruit level of about 7% of the maximum. If the current F levels are as high as 2.0, then the spawning stock biomass per recruit level would be only 2 - 3% of the maximum level.

At present, as a direct result of high rates of fishing mortality, both commercial and recreational catches of summer flounder are comprised primarily of 0 to 2 year old fish. Individuals of this species have previously been known to live up to 20 years, yet older and larger fish are now infrequent in the landings. This indicates a severely compressed age composition of the summer flounder stock. Such age class compression poses a great risk to recruitment because the older, more fecund spawning adults are being too rapidly removed

from the population and nearly all of the new fish are being spawned by individuals that only get to spawn once or at most twice before they are caught and killed by fishermen.

Summer flounder commercial landings for the first quarter of 1990 verify the fishery independent survey indices. Commercial landings in 1989 plummeted to only 21 million pounds, which was the lowest in the past 15 years and only 70% of the average landings for the 1980's. Landings for 1990 appear to be even worse; only 29% as many pounds were landed during the first quarter of 1990 as were landed in 1989. Coastwide average price for the first quarter of 1989 was $1.38/pound, whereas in 1990 the average had risen to $1.94/pound, partially offsetting the reduced landings.

4.3. MANAGEMENT OBJECTIVES

The objectives of the FMP are to:

1. reduce fishing mortality on immature summer flounder;
2. increase the yield from the fishery;
3. promote compatible management regulations between the Territorial Sea and the EEZ; and
4. minimize regulations to achieve the management objectives recognized above.

4.4. MANAGEMENT UNIT

The management unit is summer flounder (*Paralichthys dentatus*) in US waters in the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border.

5. DESCRIPTION OF THE STOCK

5.1. SPECIES DISTRIBUTION

The summer flounder is one of the lefteye flounders in the family Bothidae. The geographical range of the summer flounder (*Paralichthys dentatus*) encompasses the estuarine and coastal waters from Nova Scotia to Florida (Leim and Scott 1966 and Gutherz 1967). Briggs (1958) has given their range as extending into the northern Gulf of Mexico. The center of its abundance lies within the Middle Atlantic Bight. North of Cape Cod, Massachusetts, and south of Cape Fear, North Carolina, summer flounder numbers begin to diminish rapidly (Grosslein and Azarovitz 1982). South of Virginia, two closely related species, the southern flounder (*Paralichthys lethostigma*) and the gulf flounder (*Paralichthys albigutta*) occur and sometimes are not distinguished from summer flounder.

In the Middle Atlantic Bight, summer flounder can be found from the outer portion of the continental shelf to shallow inshore waters, and they exhibit strong seasonal inshore - offshore movements as observed in trawl survey data (Figures 1 and 2). Summer flounder normally inhabit shallow coastal and estuarine waters during the warmer months of the year and remain offshore during the fall and winter (Bigelow and Schroeder 1953).

Summer flounder are serial spawners (multiplicity of egg batches which are continuously matured and shed) with a relatively protracted reproductive season (Morse 1981). Ichthyoplankton survey data show the general spawning areas in the Middle Atlantic Bight (Figure 1). Spawning occurs during the fall and winter while the fish are moving offshore or at their wintering grounds. The well defined seasonal migratory/spawning pattern varies with latitude. Smith (1973) noted a seasonal progression with fish spawning and moving offshore earlier in the northern part of the range. Spawning generally occurs from September through December north of Chesapeake Bay and from November through February south of the Bay. Peak egg abundance (based on MARMAP surveys as reported in Able *et al.* 1990) occurs in October through December, with October and November being the two months when most eggs were collected. Unfortunately, very limited sampling, only 5 stations, occurred in December south of New England. The offshore migration is presumably keyed to declining water temperature and decreases in photoperiod during the autumn. Larvae and post larvae drift and migrate inshore, entering coastal and estuarine nursery areas from October to May. The smallest larvae (<2") are most abundant in October through December based on MARMAP surveys (Able *et al.* 1990). The fry become demersal on reaching coastal waters and the first year is spent in bays or inshore areas over the entire range of the species.

Summer flounder are distributed widely over the continental shelf during the spring, from 1 to 1000 ft in depth (Sissenwine *et al.* 1979). During summer and autumn, summer flounder are primarily captured in depths of less than 300 ft. During winter, they generally are not found at depths of less than 200 ft. The distribution of summer flounder by depth is related to their temperature distribution (Sissenwine *et al.* 1979).

During spring they are primarily found between 46° and 61° F. During summer the distribution is between 59 and 82° F. The autumn distribution is between 54 and 82° F and the winter distribution is between 41° and 52° F. Prerecruit summer flounder are most abundant at temperatures in excess of 59° F, during the months in which they are caught by the trawl surveys (Sissenwine *et al.* 1979).

Examination of the distribution pattern of prerecruit (less than or equal to 12" TL) summer flounder indicate a striking absence of small fish in northern areas (Fogarty 1981). Both spring (Figure 3) and autumn (Figure 4) bottom trawl survey data indicate that the concentration of young of year summer flounder is south of 39° latitude. The importance of the Chesapeake Bight to this species is demonstrated by the fact that almost all of the young of year caught during the 1968 through 1979 spring surveys (Figure 3) were from this area. Some young of year summer flounder appear in the other areas during the autumn (Figure 4) but the percentage is again very high in the Chesapeake area. The primary nursery grounds for juveniles are the sounds of North Carolina, Chesapeake Bay, and the bays of the eastern shore of Virginia; however, juveniles are distributed to some extent during spring, summer, and fall in many estuaries from Massachusetts to North Carolina.

Powell and Schwartz (1977) evaluated the distribution of summer flounder and southern flounder which extensively use Pamlico Sound and the adjacent estuaries as nursery areas. Both species remain in these estuaries for the first 18-20 months of their life before moving into the ocean waters. Benthic (sea floor) substrate and salinity appear to be the two most important factors governing the distribution of the two species. Powell and Schwartz (1977) reported that summer flounder are most abundant in areas of moderate to high salinities and sandy bottom, while southern flounder prefer areas of low salinity and clayey silt or organic rich mud bottom.

Juveniles in southern waters generally overwinter in bays and sounds whereas in the north there is some movement offshore with the adult migration, although many larval and juvenile summer flounder still remain inshore through the winter months (Smith and Daiber 1977 and Wilk *et al.* 1977). The offshore population returns to the coast and bays in the spring with a tendency to return to the same estuary as the year before or to move to the north and east (Poole 1962; Murawski 1970; Westman and Neville 1946; and Hamer and Lux 1962). Those which enter bays and estuaries generally stay the entire summer. In the northern part of the range, fish which spend their summer in a particular bay tend largely to return to the same bay in the subsequent year. For example, although the northeast dispersal is considerable, with some summer flounder from inshore New Jersey moving the following year to Long Island, the majority of the fish return to inshore New Jersey. This homing is evident also in the summer flounder which largely return to New York waters, with some movement to waters off Connecticut, Rhode Island and Massachusetts (Poole 1962).

Considerable attention has been devoted in recent years to determining the population structure of summer flounder in the Middle and South Atlantic Bights. Wilk *et al.* (1980), on the basis of stepwise linear discriminant analysis of morphometric and meristic features of summer flounder samples collected along the eastern seaboard from New York to Florida, concluded that a significant difference exists between summer flounder samples north and south of Cape Hatteras. Summer flounder collected throughout the Middle Atlantic Bight were statistically similar, as were fish sampled in the South Atlantic Bight. Population intermixing was most prevalent off North Carolina. Wilk *et al.* (1980) suggested that Cape Hatteras forms a zoogeographical barrier resulting in reproductive isolation of summer flounder. Fogarty *et al.* (1983) support the findings of Wilk *et al.* (1980) that summer flounder north and south of Cape Hatteras are statistically separable on the basis of morphometric characters, with apparent intermixing of northern and southern contingents in the vicinity of Cape Hatteras. Tagging studies currently being conducted in Virginia (Desfosse *et al.* 1988) preliminarily indicate that two subpopulations of summer flounder may inhabit Virginia inshore waters. The most recent summer flounder stock assessment (USDC 1986) is based on the assumption of a unit stock existing north of Cape Hatteras.

The summer flounder stock discrimination workshop reported on in Fogarty *et al.* (1983) was unable to examine adequately the hypothesis of multiple stocks in the Middle Atlantic Bight. Smith (1973) identified concentrations of summer flounder eggs off Long Island, Delaware-Virginia, and North Carolina. The workshop concluded however that distribution of summer flounder eggs and larvae was continuous throughout the Middle Atlantic Bight and that apparent concentrations identified by Smith (1973) may have been due to sampling variability.

This FMP is based on the agreement of the ASMFC Summer Flounder Scientific and Statistical Committee and the MAFMC Scientific and Statistical Committee that the most reliable biological data available indicate that management options be based on a unit stock.

5.2. ABUNDANCE AND PRESENT CONDITION

Total US commercial landings of summer flounder from the management unit of this FMP (North Carolina and north) peaked in 1979 at nearly 42 million lbs (Table 1). The reported landings in 1989 of slightly over 21 million lbs were the lowest landings in the past 15 years and one half the peak amount. Commercial landings have been consistently high since the mid 1970's but plummeted coastwide in 1989. Increased commercial landings in the mid 1980's are attributable mainly to increased levels of effort. Landings for 1990 appear to be even worse; only 29% as many pounds were landed during the first quarter of 1990 as were landed in 1989. Coastwide average price for the first quarter of 1989 was $1.38/pound, whereas in 1990 the average had risen to $1.94/pound, partially offsetting the reduced landings.

Since 1980, 71% of the reported commercial landings of summer flounder have come from the EEZ (Table 2). The percentage of landings attributable to the EEZ was at its lowest in 1983 with 63% and was the highest in 1989 at 77% (Table 2). In 1988 over 25 million lbs of summer flounder were landed from the EEZ, whereas in 1989 the EEZ amount had fallen to less than 17 million lbs. Tremendous variability in summer flounder landings exist among the States, over time, and the percent of total summer flounder landings taken from the EEZ has varied widely among the States (section 7 more fully describes some of these differences).

Estimated recreational catch of summer flounder in 1989 was 5.0 million lbs (Table 3). Estimated recreational catch derived from the 1980 through 1989 Marine Recreational Fishery Statistics Surveys (MRFSS) has averaged 30 million lbs and has ranged from 5.0 to 54.5 million lbs. No consistent annual pattern is discernible except that the 1989 catch plummeted. Summer flounder are generally the second most frequently caught species by marine recreational fishermen along the East coast and comprise roughly seven percent of the total weight of all fish caught (Table 3).

A stratified random bottom trawl survey has been conducted in the spring and autumn by NEFC (Clark 1978). The continental shelf between Cape Hatteras and Nova Scotia has been sampled since 1967 during the autumn survey and was also sampled between New Jersey and Nova Scotia during 1963 and 1966. The spring survey began in 1968 and has sampled from Cape Hatteras to Nova Scotia. The survey area is stratified into geographical zones (Figure 5) primarily on the basis of depth and latitude. Approximately 300 stations are sampled during each survey (Clark 1978). A 30 minute tow is taken at each station at an average speed of 3.5 knots.

Bottom trawl surveys conducted during the spring in offshore waters were used to provide indices of abundance for summer flounder. Spring surveys were considered the most reliable indicators of biomass because summer flounder are concentrated in offshore areas during spring surveys and are more consistently available to the gear than in the fall (USDC 1986). A smoothed index (Pennington 1986) for the survey catch per tow was constructed and used as the index of relative abundance. The method involves development of a time series model for the stratified mean catch per tow to filter measurement error (changes in catchability) from changes in population abundance. The delta distribution (Pennington 1986) stratified mean catch per tow was low during the late 1960's and early 1970's, increased during the mid 1970's and then remained high throughout the 1980's until 1989 again saw the index plummet to the low of the early years of the survey (Table 4). The 1985 and 1986 survey indices were higher than 1983 and 1984 levels, however caution is necessary in interpreting the indices since 1985 because of a change in trawl performance attributable to new doors. There appears to be a significant increase in gear efficiency for all species combined with the new door type (USDC 1986). Results of a gear comparison experiment (Fogarty pers. comm.) which targeted on summer flounder, showed no effect of door type; however, sample sizes were low, thus suggesting further experiments for summer flounder are needed. Byrne and Forrester (1987) analyzed gear comparison experiments conducted in 1984 of five flat fish species (not summer flounder) which concluded that the previously reported differences (USDC 1986) between trawl doors, primarily involved cod and haddock. If the replacement doors that were used beginning in 1985 are actually more effective at collecting summer flounder, then the survey index for 1989 may actually be lower in comparison to the early years of the survey.

Annual variations in the timing of migratory activity may directly affect the availability of summer flounder during the surveys. Prior to the autumn migration, summer flounder are generally located in coastal areas and estuaries and are not available to the survey. Any delay in movements from coastal locations could reduce availability of summer flounder during the autumn bottom trawl surveys, thus resulting in underestimation of survey abundance indices. Confidence intervals computed for survey indices differ among years (Table 4). Summer flounder at the extremes of the geographical range may be particularly vulnerable to environmental fluctuations, resulting in variable survival rates and/or changes in distribution patterns. With the

large variability, Fogarty (1981) suggests that proportional changes in abundance of less than approximately half may not be detected with high probability.

Several States have been running fisheries surveys for the past decade (Table 5), and although practically none of the surveys are specifically designed for summer flounder only, the duration of the consistent sampling allows for the detection of trends in summer flounder abundance. These surveys also allow for the detection of relatively poor or good year classes. Nearly every State had poor recruitment in 1988 (Table 5), and although quantification of the 1989 year class was not possible by SAW 9 (USDC 1989c), verbal commitments from nearly every State biologist at SAW 9, indicated that 1989 was slightly better for recruitment, than was 1988. Preliminary VIMS young of year summer flounder survey indices indicate that 1989 was about the same as the 1987 CPUE number (0.77 vs. 0.75, respectively) while the 1990 CPUE estimate was nearly triple the previous year's estimate (Table 6). Caution is necessary, however, in that the effort for 1990 was reduced to only about one-third the previous four year average effort. The appearance from VIMS data (Musick 1990) that 1989 was "fair" to "average" and that the 1990 year class was "good" is shared by numerous State summer flounder researchers: Monaghan (NC), Casey (MD), Seagraves (DE), Scarlett and Able (NJ), and Castenada (NY). This new recruitment of the 1989 year class was observable from the NEFC coastwide spring survey index, where 87% (0.62 of 0.71) of the total number of summer flounder that were caught were from that year class (Table 7). The very poor 1988 year class, that all of the States identified, also was apparent in the NEFC survey, in that the survey number in 1989 was the lowest on record (the NEFC survey does not collect summer flounder young of the year because of their estuarine distribution). Although the 1990 index was more than 50% greater than the 1989 index, the 1990 number was still the second lowest in the time series. There were no fish older than age 3 represented in the 1990 survey, while as recently as a decade ago fish up to age 10 were collected. Thus, from these indices it is obvious that, although some new recruitment to the fishery may occur in the near future (that is, the 1989 year class), unless measures to protect this year class are implemented, the fishery can quickly overharvest this one year class and have nothing else to support the fishery or the resource.

Scarlett (1981) reported that the spring biomass indices for the entire survey area were significantly correlated with commercial landings. Commercial catch per unit effort (days fished) indices were calculated for tonnage classes 2, 3, and 4 otter trawlers (5- 50 GRT, 51-150 GRT, and 151-500 GRT, respectively) for trips in which 5% or greater of the catch was comprised of summer flounder. Catch per unit effort was similar for all three vessel classes from 1967 through 1975. After 1975, similar trends in CPUE are evident, however tonnage classes 3 and 4 show significantly higher CPUE than tonnage class 2 (Table 8).

Catch per effort for tonnage class 2 vessels ranged from a low of 970 lbs in 1970 to a high of 2,646 lbs in 1974. The CPUE remained relatively constant from 1977 through 1982, increased slightly in 1983 and 1984, and then declined to its lowest level since 1972 in 1985 (Table 8).

5.3. STOCK CHARACTERISTICS AND ECOLOGICAL RELATIONSHIPS

5.3.1. Spawning

Summer flounder spawn during the fall and winter as they migrate offshore or are at their wintering grounds. Smith (1973) found that spawning starts in mid-September between southern New England and New Jersey. As the season progresses spawning moves southward, and by October spawning takes place nearly as far south as Chesapeake Bay. Spawning has been reported to continue into March (Morse 1981). Spawning habitat occurs over the entire shelf between Cape Cod, Massachusetts and Cape Lookout, North Carolina.

Morse (1981) documented that summer flounder are serial spawners (Figure 6). The multiplicity of modes indicate egg batches are continuously matured and shed during a protracted spawning season. The complete separation of a ripe egg batch just prior to being shed can be seen in the "running ripe" figure at modal egg diameter of 1.00 mm. A few residual eggs from a previously spawned batch are evident in the "partially spent" graph of Figure 6.

Morse (1981) calculated the percent of ovary weight to total fish weight as an index for maturity. The mean maturity index increased rapidly from August to September, peaked in October- November, then gradually decreased to a low in July (Table 9). The wide range in the maturity indices during the spawning season indicates nonsynchronous maturation of females and a relatively extended spawning season. The length and peak spawning time as indicated by the maturity index agree with results determined by egg and larvae occurrence (Smith 1973 and Herman 1963).

Fertilized eggs are buoyant, floating at or near the surface, and are spherical with a transparent rigid shell of about 0.04". The heaviest concentrations of eggs and larvae are found between Long Island and Cape Hatteras (Smith 1973); most eggs were taken within 17 mi of shore and larvae were most abundant 12 to 45 mi from shore. Larvae were found in the northern part of the Middle Atlantic Bight from September to February, and in the southern part from November to May. MARMAP survey data (Able *et al.*) indicate that peak egg abundance occurs in October through December with October and November being the two months when most eggs were collected. Unfortunately, very limited sampling, only 5 stations, occurred in December south of New England.

Smith (1973) found that eggs were most abundant (approximately 77% of the total) in the water column where bottom temperatures were between 53 and 66° F. However, eggs were found in temperatures as cold as 48° F and as warm as 73° F. Larvae have been found in temperatures ranging from 32° to 74° F, but are most abundant between 48° and 64° F. The incubation period from fertilization to hatching is estimated to vary with temperatures as follows: about 142 hours at 48° F; 72 to 75 hours at 64° F; and 56 hours at 73° F (Smith 1973). The smallest larvae (<2") are most abundant in October through December based on MARMAP surveys (Able *et al.* 1990).

5.3.2. Age and Growth

Several authors have investigated length at age relationships for summer flounder (Poole 1961; Eldridge 1962; Smith and Daiber 1977; Shepherd 1980 and Richards 1970). The results of these past studies are not in total agreement. Summer flounder scales and fin rays follow the generalized temperate water growth pattern and indicate that rapid growth begins in early summer, continuing (probably intermittently) into the following winter. Growth rate interpretation based upon otolith zones may not be reliable due to problems with poor calcification and/or with resorption. Since the scientific literature was not consistent and age and growth information is critical for management, ASMFC sponsored an age and growth workshop (Smith *et al.* 1981).

The calculated summer flounder lengths (Table 10) for Powell, Smith and Daiber, and Shepherd were considered realistic estimates for normal summer flounder growth by the 1980 workshop participants. Poole's (1961) lengths, while considered valid, were thought to be representative of very rapid growth not normally found. Eldridge's (1962) age groups should be adjusted back one year to fit the growth pattern selected by the workshop (Smith *et al.* 1981).

Since summer flounder spawn over half the year, the workshop considered a 1 January birthday for uniformity. Thus, fish were not considered one year old unless they passed their first summer, thereby eliminating the possibility of an October hatched fish being considered one year old the following January (Smith *et al.* 1981).

Although Poole's (1961) results show faster growth than the others, all studies showed that females grow more quickly than males and are consistently larger than their male counterparts at any given age except for the first few months after hatching.

During the 1980's, significant disagreements and confusion among summer flounder researchers arose over the results of the 1980 workshop. In June of 1990, ASMFC and NMFS sponsored a workshop at NEFC. This 1990 workshop (Almeida pers. comm.) concluded that the convention derived at the 1980 workshop, that the first mark on the structures represented the second year, was in error. Summer flounder biologists now agree more closely with the information presented by Poole (1961) in that summer flounder exhibit very rapid growth in their first year and reach mean lengths at age 1 of 10-13". Although the report of this workshop is not yet finalized, the preliminary results indicate that there were little overall differences in the von Bertalanffy parameters (l_{inf}, t_o, or K) or F_{max} values previously presented (Almeida pers. comm.).

The length-weight relationship for summer flounder has been well described by Morse (1981). The results of this study showed that there are both seasonal and slight sexual differences in the relationship (Table 11). This difference between the sexes was also noted by Smith and Daiber (1977), Eldridge (1962), Lux and Porter (1966), and Wilk *et al.* (1978).

Parameters of the von Bertalanffy growth equation (Table 12) were determined for summer flounder (USDC 1986) using length at age data for males and females collected from bottom trawl surveys between 1976 and 1983. Age determinations for 1947 males and 2030 females were available. The maximum size of male and female summer flounder was estimated as 26" and 33", respectively. Previous estimates of the maximum size for summer flounder ranged from 35 to 37 inches (Smith and Daiber 1977; Richards 1970). Henderson (1979) provided an estimate of 36" for both sexes combined based on analysis of commercial samples. Bigelow and Schroeder (1953) reported a maximum verified length of 37". Recent values (USDC 1986) of the Brody growth

coefficient (k) are comparable to those calculated in Fogarty (1981) using data which included both inshore and offshore collections.

5.3.3. Catch at Age

The stratified mean number per tow at age for the spring offshore surveys from 1976 through 1986 was dominated by ages 1, 2, and 3 (Table 13 and Figure 7). The proportion of one year olds (0.51) was high in 1986 suggesting the possibility of a strong year class. In 1985, the proportion of age one fish was very low (0.05), suggesting poor recruitment of the 1984 year class (USDC 1986).

Estimates of catch at age for commercial landings were available for 1976 through 1983 (Table 14 and Figure 8). Ages 1 through 4 comprised 94% of the landings, with ages 2 and 3 predominating (45% and 29% of the total catch, respectively). During 1980 through 1983, the contributions of age 3 and age 4 fish declined from 49% to 28%, while the proportions of age 1 and age 2 fish increased from 46% to 66% (USDC 1986).

5.3.4. Sex Ratio

No significant difference from a 1:1 sex ratio was found by Morse (1981) in his examination of 4,551 summer flounder greater than eight inches collected during 1974 through 1979 (Table 15). However, a significant trend was evident when sex ratios were calculated in roughly two inch intervals. Males dominated the intervals between eight and fourteen inches and were essentially absent in samples greater than twenty two inches. Females were more abundant in all groups greater than eighteen inches.

Morse (1981) calculated sex ratios by year and season to determine possible variations related to sampling intensity or differential distribution of sexes during the spring and fall migrations. There appeared to be no annual or seasonal effects on observed sex ratios (Table 15) even though sample sizes varied greatly between years and seasons.

The observed size related trend in sex ratios does not appear to be the result of behavioral differences between the sexes or gear selectivity according to Morse (1981). Similar results were found in Great South Bay (Poole 1966) and Delaware Bay (Smith and Daiber 1977) where different collecting gear were used. There is no evidence to suggest segregation of the sexes during any phase of their annual cycle of distribution (Morse 1981). The paucity of males greater than twenty two inches is the result of a differential growth rate between the sexes and a greater maximum age for females (Poole 1964; Smith and Daiber 1977). Female summer flounder may live up to 20 years, but males rarely exceed 7 years (USDC 1986).

5.3.5. Length at Maturity

The length at which 50% of the fish are mature (L_{50}) was estimated by Morse (1981) as 9.7" for males and 12.7" for females (Table 16). The smallest mature male was 7.5" and the largest immature was 15.7". Females began maturing at 9.8" and the largest immature was 17.3". The range of L_{50} for males and females indicate sexual maturity is attained at age 2 (Morse, 1981).

The L_{50} of males and females varied during the six year study of Morse (1981). No consistent general trend in L_{50} was evident as males and females appeared to exhibit independent changes (Table 16).

5.3.6. Fecundity and Reproductive Strategy

Fecundity of summer flounder is relatively high. Morse (1981) calculated fecundity estimates ranging from 463,000 to 4,188,000 eggs for fish between 14" and 27". Fecundity and length exhibit a curvilinear relationship, but with logarithm transformations, Morse (1981) expressed the relationship as:

$$\log_{10} \text{Fecundity} = \log_{10} a + b (\log_{10} \text{length})$$

The relationships between fecundity and weight and ovary weight were expressed by Morse (1981) as:

$$\text{Fecundity} = a + bX$$

The intercept (a) and slope (b) values for the equations are listed in Table 17.

Morse (1981) found no significant differences in summer flounder fecundity relationships among the six years of his study. The correlation coefficients indicate both length and weight provide adequate predictions of fecundity. Approximately 75% of the variation in fecundity was associated with changes in length or weight.

The relative fecundity, number of eggs produced per gram of total weight of spawning female, ranged from 1,077 to 1,265 in Morse's (1981) study. The increase of variability in fecundity estimates as weight increases

tends to obscure the true relationship. The high egg production to body weight is maintained by serial spawning, i.e. batches of eggs are shed rather than all eggs shed at one time. In fact, the weight of annual egg production, assuming an egg diameter of 0.04" and 1.0 specific gravity, equals approximately 40 to 50 percent of the biomass of spawning females (Morse 1981).

The reproductive strategy of summer flounder tends to maximize reproductive potential and avoid catastrophe. The strategy is a combination of extended spawning season with variable duration, early maturation (age 1 or 2), high fecundity, serial spawning, and extensive migrations across the continental shelf during spawning. The half year spawning season reduces larval crowding and decreases the impact of predators and adverse environmental conditions on egg and larval survival. The migration pattern disperses the eggs over large areas of the shelf and probably aids in maintaining spawning fish in areas where bottom temperatures are between 54 and 66° F (Smith 1973). The October/November spawning peak coincides with the breakdown of thermal stratification on the continental shelf and the autumn plankton production maximum which is characteristic of temperate ocean waters of the northern hemisphere. Thus the timing of peak spawning assures a high probability of adequate larval food supplies (Morse 1981).

5.3.7. Mortality

Knowledge of mortality is essential for management of most fisheries. In practice, mortality is generally divided into fishing mortality (removals by man) and natural mortality (predation, disease, accident and everything else). Natural mortality is extremely difficult to measure in oceanic fishes and is generally derived by subtraction of fishing mortality estimates from the total mortality estimate. Mortality can be expressed as an annual rate or an instantaneous rate. The F, instantaneous fishing mortality rate, is what is generally calculated from fishery assessments

Available mortality estimates derived from tagging studies yield estimated instantaneous rates of fishing mortality (F) for two experiments conducted off southern New England of 0.48 and 0.62 for Nantucket Sound and Pt. Judith releases respectively; where recovery rates were 41% for Nantucket Sound and 50% for Pt. Judith (Table 1). A total of 6,669 summer flounder were tagged in four experiments off New Jersey during 1960-67 with an overall recovery rate of 28%. Estimates of F ranged from 0.24-0.58 in these experiments (Table 18). Examination of the seasonal pattern of tag recoveries for experiments conducted in southern New England and New Jersey clearly indicate the influence of migratory activity and the seasonal distribution of fishing effort on tag returns. Summer flounder were tagged in Nantucket Sound and Block Island Sound immediately prior to the offshore autumn migration (Lux and Nichy, 1980). Return rates declined sharply after the initial 30 day interval for Block Island Sound releases while recoveries remained uniformly low for Nantucket Sound fish during the first 90 days after they wee tagged. Returns subsequently increased in both experiments as fish became available to the offshore winter trawl fishery (January through April) and again after 270 days at large, following the inshore migration when the fish were vulnerable to inshore trawlers and recreational fishermen.

Fogarty (1981) estimated that the instantaneous total rate of mortality from NMFS survey data ranged from 0.67-1.35 for females and from 0.87-2.85 for males. The instantaneous rate of mortality estimate for males collected in 1978 (2.85) appeared unreasonably high and probably was due to sampling variability. To reduce the effect of variable year class strength, age composition data were pooled over years of collection. Calculated pooled instantaneous mortality rates for females and males were 0.93 and 1.11, respectively. The higher estimate for males is of interest since it has been suggested that the absence of male fish older than age 7 may be due to higher natural mortality rates (Poole 1966 and Chang and Pacheco 1976). Henderson (1979) reported estimates of Z for summer flounder ranging from 0.53-1.42.

More recently, age composition of survey and commercial catch of summer flounder sampled during 1973 through 1981 was employed to derive estimates of the instantaneous rate of total mortality (USDC 1986). Age composition data were available for spring surveys from 1976 through 1983; provisional age determinations also have been made for a limited number of samples from fall surveys conducted in 1984 (n = 154) and 1985 (n = 147). Mean catch per tow was calculated using the smoothed (Pennington 1986) survey index. The smoothed index was used to minimize fluctuations between years caused by random changes in catchability and thus allow more reliable tracking of cohorts.

To standardize for annual variations in effort in the commercial fishery, commercial catch at age data for each year were divided by total effort (tonnage classes 2, 3, and 4 otter trawlers in which at least 5% of the catch was summer flounder) for the year. This provided an estimate of catch per unit effort at age which was used in the catch curve analysis (USDC 1986).

Assuming an M, or instantaneous rate of natural mortality (the instantaneous rate of deaths attributable to all causes except fishing) of 0.2 (USDC 1986) the mid 1980's levels of F, or the instantaneous rate of fishing mortality were on the order of 0.65 to 0.70 (USDC 1986). In general, estimates of total mortality based on commercial and survey data corresponded well (Table 19). Mortality has been highest on the 1975, 1979, and 1980 year classes (USDC 1986). The estimate of Z, or the instantaneous rate of mortality (the ratio of numbers of deaths per unit of time to the population abundance during that time) for 1976 based on survey data (Z = 0.375) appears unreliable, as the coefficient of determination was low relative to the other years ($r^2 = 0.58$).

Summer flounder are over exploited. The best currently published indicators, on which the Amendment is based, show that instantaneous fishing mortality (F) is at least 1.0, while the rate which maximizes the harvest (F_{max}) is 0.35. Thus, fishing mortality is triple the rate which would produce the maximum yield per recruit. Preliminary analyses from an October 1990 workshop indicate that the summer flounder resource could be in much worse condition. A minimum fishing mortality estimate of 1.4 was developed and fishing mortality could be as high as 2.1. A reanalysis of the F_{max} level produced an estimate of 0.23 as opposed to the previous 0.35 estimate. Thus, the difference between the fishing rate which produces the maximum yield and the current level of harvest is at least 6 fold, rather than 3 fold. The instantaneous fishing mortality rate is easily translated into an annual survival estimate. With a fishing mortality rate of 1.4, only about 20% of all summer flounder that are alive now will be alive one year later. An annual survival estimate that corresponds to a fishing mortality rate of 2.1 is only 10%. The level that corresponds to the F_{max} rate is 65%. Obviously, gains in long term yield from the fishery and increases in stock size could be realized by significantly reducing fishing mortality from current levels.

5.3.8. Yield Per Recruit

Calculations of YPR, or yield per recruit (per unit weight of recruits) were made using the Thompson-Bell (Ricker 1975) method for each sex (USDC 1986). Mean weight at age was estimated using the growth rate information from NEFC spring and fall bottom trawl surveys from 1976-1983. Estimates of spawning biomass per recruit for females were made using maturity estimates of Morse (1981). A constant natural mortality rate of 0.2 was used for both sexes. For all calculations, it was assumed that age two fish are fully recruited to the fishery and that 25% of age 1 fish are recruited. Yield per recruit was maximized at F = 0.44 for male summer flounder ($F_{0.1} = 0.26$, where $F_{0.1}$ is the rate of fishing mortality for a given method of fishing at which the increase in yield per recruit for a small increase in fishing mortality results in only one-tenth the increase in yield per recruit for the same increase in fishing mortality from a virgin fishery) and F was maximized at 0.26 for females ($F_{0.1} = 0.16$). The decrease in yield per recruit as the instantaneous rate of fishing mortality increases, is much less for males (Figure 9) than it is for females (Figure 10).

Spawning stock biomass per recruit declined markedly with increasing fishing mortality on females (Figure 11). The spawning stock biomass per recruit concept allows egg production for the population to be directly linked with F. Egg production is highest without any F and can be increased by decreasing or delaying mortality. The spawning stock biomass per recruit consistently increases with increases in the minimum legal size limits at the $F_{0.1}$ level (Table 20). Both F and the minimum size change concurrently at both F_{max} and $F_{0.1}$ (Fogarty pers. comm.). Given the 1986 F estimate of 0.65, a minimum size limit of 13" would produce a YPR estimate for males of 0.82 lb and a 14" minimum size would yield a YPR of 0.87 lb. For females, with an F estimate of 0.65, the YPR estimates would be 1.10 lbs for a 13" minimum size and 1.16 lbs for a 14" minimum size. The corresponding spawning stock biomass per recruit estimates for females would be 2.66 lbs and 2.88 lbs for 13" and 14" minimum sizes, respectively (Fogarty pers. comm.). Preliminary evidence suggests that these values may change if a hooking mortality of 25% is associated with the recreational fishery (Section 9).

Various levels of spawning stock biomass are being selected in other fisheries as targets for overfishing definitions. Examination of Figure 11 indicates that with spawning stock biomass maximized at 3.5, the minimum spawning stock biomass levels of 20%, 30% and 40% would correspond roughly with F levels of 0.35, 0.25 and 0.20 respectively. Interestingly, YPR is maximized at an F of 0.35 which corresponds to the 20% spawning stock biomass level. Current levels of F (1.0) would correspond to a spawning stock biomass level of about 7% (Figure 11). If the true current F levels are as high as some are speculating (that is, 2.0 +), then the current spawning stock biomass levels would be only 2 - 3% of the maximum level.

Estimates of F_{max} for males and females presented in USDC (1986) were generally consistent with the ranges specified in Fogarty (1981) in a sensitivity analysis for summer flounder based on a more restricted set of growth data. Fogarty (pers. comm.) evaluated yield per recruit for summer flounder with various minimum legal size limits (Table 21). The optimal levels (as defined in Gulland and Boerema (1973) (as occurring when the value of the marginal yield is equal to the marginal costs of a unit of effort) of fishing mortality ($F_{0.1}$) are

considerably lower for females than for males. At a minimum size of 14" the $F_{0.1}$, or optimal level of fishing, for females is 0.16 (Fogarty pers. comm.).

5.3.9. Predator/Prey and Species Coexistence

Summer flounder are active, voracious feeders with fish making up a very significant part of their diet. They are most active during daylight hours and may be found well up in the water column as well as on the bottom (Olla *et al.* 1972). Included in their diet are: winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, Atlantic silverside, American sand lance, bluefish, weakfish, mummichog, rock crabs, squids, shrimps, small bivalve molluscs, small crustaceans and snails, marine worms and sand dollars (Bigelow and Schroeder 1953 and Poole 1964).

All of the natural predators of adult summer flounder are not fully documented, but larger predators such as large sharks, rays, and goosefish probably include summer flounder in their diets. Larval and juvenile summer flounder undoubtedly are preyed upon until they grow large enough to fend for themselves. Results of food habit studies by NMFS from 1969-72 showed that Pleuronectiformes occurred in the stomachs of the following fish eating species: spiny dogfish, goosefish, cod, silver hake, red hake, spotted hake, sea raven, longhorn sculpin, and fourspot flounder (Bowman *et al.* 1976). These data do not indicate the proportion of summer flounder among the flat fish prey but it is likely they are represented.

A brief review of dealer sales slips for New England and New Jersey by Henderson (1979) showed that summer flounder catches also included mixed groundfish, winter flounder, *Loligo*, scup, black sea bass, conchs, tilefish, and witch flounder. Similarly, the major species in the catch from the Virginia winter trawl fishery for the years 1929-59 were: summer flounder, black sea bass, scup, and croaker (Eldridge 1962).

The composition and distribution of fish assemblages in the Middle Atlantic Bight was described by Colvocoresses and Musick (1979) by subjecting NMFS bottom trawl survey data to the statistical technique of cluster analyses. Summer flounder, scup, northern sea robin, and black sea bass, all warm temperate species, were regularly classified in the same group during spring and fall. In the spring this group was distributed in the warmer waters on the southern shelf and along the shelf break at depths of approximately 500 ft. During the fall this group was distributed primarily on the inner shelf at depths of less than 200 ft where they were often joined by smooth dogfish.

The ecological relationship between juvenile summer flounder and southern flounder was studied by Powell and Schwartz (1977) in North Carolina estuaries. The spatial distribution of the two species relative to each other appeared to be related to the salinity gradient. Southern flounder were dominant at low salinities (less than 11 ppm) while summer flounder were dominant at intermediate to high salinities (12-35 ppm). In a study of meroplankton in North Carolina estuaries, Williams and Deubler (1968) found that the distribution of gulf flounder was also controlled by salinity to some degree, finding the species only in salinities ranging from 22-35 ppm. Benthic substrate also appeared to influence summer flounder and southern flounder distributions. Summer flounder were dominant in sandy substrates while southern flounder were dominant in muddy substrates (Powell and Schwartz 1977).

5.3.10. Parasites, Diseases, Injuries, and Abnormalities

The parasites of the summer flounder have not been studied extensively (MacPhee, 1975), but Wilson (1932) mentions that they are afflicted with the fish lice *Argulus laticauda* and *Argulus megalops* and the copepods *Acanthocandrea galerita* (Rathbun) and *Lepioptheirus edwardsi*.

Mahoney *et al.* (1973) described a fin rot disease which affected summer flounder in the New York Bight. External signs of the disease were fin necrosis, skin hemorrhages, skin ulcer, and occasional blindness. In summer flounder necrosis usually began on dorsal and anal fins. The agent of the disease was apparently bacterial. Summer flounder in captivity also suffer from vibriosis, occurring when they are exposed to stressful conditions such as high temperatures, overcrowding, and dirty water (MacPhee 1975).

Abnormalities in summer flounder include incomplete ambicoloration, total ambicoloration, incomplete eye rotation, and hooked dorsal fin (Hussakof 1914; Gudger 1935 and 1936; Pearson 1932; Deubler and Fahy 1958; White and Hoss 1964; and Powell and Schwartz 1972).

5.4. MAXIMUM SUSTAINABLE YIELD

There are no generally accepted, current, numeric estimates of maximum sustainable yield (MSY) for summer flounder. According to the Magnuson Act the contents of FMPs are to include estimates of MSY [section 303(a)(3)]. The MSY is defined as the largest average annual catch or yield that can be taken over a significant

period of time from each stock under prevailing ecological and environmental conditions. Usually MSY is perceived as a numeric point estimate. However, where knowledge of the characteristics of the stock do not exist, or where inadequate sampling and/or analysis has been performed to allow the derivation of an estimate, or the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, or where frequent large scale fluctuations in stock size make this concept of limited value, an estimate of MSY should not be fabricated but should be based on the best scientific information available. National Standard 2 of the Magnuson Act states: "Conservation and management measures shall be based upon the best scientific information available."

An MSY estimate based on stock size estimates for summer flounder north of Cape Hatteras was calculated by Chang and Pacheco (1975). This estimate does not seem appropriate for this FMP mainly because of the numerous weaknesses in the data: (1) the lack of good effort data in the recreational surveys prior to 1979, (2) the lack of complete identification of summer flounder in some of the commercial catch for some States until as recently as 1978, (3) the availability of the NMFS spring bottom trawl survey only since 1968, (4) the very restricted age composition data that were available, (5) the summer flounder fishery was not considered in steady state or equilibrium condition, and (6) the current general belief that summer flounder abundance was very low during 1967 through 1974 which was the period for analyses. Chang and Pacheco (1975) were aware of the many difficulties and labeled their analysis "preliminary". This numeric estimate was not used in the ASMFC (Scarlett, 1981) summer flounder FMP where it was stated: "At the present time, adequate information is not available to determine stock size."

Several of the reasons for not fully supporting the 20,000 mt MSY estimate (Chang and Pacheco 1975) developed more than a decade ago were addressed in the original FMP. Chang and Pacheco (1975) fully recognized these limitations to their data because in their discussion section they recommended: "Better information of effort and age characteristics from both commercial and recreational landings is needed".

Although no attempts are being made here to totally dismiss the general concept of MSY, it was believed at the time of the original FMP that there was no merit in embracing the only published numeric estimate of MSY (Chang and Pacheco, 1975). Methodologically, Chang and Pacheco (1975) used a valid stock assessment approach and used the only data available to them. However, with the data that will be developed from some of the efforts currently underway, a more robust methodology, such as virtual population analysis, will be possible. Although better commercial landings data, extensive annual recreational catch data, and a longer series of NEFC bottom trawl surveys are now available for the detection of year class strength, a major new assessment analyses is not expected to be completed until 1992.

While the original summer flounder FMP did not use the MSY of Chang and Pacheco (1975) and the NEFC cannot support that specific numeric estimate, mainly because the fishery and the populations were not in equilibrium when the estimates were developed (Anthony pers. comm.), it is possible the MSY estimate is not in gross error. Over the past two decades (1970-1989) commercial landings have averaged 27.3 million lbs (Table 1). The recreational catch during the past decade has averaged 30.4 million lbs (Table 3). If the mortality from the two fisheries had been restricted to the 44 million lb (20,000 mt) MSY estimate, certainly the stock would not be in as extensive of an overfished condition as it is today. With the current condition of the stock, the management measures that are being proposed (Section 9) would restrict mortality to levels that are very close to the Chang and Pacheco estimate.

A Working Group (Long Term Potential) of the SAW explored the differences and similarities between the MSY concept which is required by the Act and what the NEFC labels "long term potential catch" (LTPC) in their *Status of the Fishery Resources* (USDC 1989a). The Working Group concluded that "LTPC can be used interchangeably with MSY for FMP purposes" (USDC 1989c). The problem, of course, is that the LTPC as defined by NEFC for summer flounder is also "unknown" (USDC 1989c).

Because of the problems in the fishery (section 4.2), the Council has concluded that management of the summer flounder fishery must be considered as soon as possible. Since no numeric estimate of MSY currently exists, the Council will proceed without an estimate of MSY and will reexamine this issue and amend the FMP when reasonable estimates of MSY are provided.

5.5. PROBABLE FUTURE CONDITION

In a very general, simplistic sense the future condition of a stock is dependent upon the recruitment, growth, natural mortality and fishing mortality that the current stock is undergoing. The following paragraphs will summarize the germane parameters from the above discussion and project where the future stocks will be in relation to the current fishery.

Commercial landings in 1989 plummeted to only 21 million lbs, which are the lowest in the past 15 years (Table 1). Total US commercial landings of summer flounder from North Carolina and north peaked in 1979 at nearly 42 million lbs, and thus, the 1989 landings were only one-half of what they were one decade earlier. Landings for 1990 appear to be even worse; only 29% as many pounds were landed during the first quarter of 1990 as were landed in 1989. Coastwide average price for the first quarter of 1989 was $1.38/pound, whereas in 1990 the average had risen to $1.94/pound, partially offsetting the reduced landings. Since 1980, 71% of the reported commercial landings of summer flounder have come from the EEZ (Table 2).

Estimated recreational catch of summer flounder in 1989 was 5.0 million lbs (Table 3), which is the lowest estimate of the entire time series. Estimated recreational catch derived from MRFSS has averaged over 30 million pounds and has ranged from 5.0 to 54.5 million lbs. No consistent annual pattern is discernible, but the plummet experienced in 1989 is alarming.

Bottom trawl surveys conducted by NMFS during the spring are used to provide indices of abundance. Stratified mean catch per tow was low during the late 1960s and early 1970s, increased during the mid 1970s and then maintained a fairly high level throughout the 1980s until 1989 when the index plummeted. (Table 4). If the trawl door changes that occurred in 1985 actually made the gear more efficient at catching summer flounder, the indices may be skewed high since 1985, and the stock may be in worse shape than believed based on the survey indices.

Catch per effort for tonnage class 2 vessels ranged from a low of 0.44 in 1970 to a high of 1.20 in 1974. The CPUE remained relatively constant from 1977 through 1982, increased slightly in 1983 and 1984, and then declined to its lowest level since 1972 in 1985 (Table 6). The CPUE from recent years is showing a poor correspondence with the NEFC survey index.

Estimates of catch at age for commercial landings were available for 1976 through 1983 (Table 16). Ages 1 through 4 comprised 94% of the landings, with ages 2 and 3 predominating. During 1980 through 1983, the contributions of age 3 and 4 fish declined from 49% to 28%, while the proportions of age 1 and 2 fish increased from 46% to 66%. It is likely the situation is even worse, in that the age groups may be more compressed, than thought (based on the 1986 assessment) if the 1990 Summer Flounder Ageing Workshop preliminarily results are correct and the ageing convention has been in error. If scales have been miss-aged and a 1 year old is really an age 0 fish, then all age classes in the catch may be actually one year younger.

Female summer flounder grow more quickly than their male counterparts and are consistently larger than males at any given age except for the first few months after hatching. Recent estimates of parameters of the von Bertalanffy growth equation yield maximum size of male and female summer flounder as 26 and 33 inches respectively. No significant difference from a 1:1 sex ratio was found by Morse (1981) in his examination of 4551 summer flounder greater than 8" (Table 15). The length at which 50% of the fish are mature (L_{50}) was estimated as 9.7" for males and 12.7" for females (Table 16). Fecundity of summer flounder is relatively high with some estimates exceeding 4 million eggs.

Chang and Pacheco (1975) developed a stock recruitment relationship which they used for their derivation of an MSY estimate. Although the original FMP did not endorse the numeric MSY, much of the background information may be valid and will be more fully explored during the development of the analytic assessment that is scheduled for completion in the next two years.

The reproductive strategy of summer flounder tends to maximize reproductive potential and avoid catastrophe. The strategy is a combination of extended spawning season with variable duration, early maturation (age 1 to 2), high fecundity, serial spawning, and extensive migrations across the continental shelf during spawning. The half year spawning season reduces larval crowding and decreases the impact of predators and adverse environmental conditions on egg and larval survival. The migration pattern disperses the eggs over large areas of the shelf and probably aids in maintaining spawning fish in areas where bottom temperatures are ideal. The timing of peak spawning assures a high probability of adequate larval food supplies.

Knowledge of mortality is essential for management of most fisheries. Assuming an instantaneous rate of natural mortality of 0.2, current levels of the instantaneous rate of fishing mortality are on the order of 1.0 or higher.

Yield per recruit is maximized at $F = 0.44$ for male summer flounder ($F_{0.1} = 0.26$) and $F = 0.26$ for females ($F_{0.1} = 0.16$). The optimal levels of fishing mortality ($F_{0.1}$) are considerably less for females than for males. Spawning biomass per recruit declines markedly with increasing fishing mortality on females (Figure 11). An Fmax level (0.35) of fishing corresponds to a spawning stock biomass level of 20%. Maximum spawning stock biomass levels of 30% and 40% would correspond roughly with F levels of 0.25 and 0.20. Current levels of F

(1.0) would be equivalent to a spawning stock biomass level of about 7% of the maximum. If the true current F levels are as high as some people are speculating (2.0+), then the spawning stock biomass levels would be only 2 - 3% of the maximum level.

Analyses indicate that yield per recruit and long term yield can be increased significantly by increasing the minimum size of fish caught and reducing fishing mortality.

In summary, summer flounder are characterized by apparent large natural fluctuations in year class strength. The complete causes of these fluctuations are uncertain, but probably to a large part are environmentally determined. Recruitment is highly variable. Long term trends in abundance and recruitment of summer flounder were derived from several local and coastwide surveys at the October 1990 workshop. In general, these indices indicated that summer flounder were approximately 5 times more abundant in the mid to late 1970's than in the late 1980's. These surveys also indicated that the 1988 year class was poor and the 1989 and 1990 year classes "no better than average". In addition, the coastwide NEFC survey did not collect any summer flounder older than age 3 in the 1990 survey, although a decade ago summer flounder as old as 10 years were collected. Harvesting of summer flounder, during the decade prior to 1989 was at or near the all time high, with more and more effort directed at this species annually (Section 7). The age composition of the catch is becoming greatly compressed around very young fish. Without question, yield per recruit and long term yield can be increased significantly. Increasing the minimum size of fish caught and reducing fishing mortality would provide some stability to the fishery by insuring more than one or two year classes in the catch. This fishery is greatly overfished and in urgent need of significant management now. Attempts to reduce the F to an F_{max} level as soon as possible are necessary. Even if good recruitment does occur, management must reduce the F significantly in order to extend the number of age classes in the fishery and thus reduce the risk of fishery collapse in the future.

6. DESCRIPTION OF HABITAT

6.1. DISTRIBUTION OF THE SPECIES, HABITAT REQUIREMENTS, AND HABITAT OF SUMMER FLOUNDER

6.1.1. Distribution of the Species and Habitat Requirements

Summer flounder range from the Gulf of Maine to Florida with the greatest concentration of fish south of Cape Cod (section 5.1). Morphometric and meristic characteristics of summer flounder suggest at least two distinct populations (Wilk *et al.* 1980 and Fogarty *et al.* 1983). The Middle Atlantic Bight population (it is possible there may be subpopulations within this population) includes fish found between Cape Cod and Cape Hatteras generally, whereas the South Atlantic Bight population consists of fish south of Cape Hatteras.

Summer flounder migrate seasonally, though their movement is often not extensive relative to more migratory species such as bluefish and swordfish. Adults migrate during late fall and winter months from their summer grounds close along ocean beaches and estuaries. They remain in shelf waters (Bigelow and Schroeder 1953), primarily on the wintering grounds located between Norfolk and Veatch Canyons east of Virginia and Rhode Island, respectively, although they are known to migrate as far northeast as Georges Bank. The southern population is believed to undertake less extensive offshore migrations (Fogarty *et al.* 1983). Tagging studies reveal that some adult fish migrate little and remain permanent residents in the northern segment of the Mid-Atlantic Bight (Lux and Nichy 1980), as well as possible year round residents in Delaware Bay (Smith and Daiber 1977). Tagging studies currently being conducted in Virginia (Desfosse *et al.* 1988) preliminarily indicate the contention of two subpopulations of summer flounder in Virginia inshore waters.

Adult summer flounder return inshore to coastal waters in April through June. In Delaware Bay, the greatest number of fish were captured from the shoreline to a maximum depth of 75 feet from May through September (Smith and Daiber 1977). Optimal habitat areas are shallow coastal waters having salinities higher than 28%, sandy bottoms, especially near inlets, and locations having fast flowing current or wave action (Powell and Schwartz 1977). Tagging studies conducted by Poole (1962) and Lux and Nichy (1980) on summer flounder released off Long Island and southern New England revealed that fish usually began seaward migrations in September and October. Recaptures demonstrated that adults migrated as far as 140 miles eastward to Veatch Canyon and 210 miles southward to the Baltimore Canyon area.

Spawning habitat occurs over the entire shelf between Cape Cod, Massachusetts, and Cape Lookout, North Carolina. Spawning begins in September in the northern most area and progresses through February south of Chesapeake Bay (Smith 1973). Optimal spawning areas have bottom water temperatures between 53 and 66° F. There is no evidence that salinity has any effect on spawning or distribution on eggs Based upon the sampling of eggs, Smith (1973) concluded that spawning peaked in October north of Chesapeake Bay and in

November south of the Bay. The great majority of eggs were taken over depths ranging from 60 to 100 feet (Smith 1973).

Spawning peaks in fall but extends from September through February (Able *et al.* 1990). While eggs and larval stages are found only at sea, juveniles are found only in or near the mouths of estuaries, indicating that the young are estuarine dependent. Summer flounder larvae enter estuarine areas soon after hatching, generally from February through April. Peak immigration periods of summer flounder larvae through Beaufort Inlet and into North Carolina estuaries were from late February through March for the years 1986 - 1988 (Monaghan pers. comm.). Estuaries along the Virginia and North Carolina coastline are believed to be principal nursery habitat for young of year flounder. Orth and Heck (1980) determined that post larvae utilize eel grass (Zostera) beds of the lower Chesapeake Bay as principal habitat areas. Juvenile flounder were found to concentrate in sea grass beds during late summer and fall, whereas earlier in the year the fish were more randomly dispersed in the bays (Weinstein and Brooks 1983). Post larval summer flounder, collected in North Carolina estuaries, have been found in waters ranging in salinities from 0.02 to 35‰, with optimal conditions at 18‰ (Williams and Deubler 1968). Norcross and Wyanski (1988) presented evidence that juvenile summer flounder require shallow, mud bottom habitats during their first months of life. These nursery areas often are found adjacent to, and within, salt marshes. In estuaries north of Chesapeake Bay, juveniles remain in their estuarine habitat for about 10 to 12 months before migrating offshore their second fall and winter. In North Carolina sounds, they often remain for 18 to 20 months.

6.1.2. Habitats of Summer Flounder

Open ocean areas of the continental shelf that are used for summer flounder spawning (Figure 1) are critical for the survival of this species. Estuaries and inshore oceanic water habitats are also critically important to the life cycle of summer flounder. These areas are also utilized for summer feeding by summer flounder adults and as nurseries by juveniles. Major alterations to the habitat could be disruptive to the species' life cycle.

Summer flounder larvae begin development at sea, then are moved into estuaries by wind and currents because the larvae are pelagic (Williams and Deubler 1968). Spawning success and, therefore, recruitment, is often determined during the larval and early juvenile stages, and these life stages are greatly impacted by the prevailing environmental conditions. Poole (1966) stated that published and unpublished reports indicate primary nursery grounds for juveniles are the sounds of North Carolina, Chesapeake Bay, and the bays of the eastern shore of Virginia; however, juveniles are distributed in spring, summer, and fall in estuaries from Massachusetts to North Carolina. Early juvenile stages of summer flounder have been captured only in estuaries, suggesting estuarine dependence. Their tolerance to wide ranging temperatures (36 - 72° F) and salinities (0.02 - 35‰) further suggests that they are physiologically adapted to estuarine nursery grounds (Smith 1973).

The Council, attempting to coordinate and obtain the best information available, requested each State from North Carolina to Maine to identify the essential summer flounder habitat under their jurisdiction. The following paragraphs are paraphrased from the responses of the States' summer flounder experts.

Summer flounder habitats vary with life stage; the most important habitats are the spawning areas on the continental shelf for summer flounder (Figure 1). The coastal areas that also serve as nursery and feeding areas for summer flounder are essential to their survival. Migratory pathways are recognized as important habitat because of the range of environmental conditions and contaminants to which summer flounder are exposed.

Important habitat in North Carolina for summer flounder was identified by Monaghan (pers. comm.), who agreed with the studies of Powell and Schwartz (1977). They found that small juvenile summer flounder were most abundant in the relatively high salinities in the eastern and central parts of Pamlico Sound, all of Croatan Sound, and around inlets. Powell and Schwartz (1977) also noted that small juvenile summer flounder were most abundant in areas with a predominantly sandy substrate, or where there was a transition from fine sand to silt and clay. Street (pers. comm.) mentioned that summer flounder distribution varied in response to salinity changes. In dry years the area of higher salinity greatly expands in Pamlico Sound, and nursery areas similarly expand. Certainly, substrate and salinity preferences are valuable as this species grows.

The most important nursery areas for summer flounder in Virginia appear to be in the lagoon system behind the barrier islands on the seaside of the Eastern Shore, and the shoal water flat areas of higher salinity (greater than 18 ppm) in lower Chesapeake Bay (Musick pers. comm.). Young of the year enter these nursery areas in early spring (March and April) and remain there until fall when water temperatures drop. Then these yearlings move into the deeper channel areas and down to the lower Bay and coastal areas. In most winters these

age 1 + fish migrate out in the ocean but in warmer years some may remain in deep water in lower Chesapeake Bay (Musick pers. comm.). In addition to the use of Virginia habitats by summer flounder for nursery areas, subadults and adult flounder use the Eastern Shore seaside lagoons and inlets and the lower Chesapeake Bay as summer feeding areas. These fish usually concentrate in shallow warm water at the upper reaches of the channels and larger tidal creeks on the Eastern Shore in April, then move toward the inlets as spring and summer progress. They are most abundant in the ocean near inlets by July and August. In Chesapeake Bay, the summer flounder first arrive in numbers in mid-April then remain in the Bay till late September or early October (Musick per. comm.).

Virginia's Artificial Reef Program provides additional suitable habitat for summer flounder, with four Atlantic Ocean reef sites and three Chesapeake Bay reef sites. Reef materials include discarded vessels, automobile tires, and fabricated concrete structures. Colonization of reef materials by encrusting marine and estuarine life forms provides food and shelter for many finfish species. Summer flounder were taken in fair abundance (Travelstead pers. comm.).

Maryland's coastal bays, rich in benthic invertebrates which form the bulk of young of year food sources, are excellent summer flounder habitat (Casey, pers. comm.). Casey (pers. comm.) indicated that in areas where notable pollution exists, a lack of proper food sources preclude the presence of summer flounder. Areas which lack sufficient water circulation appear to have considerably reduced populations. Shoreside development and resultant runoff also appear to have reduced some local populations (Casey, pers. comm.). Since the early 1970s, Maryland has been conducting trawl and seine surveys around Ocean City inlet. Casey (pers. comm.) reports that over the past few years, however, sharp declines in young of year flounder have been noted in coastal bay trawl samples. The majority of the summer flounder taken in this sampling are between 3" and 4", with larger fish basically absent. Summer flounder are sometimes found in Maryland's portion of the Chesapeake Bay with the majority of these fish in the 8" to 12" range.

Delaware Bay is an important nursery and summering area for both juvenile and adult summer flounder (R. Smith pers. comm.). Post larvae find their way into Delaware's waters during early spring, they remain and grow, some throughout the warm months, some even into their second year. Juvenile summer flounder (ages 1 and 2) have been captured in Delaware Bay during all months of the year, however they are most common from April to November, as are the adults (R. Smith pers. comm.). Delaware's coastal bays are used by summer flounder as nursery and summering areas, but their overall importance is not well documented. Young of year flounder are often found in shallow near shore areas, and thus, shoreline development potentially could have negative impacts.

The total contribution of New Jersey's estuaries from Sandy Hook Bay to Delaware Bay as nursery areas cannot presently be quantified, but these estuaries provide viable nursery habitat during most years (Freeman pers. comm.). Tagging studies by Murawski (1970) provided recaptured summer flounder from the entire New Jersey coastline (Figure 12). Summer flounder overwinter offshore of New Jersey in 100 to 600 ft of water. Freeman (pers. comm.) therefore states that all of the ocean waters off New Jersey to the 600 foot line should be considered essential habitat for migratory pathways, spawning, and overwintering.

The intertidal areas and shallow bays of the south shore of Long Island are of unknown importance to young of year summer flounder. Young of year under 3" are found in beach seines in low numbers every year (striped bass survey on the Hudson River and around Long Island). Commercial trawlers have collected samples of yearling summer flounder in the inner New York bight during January and February, supporting the offshore juvenile hypothesis of Able (Castenada pers. comm.). Based on the recently revised ageing protocol, supported by the work of Able and others, it is yearling summer flounder which enter New York waters from early May through October. Long Island's coastal bays and the Hudson - Raritan estuary support major concentrations of fast growing juveniles, which in turn support a May through October intensive sport fishery. In most years more fish are released as undersized than kept, especially early in the season. With the exception of 1987 and 1988 young of year summer flounder from 8" to 12" are recruited to hooks in the sport fishery by August (Castenada pers. comm.). The sandy bottoms of the inshore and near shore waters of New York, particularly areas around inlets and bay mouths, are critical to juvenile (yearling) summer flounder. The importance of State waters to larval and young of year summer flounder is not known. It may be that the habitat critical to the early life states of summer flounder lies in the EEZ, particularly in the northern end of its range (Castenada pers. comm.).

Summer flounder migrate from offshore, overwintering grounds to inshore waters of Connecticut in late April and early May (E. Smith pers. comm.). Summer flounder are present in Long Island Sound throughout the April - November trawl survey period, and probably occur in limited numbers in winter as well (Simpson

pers. comm.). Peak abundance is from August to October. Summer flounder are ubiquitous in summer, occurring on all bottom types, in the deepest sites sampled by trawl (150 ft) as well as in water as shallow as three feet. Survey indices indicate a tendency toward shallow water (<30 ft). Salinity range appears to be at least to 15‰ and greater. The trawl survey usually takes 400 to 700 fish in 320 tows per year. In 1989, only 47 fish were taken (Simpson pers. comm.).

Adult and juvenile summer flounder have been observed within the full range of Narragansett Bay (Lynch pers. comm.). In addition the coastal waters of Rhode Island, the immediate waters surrounding Block Island, and the waters of Little Narragansett Bay, all provide critical habitat for these three species. Larval occurrence within Rhode Island waters have been documented for these species. Lynch (pers. comm.) concludes that all the territorial waters of the State of Rhode Island are critical to the various life stages of these three species.

Summer flounder in Massachusetts migrate inshore in early May to their spring and summer feeding grounds that consist of the entire shoal area south of Cape Cod and Buzzards Bay, Vineyard Sound, Nantucket Sound, and the coastal waters around Martha's Vineyard (Figure 13). In some years summer flounder are found along the eastern side of Cape Cod and as far north as Provincetown by early May. Summer feeding grounds also include the shoal waters in Cape Cod Bay (Howe pers. comm.). Massachusetts considers the shoal waters of Cape Cod Bay and the region east and south of Cape Cod, including all estuaries, bays, and harbors thereof, as critically important habitat (Howe pers. comm.). Summer flounder begin moving offshore in late September and October. Howe (pers. comm.) believes that spawning occurs within territorial waters south of Cape Cod because occasional ripe and running fish have been taken there (Figure 13). Summer flounder are regularly taken in southern Massachusetts waters as late as December, presumably as fish are dispersing to offshore wintering grounds. In most years the wintering grounds are well out on the continental shelf from approximately Veatch Canyon to Baltimore Canyon. The winter of 1985-86 was unusual with anomalous overwintering occurring near shore (Figure 13). Howe (pers. comm.) states that in years following a build up in the local adult summer flounder population (1974-76 and 1982-85), comparatively "strong" cohorts, represented by age 0+ flounder, have been captured in early summer in estuaries along the southern shore of Cape Cod and in Buzzards Bay. Thus local nursery grounds are recipients of young fish from a northern spawning. Massachusetts considers their coastal embayments as primary nursery grounds and of critical importance in augmenting the more traditional sources of recruits from the "offshore stock".

Summer flounder in New Hampshire are not abundant (Nelson pers. comm.). New Hampshire does consider various estuaries important as food sources for visiting adults.

In Maine, summer flounder is regarded as a straggler in the Gulf of Maine (Honey pers. comm.).

6.2. HABITAT CONDITION

Summer flounder are exposed to a full range of human activities during their life history. Assessments made by the Ocean Pulse and Northeast Monitoring Programs indicate extensive, detrimental amounts of toxic organic and inorganic contaminants, such as heavy metals, PCBs, and petroleum hydrocarbons in the various physical compartments of the marine ecosystem (Boehm and Hirtzer, 1982; Boehm, 1983; Pearce, 1979; Reid *et al.* 1982). This is particularly true for sediments in the Mid-Atlantic Bight that receive contaminated dredged materials, sewage sludge, and industrial wastes. Elevated levels of petroleum hydrocarbons have even been found in all estuaries as far north as Maine. Elevated PCB levels have been found in sediments and biota in Buzzards Bay, in the New York Bight apex, as well as other locations (Reid *et al.* 1982).

Most research on the toxicological effects of various contaminants in fish is recent and ongoing. Many anomalies probably have not been described or their magnitude documented. The Councils encourage fishermen to report or provide fish with tumorous type growths to: Dr. John C. Harshberger, Director, Registry of Tumors in Lower Animals, Smithsonian Institution, Museum of Natural History, Washington, DC 20560 (202-357-2647) or to Mr. Martin Newman, NMFS, Oxford Laboratory, Railroad Ave., Oxford, MD 21654 (301-226-5193).

Coastal areas are vitally important as feeding and nursery grounds for summer flounder. However, population shifts to coastal areas and associated industrial and municipal expansion have accelerated competition for use of the same habitats. It was projected (48 *FR* 53142-53147) that by 1990, 75% of the US population will live within 50 miles of the coastlines (including the Great Lakes). As a result, these habitats have been substantially reduced and continue to suffer the adverse effects of dredging, filling, coastal construction, energy development, pollution, waste disposal, and other human related activities. In the case of wetlands, from 1954 to 1978 there was an average annual loss of 104,000 acres which was a ten fold annual increase in

acreage lost between 1780 and 1954 (48 *FR* 53142 - 53147). The pressure on coastal and ocean habitats is nowhere greater than in the densely populated, industrialized Northeast. It is obvious that new systems are needed to conserve habitats and living marine resources, while facilitating the completion of necessary, compatible economic developments.

Toward this goal, NMFS issued its formal Habitat Conservation Policy in November 1983 (48 *FR* 53142-53147). The goal of the policy is: "to maintain or enhance the capability of the environment to ensure the survival of marine mammals and endangered species and to maintain fish and shellfish populations which are used, or are important to the survival and/or health of those used, by individuals and industries for both public and private benefits: jobs, recreation, safe and wholesome food and products". The Habitat Conservation Policy provided impetus to NMFS's Regional Action Plan (RAP) process which is to foster coordinated management and research responses to major habitat conservation issues and problems, and to develop better steps to address them in the future (USDC 1985).

The RAP process identified six water management units in the Northeast region (Figure 14). The boundaries of each water management unit (WMU) were established on the basis of the biogeographic consistency of the entire WMU and its distinctness from other WMUs. Each WMU is relatively consistent in its physical and chemical characteristics with normal latitudinal and seasonal variations in temperature, salinity, and nutrient content. The biota include both endemic and migratory species that exhibit normal seasonal fluctuations in species composition, individual population size, and geographic distribution. These six units are: Coastal Gulf of Maine, Gulf of Maine, Georges Bank West to Block Channel, Coastal Middle Atlantic, Middle Atlantic Shelf, and Offshelf (USDC 1985).

The Coastal Gulf of Maine WMU encompasses an area bounded seaward by the observable limits of coastal processes, including riverine and estuarine plumes, coastal upwelling and diurnal tidal fluxes. Geographically, the area is bounded on the northeast by the Canadian Border and on the southwest by Cape Cod. This zone is generally marked by steep terrain and bathymetry, joining at a rock bound coastline with numerous isles, embayments, pocket beaches, and relatively small estuaries. Circulation is generally to the southwest along Stellwagen Bank, and finally offshore at Cape Cod. The habitats are presently affected by ocean disposal and effluents from major urban areas, along with significant nonpoint source pollution associated with the various rivers. Continued pressure to fill already depleted marsh and shallow water areas occurs in most parts of the area (USDC 1985).

The Gulf of Maine is a partly enclosed sea of 55,000 square miles separated from the Atlantic Ocean by Browns and Georges Banks. It is an area of five major basins, floored with clays and gravelly silts, and broken by rocky outcroppings, numerous ledges and banks. The circulation is only generally understood: a seasonal clockwise gyre swings around the Gulf and joins the clockwise gyre on the northern edge of Georges Bank. Presently, threats to the area are from the coastal Gulf of Maine and from ships transiting the area (USDC 1985).

The Georges Bank West to Block Channel WMU includes Georges Bank, the Great South Channel, and Nantucket Shoals. These areas have similar habitats, biota and hydrographic regimes. Overall, this WMU is highly productive and heavy fishing pressure is exerted on its numerous fish and shellfish. It is threatened by OCS exploratory drilling and by nonpoint source pollution from atmospheric fallout, general circulation patterns, and marine transportation activities (USDC 1985).

The Coastal Middle Atlantic WMU encompasses a zone from Cape Cod southwest to Cape Hatteras. The area is characterized by a series of sounds, broad estuaries, large river basins and barrier islands. The predominantly sand bottom is characterized by a ridge and swale topography. The waters of the Coastal Middle Atlantic have a complex and seasonally dependent pattern of circulation. Seasonally varying winds and irregularities in the coastline result in the formation of a complex system of local eddies and gyres. Currents tend to be strongest during the peak river discharge period in late spring and during periods of highest winds in the winter. In late summer, when winds are light and estuarine discharge is minimal, currents tend to be sluggish, and the water column is generally stratified. The Coastal Middle Atlantic provides major habitats for anadromous, estuarine, and endemic species. Migratory species play a major role in this WMU, and make up the predominant stocks in various seasons. Estuaries provide major spawning and nursery areas for many of the endemic and migratory species. These species are presently affected by nonpoint and point sources of pollution from major rivers and urban areas, as well as by direct loss of habitat caused by filling of wetlands, damming and diversion of rivers, and mosquito ditching in marshes (USDC 1985).

The Middle Atlantic Shelf WMU covers the area from the Block Island Front southward to Cape Hatteras. The inshore boundary follows the observable limits of coastal processes, primarily estuarine plumes, and lies ap-

proximately 30 miles from the coast. This WMU generally is characterized as a sandy plain, with a ridge and swale topography. Numerous submarine canyons intersect this area. The surface circulation over the shelf can be divided into a two celled system, separated at the Hudson Valley. The subsurface and bottom circulation tends to flow in a westerly-southwesterly direction that varies with the passage of weather systems and offshore warm core rings. Hydrographic conditions vary seasonally from vernal freshening and warming, through summer stratification, to fall/winter breakdown and cooling. This WMU has a different faunal composition than the Gulf of Maine or Georges Bank. Fish populations are predominantly migratory, and species composition varies with season. It is threatened by OCS exploratory drilling; by nonpoint source pollution from atmospheric fallout, general circulation patterns, and marine transportation activities; and by ocean disposal of sewage sludge and industrial wastes (USDC 1985).

The Offshelf WMU encompasses the zone defined by the mean observable limits of the shelf-slope front seaward to the mean axis of the Gulf Stream. The area is overlain by the Slope Water Regime, a mass of relatively warm saline water having a generally weak circulation to the southwest. The upwelling area along the inner boundary of the shelf-slope front is high in productivity and rich in commercially valuable fish and shellfish. Offshore, the Gulf Stream undulates as it moves to the northeast, forming a dynamic boundary from which warm core rings are borne. These rings spawned at a rate of about eight per year, are about 50 to 100 miles in diameter; they break off east of the area and transit to the southwest, eventually coming in contact with the shelf at southwestern Georges Bank. The passage of each ring marks a major event in the hydrographic regime and may significantly affect the biota of the shelf-slope front and possibly of the shelf itself. Other than ring passages, impacts on the offshelf waters are primarily from nonpoint source pollution from atmospheric fall out, marine transportation, and from point source pollution from dumping at deep water dump site 106 and ocean incineration (USDC 1985).

Each of the oceanic areas identified in Section 6.1 as important for summer flounder is subject to numerous man caused habitat threats. Rather than spend extensive efforts detailing degradation in individual oceanic systems (an effort generally already being performed by the individual States), this section will broadly address the major types of abuse (i.e., agricultural, urbanization, and industrialization) dominant in the largest, most important areas (i.e., Chesapeake Bay, Hudson River/Long Island Sound, and the New England coast).

Extensive urban development along the western shore of the Chesapeake has resulted in human population and industrial growth at the expense of the natural environment. The Baltimore - Washington - Norfolk corridor is a major demographic region where numerous commercial and industrial activities are centered. These activities have adversely affected the environment through habitat modification and destruction, and the introduction of contaminants in point and nonpoint source discharges. The eastern shore of the Bay is primarily agricultural and residential. Uncontrolled agricultural and suburban runoff, however, also introduces significant quantities of sediments, trace metals, and chemicals that degrade water quality.

The Hudson River/Long Island Sound area is heavily urbanized and in parts industrialized or supportive of large scale agriculture. The middle and upper Hudson River valley and eastern Long Island support extensive agricultural areas and large populations with the associated habitat abuses. The lower portion of the Hudson River area, northern New Jersey, and western Long Island are inhabited by the greatest concentration of people anywhere in the US as well as supporting extensive utility, petro-chemical, and other heavy industry.

The New England coast, since heavily developed, has some of all three major types of abuse. However, the areas are generally localized (i.e., an individual power generating station or urbanized center) and since the estuaries are only used on a limited basis, the abuses do not seem as detrimental as those in the previously mentioned systems.

In summary, the most concise synopsis of the health of the Nation's marine environments can be viewed as that presented in the findings of the Congressional Office of Technology Assessment report (1987):

> "Estuaries and coastal waters around the country receive the vast majority of pollutants introduced into marine environments. As a result, many of these waters have exhibited a variety of adverse impacts, and their overall health is declining or threatened.
>
> "In the absence of additional measures, new or continued degradation will occur in many estuaries and some coastal waters around the country during the next few decades (even in some areas that exhibited improvements in the past).
>
> "In contrast, the health of the open ocean generally appears to be better than that of the estuaries and coastal waters. Relatively few impacts from waste disposal in the open ocean have been documented, in part because relatively little waste disposal has taken place there

and because wastes disposed of there usually are extensively dispersed and diluted. Uncertainty exists, however, about the ability to discern impacts in the open ocean."

6.3. GENERAL CAUSES OF POLLUTION AND HABITAT DEGRADATION

6.3.1. General Habitat Degradation Threats

The Council, in efforts to coordinate with NMFS, has adopted the NMFS Regional Action Plan (USDC 1985) identified environmental threats as potential issues that may affect the summer flounder habitat.

Estuarine and coastal lands and waters are used for many purposes that often result in conflicts for space and resources. Some uses may result in the absolute loss or long term degradation of the general aquatic environment or specific aquatic habitats, and pose theoretically significant, but as yet unquantified, threats to the biota and their associated habitats. Issues arising from these activities, and the perceived threats associated with them, are of serious concern to the public.

Multiple use issues are constantly changing, as are the real or perceived impacts of certain activities on living marine resources. The coastal and oceanic activities that generate these issues can threaten living marine resources and their habitats. Threats to resources occur when human activities cause changes in physical habitat, water and sediment chemistry, and structure and function of biological communities.

The Coastal Middle Atlantic and Coastal Gulf of Maine WMU share similar activities that threaten habitats and the well being of living marine resources in estuarine and near shore areas (USDC 1985). Likewise, the Gulf of Maine, Georges Bank, Middle Atlantic Shelf and Offshore WMUs share similar activities that threaten the welfare of biota and habitats in offshore areas.

The following discussion identifies and describes each multiple use issue and the potential threats associated with that issue (USDC 1985). For the purposes of this discussion, an "issue" is a point of debate or controversy evolving from any human activity, or group of activities, that results in an effect, product, or consequence. Environmental and socio-economic issues remaining to be resolved satisfactorily with regard to their impacts on marine organisms, their habitats, and man developed from the multiple, often conflicting uses of coastal lands and waters.

6.3.1.1. Waste Disposal and Ocean Dumping

The Atlantic Ocean off the northeastern United States has been and continues to be used for the disposal of wastes, including sewage sludge, dredged material, chemical wastes, cellar dirt, and radioactive material. Some waste treatment methods, such as chlorination, pose additional problems to aquatic species. Habitats and associated organisms have been degraded by long term ocean disposal, particularly of sewage wastes. Sewage pollution causes closure of shellfish beds,and occasionally, of public swimming areas. Additional research on the impacts of ocean disposal at deep water dump sites is urgently needed (USDC 1985). A very recent potentially serious problem is the at sea incineration of toxic wastes.

Ocean disposal of sewage sludge, industrial waste products, dredged material, and radioactive wastes degrades water quality and associated habitats. The deep water dump site is 106 miles offshore, and is in the heart of the summer flounder spawning area. Concentrations of heavy metals, pesticides, insecticides, petroleum products, and other toxics all contribute significantly to degradation of waters off the northeastern States. All of the contaminants are likely to have significant affects on the survivalibility and genetic fitness of eggs and larvae in the spawning area. Organic loading of estuarine and coastal waters is an emerging problem. Symptoms of elevated levels include excessive algae blooms, shifts in abundance of algal species, biological oxygen demand (BOD) increases in sediments of heavily affected sites, and anoxic events in coastal waters. Changes in biological components are a consequence of long term ocean disposal. Harmful human pathogens and parasites can be found in biota and sediments in the vicinity of ocean dump sites. In addition, shellfish harvesting grounds have been closed because of excessive concentrations of pathogenic and indicator species of bacteria.

Many of the above issues and concerns may also be germane to the dumping of fish and shellfish waste in the ocean. The closure of land based processing plants because of the plants inability to meet National Pollution Discharge Elimination System (NPDES) or State Pollution Discharge Elimination System (SPDES) effluent requirements encourages the attempts for at sea disposal. While fishery byproducts may be nutritive in value, problems of BOD increases, excessive algal blooms, and concentrations of pathogenic bacteria, may all be associated with ocean disposal of fisheries products. The onus of proof of no environmental harm must fall to the group that wants to use the ocean for disposal purposes.

The deeper waters of the offshore WMUs present a different set of problems, compared with shallower waters, with respect to oceanic currents, warm core rings, and other physical and chemical oceanographic processes. Furthermore, less is known and understood about deep water ecosystems than their shallow water counterparts. It is imperative that studies be undertaken to reveal the fate and role of contaminants in deep water ecosystems, and to refine information about the shelf ecosystem through which these materials may be transported (USDC 1985).

6.3.1.2. Coastal Urbanization

Tremendous development pressures exist throughout the coastal area of the Northeast Region. More than 2,000 permit applications are processed annually by the NMFS Northeast Region for commercial, industrial, and private marine construction proposals. The proposals range from generally innocuous, open pile structures, to objectionable fills that encroach into aquatic habitats, thereby eliminating their productive contribution to the marine ecosystem. The projects range from small scale recreational endeavors to large scale commercial ventures to revitalize urban waterfronts.

Associated with marine construction are a number of impacts which affect living marine resources directly, and indirectly through habitat loss or modification. Many of these projects are of sufficient scope to singly cause significant, long term or permanent impacts to aquatic biota and habitat; however, most are small scale causing minor losses or temporary disruptions to organisms and environment. The significance of small scale projects lies in the cumulative effects resulting from the large number of these activities.

Urban construction is not limited to the shore, but upland development, too, which can adversely impact aquatic areas. One of the major problems arising from urban development is the increase in nonpoint source contamination of estuarine and coastal waters. Highways, parking lots, and the reduction in terrestrial vegetation and fringe marshes facilitate runoff loaded with soil particles, fertilizers, biocides, heavy metals, grease and oil products, PCBs, and other material deleterious to aquatic biota and their habitats. Atmospheric emissions resulting from certain industrial processes contain sulphurous and nitrogenous compounds that contribute to acid precipitation, a growing source of concern in some fresh water sections of tidal streams. Nonpoint pollution is incorporated in water, sediments, and living marine resources. Although nonpoint sources of pollution do not usually cause acute problems, they can contribute to subtle changes and increases of contaminants in the environment (USDC 1985).

As residential, commercial, and industrial growth continues, the demand for potable, process, and cooling water, flow pattern disruption, waste water treatment and disposal, and electric power increases. As ground water resources become depleted or contaminated, greater demands are placed on surface water through dam and reservoir construction or some other method of freshwater diversion. The consumptive use of significant volumes of surface freshwater causes reduced river flow that can affect down stream salinity regimes as saline waters intrude further upstream.

Water that is not lost through consumptive uses is returned to the rivers or streams as point source waste water discharges. Although the waste water generally is treated, it still contains contaminants. Domestic waste water contains residual chlorine compounds, nutrients, suspended organic and inorganic compounds, trace metals and bacteria. Industrial discharges may contain many dissolved and suspended pollutants, including metals, toxic substances, halogenated hydrocarbons, petroleum products, nutrients, organics and heat.

Construction in and adjacent to waterways often results in elevated suspended solids emanating from the project area. The distance the turbidity plume moves from the point of origin is dependent upon tides, currents, nature of the substrate, scope of work, and preventive measures employed by the contractor.

Excessive turbidities can abrade sensitive epithelial tissues, clog gills, decrease egg buoyancy, reduce light penetration; thereby affecting photosynthesis of phytoplanktonic and submerged vegetation, and cause localized oxygen depression. Suspended sediments subsequently settle, which can destroy or degrade productive shellfish beds and nursery sites.

The effects of turbidity and siltation are generally, but not always, temporary and short term. Other construction activities can result in permanent loss or long term disruption of habitat. Dredging can degrade productive shallow water and destroy marsh habitat or resuspend pollutants, such as heavy metals, pesticides, herbicides, and other toxins. Concomitant with dredging is spoil disposal, which traditionally occurred on marshes or in open water. Shoreline stabilization can result in gross impacts, through filling of intertidal and sublittoral habitat; or cause subtle effects, resulting in the elimination of the ecotone between shore and water, or through the scouring of benthic habitat by reflective wave energy.

Sewage treatment effluent produces changes in biological components as a result of chlorination and increased contaminant loading. Sewage treatment plants constructed where the soils are highly saturated often allow suburban expansion in areas that would have otherwise remained undeveloped, thereby exacerbating already severe pollution problems in some areas.

Another aspect of urban development is nonpoint source pollution, which is caused by land based activities that result in materials being transported to aquatic areas. Certain pollutants (pathogens, phosphorus, sediments, heavy metals, and acid precipitation) from nonpoint sources are demonstrable problems in Atlantic coastal and estuarine waters (USDC 1985). Nonpoint source pollution appears to be a chronic threat that will affect the Northwest Atlantic Ocean in the upcoming decades.

Diversion of freshwater to other streams, reservoirs, industrial plants, power plants, and municipalities can change the salinity gradient downstream and displace spawning and nursery grounds. Patterns of estuarine circulation necessary for larval and plankton transport could be modified. Such changes can expand the range of estuarine diseases and predators associated with higher salinities that affect commercial shellfish.

Industrial waste water effluent is regulated by EPA through permits. While the NPDES provides for issuance of waste discharge permits as a means of identifying, defining, and where necessary, controlling virtually all point source discharges, the problems remain due to inadequate monitoring and enforcement. It is not possible presently to estimate the singular, combined, and synergistic effects on the ecosystem impacted by industrial (and domestic) waste water.

6.3.1.3. Energy Production and Transport

Energy production facilities are widespread along Atlantic coastal areas. Electric power is generated by various methods, including land based nuclear power plants, hydroelectric plants, fossil fuel stations, and possibly future offshore floating nuclear power plants. These facilities compete for space along the coastal zone; they require water for cooling and, in the case of coal fired plants, generate voluminous amounts of fly ash and sulfur dioxide, as well as electricity. In addition, hydroelectric plants, with their need for dams, substantially modify river courses and affect anadromous fish runs and/or restoration programs.

The impacts on the marine and estuarine environment resulting from the various types of power plants include water consumption, heated water and reverse thermal shock, entrainment and impingement of organisms, discharge of heavy metals and biocides in blow down water, destruction and elimination of habitat, and disposal of dredged materials and fly ash (USDC 1985).

The Outer Continental Shelf (OCS) exploratory and production drilling and transport may affect biota and their habitats through the deposition of drilling muds and cuttings. Oils spills resulting from well blowouts, pipeline breaks, and tanker accidents are of major concern. Seismic testing operations can interfere with fishing operations and damage or destroy fishing gear. In addition, exclusion areas around drilling rigs can result in conflicts between fishermen, both recreational and commercial, and the oil companies.

6.3.1.4. Port Development and Utilization

All ports require shoreside infrastructure, mooring facilities, and adequate channel depth. Ports compete fiercely for limited national and international markets and continually strive to upgrade their facilities. Dredging and dredged material disposal, filling of aquatic habitats to create fast land for port improvement or expansion, and degradation of water quality are the most serious perturbations arising from port development. All have well recognized implications to living marine resources and habitat.

6.3.1.5. Agricultural Development

Agricultural development can affect fisheries habitat directly through physical alteration and indirectly through chemical contamination. Fertilizers, herbicides, insecticides, and other chemicals are washed into the aquatic environment with the uncontrolled nonpoint source runoff draining agricultural lands. These chemicals can affect the growth of aquatic plants, which in turn affects fish, invertebrates, and the general ecological balance of the water body. Additionally, agricultural runoff transports animal wastes and sediments that can affect spawning areas, and generally degrade water quality and benthic substrate. Excessive uncontrolled or improper irrigation practices often exacerbate the contaminant flushing as well as deplete and contaminate ground water. One of the most serious consequences of erosional runoff is that the frequent dredging of navigational channels results in dredged material that requires disposal, often in areas important to living marine resources (USDC 1985).

6.3.1.6. Marine Mineral Extraction

Mining for sand, gravel, and shell stock in near shore coastal and estuarine waters can result in the loss of infaunal benthic organisms, modifications of substrate, changes in circulation patterns, and decreased dissolved oxygen concentrations at deeply excavated sites where flushing is minimal. Sand and gravel mining tends to result in suspended materials at the mining sites, and turbidity plumes may move several miles from individual sites. Mining also results in ranges in sediment type or sediment quality, often over areas measurable in square miles. Deep borrow pits created by mining may become seasonally or permanently anaerobic (USDC 1985).

6.3.1.7. Coastal and Wetland Use and Modification

Intense population pressures have adversely affected many estuarine and marine habitats along the Atlantic coast. Demand for land suitable for home sites, resorts, marinas, and industrial expansion has resulted in the loss or alteration of large areas of wetlands through dredging, filling, diking, ditching, upland construction, and shoreline modification.

As residential and commercial use of coastal lands increased, so does the recreational use of coastal waters. Marinas, public access landings, private piers, and boat ramps all vie for space. Boating requires navigational space, a place to berth for some boat owners, and boat yards for repair and storage.

As population densities increase in these areas, greater pressures are exerted to develop remaining lands, and the demand for nuisance insect control on adjacent undeveloped wetlands either through chemical or physical (i.e., ditching) methods, also intensifies.

In addition to residential and recreational development, other competing uses further contribute to the destruction or modification of wetland areas. Agricultural development can significantly affect wetlands. Common flood control measures in low lying coastal areas include dikes, ditches, and stream channelization. Wetland drainage is practiced to increase tillable land acreage. Wildlife management techniques that also destroy or modify wetland habitat include the construction of dredged ponds, low level impoundments, and muskrat ditches and dikes (USDC 1985).

The NMFS priorities on the multiple use issues and threats to living marine resources were identified in the RAP document (USDC 1985). Activities identified as high priority included urban and port development, ocean disposal, dams and agricultural practices. Medium priority activities included industrial waste discharges, domestic waste discharges, and OCS oil and gas development (Table 22).

6.4. PROGRAMS TO PROTECT, RESTORE, PRESERVE, AND ENHANCE THE HABITAT OF THE STOCKS FROM DESTRUCTION AND DEGRADATION

The MFCMA provides for the conservation and management of living marine resources (which by definition includes habitat), principally within the EEZ, although there is concern for management throughout the range of the resource. The MFCMA also requires that a comprehensive program of fishery research be conducted to determine the impact of pollution on marine resources and how wetland and estuarine degradation affects abundance and availability of fish.

The MFCMA established Regional Fishery Management Councils that have the responsibility to prepare fishery management plans which address habitat requirements, describe potential threats to that habitat, and recommend measures to conserve those habitats critical to the survival and continued optimal production of the managed species. The NMFS Habitat Conservation Policy (48 *FR* 53142 - 53147), specifically Implementation Strategy 3, established the basis for a partnership between NMFS and the Councils to assess habitat issues pertaining to individual manages species.

Other NMFS programs relative to habitat conservation are found in the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and the Anadromous Fish Conservation Act of 1965. The NMFS shares responsibilities with the FWS for conservation programs under these laws.

In addition to the above mentioned NMFS programs, other laws regulate activities in marine and estuarine waters and their shorelines. Section 10 of the River and Harbor Act of 1899 authorizes the Army Corps of Engineers (COE) to regulate all dredge and fill activities in navigable waters (to mean high water shoreline). Section 404 of the Clean Water Act of 1980 authorizes EPA to regulate the discharge of industrial and municipal wastes into waters and adjacent wetlands. EPA has delegated authority under Section 404 to the COE to administer all dredge and fill activities under one program. Section 401 of the Clean Water Act authorizes EPA, or delegated States with approved programs, to regulate the discharge of all industrial and municipal

wastes. The EPA and COE also share regulatory responsibilities under the Marine Protection, Research, and Sanctuaries Act of 1972.

All of the activities regulated by these programs have the potential to adversely affect living marine resources and their habitat. The NMFS, EPA, FWS, and State fish and wildlife agencies have been mandated to review these activities, assess the impact of the activities on resources within their jurisdiction, and comment on and make recommendation to ameliorate those impacts to regulatory agencies. Review and comment authority is provided by the Fish and Wildlife Coordination Act of 1934 (as amended 1958) and the National Environmental Policy Act of 1969. Consultative authority extends to all projects requiring federal permits or licenses, or that are implemented with federal funds.

Other legislation under which NMFS provides comments relative to potential impacts on living marine resources, their associated habitats, and the fisheries they support include, but are not limited to, the Coastal Zone Management Act of 1972; the Marine Protection, Research, and Sanctuaries Act of 1972; and the Endangered Species Act of 1973 (Section 7 consultation).

A more detailed discussion of the pertinent legislation affecting their protection, conservation, enhancement, and management of living marine resources and habitat can be found in the NMFS Habitat Conservation Policy (48 *FR* 53142-53147).

In addition, NMFS and the other Federal resource agencies are involved in other programs with the States (e.g., NMFS Saltonstall-Kennedy and Wallop-Breaux programs) that provide grants to conserve fish habitats and improve fisheries management.

Individual States also regulate wetlands, which complements Federal habitat conservation programs.

6.5. HABITAT PRESERVATION, PROTECTION AND RESTORATION RECOMMENDATIONS

Management of fisheries requires both control of fishing mortality (by the Councils) and preservation and restoration of habitat (by EPA and the Corps of Engineers). The Council intends to work closely with these other agencies for habitat preservation.

As stated in section 4, summer flounder are over exploited. Recognizing that the stock of summer flounder is in poor shape, it is worthwhile to stress habitat conservation for increasing the survivability of juveniles, as well as management actions to control fishing mortality, which will strengthen the use of the habitat information in meeting the MAFMC mandates that "irreversible or long term adverse effects on fishery resources and the marine environment are avoided".

Commercial landings of summer flounder fell significantly during the 1980s, from the 42 million pound high in 1979 (section 5.2). Landings for 1989 were only 21 million pounds. Numerous State survey indicators of summer flounder abundance showed extremely low abundance for 1988 (section 5.2). Fishing mortality rates are excessive (at least triple the F_{max} level) relative to desirable levels (section 4), but the loss of habitat is probably also a significant reason for the decline of summer flounder.

At present, both commercial and recreational catches of summer flounder are comprised primarily of ages 0-2 fish. Individuals of this species have previously been known to live up to 20 years, yet older, larger fish are now infrequent. Such age class compression poses great risk to recruitment because the older, more fecund spawning adults are being too rapidly removed from the population and nearly all of the new recruits are being spawned by individuals that only get to spawn once or twice before they are killed.

Summer flounder are highly dependent on estuarine habitats (section 6.1) for much of their prespawning life. It is precisely these habitats that are most vulnerable to anthropogenic impacts and loss. While fishing mortality may be the primary reason for these population declines, the essential habitat areas designated by the States (section 6.1.2) must be protected in order to allow summer flounder populations to rebuild and be maintained when fishing mortality is decreased.

In order to resolve the above problems and prevent overfishing, very significant reductions in fishing mortality will be required. The reductions in fishing mortality are needed to reduce the risk of stock failure. The Council has the ability to control the fishing mortality and reduce that component of risk through the Magnuson Act.

Equally important to reducing risk is the quality of the habitat. In this area the primary responsibility is that of EPA and the Corps of Engineers, since the Magnuson Act only allows the Council the right to comment on proposals. Spawning and nursery areas and migratory pathways must be protected and kept viable if the proposed stringent fishing regulations are to succeed. Successful fishery management requires a partnership

between the fishery managers and the habitat protection agencies for the programs to succeed. It would not be fair to place stringent regulations on the fishermen in order to solve the stock problems, only to lose any gains to pollution and habitat degradation. The recommendations that follow are made in keeping with this philosophy.

It is the policy of the Mid-Atlantic Fishery Management Council (MAFMC 1987 and 1989) to oppose any loss of essential aquatic habitat or wetlands which contributes to the conservation of fish stocks. Where loss of habitat is unavoidable locally, the Council endorses recreation of quantitatively and qualitatively equivalent habitat. The Council recognizes the multiple resource base of our coastal areas and recognizes the need to accommodate other natural resource management objectives with special sensitivity to goals that may be contrary to the objectives of fishery management. The intent of the Council is to support "no net loss" of fishery habitat while minimizing all detrimental alterations of these essential habitats.

This policy will allow the MAFMC to optimize the management of fisheries in the mid-Atlantic EEZ through a concerted effort to establish a quality habitat and to seek to reverse the serious problems affecting the reproduction, size frequency and distribution of fish. The Council will accomplish this through participation in the review of private and government projects which would adversely affect fish production. The Council will also become involved in review of activities which adversely affect the safety of fish products which are intended for direct or indirect human consumption.

The Council is deeply concerned about the effects of marine and estuarine habitat degradation on fishery resources. They have a responsibility under the MFCMA to take into account the impact of habitat degradation on summer flounder. The following recommendations are made in light of that responsibility and are in full accordance with the Council's Habitat Policy and Position Paper on Habitat and the Environment.

1. All available or potential natural habitat for migratory summer flounder should be preserved by encouraging management of conflicting uses to assure access by the fish to important habitat and maintenance of high water quality standards to protect summer flounder migration, spawning, nursery, overwintering, and feeding areas.

2. Filling of wetlands should not be permitted in or near nursery summering areas. In particular, filling of wetlands should not be permitted in the lagoon system behind the barrier islands on the seaside of the Eastern Shore of Virginia and North Carolina because of its importance to summer flounder. Project proponents must demonstrate that project implementation will not negatively affect summer flounder, their habitat, or their food sources.

3. Best engineering and management practices (e.g., seasonal restrictions, dredging methods, disposal options, etc.) should be employed for all dredging and in water construction projects. Such projects should be permitted only for water dependent purposes when no feasible alternatives are available. Mitigating or compensating measures should be employed where significant adverse impacts are unavoidable. Project proponents should demonstrate that project implementation will not negatively affect summer flounder, their habitat, or their food sources.

4. The disposal of sewage sludge, industrial waste, and contaminated (contaminated means any substance that could affect the fish directly, its habitat, the food chain, or the public's perception of those parts of the ecosystem) dredged material in summer flounder habitat, including the New York Bight, should not be allowed. Advanced garbage, industrial waste, and sludge handling techniques are now available and must be encouraged. Specifically:

    a. The Council opposes ocean dumping of industrial waste, sludge and other harmful materials.

    b. It is urgent that appropriate agencies enforce all existing laws and regulations until ocean dumping ceases. Emphasis must be placed on prevention of short dumping and required release rates.

    c. The Council requests EPA to require each permitted ocean dumping vessel be required to furnish detailed information concerning each trip to the dump site. This might be in the form of transponders; locked Loran C recorder plots of trip to and from the dump site; phone call to EPA when vessel leaves and returns to port; or other appropriate method to ascertain that vessels dump only in the 106 area and take legal action to abate illegal (short or improper) material dumping.

    d. The Council requests fishermen and other members of the public to report to the EPA, Coast Guard and the Council any observance of vessels dumping other than in the approved dump

sites. A list of permitted vessels would accompany this request with the additional request for reporting of any vessel not on the approved list. The report should include date, time, location (longitude, latitude, Loran bearings), vessel name of the dumping vessel, the nature of the material dumped, name of reporting individual and vessel. This would enable EPA to take appropriate action against illegal dumping.

e. The Council's Executive Director is directed to contact necessary Congressional delegations, as necessary, relative to strengthening current measures being considered to cease ocean dumping by a date certain.

f. The Council strongly urges state and federal environmental agencies to reduce the amount of industrial waste, sludge and other harmful materials discharged into rivers and the marine environment, and for these agencies to increase their surveillance monitoring and research of waste discharge. The Council requests that the Environmental Protection Agency implement and enforce all legislation, rules and regulations with emphasis on the best available technology requirements and pretreatment standards.

g. The Council will take appropriate steps under the Magnuson Act and any other federal laws and regulations to assure the required responses to its concerns and opposition to dump site 106.

5. Ocean disposal of fish waste should not be allowed in any areas where environmental harm may occur. The burden of proof that no environmental harm exists should be on the entity proposing the disposal. An environmental monitoring program to characterize the proposed site prior to, during, and after disposal occurs must be undertaken and is the financial responsibility of the entity benefiting from the use of the ocean environment. As an example, the dumping of fish wastes in areas of surf clams or scallops could provide enrichment that could trigger undesirable organisms, such as paralytic shellfish poisoning (PSP).

6. The siting of industries requiring water diversion and large volume water withdrawals should be avoided in summer flounder critical areas. In particular, due to the link between higher salinity and summer flounder nursery areas, diversions which disrupt the local circulation or dilute existing conditions will adversely impact the use as a nursery area and should be avoided. Project proponents must demonstrate that project implementation will not negatively affect summer flounder, their habitat, or their food supply. Where such facilities currently exist, best management practices must be employed to minimize adverse effects on the environment.

7 Dechlorination facilities should be used to destroy chlorine at sewage treatment plants and power plants.

8. No toxic substances in concentrations harmful (synergistically or otherwise) to humans, fish, wildlife, and aquatic life should be discharged. The EPA's Water Quality Criteria Series should be used as guidelines for determining harmful concentration levels. Use of the best available technology to control industrial waste water discharges must be required in areas critical to the survival of summer flounder. Any new potential discharge into critical areas must be shown not to have a harmful effect on summer flounder. In calculating potential impacts, the stratification affects of mixing zones should be carefully considered.

9. The EPA, for the EEZ, and States, for the coastal zone, should review their water quality standards and make changes as needed with respect to the habitat requirements of summer flounder migratory passage and feeding and to maintain edible summer flounder; that is, flesh and organ buildup of contaminants must be considered.

10. Water quality standards in nursery, spawning, feeding, and areas of migratory passage should be enforced rigidly by State or local water quality management agencies, whose actions should be carefully monitored by the EPA. Where State or local management efforts (standards/ enforcement) are deemed inadequate, EPA should take steps to assure improvement; if these efforts continue to be inadequate, EPA should assume authority, as necessary.

11. Appropriate measures must be taken as soon as possible to reduce acid precipitation and runoff into estuaries and near shore waters.

12. EPA and appropriate agencies must establish and approve criteria for vegetated buffer strips in agricultural areas adjacent to summer flounder nursery areas to minimize pesticide, fertilizer, and sediment loads to these areas critical for survival. The effective width of these vegetated buffer strips varies with

slope of terrain and soil permeability. The Soil Conservation Service and other concerned Federal and State agencies should conduct programs and demonstration projects to educate farmers on improved agricultural practices that would minimize the wastage of pesticides, fertilizers, and top soil and reduce the adverse effects of these materials.

6.6. HABITAT RESEARCH NEEDS

The National Status and Trends Program of NOAA (USDC 1987a and 1989b) should provide guidance in making intelligent decisions involving the use and allocation of resources in the nation's coastal and estuarine regions. These decisions require reliable and continuous information about the status and trends on environmental quality in the marine environment. Four general objectives have been established for the early years of the National Status and Trends Program (USDC 1987a and 1989b). Those objectives are (1) to establish a national data base using state of the art sampling, preservation, and analysis methodologies; (2) to use the information in the data base to estimate environmental quality, to establish a statistical basis for detecting spatial and temporal change, and to identify areas of the nation that might benefit from more intensive study; (3) to seek and validate additional measurement techniques, especially those that describe a biological response to the presence of contaminants; and (4) to create a cryogenic, archival specimen bank containing environmental samples collected and preserved through techniques that will permit reliable analysis over a period of decades. While the Council concurs with these objectives, efforts by this program or other NMFS programs also must look at specific issues which include:

1. It is necessary that scientific investigations be conducted on summer flounder to emphasize the long term, synergistic effects of combinations of environmental variables on, for example, reproductive capability, genetic changes, and suitability for human consumption.

2. The Council recommends the following areas for future habitat directed investigations: field studies on the direct and indirect effects of contaminants on mortality of summer flounder; studies on the interactive effects of pH, contaminants, and other environmental variables on survival of summer flounder; and continued studies on the importance of factors controlling the production and distribution of food items that appear in the diet of young summer flounder.

7. Description of Fishing Activities

The summer flounder is a highly prized food fish sought by both commercial and recreational fishermen throughout its range. At over $1.50 per pound, the 21.4 million pounds landed by US commercial fishermen in 1989 had an ex-vessel value of $33.4 million. From 1980-1989, summer flounder comprised the second largest catch (by weight) of all species caught by marine recreational anglers along the entire Atlantic coast (Table 3), averaging over 30 million pounds annually. Millions of dollars in economic impact are associated with the catch of this over utilized species. Consequently, there is no summer flounder surplus for foreign fishing in the US EEZ.

7.1. Domestic Commercial Fishery

Summer flounder support an extensive commercial fishery along the Atlantic Coast, principally from Massachusetts through North Carolina. The most concentrated fishing activity takes place in the EEZ during the North Carolina winter trawl fishery (section 7.1.7), but significant catches are made off the southern New England States and the Delmarva peninsula.

Landings have fluctuated widely over the last five decades (Table 1), increasing from less than 10 million pounds per year prior to World War II to average around 20 million pounds during the 1950's. Landings consistently decreased during the 1960's until a low of only 6.7 million pounds was reported in 1969. Commercial landings have been consistently high since the mid 1970's, attributable mainly to increased levels of effort in the southern winter trawl fishery. Landings of summer flounder from Maine to North Carolina peaked in 1979 at nearly 42 million pounds (Table 1). Reported landings in 1989 were 21 million pounds, a decline of 39% from 1988. These landings were well below the 1980-1989 average of 29 million pounds and are the second lowest year in the 1980-1989 time series.

7.1.1 Landings by State and Fishing Area

From 1980-1989, Virginia and North Carolina combined averaged 50% of the total commercial landings, while Rhode Island and New Jersey each averaged about 15% (Table 1). There was significant variability among the States over this time frame, however. In 1980, Virginia and North Carolina accounted for over 70% of coastwide landings, making it a distinctly southern fishery. In 1985-1986, Massachusetts, Rhode Is-

land, New York and New Jersey accounted for significantly more than half the landings. By 1989, catch again shifted to the southern States.

Since 1980, an average of 71% of the commercial landings of summer flounder have come from the EEZ. The percentage of landings taken in Federal waters was at its lowest in 1983 at 63% and increased to 79% in 1989 (Table 2). Most States averaged a high proportion of landings from the EEZ throughout the 1980's. In 1989, 5 States caught over 90% of summer flounder totals from the EEZ.

Though most landings came from the EEZ, the statistical reporting areas (Figure 15) which had the highest catches were nearly all adjoining the coast. Landings from areas 621, 626 and 631 all averaged nearly 2 million pounds between 1983 and 1989. Offshore areas 537 and 622 averaged over two million pounds each, mostly taken in the winter months before summer flounder migrate inshore.

On an individual State basis, most summer flounder landings are taken from areas adjacent to the State. Massachusetts and Rhode Island landings were made from areas 526, 537 and 538 or areas south of Cape Cod (Table 23). The majority of New York's landings came from Long Island Sound (area 611) or the two areas, 612 and 613, adjoining the south shore of Long Island. The majority of New Jersey's landings came from their adjoining area, 614 or in the two areas immediately south (areas 621 and 622). The vast majority of Maryland's landings also came from area 621. Major landings for Virginia were made from areas surrounding the Chesapeake Bay, 625, 626, 631, and 632 (Figure 15).

7.1.2 Landings by Fishing Gear

Most commercial landings are made from otter trawl vessels, while the second most important gear is pound nets (Table 24). Eighty seven percent of the summer flounder landings between 1980 and 1989 came from fish otter trawls. When landings from other otter trawls are added to "fish" otter trawls, the average annual landings are over 90%. On average from 1980-1989, pound nets caught 1.4 million pounds. Gill nets and scallop dredges were the only other gear that averaged more than 100,000 pounds annually. Small catches of summer flounder were also made with haul seines, floating traps, lines, spears, purse seines, pots and traps, midwater/pair trawls, fyke nets and weirs (Table 24).

Between 1980 and 1989, over 90% of summer flounder were landed annually from otter trawls in all States except New Hampshire and North Carolina (Table 25). Although otter trawls comprised the majority of North Carolina's landings it is significant that over 20% of the total landings are attributable to other gear. Pound nets in North Carolina averaged over 1 million pounds and gill nets averaged nearly half a million pounds. These gear types, being deployed close to shore, account for the higher proportion of summer flounder landings from State waters relative to other Atlantic coast States.

Commercial landings of summer flounder from the EEZ were almost exclusively made with fish otter trawls (Table 26), averaging over 90% for all States from 1980-1989. This fact, coupled with the high proportion of landings taken from the EEZ for most States, makes otter trawl mesh regulation in the EEZ a potentially effective management tool for reducing mortality on juvenile summer flounder.

7.1.3 Landings by Season

On average from 1980-1989, more than 3 million pounds of summer flounder were landed for each of the months of November through February, making winter trawling the most significant component of the annual fishery (Table 27). An average of greater than 2 million pounds of summer flounder were landed in September, October and April also. Average landings of less than a million pounds occurred only during June and July.

A seasonal pattern of landings is also evident from monthly data by distance from shore, where during January, February, March and April more than 90% of the landings were EEZ derived (Table 27). Only from June to September were average monthly landings from State waters greater than those from the EEZ. Obviously, commercial fishing effort follows the migration of summer flounder inshore and in a northerly direction during the summer months, but trawling success is closely associated with the offshore concentrations of spawning fish during the winter months.

7.1.4 Landings by Market Category

Classification of summer flounder into categories of "small", "medium", "large", and "jumbo" are available for nearly all States for the past several years, though about one-third of the coastwide landings are left as "unclassified". From 1980-1989, the States of Connecticut and New York classified only negligible amounts of summer flounder landings and North Carolina classified about half (Table 28).

While there may not be absolute consistency across States and years in the precise length associated with each size category (Christensen pers. comm.) attempts by NMFS port agents to improve consistency enables average lengths to be associated with each size category. Further analysis of the General Canvas data in this section will be based upon the lengths of 13", 15", 17", and 19" corresponding to the "small", "medium", "large", and "jumbo" categories (New Jersey 1985).

Excluding unclassified landings, the coastwide average size composition of landings from 1980-1989 was: 27% "small", 30% "medium", 33% "large", and 10% "jumbo" (Table 28). The New England States had a higher percentage of summer flounder of "medium" and larger size categories and the percentage of "small" fish generally increases southward. Overall, this would correspond to the seasonal inshore and northward migration of summer flounder. Smaller fish would first be available to the offshore winter trawl fisheries, while individual fish would gain in size before becoming available to the northern inshore fisheries in summer.

7.1.5 Otter Trawl Directed Fishery

Estimates of catch and fishing effort by area, gear, etc. are obtained by sampling fishing captains and the data are coded using a "weighout" form. The weighout data are a sample rather than a census and do not comprise the entire fishery. Even though the weighout data collection system is limited in geographical coverage (CT ,DE, and NC are not included at this time), it is extremely important because of the associated effort data and the fact that species composition data on a tow by tow basis are available (section 7.1.7).

A year by year comparison from 1983-89 between the General Canvas and the weighout data demonstrates that about 70% of the total summer flounder landings from Maine to North Carolina are picked up by the weighout system (Table 29). When Connecticut, Delaware and North Carolina landings are excluded from the 1989 General Canvass, there is almost 100% coverage by the weighout, thus the weighout data covers a large proportion of the complete summer flounder fishery.

Over 97% of the summer flounder that were reported landed between 1983 and 1989 in the weighout system were landed by fish otter trawls (Table 30). According to the General Canvass, 87% of summer flounder landings between 1980 and 1989 were from fish otter trawls (Table 24). Due to the exclusion of North Carolina, summer flounder landings from pound nets and gill nets seem to be the least sampled and recorded in the weighout system. The weighout system is effective at recording landings of summer flounder that were caught with otter trawls, however, and can be considered representative of the otter trawl fishery.

Summer flounder are part of an overall mixed bottom trawl fishery which generally includes: winter flounder, yellowtail flounder, *Loligo*, scup, butterfish, and other species (section 7.1.6). According to 1983-1989 weighout data, mean catch of summer flounder per otter trawl trip was 2,404 pounds or 24% of total trip catch (Table 31). Since summer flounder are landed as bycatch from fisheries directed at other species as well as from directed effort, many small incidental catches can lower the mean catch estimate of summer flounder trips. Directed summer flounder trips must therefore be distinguished from non-directed trips in the weighout data.

Given fishermen's skills in choosing time, area and method of fishing, otter trawl trips directed at summer flounder will likely have a higher proportion of trip catch represented by this species. The problem of incidental trips can be avoided by setting a landings threshold for classifying a trip as directed at summer flounder.

A threshold of 500 pounds per trip restricts analysis to about 34% of otter trawl trips landing summer flounder, yet these trips still account for over 95% of the total summer flounder landed from 1983-89 (Table 32). An annual average of 4,532 otter trawl trips landing summer flounder met the 500 pound criteria from 1983-1989, while an annual average of 8,970 landed less than 500 pounds. This indicates that the majority of trips landing summer flounder are likely directed at other species. Trips meeting the 500 pound threshold averaged 5,046 pounds of summer flounder with summer flounder comprising 43% of total catch. Non-directed trips (given the 500 pound threshold) averaged 109 pounds of summer flounder, comprising about one percent of total trip catch (Table 33).

A threshold of 500 lbs per trip would have affected approximately 74% of the vessels and 34% of the trips landing summer flounder from 1983-89 based on NMFS weighout data. However, these trips accounted for over 95% of the total summer flounder landed during these years. In fact, for each year from 1983 to 1989 this percentage changed very little, ranging from 93 to 96%. this period encompassed years in which recruit-

ment was both good (1985) and very poor (1988), indicating that the 500 lb criterion is a valid threshold during years of both relatively high and low abundance.

The 500 lb threshold was used to define a directed (regulated) trip after extensive analysis of numerous threshold levels from 0 to 2,000 lbs per trip using the NMFS weighout data. Decreasing the threshold from 500 to 0 lbs resulted in a higher proportion of regulated trips (ranging from 34 to 100%), and, thus, greater regulatory impact, with an increase in affected landings of only 5% (that is, 95% to 100%). Increasing the threshold significantly reduced the proportion of both affected trips and landings. Discussions with the Council's industry advisors indicated that 500 lbs correctly identified a directed trip, corroborating the results of the weighout data analysis.

7.1.6 Species Composition of the Catch

Generally, sorting of otter trawl caught fish is begun immediately after redeployment of the net. Marketable species are sorted by size category and placed on ice as rapidly as possible. Once the valuable catch is stored, undersized fish and non-marketable bycatch is generally shoveled overboard. Several hours may lapse before discarded fish are returned to the sea, resulting in high discard mortality rates.

Fishery discards (juvenile fish and unmarketable species) are difficult to monitor accurately since they are obviously unavailable to port samplers. The amount of discards in relation to landings is influenced by a variety of factors including: net mesh size, season, area fished, the age or size structure of the population, and the particular regulatory scheme in place. Factors significantly influencing the survival of discarded fish include: degree of net damage, duration of trawl tow, time on deck, handling stress, temperature, water depth and fish size (Murawski 1985).

The NMFS contracted with the Manomet Bird Observatory to place observers on US boats in 1989 to collect a variety of data on the vessels, personnel, and catch. In 1989, 14 of the covered trips were made by otter trawl fishermen who identified summer flounder as the primary species targeted by their fishing trip. Of those 14 trips, summer flounder averaged 27% of landed weight with a range of 0 to 73% (Table 34). The average trip landed 3,150 pounds of summer flounder with a range of 0 to 17,511 pounds. In most cases, the weight of other species, e.g., spiny dogfish, exceeded that of summer flounder.

The Sea Sampling Data also contains information on discards. In 1989, 98% of the summer flounder that were caught on covered trips (67,000 pounds) were landed with only 2% discarded. Summer flounder were discarded because they were too small either for market or the 13" minimum size regulation. The low number of summer flounder discards may reflect low catches and poor recruitment in recent years, i.e., there are no small summer flounder. Length frequency data on both landed and discarded fish are not yet available but will be analyzed to determine size distributions.

Weighout data from 1983-89 were examined for species composition for the directed summer flounder fishery (Table 35). In general, the species that coexist with summer flounder (section 5.3.9) were also the species that commonly appeared in the directed summer flounder fishery. For otter trawl trips landing at least 500 pounds of summer flounder, mean bycatch per trip consisted of scup, *Loligo*, butterfish, winter flounder, whiting, and bluefish. Other species were also landed in fair quantities, amounting to 25% of the mean catch per trip. The large percent composition of miscellaneous species was mostly in New England waters, however, where other groundfish species such as cod, haddock and other flat fish are more abundant than in the Mid-Atlantic region.

7.1.7 Description of the North Carolina Fishery

An average of 31% of the coastwide summer flounder landings were made in North Carolina from 1980-1989 (Table 36), yet data on the fishery are not yet incorporated into the weighout system. Fortunately, the North Carolina fishery has been extensively sampled during the winters of 1982-89 by the North Carolina Division of Marine Fisheries (North Carolina 1990). These data enable the comparison of the North Carolina winter trawl fisheries to the southern New England and Mid-Atlantic otter trawl fisheries.

The winter trawl fishery in North Carolina has three distinct components and accounted for almost three quarters of all summer flounder landings in the State (Table 25). The bottom trawl fishery begins near shore in November, targeting primarily on summer flounder. By January, effort has moved offshore into a deep water otter trawl fishery lasting until April. Additionally, a fly net (high rise trawl fishing 10-12 ft off bottom) fishery occurs from September through April.

Catches of summer flounder dominated the near shore bottom trawl fishery for the seven seasons sampled, averaging 11,783 pounds per trip and comprising 62-94% of total trip catch (Table 37). This segment of the

fishery accounted for the majority of the summer flounder landed in the North Carolina winter fishery from 1982-89 (North Carolina 1990). The deep water trawl fishery was less selective for summer flounder, with scup sometimes the dominant species landed, but contributed most of the remainder of summer flounder landings from the winter trawl fishery. Catches of summer flounder averaged 6,690 pounds per trip and ranged from 10-72% of total catch (Table 37). The fly net fishery is directed primarily at sciaenids and bluefish, hence summer flounder is landed as incidental catch only. From 1982-1989, fly net catches of summer flounder averaged only 315 pounds per trip and comprised from 1-3% of total trip catch, making this segment of the winter trawl fishery least significant for summer flounder (Table 37).

7.1.8 Mesh Size Selectivity

Although many types of fishing gear are employed to capture summer flounder, most landings can be attributed to otter trawls (Section 7.1.2). Fish otter trawls are not a uniform gear, however, since many variations are in use throughout the range of summer flounder. Individual fishermen choose a particular net type and configure various attributes of the rig based on the target species, season, area, depth and bottom type. Mesh size is one attribute in particular which is selected according to the expected or desired size of the target species.

Size composition of summer flounder landings is greatly affected by the selectivity of a particular mesh size, but is also influenced by the availability of the various age classes at any time and place. Changes in absolute abundance, spatial distribution and migration patterns by size classes will be reflected in landings, and most fishermen will adapt their gear to observed trends.

Although specific data for mesh size on a trip by trip basis are not available from the weighout system, length samples by port agents are available. Existing mesh selectivity studies can be used in conjunction with length samples to infer the effective mesh size in the summer flounder fishery. The selectivity of a 4.0" mesh would correspond to the observed size composition of landings from Maine to Virginia from 1985-1989 (Table 38). Thus, although many different mesh sizes are currently employed in the fishery, the size composition of summer flounder landings do reflect an average otter trawl mesh of 4.0".

Specific data by mesh size are available for the North Carolina winter trawl fishery, however. The trawl used in the near shore summer flounder fishery is typically a low profile net with 5-6" mesh in the wings tapering to 4.5" in the cod end. Deep water trawl nets taper from 5" in the wings to 3" in the cod end and fish a few feet off bottom. Fly nets fish about ten feet off bottom and taper from 16-64" mesh in the wings to 2" in the cod end.

Mean size of summer flounder in the North Carolina winter trawl fishery varied with type of net, generally corresponding to mesh size. Individual summer flounder captured in near shore trawls averaged 1.8 pounds for trawls sampled over the 1988-1989 winter fishery, while fish averaged 1.5 pounds in the deep water trawl fishery and 1.1 pounds in the fly net fishery (North Carolina 1990). Given the current size limit of 13", the number of undersized summer flounder per trawl also corresponded to the mesh size of the three common net types. The 1988-1989 percent catch composition of undersized flounder for the near shore trawls was lowest at 4.5%, while deep water trawls had 8.4% and fly nets had 58.1% (North Carolina 1990). Although fly nets had a high percentage of undersized summer flounder of those summer flounder captured, the total number of summer flounder captured was low relative to the other two trawls used in the fishery. In fact, summer flounder occurred in less than half of the fly net trawls sampled over the 1988-89 season (North Carolina 1990).

7.2. Domestic Recreational Fishery

Summer flounder is one of the mainstays (Table 3) of the sport fishery along the Atlantic coast, accounting for a proportionately large catch from bridges, jetties, and small boats. The use of live bait is common, and summer flounder are also taken on squids, clams, jigs, small spoons, and spinners. Although not as strong a fighter per pound as some other sport fishes, the summer flounder provides lively action, especially on light tackle.

Recreational landings in 1989, at about 3.3 million pounds, were well below the 1980-1989 average of 19.0 million pounds. The share of total landings taken by the recreational sector was also below average in 1989, at 13% compared to the 1980-1989 average of 39% (Table 39). The decline in recreational landings is more precipitous than that noted in the commercial fisheries and underscores concern about the condition of the summer flounder stock.

7.2.1 Directed Summer Flounder Trips

Marine Recreational Fishery Statistics Surveys (MRFSS) have been conducted by NMFS on an annual basis from 1979. Random interviews are conducted with anglers at or near fishing sites over the course of each year. Information collected includes mode of fishing, area of fishing, species targeted, and species and quantity of catch. Data are presented as total catch (types A, B1, & B2) and total landings (types A & B1).

Type A catch is actually observed by interviewers. Type B1 represents catch utilized but not available for measurement and catch discarded dead. Type B2 represents those fish released alive. Catch represents the total summer flounder fishing experience (some satisfaction is gained from catching a fish and releasing it) while landings represent the associated summer flounder mortality. All total weights are based on the mean weight of type A fish multiplied by the total number of fish. MRFSS data on catch and effort from angler intercepts are expanded to the State level following telephone surveys which determine participation rates for the general population.

The method of estimating directed trips for summer flounder is potentially biased since MRFSS interviewers ask anglers, upon completion of their trip, which species they targeted. This approach may cause anglers to report the species they caught, regardless of the species they originally sought. Data on recreational catch from 1979-88 suggest that summer flounder anglers do in fact direct effort, however. An annual average of 88% percent of the total catch of summer flounder was taken during angler days for which only summer flounder were caught (Terceiro pers. comm.).

From 1980-1989, summer flounder were the second most popular species sought and accounted for 7% of the total coastwide recreational catch by weight (Table 3). The average annual number of coastwide trips (1979-1988) targeting (directing) on summer flounder was 8.3 million (Table 40). The number of trips is additive across States but the number of participants is not, due to out of state anglers. The total number of directed summer flounder trips is computed by multiplying the regional number of trips by the regional percentage of directed summer flounder trips. Directed summer flounder trips have accounted for between 31.9% (1979) and 46.5% (1984) of all recreational fishing trips coastwide, or a 10 year average of 37.6%.

Based on MRFSS groupings, the Mid-Atlantic region had the highest number of trips directed at summer flounder: on average 7 million annually from 1979-88, comprising 45% of recreational trips. In New England and in North Carolina, summer flounder was not sought as often, probably due to its availability relative to other popular species. From 1979-88, the percentage of directed summer flounder trips averaged 14.3% in New England and 27.4% in North Carolina.

7.2.2 Catch by State and Fishing Area

Based on 1989 MRFSS expanded totals, 2.8 million summer flounder were caught from Maine to North Carolina with a weight of 4.8 million pounds or 1.7 pounds per fish (Table 41). These totals indicate a precipitous decline from the 20.8 million summer flounder caught in 1988.

In 1989, New Jersey caught the largest percentage of catch by number (23%) followed by Virginia (19%), Maryland (17%), New York (16%), and North Carolina (13%). The remaining States all caught less than 5% each (Table 42). Catch was more evenly distributed than in 1988, where New Jersey and New York accounted for 70% of the coastwide catch of summer flounder, but this reflects the decline in catch for these two States, rather than better fishing for all States.

The 1989 estimated number of summer flounder caught by water area was 2.7 million (95.7%) in State waters, and 0.1 million (4.3%) in the EEZ (Table 41). Catch by weight was distributed similarly to catch by number relative to fishing area. On a regional basis, average weight was higher in the north Atlantic States (1.96 pounds) than in the Mid-Atlantic (1.75) and in North Carolina (1.31 lbs). This would correspond to the growth in individual fish during summer migration inshore and northward.

7.2.3 Catch by Fishing Mode

The number of summer flounder caught by fishing mode in 1989 was 2.2 million (78%) by private/rental boats, 285 thousand (10%) by party/charter boats, and 337 thousand (12%) from shore (Table 43). Despite the decline in catch from 1988, there was essentially no change in distribution of catch numbers by mode.

The 1989 average fish weight of catch by mode was 1.79 pounds by private/rental boats, 1.66 pounds by party/charter boats, 1.15 pounds from shore. Given the higher mean weight, distribution of catch by weight was further skewed towards private/rental boats which took 82% of the summer flounder.

Both party/charter boats and private/rental boats took the majority of catch in State waters (82% and 97%, respectively). Though private/rental boats had a higher absolute catch in the EEZ, party/charter boats caught more of their total in the EEZ than did private/rentals. This is probably due to the greater accessibility of EEZ waters to larger vessels with navigation equipment.

7.2.4 Size distribution of Catch

Individual summer flounder lengths (Type A fish) from the MRFSS survey of 1989 are summarized as percentages in Table 44. Coastwide, summer flounder under 13" accounted for only 5.4% of those landed, indicating good compliance with the size limit implemented in 1988. Very few fish were under 12".

Of the legal sized summer flounder, the highest percentage available for measurement was at 16". The sizes of summer flounder were quite evenly distributed between 13 and 19", and 98.5% of fish were 21" or less.

7.3. Foreign Fishing Activities

Given the importance to domestic commercial and recreational fishermen, summer flounder is a prohibited species for foreign fisheries in US waters. Consequently, there are no directed foreign or joint venture fisheries for summer flounder and no retention of summer flounder is permitted. Bycatch of summer flounder has occurred in directed fisheries or joint ventures for other species, however.

Two sources of foreign catch data are available for determining bycatch of summer flounder: foreign fleet observers' reports and captains' logbooks from permitted foreign fishing categories. Incidental catch in foreign directed fisheries was estimated at over 100,000 pounds in the early 1980's, but has since been reduced to negligible amounts (Table 45). The reduction of summer flounder bycatch is most likely due to the phase out of the foreign directed *Loligo* squid fishery. An increased bycatch of summer flounder in joint venture fishing has corresponded to the phase out of directed fisheries, but has been limited to a few thousand pounds (Table 45). Summer flounder caught in joint venture fisheries cannot be retained by foreign vessels, so must be returned to US catcher boats or discarded.

8. Economic Characteristics of the Fishery

Summer flounder constitutes a major component of Mid-Atlantic recreational catches and comprises a significant proportion of commercial landings from North Carolina to Maine. The commercial share averaged about 60% of the combined total landings of summer flounder from 1980-89 (Table 46). The economic characteristics of the commercial and recreational summer flounder fisheries are described in the following sections. Throughout this description, it is important to note the distinction between economic value and economic impact.

Economic value is a measure of willingness to pay for a good or service. Ex-vessel value in the commercial sector is thus a measure of processor and wholesaler willingness to pay for summer flounder in the dockside market. Likewise, retail value is a measure of final consumer willingness to pay for summer flounder at supermarkets, seafood shops and restaurants. Economic impact, on the other hand, is a measure of expenditures made by people engaged in a particular activity, and the employment, income, tax revenues, etc. which result from these expenditures. Often, it is said that recreational fishermen spend "x" dollars on gear, boats, travel, etc., and generate "y" amount of employment or "z" dollars in tax revenue.

Clearly, summer flounder are valuable to both recreational anglers and seafood consumers who do not or cannot fish for themselves. Also, individuals and firms engaged in the commercial harvesting, processing and marketing of summer flounder make expenditures and generate employment in the course of business activities, just as participants in the recreational fishery do. Summer flounder have economic value in both recreational and commercial uses and summer flounder related activities have economic impact in each use.

When considering the relative benefits of summer flounder to the two sectors, commercial values must be compared to recreational values and commercial impacts must be compared to recreational impacts. Unfortunately, recreational values are not easily measured and too often, economic impacts of recreational fishing are erroneously contrasted with ex-vessel value in the commercial sector. The reader is cautioned to avoid this confusion when impact and value estimates are presented in the following sections.

8.1. Commercial Fishery

Commercial fisheries generally consist of three distinct sectors: harvesting, processing and marketing. Many individuals and firms specialize in a single sector, although some vertically integrated companies span all sectors, and diversified companies are often involved in food related industries besides seafood.

8.1.1. Harvesting Sector

8.1.1.1 Ex-vessel Value and Price

The ex-vessel value of summer flounder landings has increased from about $16 million in the early 1980's to a peak $44 million in 1988 (Table 46). Ex-vessel value dropped to $32 million in 1989 due to a nearly 15 million pound decline in landings, but a rise in average price to $1.54 per pound helped to temper the effect on revenues to harvesters. Inflation adjusted prices (1989 dollars) have more than doubled over the 1980-89 time period from $0.66 to $1.54 per pound. The price rise corresponds to a general increase in demand for seafood over the last decade, attributable to gains in personal income and consumer awareness of the healthfulness of seafood.

The value of summer flounder landings relative to the value of total landings in 1989 varied for each State from 1% or less (Maine, New Hampshire, Delaware and Maryland) to about 5% of the total value of landings (Rhode Island, New York, New Jersey, and Virginia) (Table 47). In North Carolina, summer flounder accounted for over 15% of the total value of commercial fish landed, indicating the significance of the winter trawl fishery to the State.

Nationwide, the summer flounder percentage of overall US commercial flounder landings over the past 10 years has varied from 10% to 17% (Table 48). In terms of value, however, the summer flounder percentage has ranged from 17% to 32%, indicating the higher value placed on fresh flounder in US east coast markets.

At $1.54/lb, the average price (all sizes) of summer flounder reached a record high in 1989 in both nominal and inflation adjusted (1989) dollars (Table 46). In 1989, highest prices were received in the northern States with Massachusetts the leader at $1.96 per pound (Table 49). Real price per pound for all size categories has fluctuated over the past seven years with noticeable drops in 1983-84 and 1988. Temporary price drops were likely attributable to supply responses since landings increased considerably in those years. The supply - price relationship is also observable on a monthly basis. Months with highest average ex-vessel prices tend to coincide with months of lowest landings, normally in June and July (Table 50). Prices received for summer flounder originating in the EEZ were generally higher than for State waters and tracked the seasonal supply relationship. The 1989 coastwide average ex-vessel price per pound for jumbos was $1.93, $1.59 for larges, $1.47 for mediums, $1.11 for smalls, and $1.57 for unclassified landings (Table 51). Price premiums for larger flounder reflect higher yielding fillet weight.

8.1.1.2 Fishing Vessel Activity

The Fishery Management Plan for Summer Flounder (MAFMC 1988) requires annual permits for commercial fishing vessels taking summer flounder within the US EEZ. Without individual logbooks, however, information on the total number of vessels actually landing summer flounder (or the extent of dependence on summer flounder) is difficult to assemble. NMFS permit files indicate that 2,003 vessels have checked off summer flounder as an intended commercial fishing activity for 1990. Many vessel owners check off the summer flounder category to maintain flexibility of fishing operations pending the availability of species, or to maintain eligibility given concerns about a potential limited entry program. Other vessels anticipate taking summer flounder as bycatch during normal fishing activities for other species. Not all permit holders are participants in a full time directed fishery for summer flounder.

The NMFS weighout system records can be used to estimate the number of vessels landing summer flounder in covered States (CT, DE & NC are not currently included), but even so, the data do not constitute a complete census. Finfish otter trawl vessels comprise the vast majority of the vessels covered by the weighout system. Since 1983, between 599 and 704 otter trawl vessels have landed summer flounder on a year by year basis (Table 52) with a general trend downward. The number of otter trawl vessels with at least one trip landing 500 lbs or more of summer flounder catch was typically lower by about 200 vessels over this time period, indicating the extent of incidental catch.

There are vessels which land summer flounder in Connecticut, Delaware, and North Carolina which are missed by the weighout system. About 150 vessels participated in the 1985-6 North Carolina winter trawl fishery. Of these, about 80 landed fish north of North Carolina during the year (Ross pers. comm.). There are a substantial number of finfish otter trawl vessels which fish for summer flounder up and down the Atlantic coast. This mobile fleet is composed of vessels from North Carolina, Virginia, New Jersey, and other States (Stevenson pers. comm.). Some of these vessels direct on summer flounder in the winter and direct on scallops or other species in the summer. Other finfish otter trawl vessels fish for summer flounder in mixed fisheries with squid or other species, on the basis of local availability, or land them as bycatch in other directed fisheries.

Annual revenues for otter trawlers are significantly dependent on summer flounder. Weighout data on all trips landing summer flounder, whether as bycatch or as a result of directed effort, indicate that from 1983-89, 41% of annual revenues are attributable to summer flounder. When only trips landing 500 pounds or more of summer flounder are considered, the average annual percentage of revenues attributable to summer flounder climbs to 61% (Table 53). In all years from 1983-89, the percentage of value of summer flounder for directed trips is greater than the percentage of weight, indicating that in the directed fishery, summer flounder is more valuable on a per pound basis than the associated bycatch.

8.1.1.3 Fishing Costs

Vessel costs are composed of fixed costs (insurance, debt, depreciation, routine maintenance, etc.) and variable costs (fuel, maintenance, wages, ice, food, sale and unloading fees, etc.). An increase or decrease in vessel activity will affect only variable costs.

Vessel variable costs are proportionate to the hours traveling and fishing (operating maintenance, fuel, ice) and the quantity of fish landed (wages, sales and unloading fees, ice). Costs vary in different locations and the cost components have changed over the years. Due to the variation in vessels landing summer flounder (home port, tonnage class, directed fishery, etc.), exact cost information is difficult to obtain and generally applicable only to a hypothetical "average" vessel. A general description based on unpublished NMFS data (Logan pers. comm.) follows.

Wages are almost always in the form of a share or lay system. The captain, crew, and vessel owner split the net revenue based on a set ratio. The particular ratio of the lay system utilized varies between vessels. Often the fuel and ice are deducted from the gross revenues with the remainder divided about 50-50 between the vessel owner and the captain and crew (Logan pers. comm). When one or the other of the parties is responsible for additional costs the share split normally reflects this.

Fuel costs have varied tremendously over the past decade. Diesel fuel was approximately $1 per gallon in the early 1980's but had dropped to $.50 per gallon in New England in August, 1985 (Logan pers. comm.). Given the uncertainties of world oil markets, it is likely that fuel prices will fluctuate unpredictably from year to year. Total vessel fuel costs are directly proportional to the amount of time spent steaming and fishing and the size and drag of the fishing gear used.

Ice costs about $30 per ton in New England but varies among ports further south (Logan pers. comm.). Ice costs are related to the amount of fish expected to be caught, the expected trip length, and the type and size of storage system utilized on board.

Variable maintenance costs are related to the hours the engines, fishing gear, etc. are used and the weather conditions. Much of the minor repair work is conducted by crew members and, on larger vessels, by an engineer. Since these crew members perform their labor as part of their normal responsibilities there is no added labor cost (Crutchfield 1986). However, most major engine, electronics, and gear repairs are contracted to specialists.

Selling costs consist of lumpers (unloaders) fees, transportation costs, auction fees, etc. Lumpers fees are variable among ports. In Point Judith, RI the cost is $3 per 1,000 lbs, $6 per hour in Cape May, NJ, and over $4 per 1,000 lbs in Massachusetts (Logan pers. comm.). There are no reports available regarding lumpers fees in Virginia. Almost all Long Island, NY landings are boxed at sea and shipped directly to Fulton market. The market charges about $.10 per pound for all costs. Some areas, notably in Massachusetts, also charge fees for lumpers pension funds, etc.

In addition to the shares earned from the sale of fish, crews often receive bycatch as "shack" (Gates pers. comm.). This is fish which is not sold on the official vessel record and the gross receipts are divided among the captain and crew and, sometimes, the vessel owner. Shack varies by season, fishery, and port (Logan pers. comm.). Otter trawlers often shack all or part of the finfish catch when scalloping. No records exist to estimate shack so it is not possible to consider it separately from wages.

The New England full time otter trawl fleet increased 66% between 1976 and 1985 while per vessel deflated gross revenue decreased 20% (Kurkul and Terrill 1986). This appears to be a result of decreased landings per vessel rather than increased expenses.

Vessels which use otter trawls other than finfish otter trawls are expected to be similar in their characteristics to finfish otter trawl vessels. Scallop dredgers are predominately the same type of vessel (often the same vessels) as those which use finfish or other otter trawls. Therefore, these vessels' fixed costs, with the exception of gear costs, would be the same as finfish otter trawlers while their variable costs will vary somewhat de-

pending on weather, bottom topography and drag, etc. Summer flounder is considered to be a bycatch for these vessels for the purpose of these analyses.

Fishing costs for pound nets, fish traps, and hand line operations are much less than costs for otter trawlers. Fish trap fishermen typically use 70 ft vessels with major expenditures for wages (41%) followed by nets (15%) and taxes (12%) . Rhode Island is the only State which lands summer flounder in fish traps and in 1980 approximately six firms had permits (Norton *et al.* 1984). Hand line fishermen typically use a small boat (17 ft average), have major expenses of wages (35%), fuel (16%), and tackle (16%), and in past years made much of their income from striped bass (Norton *et al.* 1984).

8.1.2. Processing Sector

Almost all summer flounder are sold in fresh form. The catch is generally iced at the dock and then shipped to market. Some filleting is done by primary processors, for instance four processors in New Jersey and Virginia reported in 1980 that they filleted 5 to 25 % of the summer flounder they received (Scarlett 1981). All Long Island landings are currently boxed at sea and then transported to market (Mason pers. comm).

A study conducted in New England in 1982 (Hu *et al.* 1983) showed that labor costs would be reduced approximately $0.05 per pound by filleting large flounder instead of small flounder. This is the result of more fillet weight per flounder and the reduced time involved in the fillet process. The species of flounder examined and the size differences were not mentioned.

The cost of processing an average pound of New England groundfish was $0.67 in 1982 (Dressel and Hu 1983). The percentage by units of production were: 45% labor, 8% energy, 10% packaging, 4% other variable costs, 3% interest, 12% administration, and 18% other fixed costs. The processing cost increases had risen slightly less than the producer price increases in the 5 years previous to 1982. The net profit was determined to be $0.05 to $0.10 per pound depending on species. Georgianna and Dirlam (1982) determined the pretax profit on flounder processed in New England in 1979 to be between $0.03 and $0.33 per pound. Since summer flounder are sold fresh the processing costs should be less for packaging and for labor when there is no filleting. Summer flounder processing costs in Virginia and North Carolina are expected to be less due to lower wage rates. The overall marginal costs of production in New England were determined to be constant over a wide range of production (Georgianna and Hogan 1986).

Because processing plant data are not specific to summer flounder, the number of plants handling summer flounder is unknown. The number of processing plants handling all flounders from Maine through North Carolina has varied from 123 in 1981 to 138 in 1984 and 1987 (Table 54). The value of the flounder processed by these plants has varied form $ 70 million in 1980 to over $150 million in 1986 and 1987 (Table 55).

The major central wholesale market for fresh fish in the Mid- Atlantic region is the Fulton fish market. Summer flounder were received at Fulton market in 1984 and 1985 from the States of Massachusetts through North Carolina. The market handles approximately 6 to 8 percent of the total summer flounder landings (Table 56). If only those summer flounder landed north of Maryland are considered then the percentage rises to approximately 11%. Almost none of the summer flounder entering Fulton market is in the fillet form and little filleting is done there (Petrovich pers. comm.).

Summer flounder prices per pound for each size category vary from processor to processor and from day to day for each processor. The prices react to the market supply of summer flounder, other flounders available, imports, and wholesale/retail demand. The size categories of summer flounder are likewise not fixed. In the areas where more summer flounder less than 14" are landed there is a greater tendency to call smaller fish mediums than in areas where fewer summer flounder less than 14" are landed. The exact lengths which comprise a size category are known to vary from processor to processor and day to day. This variation in price leaves the fisherman with some sense of uncertainty in terms of what he will receive for his catch. Such uncertainty, however, is common in the fishing business.

In 1985 there were 20 processors handling flounder in North Carolina (MAFMC 1988). Since summer flounder is the primary flounder landed in that State, it is assumed that all processors handle summer flounder. There are 6 fish processors in Wanachese being supplied by 30 to 40 otter trawlers and 5 or 6 fish processors in Morehead City supplied by at least 10 to 15 full time otter trawlers (North Carolina 1986).

Because processing plant data are not specific to summer flounder, the number of plants handling summer flounder is unknown. The number of processing plants handling all flounders from Maine through North Carolina was 138 in 1984 and 132 in 1985 (MAFMC 1988). The value of the flounder processed by these plants was $137 million in 1984 and $138 million in 1985.

8.1.3. Marketing and Consumption

Recent and specific information on the distribution of processed summer flounder products to restaurants, specialty shops, institutional food service, and supermarkets is lacking. However, four surveys were conducted between 1970 and 1981 which determined per capita consumption of various species of fish or species groups. The surveys did not collect usable data on home consumption of fish caught by recreational fishermen so results must be interpreted for seafood obtained through commercial channels only. Findings of the four surveys were collated and summarized by Hu (1985) in order to investigate how socio-demographic and economic factors related to seafood consumption over time.

Per capita consumption of flounder ranked highest for the Mid-Atlantic region and for other coastal regions than for central regions. Urban dwellers generally consumed more than suburban/rural residents. Winter consumption ranked higher than summer and more flounder was purchased fresh than frozen. These spatial and temporal observations are consistent with marketing practices for fresh flounder and with seasonal supplies.

Regression results of the 1977-78 survey indicated positive income elasticities for both expenditures and quantity consumed (Hu 1985). Overall, a 10% increase in income would result in a 5% increase in expenditures for flounder and a 4% increase in consumption. A demand function for nationwide flounder consumption was derived by Hu, *et al.* (1983). The linear regression equation considered annual per capita consumption of flounder as a function of a constant, the average price of flounder per pound, and the annual per capita disposable income in adjusted (real) dollars. The data covered the period 1960 through 1980. The results indicated that a 10% increase in the price of flounder had no significant effect on the consumption of flounder. Also, a 10% increase in income induced an 11.9% increase in the consumption of flounder.

Hu *et al.* (1983) results, if generalized to apply to summer flounder, suggest that demand is normal and is generally inelastic. An increase or decrease in the wholesale price of summer flounder would not affect sales significantly. The implication is that the major factor affecting sales appears to be disposable real income and this will affect sales regardless of the price level.

8.1.4. Economic Impact of the Commercial Fishery

A study by the National Fisheries Education and Research Foundation estimated sales, employment, and wage impacts for flounder harvesting, processing and distribution in the Mid-Atlantic region for 1986 (NFERF 1989). Since summer flounder comprised 84% of the total flounder landings in this region in 1986, specific estimates for summer flounder can be derived from the estimates for total flounders.

Cumulative direct impacts of the Mid-Atlantic summer flounder fishery (Table 57) amounted to 2,290 person years of employment, $21.6 million in income, and $50.2 million in output (sales). Over 60% of the employment was generated in the food service sector. Harvesting and processing made up most of the remainder, each accounting for just under 15%. Income per person - year was highest in the harvesting and distribution sectors and lowest for processing and food service, probably related to the labor intensive nature of the two latter sectors. Value of output was high for harvesting, processing and food service, indicating the large markup in these sectors. These direct impact estimates are comparable to direct impacts estimated for the summer flounder recreational fishery (Section 8.2.2) and reflect the distribution (60/40) of landings between the commercial and recreational fisheries (Table 39).

8.2. Recreational Fishery

Recreational fishing contributes to the general well being of participants by affording them opportunities for relaxation, experiencing nature, and socializing with friends. The potential to catch and keep (consume) fish is an integral part of the recreational experience, though studies have shown that non-catch related aspects of the experience are often as highly regarded by anglers as the number and size of fish caught. Since equipment purchase and travel related expenditures by marine recreational anglers have a profound affect on local economies, the maintenance of healthy fish stocks and development of access sites is as important to fishery managers as the status of commercial fisheries.

8.2.1 Recreational Fishing Activity

Summer flounder anglers are diverse in terms of participation mode, but MRFSS data indicate 78% of summer flounder (by number) were caught from private or rental vessels in 1989 (unpub. MRFSS data). Ownership of a private vessel involves sizable investment and maintenance costs, thus contributing greatly to measures of economic impact. Private vessels are also used for non-fishing purposes, however, and are used to fish for

many different species. Expenditure and cost data must be prorated for summer flounder trips to account for multipurpose use.

In addition to private and rental boats, 12% of summer flounder were caught from shore and 10% from party and charter boats. The Fishery Management Plan for Summer Flounder (MAFMC 1988) requires annual permits for party and charter boats (vessels for hire) which take anglers to fish for summer flounder within the US EEZ. NMFS permit files indicate that 213 vessels have requested a summer flounder party/charter permit for 1990. It is likely that many more vessels are actually dependent on summer flounder fishing for a significant fraction of passenger revenues. Without individual logbooks, however, the total number of party and charter vessels actually directing trips on summer flounder is difficult to determine.

In 1985, a total of 528 party and 1,997 charter boats operated out of Atlantic coast ports from Maine through Florida (Table 58). These vessels generated revenues of $160 million in 1985. Estimates of party and charter boat trips directed at summer flounder are lacking for specific regions along the coast, but a 1987 survey of New Jersey party and charter boat owner/captains (Brown and Ofiara 1989) may be indicative of the Mid-Atlantic region. Survey respondents reported that, in 1987, New Jersey party boats targeted 21.7% of trips towards summer flounder and New Jersey charter boats targeted 10.4% of trips for this species.

The NMFS estimated that 8,900,000 angler trips (all modes) were nominally directed at summer flounder in 1988, and 23,941,000 trips actually caught summer flounder (Table 40). Over 80% of those directed summer flounder trips were made in the Mid-Atlantic region, further underscoring the importance of summer flounder to coastal counties in the region.

8.2.2 Economic Impact of the Recreational Fishery

In 1985, Mid-Atlantic region direct sales related to marine recreational fishing for all species amounted to over $1.0 billion (SFI 1988a). These sales and services required 17 thousand person-years of labor and generated wages of $213.8 million. Adjusting these expenditures to account for species preferences, angling for summer flounder was estimated to be the second most popular recreational fishing activity for the Mid-Atlantic region in 1985 (SFI 1988b). In the North and South Atlantic regions, summer flounder impacts were not specifically enumerated due to the greater relative popularity and abundance of other species.

The Sport Fishing Institute estimated that 10% to 15% of the $1.05 billion in retail sales directly related to Mid-Atlantic marine recreational fishing in 1985 could be attributed to summer flounder (Table 59), making it second only to bluefish in importance to anglers. The estimates disaggregate the regional economic impacts to summer flounder based on the percent of total trips where summer flounder were reported as the target species. The minimum estimate uses the target percent as given. The maximum estimate assumes that those individuals, who did not identify a target species, have the same distribution of species preferences as those who did express a preference. Estimates of the economic activity associated with recreational fishing for summer flounder on the Atlantic Coast in 1985 are: $110.1 to $152.8 million in retail sales; 1,795 to 2,494 person-years of employment; and $22.4 to $31.1 million in wages and salaries (Table 59). These estimates are comparable to the above estimates for the commercial fishery (Section 8.1.4).

8.2.3 Value of Summer Flounder to Anglers

Clearly, the economic impacts associated with Atlantic coast recreational fishing for summer flounder are significant. Estimates of aggregate economic value are not currently available, however. The value of recreational fishing can be divided into actual expenditures and a non-monetary benefit associated with satisfaction (consumer surplus). Combined, these two values divide the area under a demand or willingness-to-pay curve up to the point of the quantity of trips taken at given levels of costs, catch rates, etc. (Figure 16).

The demand for recreational fishing trips is determined by the costs of equipment, travel expenditures, catch rates, accessibility of fishing sites, weather, social experiences, and many other factors affecting angler enjoyment. Holding all other factors constant (expenditures, weather ,etc.), a decrease in the catch (or retention rate) of fish should move the demand curve to the left (Figure 16). Likewise, an increase in the catch (or retention rate) of fish should move the demand curve to the right. Each move will have an associated decrease (increase) in angler expenditures and total benefits.

The above estimate of total expenditures made fishing for summer flounder is useful for economic impact analysis, but it is impossible to estimate the total value (willingness to pay) of summer flounder without an estimate of the marginal value per trip. The determination of marginal value requires a demand curve for recreational fishing. In the case of summer flounder, as with many recreationally sought species, an aggregate demand curve is not available.

Several studies have estimated the value of a recreational fishing day for saltwater angling along the Atlantic coast. A University of Delaware study (Rockland 1983) presented value per trip for marine recreational fishing at nine sites in Delaware. This study used the travel cost method with a variety of estimation approaches. The range of average values for the boat fishing sites was $20.58 to $39.90 per day, whereas the range for shore fishing was $37.47 to $62.53 per day. A study of recreational striped bass fishing on the Atlantic Coast presented estimates of $39 to $169 per day (Norton *et al.* 1983). A 1982 study conducted for the State of Florida derived estimates of $18.97 to $57.99 per day for all marine species (Bell *et al.* 1982). Since the above studies are 7 to 8 years old, the dollar values are understated because of inflation.

It is important to note that the average cost of a summer flounder trip or fishing day is not equivalent to the marginal value of a recreationally caught summer flounder. Attributes of a recreational fishing day other than catching fish are valued by anglers, so all expenditures are not dependent on summer flounder catch. The marginal value of summer flounder catch must be estimated, and as with any normal good, marginal value declines with increasing quantity. Agnello (1989) determined the marginal value of recreationally caught summer flounder by considering fishing success as a shift factor in the demand for summer flounder trips. Using the travel cost method, estimates of marginal value for the first summer flounder caught by the average angler ranged from $4.00 to $17.73 (1987 dollars) depending on the specification of the regression model. Estimates for the average summer flounder, about four fish per angler, ranged from $2.06 to $9.24, indicating a declining marginal value for each successive summer flounder kept.

8.3 International Trade

No summer flounder are imported into the US since the species occurs primarily along the US Atlantic coast. However, imports of several other species of flat fish are substitutes for summer flounder in the market place. These imports compete with and affect the price of summer flounder, winter flounder, yellowtail flounder, and other domestic flat fish species (Wang 1984).

Import statistics are not kept by species but only by group. Imports of flounder fillets have increased gradually from 1980 to 1989, averaging just over 50 million pounds for the period (Table 60).

Summer flounder has comprised just under 10% of the total US supply of flounder fillets over this period.

Current import prices are about $2.00 per pound (Table 61).

Approximately 65% of all flat fish imports in 1984 were from Canada. This trend seems to have subsided in recent years, due to import duties imposed on Canadian fish (duties will eventually be phased out under the Free Trade Agreement) and size limits on imports pursuant to the NEFMC Multispecies Fishery Management Plan. Over the last few years, imports of flounder fillets from Argentina have increased in response to reduced supplies of summer flounder in the southeast US. It is not known whether this is replacing Canadian imports or supplementing domestically harvested flounder.

Only limited quantities of summer flounder have been exported from the US since 1981, most likely due to high demand for fresh flounder in the domestic markets. Annual quantities varied from 1,764 pounds to 197,312 pounds and export prices varied from $1.32 to $3.50 per pound (Table 62). The only consistent importer over this time frame has been Japan (R. Ross pers. comm.). In recent years, Rhode Island vessels landing larger, high quality summer flounder have been exporting to Japan (McCauley pers. comm.). Exports are targeted for the fresh (sashimi) market and command premium prices. Competition for frozen flat fish in the Japanese market is stiff, however, so there is essentially no profit in exporting summer flounder in frozen form (US Embassy Fisheries Attache, Tokyo). For example, Tokyo import value (including insurance and freight) of fresh flat fish (all spp.) from the US in January 1990, averaged $5.66 a pound, while frozen imports averaged only $0.75 per pound. However, there are recent reports of exports of very large summer flounder to Japan at $5 per pound exvessel (McCauley pers. comm.).

No international trade in summer flounder results from bycatch or directed catch in foreign or joint venture fisheries in the US EEZ since summer flounder is a prohibited species.

9. FISHERY MANAGEMENT PROGRAM

9.1. MEASURES TO ATTAIN MANAGEMENT OBJECTIVES

9.1.1. Specification of OY, DAH, DAP, JVP, and TALFF (this section remains unchanged from the current FMP)

Section 303(a)(3) of the MFCMA requires that FMPs assess and specify the OY from the fishery and include a summary of the information utilized in making such specification. OY is to be based on MSY, or on MSY as it may be adjusted for social, economic, or ecological reasons. The most important limitation on the specifica-

tion of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing. MSY (Section 5.4) has not been specified for summer flounder since there is no current valid quantified MSY estimate.

OY is all summer flounder harvested pursuant to this FMP. OY cannot be specified as a quantity because (1) there is no current valid estimate of MSY, (2) current State management regimes do not rely on quotas, and (3) this FMP does not rely on quotas.

The Council has concluded that US vessels have the capacity to, and will, harvest the OY on an annual basis, so DAH equals OY. The Council has also concluded that US fish processors, on an annual basis, will process that portion of the OY that will be harvested by US commercial fishing vessels, so DAP equals DAH and JVP equals zero. Since US fishing vessels have the capacity and intent to harvest the entire OY, there is no portion of the OY that can be made available for foreign fishing, so TALFF also equals zero.

9.1.2 Specification of Preferred Management Measures

9.1.2.1. Permits and fees

Any owner or operator of a vessel desiring to take any summer flounder within the US EEZ, or transport or deliver for sale, any summer flounder taken within the EEZ must obtain an annual permit for that purpose. This section does not apply to fishermen taking summer flounder for their personal use, but it does apply to the owners of party and charter boats (vessels for hire).

The owner or operator of a US vessel may obtain the appropriate permit by furnishing on the form provided by NMFS information specifying, at least, the names and addresses of the vessel owner, the name of the vessel, official Coast Guard number, directed fishery or fisheries, gear type or types utilized to take summer flounder, gross tonnage of vessel, the permit number of any current or previous fishery permit issued to the vessel, radio call sign, length of the vessel, engine horsepower, year the vessel was built, type of construction, type of propulsion, navigational aids (e.g., Loran C), type of echo sounder, type of computer, crew size including captain, fish hold capacity (to the nearest 100 lbs), quantity of summer flounder landed during the year prior to the one for which the permit is being applied, principal port of landing, the home port of the vessel, and number of passengers (for party and charter boats). The permit shall be subject to inspection by an authorized official upon landing.

Permits expire on 31 December of each year. Permits may be revoked for violations of this FMP.

The Council recommends that NMFS impose a permit fee as provided in the MFCMA.

9.1.2.2. Time and area restrictions (this section remains unchanged from the current FMP)

Time and area restrictions are not proposed.

9.1.2.3. Catch limitations (this section remains unchanged from the current FMP)

It is illegal to possess summer flounder less than 13" total length (TL) and it is illegal to possess parts of summer flounder less than 13" to the point of landing.

Vessels with permits issued pursuant to this FMP are required to fish and land pursuant to the provisions of this FMP unless the vessels land in States with larger minimum fish sizes than those provided in the FMP, in which case the minimum fish sizes would be required to meet the State limits.

Foreign fishermen are not permitted to retain summer flounder since US fishermen, by definition, harvest the OY.

States with minimum sizes larger than those in the FMP and minimum mesh regulations are encouraged to maintain them.

After three years of Plan implementation the Council would begin to annually examine fishing mortality estimates of age 2 summer flounder to measure the effectiveness of the size limit relative to the FMP's objectives. If the Council finds that the fishing mortality of age 2 summer flounder has increased, based on the following adjustment criteria, and if the NMFS Northeast Regional Director concurs with the Council, the minimum fish length would be increased by the NMFS Northeast Regional Director to a minimum fish length of 14" TL.

The adjustment criteria are (1) estimated fishing mortality from the NEFC spring survey and (2) estimated fishing mortality from a virtual population analysis (VPA) which would be tuned using commercial and recrea-

tional fishery CPUE indices. If a three year trend of either of these mortality estimates increases, an increase in the minimum fish length would be required.

The trend in post-FMP fishing mortality rate (age 2 fish) estimated from the NEFC spring survey will be measured relative to the baseline level defined from pre-FMP fishing mortality rates (age 2 fish) from NEFC survey data (catch at age available from 1976-1988). Likewise, the trend in post-FMP fishing mortality rates (age 2) estimated from virtual population analysis (VPA) will be measured relative to the baseline level defined from pre-FMP fishing mortality rates (age 2) from VPA (catch at age also available from 1976-1988). Best estimates of discards will be incorporated into both the catch-at-age data and commercial catch per unit effort (CPUE) data. Catch per unit effort indices to be used to tune the VPA will be evaluated from standardized fishing power analyses of commercial and recreational fisheries data. Candidate data series for CPUE indices include (but are not limited to) NEFC commercial weighout (1976-1988), North Carolina winter fishery (1982/83 - 1988/19) and Marine Recreational Fishery Statistics Survey (MRFSS) (1979-1988) data.

9.1.2.4. Minimum mesh requirement.

Only otter trawl vessels with 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh), inside measure, applied throughout the cod end for at least 75 continuous meshes forward of the terminus of the net may retain more than 500 lbs of summer flounder. If the fish are landed in a State that has a larger minimum net mesh size, the State limit would prevail. There are two exceptions to this rule:

1. Vessels fishing seaward of the line described below may obtain a special permit from NMFS in advance of doing so. Vessels with this special permit are exempted from the minimum net mesh regulations, but are prohibited from fishing west (landward) of the line. NMFS is authorized to establish procedural rules necessary to process applications for and cancellation of these special permits in order to facilitate enforcement.

   The line follows 71°30' west longitude south to its intersection with Loran C 8860-Y-43750, thence northeasterly along Loran C 8860-Y-43750 to 41°00.0'N, 70°49.5'W, thence easterly to 41°00.0'N, 70°30.0'W, thence southerly to 40°50.0'N, 70°30.0'W, thence easterly to 40°50.0'N, 69°40.0'W, thence southerly to 40°33.5'N, 69°40.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°26.5'N, 70°40.0'W, thence northerly to 40°40.5'N, 70°40.0'W, thence southwesterly along Loran C 9960-Y-43600 to 40°30.0'N, 72°00.0'W, thence southerly to 40°17.8'N, 72°00.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°15.5'N, 72°20.0'W, thence southerly along 72°20.0'W, to the southern limit of the management unit (see Figure 17).

2. Vessels fishing in the fly net fishery are exempt from the minimum mesh size requirement. A fly net is a two seam otter trawl with the following configuration:

   a. The net has large mesh webbing in the wings with a stretch mesh measure of 8" to 64".

   b. The first body (belly) section of the net consists of 35 meshes or more of 8" (stretch mesh) webbing or greater.

   c. In the body section of the net the stretch mesh decreases in size relative to the wings and continues to decrease throughout the extensions to the cod end, which generally has a webbing of 2" (stretch mesh).

   Vessels fishing in the fly net fishery under this exemption may catch no more than 50 lbs of summer flounder in any haul back of the fly net. This is necessary to assure that the exemption is not abused.

   If the Regional Director determines after a review of annual data that the summer flounder catch in the fly net fishery exceeds 1% of the total catch in the fly net fishery, he may rescind the exemption.

Otter trawl vessels retaining more than 500 lbs of summer flounder and subject to the 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh) regulation may not have available for immediate use any net, or any piece of net not meeting the mesh size requirements, or mesh that is choked off. A net that conforms to one of the four following specifications and which cannot be shown to have been in recent use is considered to be "not available for immediate use":

1. nets stowed below deck; or

2. nets stowed and lashed down on deck; or

3. nets which are on reels and are covered and secured with the cod end removed; or

4. nets which are secured in a manner approved by the Regional Director. After review and approval, the Regional Director may specify alternative manner(s) of securing nets by notice in the Federal Register.

A net is considered to be stowed below deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck of the vessel. Towing wires (any wires including the "leg" wires), must be detached from the net.

A net is considered to be stowed and lashed down on deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck or the rail of the vessel. The towing wires (any wires including the "leg" wires), must also be detached from the net.

A net on a reel is considered to be "stowed and lashed down on deck" only if the entire surface of the net on the reel is covered with canvas or similar material which is securely bound, the towing wires (any wires including the "leg" wires), must also be detached from the net, and the cod end is removed from the net and stored below deck.

A fishing vessel may not use any means or device which would obstruct the meshes on the top of the regulated portion of a trawl net, except that one net strengthener may be attached (only at its outside edges) to the top of the regulated portion of a trawl net, if such net strengthener consists of mesh material similar to the material of the regulated portion of the net and has a mesh size of at least twice the authorized minimum mesh size. "Top of the regulated portion of the net" means the 50% of the entire regulated portion of the net which (in a hypothetical situation) would not be in contact with the ocean bottom during a tow if the regulated portion of the net were laid flat on the ocean floor.

States with minimum mesh regulations larger than those established in this FMP are encouraged to maintain them.

Since it will be difficult to detect a violation of the minimum mesh net regulation, the penalty for individuals detected of such a violation must be sufficient to provide an adequate deterrent. Therefore, it is recommended that penalty for the first offense be a six month loss of permit and the penalty for a second offense be a one year loss of permit. After imposition and expiration of such a penalty, if the individual fishes without penalty for three consecutive years, the earlier offenses are expunged from the record.

9.1.2.5. Other measures. (this section remains unchanged from the current FMP)

No foreign fishing vessel shall conduct a fishery for or retain any summer flounder. Foreign nations catching summer flounder shall be subject to the incidental catch regulations set forth in 50 CFR 611.13, 611.14, and 611.50.

9.1.3. Specification and Sources of Pertinent Fishery Data. (this section remains unchanged from the current FMP)

9.1.3.1. Domestic and foreign fishermen.

Section 303(a)(5) of the MFCMA requires at least information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, and number of hauls must be submitted to the Secretary. In order to achieve the objectives of this FMP and to manage the fishery for the maximum benefit of the US, it is necessary that, at a minimum, the Secretary collects on a continuing basis and make available to the Councils: (1) summer flounder catch, effort, and ex-vessel value and the catch and ex-vessel value of those species caught in conjunction with summer flounder for the commercial fishery provided in a form that analysis can be performed at the trip, water area, gear, month, year, principal (normal) landing port, landing port for trip, and State levels of aggregation; (2) catch and effort for the recreational fishery; (3) biological (e.g., length, weight, age, and sex) samples from both the commercial and recreational fisheries; and (4) annual and fully comparable NMFS bottom trawl surveys for analyses of both CPUE and age/size frequency. The FMP includes no requirements as to how these data are to be submitted to the Secretary. The Secretary may implement necessary data collection procedures through amendments to the regulations. It is mandatory that these data be collected for the entire management unit, including North Carolina, on a compatible and comparable basis.

Foreign fishermen are subject to the reporting and recordkeeping requirements in 50 CFR 611.50(d).

9.1.3.2. Processors. Section 303(a)(5) of the MFCMA requires at least estimated processing capacity of, and the actual processing capacity utilized by US fish processors must be submitted to the Secretary. The FMP in-

cludes no requirements as to how these data are to be submitted to the Secretary. The Secretary may implement necessary data collection procedures through amendments to the regulations.

9.2. ANALYSIS OF BENEFICIAL AND ADVERSE IMPACTS OF ADOPTED MANAGEMENT MEASURES

9.2.1. The FMP Relative to the National Standards

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

A quantified MSY (Section 5.4) has not been specified for summer flounder because of various data difficulties and model inappropriateness. OY is all summer flounder harvested pursuant to this FMP.

Populations of most species oscillate due to natural causes. This oscillation can be imagined as a distorted sine wave. Many species are susceptible of reaching population levels low enough that reproduction is hindered (recruitment overfishing) and it then becomes very difficult for population levels to rebuild (right whales, shortnosed sturgeon, sharks, and whooping cranes are examples).

No relationship between stock size and the recruitment of summer flounder has been detected, but one certainly is intuitive. Environmental variations can have a tremendous impact on summer founder. The level of summer flounder harvest has increased dramatically during the past decade (Table 1) yet very high levels of young were reported in 1986 (R. Smith, pers. comm., Howe, pers. comm., Casey, pers. comm., Musick, pers. comm.).

State survey data indicate that recruitment of the 1988 year class was poor. These surveys also indicate that 1989 and 1990 year classes were "no better than average".

Summer flounder are overexploited. Current F levels (1.0) are at least triple the F_{max} level (0.35). These proposed regulations are intended to preserve the 1989 and 1990 year classes. If mortality on these sublegal, juvenile fish can be reduced, this Amendment will be helpful in meeting the FMP objectives. It is recognized that the measures added to the management regime through this Amendment will not reduce fishing mortality on summer flounder to the F_{max} level.

Overfishing for summer flounder is defined as fishing in excess of the F_{max} level. F_{max} is a commonly used biological reference point corresponding to the level of fishing mortality (F) that produces a maximum yield per recruit, which specifically addresses the growth overfishing problem. A common alternative reference point, $F_{0.1}$, is a more conservative level of fishing mortality, implying a lower risk of recruitment overfishing than F_{max}, a higher catch per unit of effort, and which produces a greater number of age groups in the exploitable stock and spawning stock. It also enhances stability in catches. In the case of this fishery, the distinction between the two reference points is small. Based on recent information, F_{max} has been preliminarily reestimated at 0.23, $F_{0.1}$ has been preliminarily reestimated as 0.14, while current F appears near 1.4. Moreover, F_{max} is presently a much lower target level than F_{med} (or F_{rep}), another biological reference point based on spawning stock biomass per recruit and information from spawning stock biomass and resulting recruitment. In the past six years, recruitment (per kg of spawning stock biomass) has indicated an F_{med} level of approximately 1.0. An F level used as a definition of overfishing which is well below F_{med}, such as F_{max}, should also provide protection from recruitment overfishing once the stock is rebuilt. It would also provide significant opportunities for stock rebuilding is recent patterns of recruitment (per unit of spawning stock biomass) continue, although this level of fishing (F_{max}) has not been proposed as a current target for rebuilding.

A more important aspect than the overfishing definition is the current status of the stock. It is presently in an overfished condition as indicated by a steady decline in resource survey abundance declines since the mid-1970's and a reduction in the number of age groups from 10 to 4.

The Council is working on a major amendment to the FMP (Amendment 2) to, among other things, address the overfishing issue. However, because a significant portion of the fishery occurs in State waters, the major amendment requires a high degree of coordination with the States, working through ASMFC. The requisite coordination procedures have been established and a schedule has been agreed to that will result in a public hearing draft of the major amendment by the spring 1991 ASMFC meeting. Specifically, ASMFC has created a Summer Flounder, Scup, and Black Sea Bass Board made up of representatives from Massachusetts, New York, New Jersey, Virginia, and North Carolina. That Board has recommended that the existing ASMFC Summer Flounder Plan be amended at the fall 1990 ASMFC annual meeting to require a 5.5" minimum mesh size and has also adopted a schedule that would result in a hearing draft ready for adoption at the spring 1991 ASMFC meeting (May 1991). This draft would also be adopted by the Council, with hearings in the early summer and adoption by the Council in August 1991. Coordination between the Council and ASMFC is enhanced by the

fact that the Chairman of the ASMFC Summer Flounder, Scup, and Black Sea Bass Board is also Chairman of the Council's Demersal Species Committee, the oversight committee for this FMP and by the fact that a Council staff member is a member of the ASMFC Scientific and Statistical Committee. The Council has also created a Plan Development Team for Amendment 2 that includes in its membership representatives of the Northeast Fisheries Center, the NMFS Northeast Regional Office, and NMFS Headquarters staff.

The organizational arrangements for Amendment 2 follow those used with much success in the development of the Bluefish FMP.

The record shows that the Council is aware of the resource situation regarding summer flounder, is aware of the 602 *guidelines*, and is working toward a solution to the problems involved in a way that resolve the problems involved in a realistic fashion in a complex interjurisdictional environment.

The mesh regulation to be implemented through this Amendment 1 is a critical interim measure that cannot wait until the major amendment has been completed and implemented.

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

This FMP is based on the best and most recent scientific information available. Future summer flounder research should be devoted toward both data collection and analysis in order to evaluate the effectiveness of this FMP. This species should be periodically reviewed by the NEFC Stock Assessment Workshop process.

9.2.1.3. 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 FMP's management unit is summer flounder throughout their range on the Atlantic coast from Maine through North Carolina, including the EEZ, territorial sea, and internal waters. This specification is considered to be consistent with National Standard 3.

9.2.1.4. 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.

The FMP does not discriminate among residents of different States. It does not differentiate among US citizens, nationals, resident aliens, or corporations on the basis of their State of residence. It does not incorporate or rely on a State statute or regulation that discriminates against residents of another State.

9.2.1.5. 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 management regime is intended to allow the fishery to operate at the lowest possible cost (e.g., fishing effort, administration, and enforcement) given the FMP's objectives. The objectives focus on the issue of administrative and enforcement costs by encouraging compatibility with State regulations since a substantial portion of the fishery occurs in State waters. The FMP places no restrictions on processing, or marketing and no unnecessary restrictions on the use of efficient techniques of harvesting.

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

The management regime was developed to be compatible with and reinforce the management efforts of the States and ASMFC.

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

The management regime was developed to be compatible with and reinforce the management efforts of the States and ASMFC. Costs are discussed in section 9.2.2. The ASMFC Summer Flounder, Scup, and Black Sea Bass Board has recommended adding the 5.5" minimum mesh size as a mandatory measure to the ASMFC Summer Flounder FMP. Amendment 1 will improve compatibility with State regulations (section 9.3.4.1).

9.2.2. Cost/Benefit Analysis.

In the short term, the proposed 5.5" minimum mesh (diamond) or 6" minimum mesh (square) size restriction will directly impact landings of summer flounder and certain species taken as bycatch. In the long term, stock

recovery will result in higher sustainable catch rates of summer flounder, thus providing fishery participants with a return on investment in the stock. Costs and benefits to the industry, Federal government, and consumers of increasing mesh size to 5.5" (diamond) or 6" (square) are addressed in the following sections.

The exemptions for the northeastern fishery and the fly net fishery should reduce costs to those fishermen with minimal risk to the resource.

9.2.2.1 Recreational Fishery

This amendment contains no new management measures pertaining to recreational fishing for summer flounder. The 13" size limit in the EEZ will be maintained. No adverse impacts to the recreational fishery will result from mesh size regulations in the commercial fishery. Long term benefits to recreational fishermen will be manifested through higher catch rates and a higher proportion of "keepers" as the summer flounder stock size recovers and older cohorts are re-established.

9.2.2.2 Commercial Fishery

The proposed management measure of 5.5" minimum codend mesh (diamond) or 6" minimum square, will impact the costs and revenues of the directed summer flounder fishery. Landings of other species taken as bycatch to the directed summer flounder fishery will also be affected, as will landings of small mesh fisheries not directed at summer flounder but which will be subject to the mesh regulation due to summer flounder catches of 500 pounds or greater.

Weighout data indicate that 2,856 trips landing 500 lbs or more of summer flounder were made in 1989 (Table 63), by approximately 422 vessels. In order to account for vessels not covered by the weighout system (CT, DE, NC), approximately 500 vessels shall be assumed to be affected by the mesh size restrictions. Compliance costs to these vessels fall into the following categories: reduced catch of summer flounder; reduced bycatch of marketable species; and gear conversion and other costs related to altered fishing practices.

Reduced catch of legal sized summer flounder will likely be minimal. A 5.5" diamond mesh has a length of 50% selection (L_{50}) of 13.5" (Tables 64 and 65) and a 6" square mesh is considered equivalent (section 9.2.2.3). All States currently have a minimum legal size limit for summer flounder at 13" or greater (Table 66) so small amounts of flounder which could be legally retained would in fact be lost due to the mesh restriction.

Bycatch of marketable species will be markedly affected, however, since an average of 40% of revenues from weighout trips landing 500 pounds or more of summer flounder were derived from other species during 1983-89. The extent to which marketable bycatch is reduced will depend on fishing practices (season, area, etc.) and the selection characteristics of a 5.5" mesh for the particular species. Without specific selectivity information, the magnitude of bycatch losses cannot be determined. The problem may be most acute in the southern New England area where other groundfish are relatively abundant and contribute a greater share of the catch. However, the 5.5" minimum mesh requirement in Amendment 4 to the Multispecies FMP (NEFMC 1990) will significantly reduce the bycatch of many of these trips even before these proposed regulations become effective.

Cost increases associated with gear conversion are estimated to be about $1000 per codend. Full costs cannot be attributable to the mesh size restriction, however, since many fishermen would be replacing codends due to State regulations and the Multispecies FMP or to normal wear and tear form fishing activities. Costs of replacing a complete otter trawl are estimated to be about $8000 per net. Again, full costs cannot be attributable to the mesh size restriction since many fishermen would be replacing codends due to State regulations or the Multispecies FMP or to normal wear and tear form fishing activities. In addition, many fishermen commonly use larger mesh in the wings and body of the net in order to reduce drag and fuel consumption, and thus would not need to replace an entire net.

Benefits of mesh size restriction in the directed summer flounder fishery would result from reduced fuel consumption and increased summer flounder catches in future years. Studies on fishing net drag and fuel consumption indicate only marginal gains in fuel efficiency with small increases in mesh size, but in times of rising fuel prices savings can be more significant.

Greater gains will accrue to fishermen through protecting small summer flounder until they reach legal size. Discard mortality is extremely high (estimated at 80%) for trawl caught flat fish and the problem is particularly acute when new year classes are abundant. Recent evidence of strong recruitment indicates that a mesh size restriction at this time would enhance stock rebuilding efforts and reduce mortality of small flounder (Tables 67 and 68). The benefits of the proposed mesh size regulation will be manifested through a more bal-

anced age structure of the summer flounder stock. Further, waste will be reduced due to lower total discards and lower mortality of net encounter.

A threshold of 500 lbs per trip would have affected approximately 74% of the vessels and 34% of the trips landing summer flounder from 1983-89 based on NMFS weighout data. However, these trips accounted for over 95% of the total summer flounder landed during these years. In fact, for each year from 1983 to 1989 this percentage changed very little, ranging from 93 to 96%. this period encompassed years in which recruitment was both good (1985) and very poor (1988), indicating that the 500 lb criterion is a valid threshold during years of both relatively high and low abundance.

The 500 lb threshold was used to define a directed (regulated) trip after extensive analysis of numerous threshold levels from 0 to 2,000 lbs per trip using the NMFS weighout data. Decreasing the threshold from 500 to 0 lbs resulted in a higher proportion of regulated trips (ranging from 34 to 100%), and, thus, greater regulatory impact, with an increase in affected landings of only 5% (that is, 95% to 100%). Increasing the threshold significantly reduced the proportion of both affected trips and landings. Discussions with the Council's industry advisors indicated that 500 lbs correctly identified a directed trip, corroborating the results of the weighout data analysis.

9.2.2.3. Square and diamond mesh equivalency

Data are limited on the selectivity of a square mesh for summer flounder on which to base an equivalent to the 5.5" diamond mesh. Unquestionably, mesh selectivity for cod, haddock, and pollock demonstrate that for round fish, diamond mesh of 5.5" has roughly the same selectivity characteristics as a square mesh of 5.0". However, selectivity behavior for flat fishes, like summer flounder, have been evaluated significantly less. The equivalency of a 5.5" diamond mesh selectivity to a 6.0" square mesh for summer flounder is based on three sources. First, Amendment 4 to the Northeast Multispecies FMP (NEFMC 1990) states: "The use of square mesh codends is known to significantly increase the retention of small flounders. Preliminary information indicates that a 5.5" square mesh codend may have roughly the same flat fish selectivity characteristics as a 5" diamond mesh codend." Second, in selectivity study for nets for winter flounder in Connecticut, Simpson (1989) states: "Diamond mesh was found to have a length at 50% retention about 1 cm longer (L_{50} = 22.6 cm), and a selection range (3.4 cm) about 1 cm narrower, than square mesh in 102 mm codends." (Conversion from metric is 1 cm = 0.39"). The third source is from Canadian researchers in Nova Scotia (Cooper and Hickey 1989) who, while exploring selectivity behavior mainly for cod and haddock, observed: "For flounder, the diamond mesh codends always have higher 50% retention lengths and selection factors."

9.2.2.4. Exemptions to mesh regulation

There are two exemptions to the minimum mesh regulation. One is the area offshore 71°30'W, the yellowtail closed area, and 72°20'W. The other exemption is the fly net fishery.

The exempted area was suggested by the New England Fishery Management Council.

Among the adverse impacts of a 5.5" diamond minimum mesh size (6" square) restriction for otter trawl trips would be the loss of marketable bycatch to fishermen who currently use smaller mesh in directed fisheries for other species, yet land 500 pounds or more of summer flounder. Many of these trips occur during the winter months off southern New England when vessels target on squid, butterfish, and other species with small mesh.

An analysis of 39 trips landing at the Pt. Judith Fishermen's Coop between December 1989 and April 1990 indicated that the summer flounder landings totalled between 565 and 3,834 lbs, while accounting for between 1.5 and 21.5% of the fish on board. A mesh of 5.5 " would reduce total catch to the point where profits would be reduced. On the other hand, discarding summer flounder to reduce landings below the 500 pound threshold would be wasteful since the fish are generally large. "Large" and "Jumbo" categories comprised 75% of the landings of summer flounder in Rhode Island during the first quarter of 1990.

NEFC commercial weighout data were used to determine the length frequencies of summer flounder caught in northeast statistical areas that were entirely offshore 71°30'W, the yellowtail closed area, and 72°20'W. Based on combined 1985 to 1989 data, 99.8% of the summer flounder caught in these areas and landed by commercial fishermen were 13" or greater in length. A total of 84.7% were 15" or larger. These values were higher than the percentages for all other water areas combined, that is, 88.6% of the summer flounder landed from the other water areas were 13" or larger and only 50% were 15" or larger.

Under this alternative, vessels fishing east of the line are exempt from the mesh size requirement if the vessel has a permit from NMFS to fish east of the line. Vessels with this special permit are prohibited from fishing

west of the line and inshore in the yellowtail area. This provision also reduces waste by eliminating the need to discard summer flounder in order to avoid the mesh size requirement.

The mesh size requirement is designed to protect smaller summer flounder, which do not occur in these offshore areas in the winter months. The exemption is thus viewed consistent with the conservation goals of the FMP, while reducing discard waste in the summer flounder fishery.

The special permit mechanism for implementing this exemption is readily enforceable without boarding the fishing vessel. The effort needed to obtain and cancel these permits should be more than offset by the flexibility the exemption offers the fishermen.

The fly net exemption was suggested by the South Atlantic Council and by the State of North Carolina.

The use of fly nets occurs generally between Cape Henlopen, Delaware, and North Carolina in the fall - winter season. Atlantic croaker, weakfish, and Atlantic mackerel were the dominant species in the fly net catches made during successive fishing seasons from 1985 to 1988 (in 1987-88 several catches of large bluefish increased this species' relative importance). Limited amounts of summer flounder are traditionally harvested by this gear, with estimates of only 266 pounds (0.8% of the catch), 91 pounds (0.3%), and 58 pounds (0.2%) for the 1985-86, 1986-87, and 1987-88 fishing seasons harvested per trip. If one extrapolates the North Carolina sampled fly net catch to the total landings in North Carolina, it appears there are between 300 and 500 fly net trips per year.The exemption should increase flexibility to the fishermen while not negatively impacting the conservation objective of the FMP.

The provision that vessels may haul back no more than 50 lbs of summer flounder per fly net trawl should serve to prevent a directed summer flounder fishery with this gear. The provision that the Regional Director may withdraw the exemption if the annual average summer flounder catch in the fly net fishery exceeds 1% of the total is another safeguard. The 1% is reasonable in light of the statistics in the preceding paragraph.

9.2.2.5. Administrative, enforcement, and information costs

The minimum mesh regulation requires at sea enforcement in addition to the existing dockside enforcement of minimum size. The at sea enforcement efforts will be estimated by determining the number of vessels fishing for summer flounder in the EEZ (mesh regulation) and the number of vessels landing summer flounder (minimum size regulation). A change in mesh size will not affect enforcement requirements.

The number of vessels that landed at least 500 lbs of summer flounder caught in the EEZ in 1989 is estimated to be 492 (422 from the Weighout files and 70 in North Carolina). However, the following analysis is based on 525 vessels requiring at sea inspection to reflect the redirection of groundfish otter trawlers to summer flounder and some vessels which will not be fishing for summer flounder but will be trawling in the same area and therefore need to be checked.

At sea enforcement is estimated to require 2 contacts per vessel per year (1,050 contacts) with an average of 4 contacts per enforcement vessel per day (263 days). It is estimated that patrol vessels ($6,828 per day) would be used for most of the contacts although medium endurance cutters ($26,664 per day) would be required during rough weather (assumed to be 15% of the time).

It is important to understand, however, that the costs of at-sea enforcement by the Coast Guard are not simply additive among fishery management plans, or any other area of enforcement. Coast Guard officials are required to enforce all applicable laws when boarding a vessel, whether they pertain to fisheries, illegal immigration, or narcotics trafficking.

The actual costs that may be attributed to summer flounder enforcement at sea equal the administrative costs of educating Coast Guard personnel on summer flounder regulations, plus the costs of *new* boardings that would not otherwise have taken place in the absence of summer flounder regulations.

Estimating these latter costs are, of course, problematic, and to a certain extent involve the criteria which a Coast Guard official would use in making a decision to board or not board a particular vessel. As with any law enforcement agency, officers will seek out patterns of behavior or activity which tend to be associated with illegal acts. An obvious example at sea would be the case where vessels change course or speed, or initiate the haulback of gear as soon as the enforcement vessel becomes identifiable on the horizon. A vessel exhibiting this type of behavior is going to arouse the suspicion of any responsible authority, and whether the Coast Guard Commander believes it is most likely due to a fisheries violation or a drug violation will make little difference to the decision to board.

It is also true that not all laws are equivalent in the level of effort they impose on an enforcement official on patrol. Enforcement of a closed area, for example, requires that a vessel steam to a particular location in order to enforce it, while overseeing a size limit or gear restriction that applies to a wide area allows a Commander more freedom of movement in placing a vessel where the greatest number of needs might be met simultaneously.

The mesh restriction contained within this Amendment is specified to apply over the entire Mid-Atlantic coast, and therefore intended to blend with existing regulations and add as little additional burden as possible. Atlantic Coast domestic fishery boardings were specified as totalling 2,943 for FY89 and 2,067 for FY90, of which 950 and 731 occurred respectively in the Mid-Atlantic area. Given the multi-purpose nature of all Coast Guard boardings, therefore, it is considered that a majority of the necessary summer flounder enforcement is already in place.

Using the figures above for boarding costs per day and 1,050 annual contacts, the total cost would equal $2.6 million assuming that the Coast Guard was doing nothing at all on those boardings besides summer flounder enforcement. Again, however, given that all Coast Guard boardings are multi-purpose, this figure should be prorated for that "portion" of a boarding which might be ascribed to summer flounder. While only lengthy study by Coast Guard personnel could attempt to accurately estimate this number, it is not unreasonable to assume that it would be something less than 10%, given all the other bodies of law which the Coast Guard is asked to enforce. Therefore, a figure of $260,000 might be considered as an upper bound for these costs, with assistance given by State agencies substantially lowering the costs for enforcement closer inshore.

The cost of enforcing the exemption in the offshore fishery in the northeast should be minimal because it can be enforced from aircraft, so no boarding will be needed. Also, significant enforcement in the New York and New England Area for summer flounder will occur while enforcement agents are checking vessels for compliance with the Northeast Multispecies FMP. It must be recognized that the mesh storage requirements of this Amendment are the same as those in the Multispecies FMP. Also, a portion of the exemption line is a portion of the border of the yellowtail closed area established in the Multispecies FMP. Since that FMP requires a 5.5" minimum mesh in this area when it is opened, the two FMPs are reinforced.

The compatibility between the two FMPs should also assist fishermen, not only by requiring the same minimum net mesh, but in the similarity of the regulations they must understand and comply with.

Additionally, it is likely that NMFS will implement the fishing area selection process using a telephone call in system similar to that used in the Northeast Multispecies FMP exempted fishery program. Based on NMFS weighout data, the number of vessels that fished east of the line (Figure 17) that caught more than 500 lbs of summer flounder per trip declined from 300 to 173 between 1983 and 1989. Since the weighout data file is not a complete census, the number of vessels that will apply for a permit to fish seaward of the line in 1991 is estimated at approximately 200.

9.2.2.6. Prices to consumers.

Recent upward trends in the real price per pound of commercially caught summer flounder indicate that the demand and/or supply factors may be shifting. The 1989 price per pound for all size categories was the highest in seven years in both nominal and adjusted dollars (Table 46). It is possible that increased demand for fish in general (e.g., due to health concerns) and summer flounder in particular (e.g. increases in income, Section 8.1.3) could be the cause for increased exvessel revenue. To the extent that these factors continue to influence the ex-vessel price, the FMP effects will be obscured.

It is expected that the reduction in landings and value attributable to this plan in its early years will not significantly increase overall exvessel summer flounder prices. To the extent that the supply of summer flounder is increased in future years by the reduction in mortality, higher average harvest weight, and stock stability, the price of summer flounder should stay steady or decrease only slightly, *ceteris paribus*.

9.2.2.7. Redistribution of costs.

The FMP is designed to give fishermen the greatest possible freedom of action in conducting business and pursuing recreational opportunities consistent with the objectives. It is not anticipated that the proposed management measures will redistribute costs between users or from one level of government to another.

9.3. RELATION OF RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND POLICIES

9.3.1. FMPs

This FMP is related to other plans to the extent that all fisheries of the northwest Atlantic are part of the same general geophysical, biological, social, and economic setting. US fishermen often are active in more than a single fishery. Thus regulations implemented to govern harvesting of one species or a group of related species may impact on other fisheries by causing transfers of fishing effort.

Many fisheries of the northwest Atlantic result in significant nontarget species fishing mortality. Therefore, each FMP must consider the impact of nontarget species fishing mortality on other stocks and as a result of other fisheries.

9.3.2. Treaties or international agreements.

No treaties or international agreements, other than GIFAs entered into pursuant to the MFCMA, relate to this fishery.

9.3.3. Federal law and policies.

9.3.3.1. Marine Mammals and Endangered Species.

Numerous species of marine mammals and sea turtles occur in the northwest Atlantic Ocean. The most recent comprehensive survey in this region was done from 1979-1982 by the Cetacean and Turtle Assessment Program (CETAP), at the University of Rhode Island (University of Rhode Island 1982), under contract to the Minerals Management Service (MMS), Department of the Interior. The following is a summary of the information gathered in that study, which covered the area from Cape Sable, Nova Scotia, to Cape Hatteras, North Carolina, from the coastline to 5 nautical miles seaward of the 1000 fathom isobath.

Four hundred and seventy one large whale sightings, 1547 small whale sightings and 1172 sea turtles were encountered in the surveys (Table 69). The "estimated minimum population number" for each mammal and turtle in the area, as well as those species currently included under the Endangered Species Act, were also tabulated.

CETAP concluded that both large and small cetaceans were widely distributed throughout the study area in all four seasons, and grouped the 13 most commonly seen species into three categories, based on geographical distribution. The first group contained only the harbor porpoise, which is distributed only over the shelf and throughout the Gulf of Maine, Cape Cod, and Georges Bank, but probably not southwest of Nantucket. The second group contained the most frequently encountered baleen whales (fin, humpback, minke, and right whales) and the white-sided dolphin. These were found in the same areas as the harbor porpoise, and also occasionally over the shelf at least to Cape Hatteras or out to the shelf edge. The third group indicated a "strong tendency for association with the shelf edge" and included the grampus, striped, spotted, saddleback, and bottlenose dolphins, and the sperm and pilot whales.

Loggerhead turtles were found throughout the study area, but appeared to migrate north to about Massachusetts in summer and south in winter. Leatherbacks appeared to have had a more northerly distribution. CETAP hypothesized a northward migration of both species in the Gulf Stream with a southward return in continental shelf waters nearer to shore. Both species usually were found over the shore ward half of the slope and in depths less than 200 feet. The northwest Atlantic may be important for sea turtle feeding or migrations, but the nesting areas for these species generally are in the South Atlantic and Gulf of Mexico.

Pound nets in Maryland and Virginia take over 35% of the commercial summer flounder landings in each of these states (Table 25). An investigation of the causes of sea turtle (loggerhead and some ridley) mortality in Chesapeake Bay indicated pound nets accounted for about 19% of the deaths (Musick *et al.* 1985). Other identifiable causes accounted for 11% of the mortalities with the cause of death undetermined for the remaining 70%. The prohibition on trawling in Virginia Atlantic Ocean waters is anticipated to greatly diminish the probability of mortality associated with flounder fishing as the flounder and sea turtles both leave Chesapeake Bay in the fall at about the same time.

The winter trawl fishery for summer flounder, which takes place principally off the coast of North Carolina may contribute to the mortality of loggerhead sea turtles (classified as "threatened") and Kemp's ridley sea turtles (classified as "endangered"). Studies at the Virginia Institute of Marine Science (VIMS) (Musick *et al.* 1985, Bellmund *et al.* 1987, Lutcavage and Musick 1985) have shown that large juveniles of these two sea turtles use Chesapeake Bay as a foraging area during the summer. Both species emigrate from the Bay with the onset of northeast storms and falling water temperatures, usually in October. These turtles then migrate

south along the coast to the vicinity of Capt Hatteras, North Carolina. Migration south of the Cape usually occurs in early December. The winter trawl fishery usually operates from early October to April in Carolina waters. Thus, there is a potential for incidental capture of sea turtles in the fishery during some years.

This problem may become acute when climatic conditions result in concentration of turtles and fish in the same area at the same time. These conditions apparently are met when temperatures are cool in October but then remain moderate into mid-December and result in a concentration of turtles between Oregon Inlet and Cape Hatteras, North Carolina. In most years sea turtles leave Chesapeake Bay and filter through the area a few weeks before the summer flounder fishery becomes concentrated. Efforts are currently under way (by VIMS and the US Fish and Wildlife Service refuges at Back Bay, Virginia, and Pea Island, North Carolina) to more closely monitor these mortalities due to trawls. Fishermen are encouraged to carefully release turtles captured incidentally and to attempt resuscitation of unconscious turtles as recommended in the 1981 *Federal Register* (pages 43976 and 43977).

The endangered shortnose sturgeon (*Acipenser brevirostrum*) also occurs in the northwest Atlantic. Although it is unlikely that a shortnose sturgeon will be caught in the summer flounder fishery, any takes should be reported to the Regional Director, NMFS, One Blackburn Drive, Gloucester, MA 01930.

The range of summer flounder and the above mentioned marine mammals and endangered species overlap and there always exists a potential for an incidental kill. Except in unique situations, such accidental catches should have a negligible impact on marine mammal or abundances of endangered species, and the Councils do not believe that implementation of this FMP will have any adverse impact upon these populations.

Commercial and recreational fisheries lose thousands of pounds of fishing gear annually. Incidences of entanglement in and ingestion of this gear is common among sea turtles and marine mammals, and may result directly or indirectly in some deaths.

9.3.3.2. Marine Sanctuaries.

There is one national marine sanctuary in the area covered by the FMP: the USS *Monitor* National Marine Sanctuary off North Carolina. The Sanctuary was officially established on 30 January 1975 under the Marine Protection, Research, and Sanctuaries Act of 1972. Rules and regulations have been issued (15 CFR 924) that prohibit deploying any equipment in the Sanctuary, fishing activities which involve "anchoring in any manner, stopping, remaining, or drifting without power at any time" (924.3 (a)), and "trawling" (924.3(h)). The Sanctuary is clearly designated on all National Ocean Survey charts by the caption "protected area". This minimizes the potential for damage to the Sanctuary by fishing operations. Details on sanctuary regulations may be obtained from the Director, Sanctuary Programs Office, Office of Coastal Zone Management, NOAA, 3300 Whitehaven Street NW, Washington, DC 20235.

9.3.3.3. Indian treaty fishing rights

No Indian treaty fishing rights are known to exist in the fishery.

9.3.3.4. Oil, Gas, Mineral, and Deep Water Port Development

While Outer Continental Shelf (OCS) development plans may involve areas overlapping those contemplated for offshore fishery management, no major conflicts have been identified to date. The Councils, through involvement in the Intergovernmental Planning Program of the MMS, monitor OCS activities and have opportunity to comment and to advise MMS of the Councils' activities. Certainly, the potential for conflict exists if communication between interests is not maintained or appreciation of each other's efforts is lacking. Potential conflicts include, from a fishery management position: (1) exclusion areas, (2) adverse impacts to sensitive biologically important areas, (3) oil contamination, (4) substrate hazards to conventional fishing gear, and (5) competition for crews and harbor space. The Councils are unaware of pending deep water port plans which would directly impact offshore fishery management goals in the areas under consideration, and are unaware of potential effects of offshore FMPs upon future development of deep water port facilities.

Approximately 70% of the commercial fishery occurs in the EEZ (Table 2). While the fishery varies among the States and targets on the concentrations of fish as they move inshore in the spring and offshore in the fall, the offshore winter fishery targets on large concentrations of fish that are overwintering along the shelf edge. Offshore (depths up to 500 ft.) areas (section 5.1), where overwintering occurs, and where spawning occurs in the spring, are areas where significant potential conflicts between this resource and offshore energy resources may occur.

9.3.3.5. Vessel Safety

Section 303(a)(6) of the MFCMA requires that FMPs consider access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of vessels. The proposed management measures of this FMP do not limit the times or places when or where vessels may fish. Therefore, the Council has concluded that the proposed FMP will not impact or effect the safety of vessels fishing in this fishery.

9.3.4. State, Local, and Other Applicable Law and Policies.

9.3.4.1. State management activities.

Maine, New Hampshire, New Jersey, Delaware, Maryland, Virginia, and North Carolina have 13" minimum possession size limits for summer flounder. Massachusetts, Rhode Island, Connecticut, and New York have 14" minimum possession size limits. Maryland has a tolerance of 5% by number and Virginia has a tolerance of 10% or 2 fish, whichever is greater, for trawl landings (Table 66).

Most of the States regulate fishing gear (Table 66). Maine has a 5.5" minimum mesh size for trawls, scottish seines, bottom tending gillnets and bottom tending seines. Mobile fishing gear may not be used in New Hampshire state waters between April 16 and Dec 14. In Massachusetts, minimum mesh sizes for mobile trawl and seine gear are: - north of Cape Cod: - 5" required year round except in northern Cape Cod Bay (5.5" after 1/1/91); south of Cape Cod: - 5" required Nov. 1 - April 14 (5.5" after 1/1/91); 3.5" required June 16 - Oct. 31, and no minimum required April 15 - June 15; and east of Cape Cod: - 5" required Nov. 1 - April 30 (5.5" after 1/1/91). In Rhode Island, trawling is prohibited in the upper portion of Narragansett Bay from Nov 1 - July 1; 5" codend minimum mesh size in a portion of central Narragansett Bay from Nov 1 - Feb 28. Connecticut has a codend minimum mesh size of 4.5" in trawls from Nov 15 - May 14, and 3" from Aug 1 - Nov 14. New York has no minimum mesh size for trawls at the present time. In New Jersey, trawls fishing for summer flounder must have a 4.5" minimum mesh size in the codend. (A summer flounder trip is defined as one in which 20% of the weight of the catch is comprised of summer flounder). In Delaware, trawls, purse seines, power operated seines, and runaround gillnets are prohibited and there is a moratorium on issuance of new commercial (> 200 ft) gillnet permits until the number of fishermen falls below 30. In Maryland, trawls are prohibited within one mile of the coastline, and in Chesapeake Bay. Use of monofilament gillnets prohibited, except in coastal bays and the Atlantic Ocean; several specific gillnet restrictions exist for Chesapeake Bay; minimum mesh sizes for pound nets, haul seines, and fyke nets are 1.5"; purse seines prohibited. Trawls and encircling gillnets are prohibited in Virginia waters. In North Carolina, trawl nets my not be used in internal, coastal fishing waters for finfish, however an unlimited quantity of legal size flounder may be retained as a bycatch in the trawl fisheries for crab and shrimp (non-flounder bycatch is limited to 1,000 pounds per trip).

Many of the states have areas closed at certain times or for certain gear (Table 66), but only Maine has a spawning area closure for groundfish, which includes summer flounder (in Booth Bay and Sheepscot Bay from May 1 to June 30)

Except for the spawning closure in Maine noted above, none of the States have seasonal restrictions on the fisheries for summer flounder (Table 66).

All of the States have some type of license requirement (Table 66). Maine requires a commercial license for the harvest, transport, and sale of fish that are not for personal use; no license is required for fish taken with hook and line for personal use. In New Hampshire there is a resident commercial saltwater fishing license; no sport fishing license; residents are not required to have a license to sell fish caught by hook and line, but a $200 minimum license fee is required for nonresidents. Massachusetts requires commercial fishing licenses; there is no sport license for fish caught for personal use; there is a license to sell fish caught with hook and line is, except for those who sell less than 100 lbs "plus one fish" per day. Rhode Island requires multipurpose commercial licenses allow for harvest and sale of fish; there is no sport license to fish for personal use. In Connecticut, there are a variety of commercial resident and nonresident licenses available allowing for the harvest and sale of fish; marine angling with hook and line does not require a license if fish are for personal use only; personal use fishing with trawls and other specific gear will require a commercial license. A commercial license is required in New York for the harvest and sale of fish; a nonresident license allows landing only; there is no sport license for fish caught for personal use. In New Jersey, commercial gears are licensed; there is no sport fishing license for hook and line gear, and no license is required to sell hook and line caught fish. Commercial food fishing license is required in Delaware for the harvest and sale of fish; there is no sport license for fish caught for personal use. A Maryland tidal fish license is required to catch, buy, or sell fish from tidal waters for commercial purposes; there is a Chesapeake sport fishing license. Commercial licenses are re-

quired in Virginia for specific fishing gears; there is no sport fishing license, and no license is required to sell hook and line caught fish. A commercial license is required in North Carolina for vessels; an inland sport fishing license is necessary for some portions of tidal waters; a license is required to sell fish caught by hook and line, but there is a 500 lb exemption per 12 month period.

Virginia has a 10 fish per day summer flounder possession limit (a voluntary 6 fish per day limit is encouraged, as well as not making use of the 2 undersized fish tolerance). No other States in the management unit have summer flounder possession limits.

Nonresidents in Maine are required by law to report all groundfish (summer flounder) catches.

9.3.4.2. State action necessary to implement measures within State waters to achieve FMP objectives, consequences of State inaction or contrary action, and recommendations.

The FMP's objectives are basically designed to make Federal management in the EEZ compatible with State management. To the extent that certain management measures in the FMP differ from State management measures, successful implementation will require the cooperation of the States, ASMFC, and the Federal government. To the extent that management measures differ between State waters and the EEZ, management and enforcement costs could be higher. However, the provision of the FMP that requires that federal permit holders land under the more stringent of the State or federal minimum fish sizes should minimize conflicts.

The fishery directors of the States that are associated with this FMP are voting members of the three Councils involved in the FMP. To the extent they are supportive of the FMP it is anticipated that they would work to have compatible measures implemented in their States.

Maine requires a 5.5" minimum mesh size for trawls.

Massachusetts (after 1 January 1991) will require 5.5" minimum mesh net year round north and east of Cape Cod; 1 Nov. - 14 April south of Cape Cod (3.5" required 16 June - 31 Oct. and no minimum required 15 April - 15 June.

New Hampshire prohibits mobile fishing gear in state waters between April 16 and Dec 14.

Rhode Island prohibits trawling in the upper portion of Narragansett Bay from 1 Nov - 1 July and requires a 5" codend minimum mesh size in a portion of central Narragansett Bay from 1 Nov - 28 Feb.

Connecticut has a codend minimum mesh size of 4.5" in trawls from 15 Nov - 14 May, and 3" from 1 Aug - 14 Nov.

New York has no minimum mesh size for trawls at the present time.

New Jersey requires that trawls fishing for summer flounder must have a 4.5" minimum mesh size in the codend. (A summer flounder trip is defined as one in which 20% of the weight of the catch is comprised of summer flounder.)

Delaware prohibits trawls, purse seines, power operated seines, and runaround gillnets.

Maryland prohibits trawls within one mile of the coastline and in Chesapeake Bay.

Virginia prohibits trawls and encircling gillnets.

North Carolina will institute a 5.5" minimum mesh requirement for the codends of trawls used in the Atlantic Ocean within 3 miles of the beach from the NC/VA State line to Beaufort Inlet 1 November 1990.

Therefore, Maine, Massachusetts, and North Carolina are compatible with the 5.5" minimum mesh regulation by virtue of their existing regulations. New Hampshire, Delaware, and Virginia are in compliance by virtue of their bans of trawling. Rhode Island, Connecticut, New York, New Jersey, and Maryland would need to take some action to comply with the proposed regulations.

It must be remembered that the 1982 ASMFC Summer Flounder Plan calls for a 5.5" minimum mesh net.

This Amendment does not have any Federalism impacts.

9.3.4.3. Impact of Federal regulations on State management activities.

All States have 13" or 14" minimum size possession laws and are, therefore, compatible with the FMP.

As noted above, Maine, Massachusetts, and North Carolina are compatible with the 5.5" minimum mesh regulation by virtue of their existing regulations. New Hampshire, Delaware, and Virginia and in compliance by

virtue of their bans of trawling. Rhode Island, Connecticut, New York, New Jersey, and Maryland would need to take some action to comply with the proposed regulations.

9.3.4.4. Coastal Zone Management Program Consistency.

The CZM Act of 1972, as amended, provides measures for ensuring stability of productive fishery habitat while striving to balance development pressures with social, economic, cultural, and other impacts on the coastal zone. It is recognized that responsible management of both coastal zones and fish stocks must involve mutually supportive goals.

The Council must determine whether the FMP will affect a State's coastal zone. If it will, the FMP must be evaluated relative to the State's approved CZM program to determine whether it is consistent to the maximum extent practicable. The States have 45 days in which to agree or disagree with the Councils' evaluation. If a State fails to respond within 45 days, the State's agreement may be presumed. If a State disagrees, the issue may be resolved through negotiation or, if that fails, by the Secretary.

The FMP was reviewed relative to CZM programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. Letters will be sent to all of the States listed above. The letters to all of the States except New Hampshire and Pennsylvania will state that the Council concluded that the FMP would affect the State's coastal zone and was consistent to the maximum extent practicable with the State's CZM program as understood by the Council. For New Hampshire, the evaluation was that the FMP might affect the coastal zone and was consistent. For Pennsylvania, the evaluation was that the FMP would not affect the coastal zone. The letters were mailed to the States along with a copy of the hearing draft of the FMP.

As of this date, Delaware, Pennsylvania, and New Hampshire have concurred with the Council's position. The other States have not responded.

9.4. COUNCIL REVIEW AND MONITORING OF THE FMP

The Councils will monitor the fishery using the best available data, including that specified in Section 9.1.3. The commercial, recreational, biological, and survey data specified in Section 9.1.3 are critical to the evaluation of the management measures adjustment mechanism. It is necessary that NMFS incorporate all of the above data types from North Carolina summer flounder into the overall NEFC data bases. Additionally, improved stock assessments are necessary for FMP monitoring. As a result of that monitoring, the Councils will determine whether it is necessary to amend the FMP.

It is also necessary that NMFS conduct more studies to evaluate the equivalency between diamond and square mesh nets. The regulations proposed in this Amendment are based on the best information available. To not provide for diamond versus square mesh would allow a fishermen to use 5.5" square mesh, which, based on all research available to the Council, would select summer flounder smaller than the 13" minimum size limit. Conservation of the resource requires the differentiation be made. However, much more research in this area is needed, not only for summer flounder, but for all commercially important species caught with trawls.

As age structure and stock biomass of summer flounder are rebuilt, recruitment patterns and life history parameters, such as growth rates and maturity schedules, should be monitored. New density dependent effects, environments effects, and different recruitment patterns may eventually make Fmax less suitable as a definition of overfishing, as the stock reaches a new equilibrium level associated with a reduced level of F. Periodic review of the stock status of summer flounder should occur at the NEFC sponsored Stock Assessment Workshop.

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Table 1. Summer Flounder Commercial Landings (thousands of lbs) by State, 1940-1989.

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD+	VA+	NC+	Total
1940	0	0	2847	258	149	1814	3554	3	444	1247	498	10814
1941	na	na	na	na	na	na	na	na	183	764	na	947
1942	0	0	193	235	126	1286	987	2	143	475	498	3945
1943	0	0	122	202	220	1607	2224	11	143	475	498	5502
1944	0	0	719	414	437	2151	3159	8	197	2629	498	10212
1945	0	0	1730	467	270	3182	3102	2	460	1652	1204	12297
1946	0	0	1579	625	478	3494	3310	22	704	2889	1204	14305
1947	0	0	1467	333	813	2695	2302	46	532	1754	1204	11146
1948	0	0	2370	406	518	2308	3044	15	472	1882	1204	12219
1949	0	0	1787	470	372	3560	3025	8	783	2361	1204	13570
1950	0	0	3614	1036	270	3838	2515	25	543	1761	1840	15442
1951	0	0	4506	1189	441	2636	2865	20	327	2006	1479	15469
1952	0	0	4898	1336	627	3680	4721	69	467	1671	2156	19625
1953	0	0	3836	1043	396	2910	7117	53	1176	1838	1844	20213
1954	0	0	3363	2374	213	3683	6577	21	1090	2257	1645	21223
1955	0	0	5407	2152	385	2608	5208	26	1108	1706	1126	19726
1956	0	0	5469	1604	322	4260	6357	60	1049	2168	1002	22291
1957	0	0	5991	1486	677	3488	5059	48	1171	1692	1236	20848
1958	0	0	4172	950	360	2341	8109	209	1452	2039	892	20524
1959	0	0	4524	1070	320	2809	6294	95	1334	3255	1529	21230
1960	0	0	5583	1278	321	2512	6355	44	1028	2730	1236	21087
1961	0	0	5240	948	155	2324	6031	76	539	2193	1897	19403
1962	0	0	3795	676	124	1590	4749	24	715	1914	1876	15463
1963	0	0	2296	512	98	1306	4444	17	550	1720	2674	13617
1964	0	0	1384	678	136	1854	3670	16	557	1492	2450	12237
1965	0	0	431	499	106	2451	3620	25	734	1977	272	10115
1966	0	0	264	456	90	2466	3830	13	630	2343	4017	14109
1967	0	0	447	706	48	1964	3035	0	439	1900	4391	12930
1968	0	0	163	384	35	1216	2139	0	350	2164	2602	9053
1969	0	0	78	267	23	574	1276	0	203	1508	2766	6695
1970	0	0	41	259	23	900	1958	0	371	2146	3163	8861
1971	0	0	89	275	34	1090	1850	0	296	1707	4011	9352
1972	0	0	93	275	7	1101	1852	0	277	1857	4655	10117
1973	0	0	506	640	52	1826	3091	*	495	3232	7365	17207
1974	*	0	1689	2552	26	2487	3499	0	709	3111	11812	25885
1975	0	0	1768	3093	39	3233	4314	5	893	3418	11510	28273
1976	*	0	4019	6790	79	3203	5647	3	697	3303	11452	35193
1977	0	0	1477	4058	64	2147	6566	4	739	4540	11137	30732
1978	0	0	1439	2238	111	1948	5414	1	676	5940	12316	30083
1979	5	0	1175	2825	30	1427	6279	7	1712	10019	18420	41899
1980	4	0	366	1277	48	1246	4805	1	1324	8504	13414	30988
1981	3	0	598	2861	81	1985	4008	7	403	3652	8239	21835
1982	18	*	1665	3983	64	1865	4318	8	360	4332	7045	23658
1983	84	0	2341	4599	129	1435	4826	5	937	8134	8247	30737
1984	2	*	1488	4479	131	2295	6364	9	813	9673	12205	37460
1985	3	*	2249	7533	183	2517	5634	10	577	5037	7157	32895
1986	0	*	2954	7042	160	2738	4017	4	316	3712	7618	28560
1987	8	*	3327	4774	609	2641	4451	4	319	5791	6686	28610
1988	5	0	2421	4719	741	3439	6006	7	514	7756	10266	35874
1989	9	0	1901	3066	514	1338	2861	7	184	3691	7817	21388

* = less than 500 lbs.; na = not available; + = NMFS did not identify flounders to species prior to 1978 for NC and 1957 for both MD and VA and thus the numbers represent all unclassified flounders (North Carolina reports that the 1973-1989 data include all *Paralichthys*, not just *P. dentatus*, inflating NC landings by 15-20%).

NOTE: numbers may not total due to rounding.

Source: 1940 1977 USDC 1984; 1978- 1989 Schultz pers comm.

Table 2. Summer Flounder Commercial Landings (thousands of lbs) by State by Distance from Shore (miles) and Percent of Total Summer Flounder Landings Taken from the EEZ, 1980-1989

Year	Distance	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC+	All
1980	0-3	-	-	218	185	3	1,090	493	1	65	1,238	5,644	8,940
	3-200	4	-	147	1,091	44	155	4,311	-	1,258	7,265	7,770	22,048
	Total	4	-	365	1,276	48	1,245	4,805	1	1,323	8,503	13,414	30,988
	% EEZ	100	-	40	85	91	12	89	-	95	85	57	71
1981	0-3	-	-	406	352	21	1,727	853	6	8	441	2,823	6,641
	3-200	2	-	191	2,507	59	257	3,155	-	394	3,210	5,415	15,194
	Total	2	-	597	2,860	81	1,984	4,008	6	403	3,651	8,239	21,835
	% EEZ	100	-	32	87	73	12	78	-	97	87	65	69
1982	0-3	-	-	855	475	8	1,282	402	7	59	463	3,730	7,284
	3-200	17	1	810	3,507	56	582	3,916	-	300	3,868	3,314	16,374
	Total	17	1	1,665	3,982	64	1,865	4,318	7	360	4,331	7,045	23,658
	% EEZ	100	100	48	88	87	31	90	-	83	89	47	69
1983	0-3	1	-	693	507	32	977	485	5	125	2,757	5,497	11,082
	3-200	82	-	1,648	4,091	96	458	4,340	-	811	5,376	2,749	19,655
	Total	83	-	2,341	4,599	129	1,435	4,826	5	936	8,134	8,247	30,737
	% EEZ	98	-	70	88	74	31	89	-	86	66	33	63
1984	0-3	-	-	721	617	59	1,571	1,342	8	125	3,618	4,773	12,837
	3-200	2	1	766	3,862	71	722	5,021	-	687	6,055	7,432	24,622
	Total	2	1	1,488	4,479	130	2,294	6,364	8	812	9,673	12,205	37,460
	% EEZ	100	100	51	86	54	31	78	-	84	62	60	65
1985	0-3	1	-	530	822	133	1,419	1,187	4	79	928	3,341	8,448
	3-200	1	1	1,718	6,710	50	1,098	4,446	-	498	4,107	5,816	24,446
	Total	2	1	2,249	7,532	183	2,517	5,634	4	577	5,036	9,157	32,895
	% EEZ	28	100	76	89	27	43	78	-	86	81	63	74
1986	0-3	-	-	465	914	145	1,808	1,049	3	27	510	4,580	9,504
	3-200	-	1	2,488	6,127	15	929	2,967	-	288	3,202	3,038	19,056
	Total	-	1	2,953	7,042	160	2,737	4,016	3	315	3,712	7,618	28,560
	% EEZ	-	100	84	87	9	33	73	-	91	86	39	66
1987	0-3	-	-	727	349	82	1,062	480	4	122	1,500	3,587	7,916
	3-200	7	1	2,600	4,424	526	1,578	3,970	-	196	4,290	3,098	20,693
	Total	7	1	3,327	4,774	609	2,641	4,450	4	318	5,790	6,686	28,610
	% EEZ	100	100	78	92	86	59	89	-	61	74	46	72
1988	0-3	-	-	801	338	277	1,685	834	6	192	1,078	5,323	10,538
	3-200	4	-	1,619	4,380	463	1,753	5,171	1	321	6,677	4,942	25,334
	Total	4	-	2,420	4,718	740	3,438	6,006	6	513	7,756	10,265	35,872
	% EEZ	100	-	66	92	62	50	86	3	62	86	48	70
1989	0-3	-	-	319	140	29	6	126	7	86	320	3,531	4,564
	3-200	9	-	1,582	2,926	485	1,330	2,736	-	98	3,371	4,286	16,823
	Total	9	-	1,901	3,066	514	1,337	2,862	7	184	3,691	7,817	21,388
	% EEZ	100	-	83	95	94	99	95	-	53	91	55	79

- = zero

+ = NMFS did not identify flounders to species prior to 1978 for NC and thus the numbers represent all unclassified flounders (North Carolina reports that the 1973-1989 data include all *Paralichthys*, not just *P. dentatus*, inflating NC landings by 15-20%).

Note: numbers may not total due to rounding.

Source: Schultz pers comm.

Table 3. Estimated Total Weight (millions of lbs)+ of Several Substitutable Species Caught by Marine Recreational Anglers, US East Coast, 1960 - 1989

	Summer Flounder		Bluefish		Weakfish and Sea trout		Striped Bass		Scup		Sea Bass		Total Weight of Recreational	
	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%
1960	53.0	7	50.6	7	26.9	4	37.5	5	16.6	2	12.6	2	731.9	100
1965	34.8	4	90.5	11	20.5	2	56.9	7	14.4	2	10.9	1	836.5	100
1970	28.3	3	119.2	13	40.7	4	73.3	8	4.4	*	21.5	2	917.6	100
1979	25.1	5	136.9	26	19.6	4	8.9	2	9.5	2	NA	NA	534.4	100
1980	33.1	7	148.6	29	48.0	9	2.2	*	9.6	2	8.5	2	476.1	100
1981	16.7	4	123.2	29	17.8	4	1.5	*	5.7	2	6.5	2	426.4	100
1982	27.9	7	104.2	26	14.3	4	12.9	3	7.4	2	25.2	7	396.1	100
1983	54.5	11	144.2	29	15.4	3	5.2	1	8.6	2	10.1	3	494.5	100
1984	47.9	13	88.4	24	8.8	2	4.8	1	4.0	1	11.4	4	365.8	100
1985	20.6	5	100.3	25	9.4	2	5.0	1	9.1	2	9.7	3	397.4	100
1986	35.5	6	130.9	22	17.1	3	15.1	2	16.2	3	19.0	3	608.6	100
1987	32.2	9	109.5	29	13.1	3	16.1	4	8.1	2	3.8	1	374.3	100
1988	30.8	6	73.5	14	16.5	3	16.5	3	6.4	1	9.5	2	535.5	100
1989	5.0	1	51.5	12	28.2	7	NA	NA	9.8	2	11.5	3	417.9	100
1960-70 Mean	38.7	5	86.8	10	29.4	3	55.9	7	11.8	2	15.0	2	828.7	100
1980-89 Mean	30.4	7	107.4	24	18.9	4	8.8	2	8.5	2	11.5	3	449.3	100

+ = total number of fish (Types A, B1, and B2) multiplied by mean weight of Type A fish.
NA = data not available.
* = less than 0.5%.
In 1960, summer flounder was listed with other species under "flat fishes".
In 1979, black sea bass was listed with other species under "sea basses".
Sources: 1960: Clark, 1962. 1965: Deuel and Clark, 1968. 1970: Deuel, 1973. 1974: Deuel, pers. comm. 1979 - 1986: USDC 1987b. 1987-1989: Essig pers.comm.

Table 4. Summer Flounder Spring Offshore Mean Number and Mean Weight per Tow Delta Values Fitted to an ARIMA Model with Theta Value = 0.240

	Mean Number				Mean Weight			
Year	Delta Mean	Fitted Mean	Fitted Upper 95%ci	Fitted Lower 95%ci	Delta Mean	Fitted Mean	Fitted Upper 95%ci	Fitted Lower 95%ci
1968	0.15	0.15			0.16	0.16		
1969	0.19	0.17			0.16	0.15		
1970	0.09	0.13			0.09	0.12		
1971	0.22	0.23	0.417	0.124	0.28	0.23	0.390	0.136
1972	0.47	0.44	0.813	0.243	0.21	0.26	0.447	0.156
1973	0.75	0.75	1.382	0.412	0.52	0.52	0.892	0.311
1974	1.40	1.30	2.386	0.712	1.27	1.08	1.833	0.639
1975	1.98	1.89	3.463	1.033	1.63	1.51	2.563	0.894
1976	2.72	2.46	4.502	1.343	1.94	1.77	2.999	1.045
1977	2.82	2.51	4.590	1.369	1.84	1.66	2.816	0.982
1978	2.58	1.92	3.524	1.051	1.50	1.22	2.071	0.722
1979	0.40	0.73	1.336	0.399	0.35	0.55	0.931	0.324
1980	1.31	1.18	2.154	0.643	0.79	0.73	1.241	0.432
1981	1.50	1.46	2.681	0.800	0.81	0.81	1.378	0.480
1982	2.23	1.72	3.149	0.939	1.15	0.91	1.546	0.539
1983	0.95	1.08	1.979	0.590	0.52	0.59	0.996	0.347
1984	0.66	0.93	1.697	0.506	0.38	0.51	0.863	0.301
1985	2.38	1.80	3.292	0.982	1.21	0.89	1.514	0.528
1986	2.15	1.78	3.252	0.970	0.85	0.76	1.281	0.446
1987	0.93	1.11	2.029	0.605	0.39	0.48	0.817	0.285
1988	1.46	1.05	1.934	0.572	0.66	0.51	0.874	0.302
1989	0.32	0.45	0.890	0.231	0.24	0.30	0.540	0.167

Source: Gabriel, pers. comm. Working Paper SAW 9.

Table 5. Preliminary Summary of State Survey Information as Presented at SAW 9, November 1989

State	Survey Design	Trawl Size	Mesh Size	Duration	CV	Trend	Recruitment Good	Recruitment Poor
NC	F	20.0′	0.75″	1980-89	240-520	None	87	
	F	10.5′	0.25″	1980-89	350-1100	None	83	
	RS	(2) 30.0′		1987-89	200-300	None	87	88
VA		4.9m	3.2mm	1985-89	NA	Decline	86	88
		6′, 100′		1987-89	NA	Decline	87	88
MD	F	15′		1975-88	NA	None	83, 84	88
DE		30′		1966-71	7100	Increase		
				1979-84		None		
NJ	RS			1988-89	NA	Increase		88
	S	16′	1.4″	1987-89	NA		87, 89	88
CT	S	46′		1984-89	NC	None		
RI	S		0.5″					
MA	S			1978-88	NC	Decline	80	86
						from 82 (?)	83	87

Source: Gabriel, pers. comm. Working Paper SAW 9.

Table 6. VIMS Young of the year (YOY) Summer Flounder Index, 1986-90

Year	No. of Tows	No. of Mins.	No. Caught	CPUE*
1986	125	613.8	397	3.23
1987	206	1,015.5	152	0.75
1988	296	1,467.8	17	0.06
1989	273	1,349.0	208	0.77
1990**	80	398.0	164	2.05

* = CPUE calculated as number of YOY caught per five minute tow.
** = 1990 preliminary data.
Sources: 1986-88 from Norcross and Wyanski, in review; 1989-90 from VIMS unpub. data.

Table 7. Summer Flounder Spring Offshore Mean Number per Tow (fitted delta values)

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1976	0.00	0.03	1.50	0.60	0.25	0.06	0.01	0.01	-	-	-	2.46
1977	0.00	0.54	1.17	0.62	0.09	0.08	0.01	-	0.01	-	-	2.51
1978	0.00	0.52	0.71	0.49	0.14	0.03	0.02	0.02	-	-	0.01	1.92
1979	0.00	0.11	0.32	0.15	0.07	0.06	-	-	0.02	-	-	0.73
1980	0.00	0.01	0.64	0.28	0.13	0.02	0.05	0.03	0.01	-	0.01	1.18
1981	0.00	0.58	0.52	0.17	0.08	0.05	0.03	0.02	0.01	-	-	1.47
1982	0.00	0.53	1.09	0.09	0.02	-	-	-	-	-	-	1.72
1983	0.00	0.36	0.44	0.21	0.05	0.01	-	-	-	0.01	-	1.08
1984	0.00	0.24	0.46	0.13	0.07	-	0.01	0.01	-	-	-	0.93
1985	0.00	0.42	1.18	0.16	0.03	0.02	-	-	-	-	-	1.80
1986	0.00	1.23	0.36	0.17	0.02	0.01	-	-	-	-	-	1.78
1987	0.00	0.55	0.51	0.02	0.02	-	-	-	-	-	-	1.11
1988	0.00	0.42	0.58	0.05	0.02	-	-	-	-	-	-	1.07
1989	0.00	0.08	0.35	0.03	0.01	-	-	-	-	-	-	0.49
1990	0.00	0.62	0.03	0.06	-	-	-	-	-	-	-	0.71

Source: Gabriel pers. comm.

Table 8. Summer Flounder Commercial Catch per Unit Effort (lbs/trip) for Tonnage Classes 2, 3, and 4 Vessels for Trips in which Summer Flounder Comprised Greater than 5% of the Catch, 1967-1985.

	Commercial CPUE (lbs/trip)		
Year	Class 2 (5-50 GRT)	Class 3 (51-150 GRT)	Class 4 (151-500 GRT)
1967	1,477	1,588	922
1968	1,720	1,720	1,014
1969	1,301	1,918	1,367
1970	970	1,610	1,610
1971	1,257	1,698	1,257
1972	1,323	1,257	1,323
1973	1,742	1,389	221
1974	2,646	2,227	2,381
1975	1,786	1,852	2,337
1976	2,161	2,866	3,616
1977	1,786	3,065	3,263
1978	2,095	3,440	6,924
1979	1,874	4,013	6,174
1980	1,896	4,388	6,262
1981	1,632	3,528	5,468
1982	1,808	3,793	7,387
1983	2,117	3,506	5,270
1984	2,073	3,396	4,542
1985	1,433	2,448	3,396

Source: USDC 1986.

Table 9. Maturity Indices (% Ovary Weight of Total Fish Weight) for Summer Flounder, June 1974-October 1976.

Month	Year	n	Mean	SD	Range
June	1974	58	0.65	0.33	0.31-2.26
	1975	100	0.76	0.55	0.34-3.34
July	1974	64	0.56	0.19	0.27-1.27
August	1974	43	0.57	0.17	0.21-1.01
September	1974	95	1.34	1.30	0.23-5.59
	1975	81	1.38	1.40	0.34-7.77
October	1974	78	1.83	2.05	0.23-11.53
	1976	139	2.05	1.38	0.37-7.91
November	1974	39	1.87	1.39	0.41-6.35
December	1975	171	1.60	0.90	0.31-8.71
February	1975	14	1.26	2.29	0.43-9.23
March	1975	14	0.84	0.38	0.51-1.79
	1976	72	0.94	0.95	0.36-6.20
April	1975	12	0.81	0.38	0.46-1.91
May	1975	42	0.71	0.23	0.32-1.17

Source: Morse, 1981.

Table 10. Comparison of Summer Flounder Age Studies (Otoliths used for aging except as noted)

Study	Study Area	Location of Annulus and Estimated Time of Annulus Formation	Estimated Age at Distinct Annulus	Mean Calculated Total Length (in) at Successive Annuli								
				1	2	3	4	5	6	7	8	9
								Male				
Poole (1961)	Great South Bay Long Island, NY	Outer edge-opaque zone February - March	one	10	13	15	17	-	-	-	-	-
Eldridge (1962)	Winter Trawl Fishery Hampton, VA	Outer edge-opaque zone February - March	three	7[a]	9[a]	13	14	15	16	16	17	-
Powell (1974)	Pamlico Sound, NC	Outer edge-opaque zone January - February	one	7	-	-	-	-	-	-	-	-
Smith & Daiber (1977)	Delaware Bay, DE	Outer edge-opaque zone February - March	two	-	10	14	16	18	19	20	-	-
								Female				
Poole (1961)	Great South Bay Long Island, NY	Outer edge-opaque zone February - March	one	11	15	18	21	25	-	-	-	-
Eldridge (1962)	Winter Trawl Fishery Hampton, VA	Outer edge-opaque zone February - March	three	7[a]	9[a]	15	17	19	20	22	24	26
Powell (1974)	Pamlico Sound, NC	Outer edge-opaque zone January - February	one	7	11	15	-	-	-	-	-	-
Smith & Daiber (1977)	Delaware Bay, DE	Outer edge-opaque zone February - March	two	-	11	15	18	20	22	24	26	-
Shepherd (1980)	Martha's Vineyard Sound, MA	Outer edge-hyaline zone March (otolith)	two	5[b]	11[b]	15[b]	18[b]	20[b]	-	-	-	-
		Circuli scale crossover March - April (scale)		5[c]	10[c]	14[c]	18[c]	21[c]	23[c]	27[c]	-	-

a - lengths are estimates or means of observed length frequency.
b - lengths as calculated from otoliths.
c - lengths as calculated from scales.

Source: Smith *et al.*, 1981.

Table 11. Length-Weight Relationships for Summer Flounder, Expressed as Log_{10} Weight = Log_{10} a + b (Log_{10} Length), Correlation Coefficient (r), and Expected Mean Weight at 400 mm TL for Each Month by Sex.

Month	Year	Sex	n	Mean Wt.(g)*	Log10 a	b	r
June	1974	M	46	687	-5.565	3.229	0.97
		F	68	692	-5.810	3.324	0.99
July	1974	M	23	739	-5.827	3.342	0.99
		F	75	717	-5.495	3.207	0.98
August	1974	M	30	739	-5.826	3.341	0.97
		F	75	720	-5.398	3.170	0.98
September	1974	M	110	747	-4.675	2.901	0.96
		F	104	735	-5.477	3.206	0.98
October	1974	M	54	727	-4.719	2.914	0.99
		F	87	756	-5.111	3.070	0.99
November	1974	M	42	711	-5.98	3.055	0.99
		F	40	713	-5.421	3.180	0.99
February	1975	M	33	702	-5.178	3.084	0.99
		F	18	691	-4.848	2.953	0.98
March	1975	M	11	663	-4.617	2.859	0.98
		F	15	692	-5.287	3.123	0.98
April	1975	M	10	655	-5.230	3.092	0.99
		F	20	682	-5.408	3.167	0.99
May	1975	M	55	670	-5.886	3.339	0.98
		F	80	666	-5.498	3.198	0.99
June	1975	M	154	676	-5.700	3.278	0.99
		F	151	675	-5.584	3.233	0.99
Total		M	568	703	-5.289	3.126	0.98
		F	702	703	-5.548	3.226	0.99

* 1 gram = 0.035 ounces: 1 ounce = 28.35 g.
Source: Morse, 1981.

Table 12. Parameters of the von Bertalanffy Growth Equation Derived for Summer Flounder in the Middle Atlantic Bight.*

Parameter	Male	Female
L_{oo}	67.49 (9.26)	82.67 (8.68)
k	0.183 (0.068)	0.1731 (0.056)
t_o	-1.657 (0.649)	-1.039 (0.691)

* Asymptotic standard errors for each parameter in parentheses.
Source: USDC 1986.

Table 13. Catch per Tow at Age (numbers) of Summer Flounder from NMFS Spring Offshore Surveys, Georges Bank to Cape Hatteras, 1976-1986, Using the Smoothed Survey Index

	Age												
Year	0	1	2	3	4	5	6	7	8	9	10	Total	Survey Index
1976	-	.1867	.9172	.3472	.1163	.0622	.0082	-	-	-	-	1.6378	1.6879
1977	-	.3485	.7921	.4182	.0612	.0510	.0085	-	.0051	-	-	1.6846	1.6998
1978	-	.3470	.4617	.3375	.1593	.0230	.0108	.0108	-	-	.0027	1.3528	1.3501
1979	-	.0673	.2019	.0874	.0446	.0157	-	-	-	.0166	-	.4335	.4371
1980	.0046	.4238	.1821	.0899	.0139	.0271	.0170	-	-	-	-	.7584	.7747
1981	.0288	.3607	.3458	.1222	.0666	.0318	.0129	.0199	.0060	-	-	.9947	.9937
1982	.0036	.2431	.5020	.3314	.0835	.0157	.0169	.0048	-	-	-	1.2010	1.2098
1983	-	.1991	.1768	.2682	.0468	.0223	.0097	.0223	-	-	-	.7462	.7435
1984	.0143	.1486	.2847	.0776	.0298	.0275	.0275	-	.0054	-	-	.6154	.5968
1985	-	.0618	.7242	.3848	.0921	.0088	-	.0025	-	-	-	1.2742	1.2616
1986	-	.6992	.4439	.1652	.0396	.0205	-	-	-	-	-	1.3384	1.3657

Note: Discrepancies between the totals and the overall survey index are due to rounding errors.

Source: USDC, 1986.

Table 14. Commercial Catch at Age in Numbers (hundreds) of Summer Flounder, 1976-1983*

	Age													
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13
1976	-	4,280	28,370	9,837	8,175	1,134	130	6	-	-	-	-	-	-
1977	-	452	11,909	11,257	1,597	1,031	190	25	31	-	-	-	-	-
1978	52	1,409	10,028	22,706	8,038	1,636	1,400	106	23	-	-	-	-	-
1979	74	4,857	20,272	14,921	7,251	2,945	681	204	178	55	9	20	-	-
1980	-	6,280	19,669	9,205	2,792	1,425	541	105	13	-	-	-	-	-
1981	931	13,620	32,243	13,692	2,866	2,510	903	395	46	221	133	-	-	-
1982	1,970	19,639	63,287	24,408	4,665	1,549	452	334	203	112	26	34	10	8
1983*	1,123	14,513	78,330	39,407	11,928	5,382	2,302	581	146	348	220	-	-	-

Note: Figures do not include summer flounder in the "unclassified" market category.

* Does not include market category 5 ("pee-wee's").

Source: USDC, 1986.

Table 15. Sex Ratios (male:female) of Summer Flounder, Collected in NMFS Bottom Trawls Between Cape Cod and Cape Hatteras, 1974-1979.

Total Length interval (in)	1974-1979 (combined) Spring	Summer	Fall	Winter	Total
8.1-10.0	15:7	12:4	175:63	49:12	251:86
10.1-12.0	76:32	90:31	298:84	38:16	502:163
12.1-14.0	93:56	213:93	430:205	31:24	767:378
14.1-15.9	80:94	139:137	284:456	28:42	531:729
16.0-17.9	22:90	50:115	71:204	16:32	159:441
18.0-19.9	7:41	7:63	31:138	4:20	49:262
20.0-21.9	2:16	4:28	3:77	2:10	11:131
22.0-23.8	0:10	0:6	1:36	0:5	1:57
>23.9	0:3	0:5	0:20	0:5	0:33
Total	295:349	515:482	1293:1283	168:166	2271:2280
%	46:54	52:48	50:50	50:50	50:50

Source: Morse, 1981 modified.

Table 16. Length at Maturity of Summer Flounder, Collected in NMFS Bottom Trawls, Between Cape Cod and Cape Hatteras, 1974-1979

	Males								Females											
							1974-76								1974-76		Males		Females	
Total	1974-75		1976-77		1978-79		(fall only)		1974-75		1976-77		1978-79		(fall only)		1974-79		1974-79	
Length	# of	%	# of	%	# of	%	# of	%	# of	%	# of	%	# of	%	# of	%	# of	%	# of	%
(in)	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature	Obs.	Mature
7.1	-	-	3	0	-	-	-	-	-	-	-	-	-	-	-	-	3	0	-	-
7.5	3	0	9	33	-	-	-	-	-	-	-	-	-	-	-	-	12	25	-	-
7.9	5	20	8	38	-	-	2	0	-	-	-	-	-	-	-	-	13	31	-	-
8.3	15	33	15	20	-	-	9	11	-	-	-	-	-	-	-	-	30	27	-	-
8.7	25	24	24	21	8	0	33	27	-	-	-	-	-	-	-	-	57	19	-	-
9.1	26	35	43	35	7	14	30	30	-	-	-	-	-	-	-	-	74	33	-	-
9.4	36	36	25	52	5	20	43	42	-	-	5	0	-	-	-	-	66	41	5	0
9.8	57	37	38	58	7	29	54	27	-	-	5	20	5	0	-	-	102	44	10	10
10.2	78	45	29	69	12	75	69	44	17	0	15	7	8	13	17	0	119	54	40	5
10.6	64	70	40	90	16	44	53	70	14	7	11	27	10	10	8	13	120	73	35	14
11.0	80	76	35	89	26	58	63	76	33	3	16	25	7	14	19	5	141	76	56	11
11.4	83	77	45	87	19	63	51	88	18	6	15	40	10	40	15	13	147	78	43	26
11.8	92	89	28	89	19	74	59	92	37	22	11	27	20	60	25	28	139	87	68	34
12.2	95	96	39	97	19	74	55	98	30	30	25	60	9	89	26	31	153	94	64	50
12.6	122	94	34	94	19	68	71	100	45	42	11	82	10	60	33	55	175	91	66	52
13.0	122	91	40	98	15	73	84	99	60	47	11	73	13	77	33	67	177	91	84	55
13.4	141	97	44	100	15	87	108	99	73	59	22	82	7	86	44	71	200	97	102	66
13.8	112	96	-	-	15	87	104	98	94	64	10	90	10	60	66	71	127	95	114	66
14.2	103	94	-	-	14	79	78	100	117	80	16	88	10	70	75	84	117	92	143	80
14.6	97	95	-	-	25	100	-	-	117	79	28	96	11	82	103	87	122	96	156	82
15.0	85	97	-	-	-	-	-	-	131	82	39	95	12	50	109	96	85	97	182	82
15.4	76	99	-	-	-	-	-	-	124	84	34	97	12	58	97	95	76	99	170	85
15.7	48	98	-	-	-	-	-	-	93	90	28	100	11	82	70	96	48	98	132	90
16.1	45	100	-	-	-	-	-	-	87	91	-	-	10	90	61	95	45	100	97	91
16.5	-	-	-	-	-	-	-	-	68	93	-	-	10	100	41	98	-	-	78	94
16.9	-	-	-	-	-	-	-	-	74	87	-	-	-	-	45	100	-	-	74	87
17.3	-	-	-	-	-	-	-	-	70	99	-	-	-	-	-	-	-	-	70	99
17.7	-	-	-	-	-	-	-	-	32	100	-	-	-	-	-	-	-	-	32	100
Total	1610		499		241		966		1334		302		185		887		1821		2350	
Size at 50% Maturity		9.9		9		10.7		10		13		11.9		12		12.7		9.7		12.7
95% Confid. Interval		9.6-10		9-9.6		10-11		9.8-10		12.9-13		11.6-12		11-13		12.5-12.9		9.5-9.9		12.5-12.9

- = zero

Source: Morse, 1981.

Table 17. Fecundity Relationships of Summer Flounder, with Length Expressed as Log10 Fecundity = Log10 a + b, and Weight and Ovary Weight Expressed as Fecundity = a + bX. SE is Standard Error and r is Correlation Coefficient.

Years		n	a	SE of a	b	SE of b	r
1974-1977	Length (cm)*	134	-3.098	0.430	3.402	0.159	0.88
1974-1976	Weight (g)**	79	-101867.500	109445.000	908.864	58.894	0.87
1974-1976	Ovary weight (g)	79	552515.161	100552.620	10998.048	1031.153	0.77

* 1 cm = 0.394 inches: 1 inch = 2.540 cm.
** 1 gram = 0.035 ounces: 1 ounce = 28.35 grams.

Source: Morse, 1981.

Table 18. Estimates of Annual Survival Rate and Instantaneous Fishing Mortality Rate for Summer Flounder Based on Tag-Recapture Experiments Using the Maximum Likelihood Method of Paulik (1963).

Area	Release Dates	Tag Type	Number Released	Number Recovered	S	F	Source
Nantucket Sound	Sept. 6-8, 21, 1962	Petersen Disc	600	245	0.307	0.482	Lux and Nichy 1980
Block Island Sound	Sept. 6-8, 1962	Petersen Disc	406	203	0.289	0.622	Lux and Nichy 1980
New Jersey	Sept. 23 - Oct. 19, 1960	Atkins Tag	692	96	0.174	0.244	Murawski 1970
New Jersey	July 31 - Aug. 10, 1961	Atkins Tag	613	133	0.102	0.496	Murawski 1970
New Jersey	July 18 - Aug. 31, 1961	Petersen Disc	2,767	949	0.314	0.397	Murawski 1970
New Jersey	June 20 - Aug. 29, 1966	Petersen Disc	1,392	420	0.147	0.580	Murawski 1970
New Jersey	June 12 - Aug. 22, 1966	Petersen Disc	1,205	296	0.192	0.407	Murawski 1970
North Carolina	Nov. 8, 1973 - Dec. 19, 1974	Petersen Disc	7,040*	178	0.343	0.107	Gillikin, Pers. Comm.
GREATER THAN 12" TL ONLY			2,300*	133	0.396	0.240	

* Adjusted total (see source)
Source: Fogarty, 1981.

Table 19. Estimates of Summer Flounder Instantaneous Rate of Total Mortality (Z). Estimates are Based on Catch Curve Analysis of Commercial Age-length Data Adjusted for Total Effort and on NEFC Survey Data. Males and Females are Combined. Std (Z) is the Standard Error of the Estimate of Z, r^2 is the Coefficient of Determination.

	Survey			Commercial		
Year Class	Z	Std (Z)	r^2	Z	Std (Z)	r^2
1973	-	-	-	.687	.116	.85
1974	.833	.275	.75	.838	.093	.94
1975	.975	.141	.94	1.090	.070	.98
1976	.375	.161	.58	.986	.186	.90
1977	.782	.089	.96	.700	.174	.89
1978	.889	.212	.85	.850	.336	.86
1979	.955	.249	.88	-	-	-
1980	1.708	.282	.97	-	-	-
1981	.629	.217	.81	-	-	-

Source: USDC 1986.

Table 20. Spawning Stock Biomass per Recruit (kg) for Female Summer Flounder with Legal Size Limits of 10-18 inches and Fishing Mortality Rates at F_{max} and $F_{0.1}$.

	Spawning Stock Biomass	
Minimum Size	F_{max}	$F_{0.1}$
10	2.37	3.66
11	2.31	3.68
12	2.49	3.84
13	2.34	3.91
14	2.46	3.92
15	2.26	3.99
16	2.19	4.00
17	--	4.16
18	--	4.11

Source: Fogarty, pers. comm.

Table 21. Yield per Recruit (kg) for Summer Flounder for Minimum Legal Size Limits of 10-18". F_{max} is the Fishing Mortality Rate at which Yield-per-Recruit is Maximized, $F_{0.1}$ is the 'Marginal' Mortality Rate (Gulland and Boerema), Y_{max} is the Yield per Recruit at F_{max} and $Y_{0.1}$ is the Yield per Recruit at $F_{0.1}$.

Minimum	Female				Male			
Size	F_{max}	$F_{0.1}$	Y_{max}	$Y_{0.1}$	F_{max}	$F_{0.1}$	Y_{max}	$Y_{0.1}$
10	.18	.11	.43	.40	.44	.28	.29	.28
11	.19	.12	.45	.43	.53	.32	.32	.30
12	.26	.15	.51	.48	.62	.36	.35	.32
13	.29	.15	.54	.50	.77	.42	.38	.35
14	.32	.16	.55	.51	.95	.47	.40	.37
15	.40	.18	.59	.53	1.46	.58	.45	.39
16	.49	.19	.62	.55	1.50	.65	.45	.40
17	--	.21	--	.58	--	.85	--	.47
18	--	.22	--	.59	--	1.06	--	.48

-- no maximum
Source: Fogarty, pers. comm.

Table 22. Preliminary Ranking of Major Threats to Living Marine Resources and Habitats in the Northeast.

1. Urban and Port Development *
2. Ocean Disposal #
3. Dams
4. Agricultural Practices ●
5. Industrial Waste Discharges @
6. Domestic Waste Discharges @
7. OCS Oil and Gas Development
8. Insect Control
9. Water Diversion
10. Sand and Gravel Mining
11. Power Generation

* Includes dredge and fill and construction activities covered by Section 10/104 permits, as well as point source pollution covered by NPDES permits and nonpoint source pollution.

Includes dredged material disposal in State waters, as well as actual ocean dumping of dredged material, sewage sludge, etc., covered by Section 103 permits.

● Includes nonpoint source pollution (fertilizers, animal wastes, biocides, sediments, heavy metals, etc.) that affects coastal aquatic areas.

@ Point source pollution covered by NPDES permits.

Source: USDC, 1985.

Table 23. Summer flounder landings by state and fishing area, 1983-89 combined.

	ME		MD		MA		NH		NJ		NY		RI		VA		ALL	
Area	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%	1000 Lbs	%
464	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*
465	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*
511	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	*
512	19	15	-	-	*	*	-	-	-	-	-	-	-	-	-	-	19	*
513	62	49	-	-	3	*	1	100	-	-	-	-	-	-	-	-	66	*
514	*	*	-	-	526	3	-	-	-	-	-	-	5	*	-	-	532	*
515	23	18	-	-	4	*	-	-	-	-	-	-	10	*	-	-	37	*
521	-	-	-	-	187	1	-	-	*	*	-	-	25	*	*	*	213	*
522	*	*	-	-	124	1	-	-	-	-	-	-	56	*	-	-	181	*
523	*	*	-	-	16	*	-	-	-	-	-	-	10	*	-	-	27	*
524	*	*	-	-	238	1	-	-	-	-	-	-	127	*	-	-	366	*
525	*	*	-	-	600	3	-	-	-	-	-	-	4,501	12	1	*	5,103	3
526	*	*	-	-	4,015	24	-	-	-	-	160	1	7,010	19	80	*	11,267	7
533	-	-	-	-	-	-	-	-	-	-	-	-	1	*	-	-	1	*
534	-	-	-	-	-	-	-	-	-	-	28	*	-	-	-	-	28	*
537	2	2	*	*	2,738	16	-	-	36	*	1,020	10	16,362	45	55	*	20,216	14
538	-	-	-	-	6,318	39	-	-	-	-	*	*	1,753	4	12	*	8,085	5
539	-	-	-	-	143	1	-	-	-	-	4	*	3,180	8	-	-	3,328	2
561	*	*	-	-	4	*	-	-	-	-	-	-	*	*	-	-	4	*
562	*	*	-	-	33	*	-	-	-	-	-	-	4	*	-	-	38	*
611	-	-	-	-	-	-	-	-	*	*	2,013	19	216	1	-	-	2,230	1
612	-	-	3	*	270	1	-	-	2,522	7	1,570	15	34	*	249	1	4,650	3
613	*	*	1	*	634	3	-	-	1,639	4	2,893	28	1,096	3	443	1	6,709	4
614	*	*	12	*	-	-	-	-	3,247	9	-	-	-	-	173	*	3,433	2
615	*	*	73	2	26	*	-	-	1,636	4	3	*	4	*	281	1	2,026	1
616	6	5	123	3	218	1	-	-	2,880	8	2,444	24	1,619	4	721	1	8,014	5
621	-	-	1,995	59	18	*	-	-	9,063	26	-	-	9	*	4,058	9	15,145	10
622	3	2	526	15	20	*	-	-	12,992	38	16	*	8	*	4,178	9	17,745	12
623	5	4	-	-	-	-	-	-	-	-	-	-	-	-	35	*	41	*
624	-	-	*	*	-	-	-	-	-	-	-	-	1	*	-	-	1	*
625	-	-	29	1	-	-	-	-	*	*	-	-	-	-	4,581	10	4,610	3
626	*	*	537	16	8	*	-	-	*	*	-	-	3	*	10,788	25	11,337	7
627	-	-	26	1	-	-	-	-	*	*	-	-	-	-	-	-	26	*
631	-	-	-	-	-	-	-	-	-	-	-	-	8	*	11,816	27	11,824	8
632	-	-	-	-	1	*	-	-	-	-	-	-	-	-	4,485	10	4,486	3
635	-	-	-	-	-	-	-	-	-	-	-	-	-	-	319	1	319	*
636	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	*	13	*
700	-	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	*	*
All	126	100	3,330	100	16,154	100	1	100	34,020	100	10,154	100	36,053	100	42,297	100	142,137	100

* = less than 500 Lbs or 0.5%

Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 24. Summer flounder commercial landings by gear, States ME-NC, years 1980-89 combined.

Gear	1000 Pounds	Percent
Haul Seines, Beach	173	*
Haul Seines, Long	750	*
Haul Seines, Long(Danish)	6	*
Stop Nets	2	*
Purse Seines, Menhaden	239	*
Beam Trawls, Other	8	*
Otter Trawl Bottom, Crab	2,688	1
Otter Trawl Bottom, Fish	254,951	87
Otter Trawl Bottom, Lobster	119	*
Otter Trawl Bottom, Scallop	202	*
Otter Trawl Bottom, Shrimp	5,588	1
Otter Trawl Bottom, Other	1,249	*
Otter Trawl Midwater	1	*
Trawl Midwater, Paired	110	*
Trawl Bottom, Paired	27	*
Scottish Seine	5	*
Weirs	1	*
Pound Nets, Fish	14,358	4
Pound Nets, Other	25	*
Floating Traps (Shallow)	619	*
Fyke And Hoop Nets, Fish	13	*
Pots And Traps, Crab, Blue	37	*
Pots And Traps, Eel	1	*
Pots And Traps, Fish	21	*
Pots And Traps, Lobster Inshore	2	*
Pots And Traps, Lobster Offshore	1	*
Gill Nets, Other	4,868	1
Gill Nets, Drift, Other	79	*
Gill Nets, Drift, Runaround	10	*
Gill Nets, Stake	17	*
Lines Hand, Other	679	*
Lines Troll, Other	59	*
Lines Long Set With Hooks	10	*
Spears	760	*
Dredges, Clam	1	*
Dredges, Conch	1	*
Dredges, Oyster, Common	1	*
Dredges Scallop, Bay	1	*
Dredges Scallop, Sea	3,413	1
Rakes, Other	2	*
Unk. 989	1	*
ALL GEAR	291,110	100

* = less than 0.5 %
Source: Unpublished NMFS General Canvass data.

Table 25. Summer flounder commercial landings by state and gear type, 1980-89 combined.

Gear	ME % of Total	NH % of Total	MA % of Total	RI % of Total	CT % of Total	NY % of Total	NJ % of Total	DE % of Total	MD % of Total	VA % of Total	NC % of Total
Haul Seines, Beach	-	-	-	0.1	0.1	0.1	-	2.8	0.4	0.1	0.1
Haul Seines, Long	-	-	-	-	-	-	-	-	-	-	0.8
Haul Seines, Long(Danish)	-	-	0.1	-	-	-	0.1	-	-	-	-
Stop Nets	-	-	-	0.1	-	-	-	-	-	-	-
Purse Seines, Menhaden	-	-	1.2	-	-	-	0.1	-	-	0.1	-
Beam Trawls, Other	-	-	-	-	-	-	-	-	-	0.1	-
Otter Trawl Bottom, Crab	-	-	-	-	-	-	-	-	-	-	3.0
Otter Trawl Bottom, Fish	93.5	76.9	93.7	94.3	99.1	97.9	98.4	-	93.9	92.5	70.9
Otter Trawl Bottom, Lobster	-	-	-	0.1	-	0.5	0.1	-	-	0.1	-
Otter Trawl Bottom, Scallop	-	-	0.1	-	-	0.1	0.1	-	0.1	0.1	0.2
Otter Trawl Bottom, Shrimp	3.5	15.4	0.1	-	-	-	-	-	-	-	6.2
Otter Trawl Bottom, Other	-	-	-	2.8	-	-	-	-	-	-	0.1
Otter Trawl Midwater	-	-	-	-	-	-	-	-	-	0.1	-
Trawl Midwater, Paired	-	-	0.5	0.1	-	-	0.1	-	-	-	-
Trawl Bottom, Paired	-	-	-	0.1	-	0.1	-	-	-	-	-
Scottish Seine	0.5	-	0.1	0.1	-	-	0.1	-	-	-	-
Weirs	-	-	-	-	-	-	-	-	-	0.1	-
Pound Nets, Fish	-	-	0.6	-	0.1	0.8	0.2	-	2.1	3.9	12.7
Pound Nets, Other	-	-	0.1	-	-	-	-	-	-	-	-
Floating Traps (Shallow)	-	-	-	1.4	-	-	-	-	-	-	-
Fyke And Hoop Nets, Fish	-	-	-	0.1	-	-	-	1.0	0.2	0.1	-
Pots And Traps, Crab, Blue	-	-	-	-	-	-	-	-	-	0.1	0.1
Pots And Traps, Eel	-	-	0.1	-	-	-	-	-	-	0.1	-
Pots And Traps, Fish	-	-	0.1	-	-	-	-	-	0.2	0.1	0.1
Pots And Traps, Lobster Inshore	-	-	-	-	0.1	-	0.1	-	-	-	-
Pots And Traps, Lobster Offshore	-	-	-	-	-	-	0.1	-	-	-	-
Gill Nets, Other	1.7	7.7	0.1	0.1	0.1	0.1	0.1	83.1	1.0	0.1	5.2
Gill Nets, Drift, Other	-	-	-	-	0.1	-	0.1	8.7	0.1	0.1	0.1
Gill Nets, Drift, Runaround	-	-	-	-	-	-	0.1	-	-	-	0.1
Gill Nets, Stake	-	-	-	-	-	-	-	-	0.3	-	-
Lines Hand, Other	-	-	1.6	0.3	0.7	0.5	0.1	4.4	1.5	0.1	0.1
Lines Troll, Other	-	-	-	0.1	-	-	-	-	-	-	0.1
Lines Long Set With Hooks	-	-	0.1	0.1	-	-	-	-	-	-	-
Spears	-	-	-	-	0.1	-	-	-	-	-	0.8
Dredges, Clam	-	-	-	-	-	-	-	-	0.1	-	-
Dredges, Conch	-	-	-	-	-	-	-	-	0.1	0.1	-
Dredges, Oyster, Common	-	-	-	-	-	-	-	-	-	-	0.1
Dredges Scallop, Bay	-	-	-	-	-	-	-	-	0.1	-	-
Dredges Scallop, Sea	0.8	-	2.1	0.8	-	0.2	1.3	-	0.4	3.2	0.1
Rakes, Other	-	-	-	-	-	-	-	-	-	-	0.1
Unk. 989	-	-	-	-	0.1	-	-	-	-	-	-
All Gear	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* = less than 0.05 %

Source: Unpublished NMFS General Canvass data.

Table 26. Percent of summer flounder landings taken by otter trawl in each fishing area (distance from shore), by state, 1980-89 combined.

	Percent of Fishing Area Total	
State	State Waters (<3 Miles)	EEZ (>3 Miles)
ME	100.0	96.9
NH	-	92.3
MA	90.9	95.0
RI	83.7	98.8
CT	97.4	100.0
NY	97.7	99.6
NJ	98.6	98.6
DE	-	-
MD	63.3	99.3
VA	80.4	96.1
NC	58.6	100.0

Source: Unpublished NMFS General Canvass data.

Table 27. Summer flounder average landings (thousands of pounds) by month states ME-NC, years 1980-89, all gear combined

Month	State (<3 MI) Landings	EEZ (>3 MI) Landings	Total Landings
JAN	489	3,949	4,438
FEB	90	3,183	3,273
MAR	84	2,534	2,619
APR	118	1,510	1,629
MAY	652	722	1,374
JUN	536	401	937
JUL	637	270	907
AUG	868	451	1,320
SEP	1,205	1,093	2,298
OCT	1,249	1,694	2,944
NOV	1,617	1,740	3,358
DEC	1,083	2,632	3,716
ALL	8,632	20,185	28,818

Source: Unpublished NMFS General Canvass data.

Table 28. Summer flounder commercial landings by state and size class, years 1980-89 combined

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	All
Size Class	%	%	%	%	%	%	%	%	%	%	%	%
Jumbo	9	8	11	23	-	1	5	-	3	3	3	6
Large	27	31	35	33	-	1	26	-	18	20	19	22
Medium	44	38	38	28	-	1	36	73	23	29	4	20
Small	14	8	6	11	-	-	29	-	22	26	19	18
Uncl.	6	15	9	5	100	97	4	27	34	22	55	32

Source: Unpublished NMFS General Canvass data.

Table 29. Coverage of weighout system relative to general canvass for summer flounder. Last column is weighout percent of general canvass. Data are all gear, Maine to North Carolina, but note that CT, DE and NC are not included in the weighout system.

	Weighout			General Canvass			
	Landings (1000 lbs)	Value ($1000)	Avg. Price	Landings (1000 lbs)	Value ($1000)	Avg. Price	WO/GC %
80	-	-	-	30,988	16,275	0.53	-
81	-	-	-	21,835	15,178	0.70	-
82	-	-	-	23,658	17,172	0.73	-
83	20,416	14,150	0.69	30,737	20,748	0.68	66
84	22,173	15,777	0.71	37,460	26,138	0.70	59
85	20,753	20,048	0.97	32,895	31,394	0.95	63
86	20,509	25,737	1.25	28,560	34,220	1.20	72
87	20,980	30,447	1.45	28,610	39,835	1.39	73
88	24,394	31,757	1.30	35,872	44,385	1.24	68
89	12,912	20,618	1.60	20,489	31,623	1.54	63

Source: Unpublished NMFS General Canvass and weighout data.

Table 30. Total summer flounder landings and percent taken by otter trawl for States included in weighout, 1983-89.

	Summer Flounder Landings (Pounds)		Otter Trawl
Year	All Gear	Otter Trawl	Percent
1983	20,415,693	20,047,416	98.2
1984	22,173,282	21,641,547	97.6
1985	20,752,977	20,001,042	96.4
1986	20,508,872	19,942,525	97.2
1987	20,980,158	20,311,298	96.8
1988	24,394,428	23,640,259	96.9
1989	12,912,205	12,478,982	96.6
Total	142,137,615	138,063,069	97.1

Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 31. Mean catch composition of all otter trawl trips landing summer flounder, 1983-89.

	83		84		85		86		87		88		89		All Years	
Species	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%
Black Sea Bass	195	1	233	1	152	1	204	2	223	2	166	1	151	1	190	1
Scup	766	5	711	5	580	6	669	7	555	6	503	5	460	4	613	6
Bluefish	80	1	103	1	126	1	135	1	118	1	88	1	100	1	108	1
Butterfish	341	2	1,002	8	391	4	383	4	348	4	199	2	275	2	432	4
Croaker	2	*	14	*	21	*	13	*	12	*	5	*	25	*	13	*
Winter Flounder	1,045	7	839	7	642	7	524	6	480	5	425	4	334	3	627	6
Summer Flounder	2,553	18	2,564	21	2,351	28	2,257	26	2,345	28	2,725	30	1,941	20	2,404	24
Mackerel	58	*	129	1	231	2	91	1	109	1	259	2	245	2	157	1
Weakfish	88	1	93	1	69	1	106	1	97	1	58	1	53	1	82	0
Tautog	3	*	21	*	19	*	15	*	12	*	11	*	8	*	13	*
Whiting	715	5	791	6	781	9	830	9	964	11	828	9	873	9	822	8
Lobster	11	*	20	*	11	*	8	*	19	*	17	*	10	*	14	*
Sea Scallop	46	*	28	*	40	*	23	*	108	1	152	1	96	1	68	0
Loligo Squid	856	6	846	7	810	9	1,111	13	1,005	12	1,446	16	2,339	24	1,158	11
Misc. Species	7,004	50	4,474	37	2,139	25	2,104	24	1,786	21	2,022	22	2,656	27	3,219	32
Total Trip	13,763	100	11,866	100	8,362	100	8,473	100	8,182	100	8,904	100	9,568	100	9,920	100

* = less than 0.5%
Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 32. Weighout otter trawl trips landings 500 lbs or more summer flounder. Note that weighout data are a sample of fishing activity, not a census.

	Mean 83	84	85	86	87	88	89	83-89
Mean lbs/trip	5623	5864	4732	4537	4689	5439	4351	5046
# of trips	4045	4212	5013	5881	5084	4632	2856	4532
Landings ('000)	19303	20684	18995	17962	18206	19997	10916	18007
% of WO Total*	96	94	95	93	94	95	94	95

* Percent of weighout total summer flounder where effort data available.
Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 33. Weighout otter trawl trips landings less than 500 lbs of summer flounder. Note that weighout data are a sample of fishing activity, not a census.

	Mean 83	84	85	86	87	88	89	83-89
Mean lbs/trip	110	119	115	109	110	113	85	109
# of trips	7598	8111	9661	10838	9669	8940	7972	8970
Landings ('000)	743	957	1005	1299	1260	1062	658	998
% of WO Total*	4	6	5	7	6	5	6	5

* Percent of weighout total summer flounder where effort data available.
Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 34. Total and average weight, and average percent of several species of fish landed by otter trawls which identified summer flounder as the principal species for the fishing trip. Data are from the 1989 NMFS Sea Sampling data and represent vessels fishing from Southern New England to Virginia on 14 individual trips.

Species	Total Pounds	Average Pounds	Average %
Summer Flounder	44,113	3,151	27
Spiny Dogfish	56,088	4,006	17
Skates	37,627	2,688	9
Sea Robin	17,022	1,216	2
Silver Hake	10,023	716	2
Fourspot Flounder	12,594	900	1
Angler	7,278	520	2
Scallop	7,038	503	1
Loligo	4,616	330	7
Scup	1,057	76	*
Black Sea Bass	1,599	114	*

Source: NMFS unpublished Sea Sample data.

Table 35. Mean catch composition of summer flounder otter trawl trips landing 500 Lbs/trip or greater.

	83		84		85		86		87		88		89		All Years	
Species	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%	Lbs	%
Black Sea Bass	276	1	324	2	214	2	326	3	255	2	224	2	194	1	261	2
Scup	446	2	524	4	561	5	703	6	446	4	404	3	347	2	499	4
Bluefish	81	1	127	1	111	1	164	1	143	1	103	1	95	1	119	1
Butterfish	301	1	704	5	498	5	649	6	560	5	260	2	357	3	482	4
Croaker	4	*	16	*	25	*	10	*	8	*	7	*	20	*	13	*
Winter Flounder	742	4	470	3	363	3	388	3	312	3	301	2	128	1	394	3
Summer Flounder	5,623	35	5,864	45	4,732	50	4,537	43	4,689	45	5,439	49	4,351	36	5,046	43
Mackerel	32	*	44	*	252	2	66	1	93	1	227	2	130	1	122	1
Weakfish	120	1	90	1	68	1	85	1	73	1	44	*	51	*	77	0
Tautog	3	*	17	*	17	*	13	*	9	*	9	*	6	*	11	*
Whiting	367	2	294	2	448	4	590	5	781	7	616	5	636	5	530	4
Lobster	5	*	10	*	5	*	6	*	14	*	9	*	4	*	8	*
Sea Scallop	81	1	25	*	33	*	40	*	127	1	95	1	79	1	67	0
Loligo Squid	491	3	745	5	538	5	947	9	1,030	10	1,397	12	2,800	23	1,065	9
Misc. Species	7,332	46	3,680	28	1,587	16	1,919	18	1,669	16	1,852	16	2,583	21	2,914	25
Total Trip	15,904	100	12,933	100	9,452	100	10,443	100	10,209	100	10,989	100	11,781	100	11,607	100

* = less than 0.5%
Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 36. Average annual summer flounder landings by state, years 1980-89, all gear combined.

State	1000 lbs	Percent
ME	13	*
NH	1	*
MA	1,925	6
RI	4,431	15
CT	214	1
NY	2,149	7
NJ	4,729	16
DE	5	*
MD	570	1
VA	6,027	20
NC	9,043	31
Total	29,111	100

* = less than 0.5%
Source: Unpublished NMFS General Canvass data.

Table 37. Summer flounder mean catch per trip and percent of total trip catch in sampled North Carolina winter trawl fisheries, 1982-89.

	Nearshore		Deepwater		Flynet	
Season	lbs/trip	%	lbs/trip	%	lbs/trip	%
1982-83	12,285	93.7	3,029	10.3	713	2.9
1983-84	21,707	93.3	6,296	29.2	884	2.9
1984-85	18,286	88.6	9,755	38.2	108	0.4
1985-86	7,390	74.2	5,559	35.0	266	0.8
1986-87	6,822	62.0	5,185	24.2	92	0.3
1987-88	9,101	81.5	8,096	56.2	53	0.2
1988-89	6,895	91.7	8,917	72.0	88	0.4
Mean	11,783	83.6	6,690	37.9	315	1.1

Source: North Carolina 1990.

Table 38. Percent reductions (PR) in number of summer flounder killed by commercial fishermen assuming various mesh and minimum size regulations. Estimates are based on NEFC weighout data, 1985-1989, and were derived using selectivity curves with assumed 80% mortality of discards and 25% mortality of fish escaping from the net. Given the current size limit of 13 inches, effective mesh size in the fishery is about 4.0 inches.

	Mesh Size (inches)				
Min Size (TL inches)	4.0 PR	4.5 PR	5.0 PR	5.5 PR	6.0 PR
None	*	1	5	14	21
11	*	1	5	14	21
12	*	2	5	14	21
13	2	3	6	14	22
14	5	6	8	17	24
15	9	10	13	21	27
16	12	13	16	24	30

* = <1.0%
Note: Mesh sizes are inside stretch measurements.
Source: unpublished NMFS Weighout data.

Table 39. Summer Flounder - Commercial and Recreational Landings (thousands of pounds)

Year	Comm	Rec	Total	% Comm	% Rec
1980	30988	25842	56830	55	45
1981	21836	11297	33133	66	34
1982	23658	18901	42559	56	44
1983	30738	35651	66389	46	54
1984	37640	28878	66518	57	43
1985	32895	17085	49980	66	34
1986	28561	17573	46134	62	38
1987	28611	13131	41742	69	31
1988	35873	18422	54295	66	34
1989	21388	3333	24721	87	13
Ave	29219	19011	48230	61	39

Source: Commercial - Schultz, pers. comm.; Recreational - USDC 1987b and Essig pers. comm.

Table 40. Number of recreational fishing trips (000s) for all species in bimonthly state/fishing mode/fishing area cells with summer flounder catch, compared with numbers of nominal summer flounder recreational trips (000s) in these cells, aggregated at the subregional level.

Year	Subregion	All species trips	Nominal summer flounder trips	Proportion nominal summer flounder to all species trips
1980	New England	2,626	277	0.106
	Mid-Atlantic	21,097	9,295	0.441
	South Atlantic	2,270	287	0.126
	Total	25,992	9,859	0.379
1981	New England	1,701	196	0.115
	Mid-Atlantic	10,919	4,532	0.415
	South Atlantic	1,740	623	0.358
	Total	14,361	5,351	0,373
1982	New England	3,607	551	0.153
	Mid-Atlantic	11,463	5,541	0.483
	South Atlantic	2,905	1,010	0.358
	Total	17,974	7,102	0.395
1983	New England	4,792	745	0.155
	Mid-Atlantic	19,407	01,100	0.520
	South Atlantic	3,396	855	0.252
	Total	27,595	11,700	0.424
1984	New England	2,996	667	0.223
	Mid-Atlantic	17,018	9,075	0.533
	South Atlantic	3,811	1,348	0.354
	Total	23,826	11,090	0.465
1985	New England	3,369	388	0.115
	Mid-Atlantic	12,152	5,311	0.437
	South Atlantic	3,584	1,501	0.419
	Total	19,105	7,200	0.377
1986	New England	4,653	670	0.144
	Mid-Atlantic	17,428	6,578	0.377
	South Atlantic	2,090	666	0.318
	Total	24,172	7,914	0.327
1987	New England	3,870	583	0.150
	Mid-Atlantic	16,069	6,649	0.401
	South Atlantic	3,098	307	0.099
	Total	23,037	7,340	0.319
1988	New England	4,929	650	0.132
	Mid-Atlantic	15,142	7,366	0.486
	South Atlantic	3,870	884	0.228
	Total	23,941	8,900	0.372

Source: Essig pers. comm.

Table 41. Estimated total summer flounder recreational catch number, weight and average weight by region and fishing area, 1989.

Region	Area	Number	Pounds	Avg. Weight
New England	State	178,902	350,524	2.0
	EEZ	8,297	-	-
	Total	187,199	-	-
Mid-Atlantic	State	2,132,621	3,744,893	1.8
	EEZ	111,688	189,996	1.7
	Total	2,244,309	3,934,889	1.8
North Carolina	State	371,367	488,870	1.3
	EEZ	1,286	1,120	0.9
	Total	372,653	489,990	1.3
Total	State	2,682,889	4,584,287	1.7
	EEZ	121,270	191,116	1.7
	Total	2,804,160	4,775,404	1.7

Source: Unpublished NMFS MRFSS data.

Table 42. Estimated total recreational catch of all species and summer flounder, Maine to North Carolina, 1989.

State	Total Catch	Summer Flounder Catch	% of Coast SF Catch	SF % of State Catch
ME	2,206,420	-	-	-
NH	1,765,093	6,360	0.2	0.4
MA	14,137,658	26,122	0.9	0.2
RI	4,984,989	120,842	4.3	2.4
CT	5,908,942	33,875	1.2	0.6
NY	20,114,161	449,865	16.0	2.2
NJ	17,176,916	651,288	23.2	3.8
DE	4,371,203	143,750	5.1	3.3
MD	12,791,667	471,839	16.8	3.7
VA	20,127,089	527,566	18.8	2.6
NC	16,852,753	372,652	13.3	2.2

Source: Unpublished NMFS MRFSS data.

Table 43. Estimated total summer flounder recreational catch number and weight by region and mode of fishing, 1989.

Region/Mode	Number State	Number EEZ	Number Total	Pounds State	Pounds EEZ	Pounds Total
New England						
Shore	8,059	-	8,059	6,530	-	6,530
Party/Charter	1,819	2,357	4,176	9,222	-	9,222
Private/Rental	169,024	5,940	174,964	334,772	-	334,772
Mid-Atlantic						
Shore	174,879	-	174,879	175,043	-	175,043
Party/Charter	230,193	50,212	280,405	363,926	8,495	372,421
Private/Rental	1,727,549	61,476	1,789,025	3,205,923	91,501	3,297,424
North Carolina						
Shore	154,548	-	154,548	206,390	-	206,390
Party/Charter	223	-	223	276	-	276
Private/Rental	216,595	1,286	217,881	282,205	1,120	283,325
Total						
Shore	337,486	-	337,486	387,963	-	387,963
Party/Charter	232,235	52,569	284,803	373,424	8,495	381,919
Private/Rental	2,113,168	68,702	2,181,870	3,822,900	92,621	3,915,521

Source: Unpublished NMFS MRFSS data.

Table 44. Size frequency of recreational summer flounder catch (Type A) for 1989.

Inches	Frequency	Percent	Cumulative Frequency	Cumulative Percent
4	2	0.1	2	0.1
5	2	0.1	4	0.2
8	1	0.0	5	0.2
9	13	0.6	18	0.9
10	9	0.4	27	1.3
11	20	1.0	47	2.3
12	62	3.1	109	5.4
13	231	11.4	340	6.8
14	246	12.1	586	28.9
15	275	13.6	861	42.5
16	296	14.6	1157	57.1
17	269	13.3	1426	70.4
18	226	11.1	1652	81.5
19	206	10.2	1858	91.7
20	93	4.6	1951	96.3
21	46	2.3	1997	98.5
22	16	0.8	2013	99.3
23	7	0.3	2020	99.7
24	2	0.1	2022	99.8
25	2	0.1	2024	99.9
26	1	0.0	2025	99.9
27	2	0.1	2027	100.0

Source: Unpublished NMFS MRFSS data.

Table 45. Observer estimated catch (pounds) of summer flounder by foreign directed fishing and by joint venture fishing, 1979-1988

	Directed Foreign Fishing	Joint Venture Fishing
1979	78,200	-
1980	164,300	-
1981	129,100	-
1982	76,300	1,400
1983	-	<100
1984	<100	100
1985	<100	4,900
1986	-	5,200
1987	100	2,400
1988	<100	100

Note: Observer coverage was less than 100% prior to 1987.
Source: Gerrior pers. comm.

Table 46. Ex-vessel value, nominal price and 1989 adjusted price of summer flounder by year, states ME-NC and all gear combined.

Year	Nominal Value 1000 $	Nominal Price Mean	1989 Adj. Price Mean
80	16,275	0.53	0.66
81	15,178	0.70	0.80
82	17,172	0.73	0.81
83	20,748	0.68	0.75
84	26,138	0.70	0.75
85	31,394	0.95	1.04
86	34,220	1.20	1.34
87	39,835	1.39	1.52
88	44,385	1.24	1.30
89	31,623	1.54	1.54

Note: Prices adjusted with PPI.
Source: Unpublished NMFS General Canvass data.

Table 47. Total value of all finfish and shellfish landings, value of summer flounder landings, and summer flounder percent of total value by state, 1989.

State	Total Value ($1000)	Summer flounder ($1000)	Summer Flounder Percent
ME	132,522	5	*
NH	10,247	-	-
MA	272,847	3,612	1.3
RI	75,004	5,232	7.0
CT	18,309	898	4.9
NY	51,096	2,299	4.5
NJ	78,802	4,136	5.2
DE	3,453	4	0.1
MD	52,050	233	0.4
VA	100,014	5,116	5.1
NC	70,582	10,975	15.5

* = less than 0.1%
Sources: USDC 1990 and unpub. NMFS General Canvass data.

Table 48. Total US flounder landings and ex-vessel value, summer flounder landings and ex-vessel value, and summer flounder percent of total, 1980-89.

	Total Flounders		Summer Flounder		SF % of Total	
Year	1000 lbs	$ 1000	1000 lbs	$ 1000	Lbs	Value
80	216,920	82,488	30,988	16,275	14	20
81	201,053	85,892	21,835	15,178	11	18
82	228,341	102,029	23,658	17,172	10	17
83	253,528	116,440	30,737	20,748	12	18
84	219,995	124,259	37,460	26,138	17	21
85	195,718	129,121	32,895	31,395	17	24
86	169,050	124,586	28,560	34,220	17	27
87	199,711	145,080	28,610	39,835	14	27
88	228,620	140,142	35,872	44,385	16	32
89	202,489	119,831	21,840	33,447	11	28

Source: USDC 1990.

Table 49. Landings, value and price of summer flounder by state for 1989, all gear combined.

State	Landings 1000 lbs	Value $ 1000	Price $/lb
ME	9	5	0.58
MA	1,847	3,612	1.96
RI	3,045	5,239	1.72
NY	1,337	2,299	1.72
NJ	2,862	4,136	1.45
DE	2	4	1.68
MD	140	233	1.66
VA	3,688	5,116	1.39
NC	7,555	10,975	1.45

Source: Unpublished NMFS General Canvass data.

Table 50. Landings, value and price of summer flounder by month, years 1980-89 averaged, all gear combined.

	State (<3 mi)			EEZ (>3 Mi)			All		
Month	1989 1000 Lbs	1989 Value $1000	1989 Adj. Price	1989 1000 Lbs	1989 Value $1000	1989 Adj. Price	1000 Lbs	Value $1000	Adj. Price
JAN	489	451	0.92	3,949	3,539	0.90	4,438	3,990	0.90
FEB	90	76	0.85	3,183	3,436	1.08	3,273	3,513	1.07
MAR	84	75	0.89	2,534	3,273	1.29	2,619	3,348	1.28
APR	118	119	1.01	1,510	1,831	1.21	1,629	1,951	1.20
MAY	652	820	1.26	722	867	1.20	1,374	1,687	1.23
JUN	536	710	1.32	401	575	1.43	937	1,285	1.37
JUL	637	932	1.46	270	477	1.77	907	1,410	1.55
AUG	868	1,206	1.39	451	586	1.30	1,320	1,792	1.36
SEP	1,205	1,292	1.07	1,093	1,024	0.94	2,298	2,316	1.01
OCT	1,249	1,134	0.91	1,694	1,570	0.93	2,944	2,705	0.92
NOV	1,617	1,312	0.81	1,740	1,409	0.81	3,358	2,721	0.81
DEC	1,083	801	0.74	2,632	2,272	0.86	3,716	3,073	0.83
ALL	8,632	8,932	1.03	20,185	20,864	1.03	28,818	29,796	1.03

Note: Prices adjusted with PPI.
Source: Unpublished NMFS General Canvass data.

Table 51. Landings, ex-vessel value and price of summer flounder by size category for 1989, all states and all gear combined.

Size Category	Landings 1000 lbs	Value $1000	Price $/lb
Jumbo	1,987	2,406	1.93
Large	6,406	10,436	1.59
Medium	5,929	8,852	1.47
Small	5,362	1,099	1.11
Unclassified	9,426	8,828	1.57

Source: Unpublished NMFS General Canvass data.

Table 52. Annual number of otter trawl vessels with at least one trip landing a given threshold of summer flounder, 1983-89. Note that weighout data are a sample of fishing activity, not a census.

Threshold	83 Vessels	84 Vessels	85 Vessels	86 Vessels	87 Vessels	88 Vessels	89 Vessels
>= 1 lb	702	704	653	640	603	624	599
>= 100 lbs	612	604	596	553	522	563	510
>= 200 lbs	572	576	562	525	502	540	468
>= 300 lbs	543	555	535	511	478	521	443
>= 400 lbs	530	531	509	494	464	488	433
>= 500 lbs	519	517	495	477	448	470	422

Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 53. Mean value (thousands of $) of landings of summer flounder otter trawl trips landing 500 Lbs/trip or greater.

	83		84		85		86		87		88		89		All Years	
	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%
Black Sea Bass	182	2	205	2	189	2	286	3	250	2	199	2	204	1	217	2
Scup	180	2	243	3	278	4	362	3	339	3	252	2	262	2	275	3
Bluefish	10	*	18	*	18	*	26	*	22	*	13	*	14	*	17	*
Butterfish	95	1	189	2	141	2	563	6	361	3	213	2	174	1	253	2
Croaker	1	*	3	*	6	*	3	*	3	*	3	*	7	*	4	*
Winter Flounder	342	4	294	3	233	3	269	2	278	2	270	2	113	1	262	2
Summer Flounder	3,878	45	4,080	54	4,532	67	5,537	60	6,472	64	6,640	69	6,711	65	5,356	61
Mackerel	4	*	8	*	57	0	6	*	12	*	39	*	17	*	21	*
Weakfish	32	*	31	*	32	*	30	*	26	*	17	*	27	*	28	*
Tautog	0	*	2	*	3	*	4	*	3	*	4	*	2	*	3	*
Whiting	92	1	38	0	102	1	161	1	316	3	177	1	138	1	147	1
Lobster	15	*	30	*	16	*	18	*	49	*	33	*	15	*	25	*
Sea Scallop	54	0	16	*	22	*	23	*	64	0	42	*	37	*	37	*
Loligo Squid	156	1	195	2	156	2	376	4	432	4	533	5	1,014	9	383	4
Misc. Species	3,494	40	2,086	28	957	14	1,469	16	1,370	13	1,074	11	1,512	14	1,696	19
Total Trip	8,534	100	7,437	100	6,744	100	9,134	100	9,997	100	9,508	100	10,244	100	8,724	100

* = less than 0.5%
Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 54. Annual number of plants processing flounder (all species) by state, 1980-88.

Year	ME	NH	MA	RI	CT	NY	NJ	MD	VA	NC	All
80	15	1	52	2	-	14	1	2	7	31	125
81	18	1	49	2	-	17	1	2	7	26	123
82	18	2	48	9	-	18	2	2	6	28	133
83	19	2	47	13	1	18	2	3	4	27	136
84	23	2	49	12	1	17	2	3	4	25	138
85	21	2	51	8	2	19	2	3	4	20	132
86	26	2	49	7	1	19	2	3	5	18	132
87	27	3	49	8	-	22	2	3	4	20	138
88	21	1	50	6	1	19	2	3	4	20	127

Note: These plants also processed seafood other than flounders.
Source: Unpublished NMFS Processed Products Survey data.

Table 55. Value of flounder (all species, thousands of $) processed product by state, 1980-88.

YEAR	ME	NH	MA	RI	CT	NY	NJ	MD	VA	NC	ALL
80	2,395	82	45,456	1,483	-	8,971	391	174	7,978	3,305	70,239
81	8,148	1,315	50,356	559	-	11,275	410	123	5,508	2,016	79,715
82	8,847	498	90,794	4,038	-	7,375	1,532	96	5,336	7,190	125,710
83	7,365	3,236	73,071	11,194	680	7,853	1,386	176	5,662	6,891	117,519
84	10,030	1,934	89,046	8,146	1,584	12,537	1,413	115	2,800	8,797	136,407
85	7,177	494	100,319	3,618	1,692	11,155	960	1,424	1,019	10,470	138,332
86	8,031	361	104,898	6,852	1,740	12,811	1,000	3,011	907	10,713	150,326
87	10,746	551	87,936	6,884	-	18,740	860	2,161	831	22,150	150,861
88	8,614	19	85,489	3,481	1,440	15,949	850	2,658	1,962	9,506	129,972

Note: Flounder product passed between firms has been double counted.
Source: Unpublished NMFS Processed Products Survey data.

Table 56. Fulton Market Share of Total Summer Flounder Landings (lbs x 000) 1984 and 1985

	1984			1985*		
	State Landings	Fulton Market	% Fulton	State Landings	Fulton Market	% Fulton
ME	2.4	.0	-	2.5	.0	-
NH	.2	.0	-	.3	.0	-
MA	1,488.1	47.9	3.22	2,224.4	147.2	6.62
RI	4,479.3	535.7	11.96	7,532.8	712.6	9.46
CT	130.8	112.1	85.70	N/A	124.6	N/A
NY	2,294.7	697.1	30.38	2,517.4	1,004.3	39.89
NJ	6,364.4	174.7	2.74	5,634.2	147.5	2.62
DE	8.7	.0	-	.0	.0	-
MD	812.7	7.5	.92	539.8	.0	-
VA	9,673.4	126.9	1.31	5,036.3	29.8	.59
NC	15,086.5	692.6	4.59	10,964.6	771.0	7.03
Total	40,341.2	2,394.5	5.94	34,452.3	2,937.0	8.52
Total ME-DE	14,768.6	1,567.5	10.61	17,911.6	2,136.2	11.93

* = Landings data are not reported (N/A) for Connecticut, and some of Massachusetts and Maryland. Therefore, 1985 percentages are overestimated.
Sources: MAFMC 1988.

Table 57. National economic impacts of total flounder and summer flounder commercial fishing in the Mid-Atlantic Region. Employment in person-years and income/output in $1000.

	Total Flounders			Summer Flounder		
	Employment	Income	Output	Employment	Income	Output
Harvest	368	6,154	14,547	309	5,169	12,219
Processing	379	3,408	15,855	318	2,863	13,318
Distribution	93	1,815	3,378	78	1,525	2,838
Food Service	1,660	11,742	20,983	1,394	9,863	17,626
Retail	225	2,558	5,026	189	2,149	4,222
Cumulative	2,726	2,5677	59,789	2,290	21,569	50,223

Sources: Total flounders from NFERF 1990. Summer flounder from NFERF 1990 as modified by unpublished NMFS General Canvass data.

Table 58. Estimated number of party and charter boats operating along the Atlantic coast and associated revenues by State, 1985.

State	Charter	Party	Revenues ('000 1985 $)
Maine	35	10	2,696
New Hampshire	19	21	3,226
Massachusetts	136	41	10,717
Rhode Island	78	6	4,164
Connecticut	46	15	3,753
New York	300	100	24,723
New Jersey	375	100	28,074
Delaware	80	12	2,511
Maryland	221	109	11,307
Virginia	200	30	5,196
North Carolina	136	10	4,376
South Carolina	66	21	3,163
Georgia	17	0	467
Florida	288	53	55,764
Total	1,997	528	160,137

Source: Sport Fishing Institute 1988a.

Table 59. National direct economic impacts of all species and summer flounder recreational fishing in the Mid-Atlantic Region.

	Employment (Person-years)	Wages (Million $)	Retail Sales (Million $)
All species	17,114	213.8	1,048.8
Summer Flounder	1,795-2,494	22.4-31.1	110.0-152.8

Sources: Sport Fishing Institute 1988 a and b.

Table 60. US supply of flounder fillets (1000 lbs)*, and summer flounder percent of total, 1980-89.

Year	Domestic	Imports	Total	Summer Flounder Lbs	SF %
80	86,768	36,511	123,279	12,395	10
81	80,421	54,297	134,718	8,734	6
82	91,336	43,937	135,273	9,463	7
83	101,411	35,690	137,101	12,295	9
84	87,998	45,761	133,759	14,984	11
85	78,287	57,964	136,251	13,158	10
86	67,620	65,452	133,072	11,424	9
87	79,884	73,003	152,887	11,444	7
88	91,448	58,534	149,982	14,349	10
89	80,996	58,455	139,451	8,736	6

* = assumes 40% recovery rate from round weight to fillets
Source: USDC 1990.

Table 61. US imports of flounder fillets, 1980-89.

Year	1000 lbs	$ 1000	$/lb
80	36,511	47,126	1.29
81	54,297	74,832	1.38
82	43,937	62,883	1.43
83	35,690	53,590	1.50
84	45,761	68,240	1.49
85	57,964	89,675	1.55
86	65,452	112,096	1.71
87	73,003	148,734	2.04
88	58,534	119,996	2.05
89	58,455	125,656	2.15

Source: USDC 1990.

Table 62. Quantity (pounds), value ($), and price ($/lb) of yearly exports of summer flounder from Atlantic and Gulf coast ports, 1981-1987.

Year	Quantity	Value	Price
1981	47,840	101,083	2.11
1982	11,243	20,998	1.87
1983	25,573	50,880	1.99
1984	1,764	4,129	2.34
1985	8,377	16,728	2.00
1986	197,312	261,157	1.32
1987*	27,558	96,344	3.50

* = January to June.
Source: R. Ross pers. comm.

Table 63. Annual number of otter trawl trips landing a given threshold of summer flounder, 1983-89. Note that weighout data are a sample of fishing activity, not a census.

Threshold	83 Trips	84 Trips	85 Trips	86 Trips	87 Trips	88 Trips	89 Trips
>= 1 lb	11,643	12,323	14,674	16,719	14,753	13,572	10,828
>= 100 lbs	6,509	7,632	8,147	10,166	9,674	8,306	5,215
>= 200 lbs	5,412	6,124	6,863	8,678	7,835	6,686	3,969
>= 300 lbs	4,816	5,181	6,005	7,347	6,584	5,840	3,386
>= 400 lbs	4,349	4,599	5,445	6,474	5,611	5,084	3,016
>= 500 lbs	4,045	4,212	5,013	5,881	5,084	4,632	2,856

Source: Unpublished NMFS weighout data (CT, DE, NC not included).

Table 64. Summer Flounder Mesh Selectivity Studies

			ICES Gauge Mesh Size Retention					Selection	Total	< 14"		> = 14"		Fluke		
Size	Study	Month	Ave	Dry	Wet	L50	SD	Factor	Fluke	Number	%	Number	%	lbs	Bycatch	
1.5"	NC (a)	Dec	-	-	-	-	-	-	188	85	45.2	103	54.8	272	515	lbs
	NC (b)	Dec	-	-	-	-	-	-	192	90	46.9	102	53.1	282	345	lbs
	NC (c)	Jan	-	-	-	-	-	-	93	64	68.8	29	31.2	111	1,833	lbs
	NC (d)	Jan	-	-	-	-	-	-	211	180	85.3	31	14.7	127	326	lbs
	NC (e)	Dec-Feb	-	-	-	-	-	-	174	82	47.1	92	52.9	254	4,979	lbs
	NC (f)	Jan-Feb	-	-	-	-	-	-	154	82	53.2	72	46.8	226	2,407	lbs
	NC (g)	Dec,Feb	-	-	-	-	-	-	182	85	46.7	97	53.3	269	891	lbs
	NC (h)	Nov-Dec	-	-	-	-	-	-	367	251	68.4	116	31.6	-	-	
2.25"	LI S (a)	May	2.3	-	-	-	-	-	1,983	1,092	55.1	891	44.9	2,110	10,989	lbs
2.5"	LI M (a)	May	2.6	-	-	-	-	-	170	29	17.1	141	82.9	262	6,042	lbs
	LI M (b)	May	2.5	-	-	-	-	-	1,492	482	32.3	1,010	67.7	1,992	25,301	lbs
	LI S (b)	May	2.5	-	-	-	-	-	2,950	1,485	50.3	1,465	49.7	3,231	13,283	lbs
3.0"	NJ N	Sept	-	2.5	2.6	-	-	-	274	185	67.5	89	32.5	-	-	
	NJ C	Sept	-	3.2	3.3	-	-	-	490	370	75.5	120	24.5	-	-	
	NJ S	Sept	-	2.7	2.8	-	-	-	186	99	53.2	87	46.8	-	-	
	NJ All	Sept	-	-	-	-	-	-	950	654	68.8	296	31.2	-	9,945	fish
	NC (a)	Dec	2.9	2.8	-	-	-	-	304	97	31.9	207	68.1	529	1,065	lbs
3.5"	NC (b)	Dec	3.8	3.8	-	-	-	-	292	164	56.2	128	43.8	337	349	lbs
4.0"	NC (c)	Jan	4.5	4.7	-	11.0	0.51	-	192	104	54.2	88	45.8	297	2,783	lbs
4.5"	NC (d)	Jan	5.0	5.2	-	12.8	0.35	-	107	52	48.6	55	51.4	138	303	lbs
	NC (h)	Nov-Dec	4.4	-	-	-	-	-	306	157	51.3	149	48.7	-	-	
5.0"	NJ N	Sept	-	4.4	4.4	-	-	-	157	97	61.8	60	38.2	-	-	
	NJ C	Sept	-	4.6	4.7	-	-	-	325	195	60.0	130	40.0	-	-	
	NJ S	Sept	-	4.4	4.4	-	-	-	153	92	60.1	61	39.9	-	-	
	NJ All	Sept	-	-	-	-	-	-	635	384	60.5	251	39.5	-	1,716	fish
	NC (e)	Dec-Feb	5.2	5.2	-	12.6	3.41	-	133	36	27.1	97	72.9	199	630	lbs
5.5"	NJ N	Sept	-	5.0	4.8	-	-	-	107	36	33.6	71	66.4	-	-	
	NJ C	Sept	-	5.2	5.7	-	-	-	223	110	49.3	113	50.7	-	-	
	NJ S	Sept	-	5.2	5.0	-	-	-	129	57	44.2	72	55.8	-	-	
	NJ All	Sept	-	-	-	-	-	-	459	203	44.2	256	55.8	-	2,265	fish
	LI M (a)	May	5.8	-	-	14.7	0.24	2.52	136	6	4.4	130	95.6	223	2,741	lbs
	LI M (b)	May	5.7	-	-	14.9	0.10	2.62	671	53	7.9	618	92.1	1,125	6,045	lbs
	LI S (a)	May	5.6	-	-	12.8	0.08	2.29	1,872	760	40.6	1,112	59.4	2,255	8,823	lbs
	LI S (b)	May	5.6	-	-	13.6	0.08	2.45	1,542	460	29.8	1,082	70.2	1,974	7,011	lbs
	NC (f)	Jan-Feb	5.7	5.9	-	14.3	2.52	-	89	9	10.1	80	89.9	178	658	lbs
6.0"	NC (g)	Dec,Feb	6.3	6.2	-	16.9	2.40	-	96	15	15.6	81	84.4	235	400	lbs

Note: All letter footnotes after the studies are used to match control and experimental sets.

Sources: Anderson, *et al.*, 1983; Gillikin, *et al.*, 1981; Gillikin, 1982; and New Jersey, 1985.

Table 65. Summer Flounder Retention Level by Mesh Size

Retention Percent	Mesh Size 4.5"	5.0"	5.5"	Mesh Selection Factors*	Adjusted R^2
10%	8.4	9.3	10.2	1.86	0.27
25%	9.8	10.9	12.0	2.18	0.45
50%	11.1	12.3	13.5	2.46	0.88
75%	11.6	12.9	14.2	2.58	0.81
90%	11.8	13.2	14.5	2.63	0.81

Note: The mesh selection factor is the calculated ratio between the retention percent and the mesh size (i.e., 2.46 is 13.5" divided by 5.5"). Overall mesh selection factors were developed by pooling all appropriate data from the previous studies and was derived as the best estimate of the slope, through linear regression techniques.

* All R^2 values were significant.

Source: Pooling of all data from Anderson *et al.*, 1983; Gillikin *et al.*, 1981; Gillikin, 1982; and New Jersey, 1985.

Table 66. State Laws for Summer Flounder: ME to NC.

Maine

Size limits:	13" possession restriction. It is also illegal to possess groundfish (including summer flounder) aboard any vessel rigged for groundfishing that has its head or tail removed and is less than the legal size limit.
Gear restrictions:	5.5" minimum mesh size for trawls, Scottish seines, bottom tending gillnets and bottom tending seines. Regulations exist regarding the placement of stop seines and fish weirs. Additional gear/season restrictions for specific locations are detailed in Department regulations.
Area closures:	Groundfish (summer flounder) spawning closure in Booth Bay and Sheepscot Bay from May 1 to June 30.
Seasons:	See above.
Licenses:	A commercial license is required for the harvest, transport, and sale of fish that are not for personal use: $20 for individual, resident operators; $53 for resident operator with crew; $200 for nonresident operator and crew. No license is required for fish taken with hook and line for personal use. There is no recreational license, except for Atlantic Salmon.
Other:	Nonresidents are required by law to report all groundfish (summer flounder) catches.

New Hampshire

Size limits:	13" possession restriction.
Gear restrictions:	Mobile fishing gear may not be used in state waters between April 16 and Dec 14. Use of trawls and drag seines are prohibited in Piscataqua River or its tributaries north of the Portsmouth Memorial Bridge.
Area closures:	See above
Seasons:	None specific to summer flounder.
Licenses:	Resident commercial saltwater fishing license: $26; no sport fishing license. Residents are not required to have a license to sell fish caught by hook and line, but a $200 minimum license fee is required for nonresidents.

Massachusetts

Size limits:	14"
Gear restrictions:	Minimum mesh sizes for mobile trawl and seine gear: * North of Cape Cod: - 5" required year round except in northern Cape Cod Bay (5.5" after 1/1/91). * South of Cape Cod: 5" required Nov. 1 - April 14 (5.5" after 1/1/91); 3.5" required June 16 - Oct. 31; and no minimum required April 15 - June 15. * East of Cape Cod: 5" required Nov. 1 - April 30 (5.5" after 1/1/91). Gillnets may not exceed 2,400 feet; mesh size of gillnets must be greater than 6" stretched measure.
Area closures:	Buzzards Bay is closed to trawling year round. State waters from Nauset Light around Monomoy west to Succonessett Point, Mashpee are closed to trawling from May 1 - Oct. 31. All waters south of Cape Cod banned to gillnetting April 1 - Nov. 15. (See Mass. regulations for additional closures.)
Seasons:	See above
Licenses:	Commercial fishing licenses: Vessel license ranges from $130 to $260, depending on length; license for individuals = $65 each. There is no sport license for fish caught for personal use. A license to sell fish caught with hook and line is $35, and applies to any individual selling fish

Rhode Island

Size limits:	14" possession restriction.
Gear restrictions:	Trawling is prohibited in the upper portion of Narragansett Bay from Nov 1 - July 1; 5" cod end minimum mesh size in a portion of central Narragansett Bay from Nov 1 - Feb 28. Numerous specific gillnet regulations by geographic location and season; trap and fyke net regulations regarding leaders, distance from shore, distance between traps, etc.
Area closures:	Numerous restrictions on the location of traps off the Island of Rhode Island, the Sakonnet River, and in Narragansett Bay. Cannot set, haul, and/or maintain a seine within 0.5 mile of the seaward entrance of several ponds/rivers; significant portion of the state is closed to various forms of netting.
Seasons:	Fish traps must be out of the water Jan 1 - end of Feb.
Licenses:	Multipurpose commercial licenses allow for harvest and sale of fish: $150, with additional fees for specific gear types. There is no sport license to fish for personal use.

Connecticut

Size limits:	14" possession restriction.
Gear restrictions:	Cod end minimum mesh size of 4.5" in trawls from Nov 15 - May 14, and 3" from Aug 1 - Nov 14. Gillnet minimum mesh size 3"; Pound, trap, fyke, and weir minimum mesh: 2".
Area closures:	Fish traps and pound nets may not be set in an area off the mouth of the Connecticut River; pound nets must be set at least one mile apart; trawling is prohibited within an "inshore trawl line;" numerous specific areas are closed to trawl and/or other forms of net gear.
Seasons:	None except as noted above
Licenses:	A variety of commercial resident and nonresident licenses are available allowing for the harvest and sale of fish. Fees are typically in the $25 - $150 range. Marine angling with hook and line does not require a license if fish are for personal use only. Personal use fishing with trawls and other specific gear will require a commercial license.

New York

Size limits:	14" possession restriction.
Gear restrictions:	No minimum mesh size for trawls at the present time.
Area closures:	There are numerous specific locations where trawl and/or other net gear are restricted.
Seasons:	None
Licenses:	A commercial license is required for the harvest and sale of fish: Resident: $100, Nonresident: $1,000. (The nonresident harvest license may only be purchased in January.) A nonresident license which allows landing only: $250. There is no sport license for fish caught for personal use.

New Jersey

Size limits:	13" possession restriction.
Gear restrictions:	Trawls fishing for summer flounder must have a 4.5" minimum mesh size in the cod end. (A summer flounder trip is defined as one in which 20% of the weight of the catch is comprised of summer flounder.) Gillnets may not exceed 2,400 ft in length from Feb 1 - May 15, and may not exceed 1,200 ft from May 15 - Dec 15.
Area closures:	Trawling and purse seining are prohibited within two miles of the coast; gillnetting is limited to the Atlantic Ocean and Delaware Bay.
Seasons:	Gillnets cannot be fished from Dec 16 - Feb 1.
Licenses:	Commercial gears are licensed, with fees dependent on the gear type. There is no sport fishing license for hook and line gear, and no license is required to sell hook and line caught fish.

Delaware

Size limits:	13" possession restriction.
Gear restrictions:	Trawls, purse seines, power operated seines, and runaround gillnets are prohibited. A single gillnet cannot exceed 200 yards in length; a series of connected gillnets cannot exceed 500 yards; a fyke net cannot exceed 72" in diameter; fish traps may not exceed 125 cubic ft and must have an escape panel. There is a moratorium on issuance of new commercial (> 200 ft) gillnet permits until the number of fishermen falls below 30.
Area closures:	Areas within a 0.5 mile sector at the mouths of all major tributaries to the Delaware River and Bay are closed to all fixed gears; numerous specific areas closed to commercial fishing.
Seasons:	From April 1 - May 10, commercial fishermen cannot set over 1,000 yards of <u>fixed</u> gillnet from one vessel; from May 10 to Sept 30, commercial fishermen cannot set over 1,000 yards of <u>drifting</u> gillnet from one vessel; drift gillnets cannot be set from 2,400 hours Friday - 1,600 hours Sunday during this period; specific seasonal closures for gillnets in certain areas.
Licenses:	Commercial food fishing license is required for the harvest and sale of fish: Residents: $150; Nonresidents: $1,500. Additional fees are levied for the use of specific gear types. There is no sport license for fish caught for personal use.

Maryland

Size limits:	13" possession restriction, with a 5% tolerance (by number) for commercial fishermen only.
Gear restrictions:	Trawls prohibited within one mile of the coastline, and in Chesapeake Bay. Use of monofilament gillnets prohibited, except in coastal bays and the Atlantic Ocean; several specific gillnet restrictions exist for Chesapeake Bay; minimum mesh sizes for pound nets, haul seines, and fyke nets are 1.5"; purse seines prohibited.
Area closures:	There are numerous specific locations where trawl, gill, seine and/or other net gear are restricted.
Seasons:	None
Licenses:	A tidal fish license is required to catch, buy, or sell fish from tidal waters for commercial purposes: Resident: $35, Nonresident: $100. Additional fees are levied to validate the license for individual gear types; for example: nets, seines, trawls, and pots used in the ocean: $100, hook and line: $25. There is a mandatory 2 year waiting period for any commercial fishing gear license. Chesapeake sport fishing license: $5.

Virginia

Size limits:	13" possession restriction, with a 10% (or 2 fish, whichever is greater) enforcement tolerance.
Possession limits:	Summer flounder = 10 fish per day. (A voluntary 6 fish per day limit is encouraged, as well as not making use of the 2 undersized fish tolerance.)
Gear restrictions:	Trawls and encircling gillnets are prohibited in Virginia waters. Minimum mesh sizes: pound nets: 2"; haul seines over 200 yards: 3"; gill nets = 2-7/8". The gill net limit increases to 3" on 1/1/92.
Area closures:	Fish trout lines cannot be set on the sea side of the eastern shore.
Seasons:	Haul seining in the Chesapeake Bay or its tributaries is prohibited on Sundays. (This prohibition will be rescinded as of 7/1/90.)
Licenses:	Commercial licenses are required for specific fishing gears, with the fee dependent on the gear type. There is no sport fishing license, and no license is required to sell hook and line caught fish.
Other:	Virginia has developed a State management plan for summer flounder. It proposes: a zero tolerance on undersize fish for all gears except pound nets; special licenses for seafood sellers and commercial hook and line fishermen; and limited and delayed entry programs. It also requests the Mid-Atlantic Council to adopt: a 5.5 minimum mesh size for trawls when targeting summer flounder; individual state quotas for summer flounder; and to request that North Carolina either prohibit trawling in the northern portion of its waters from November - February, or establish a 5.5" minimum mesh size during that same period.

North Carolina

Size limits: 13" possession restriction.

Gear restrictions: A 5.5" minimum mesh requirement was issued for the cod ends of trawls used in the Atlantic Ocean within 3 miles of the beach from the NC/VA State line to Beaufort Inlet. This requirement extends from 1 November 1990 to 30 April 1991, and must be reissued to take effect in subsequent years.

Trawl nets may not be used in internal, coastal fishing waters for finfish, however an unlimited quantity of legal size flounder may be retained as a bycatch in the trawl fisheries for crab and shrimp. (Non-flounder bycatch is limited to 1,000 pounds per trip). Purse seines are prohibited except for menhaden and Atlantic thread herring; no net may be towed by more than one vessel except in long haul (seine) fishing operations.

Area closures: Numerous specific gear restrictions by geographic area. Trawls are prohibited within one half mile of the beach between the Virginia line and Oregon Inlet. Trawling is prohibited in designated nursery areas.

Seasons: Several specific seasonal restrictions pertaining to gillnets. The Fishery Director may, by Proclamation, establish fishing gear specifications for trawls in the territorial sea to protect small flounder from Oct 1 - April 30.

Licenses: A commercial license is required for vessels, with fees dependent on vessel length (non-residents have an additional $200 surcharge). An inland sport fishing license is necessary for some portions of tidal waters. A license is required to sell fish caught by hook and line, but there is a $500 exemption per 12 month period.

Other: North Carolina is considering revising trawl regulations in internal, coastal waters as follows: limit finfish bycatch to 200 lbs (including flounder) in the crab and shrimp fisheries; require a 5" - 5.5" minimum mesh from Nov 1 - March 31 in several key river systems (Paplico, Pungo Bay, Neuse, and New River), or alternatively, close them to trawling during this period.

Table 67. The impact of mesh and minimum size regulations on commercial trawl landings of summer flounder based on NEFC weighout data, 1985-1989 combined. The percent discarded (D) and the percent reduction (PR) in number of fish killed by commercial fishermen were derived using selectivity curves. The percent reductions assume an 80% mortality of discards and 25% mortality of fish escaping from the net.

	Mesh Size (inches)									
Min Size	4.0		4.5		5.0		5.5		6.0	
(TL inches)	D	PR	D	PR	D	PR	D	PR	D	PR
None	-	*	-	1	-	5	-	14	-	21
11	*	*	*	1	*	5	*	14	*	21
12	1	*	1	2	1	5	*	14	*	21
13	8	2	8	3	6	6	4	14	3	22
14	22	5	22	6	19	8	15	17	11	24
15	44	9	44	10	41	13	37	21	29	27
16	58	12	57	13	55	16	51	24	44	30

* = <1.0%

Note: Mesh sizes are inside stretch measurements.

Table 68. The impact of mesh and minimum size regulations on North Carolina commercial trawl landings of summer flounder, 1985-89 combined. The percent discarded (D) and the percent reduction (PR) in number of fish killed by commercial fishermen were derived using selectivity curves. The percent reductions assume an 80% mortality of discards and 25% mortality of fish escaping from the net.

	Mesh Size (inches)									
Min Size	4.0		4.5		5.0		5.5		6.0	
(TL inches)	D	PR	D	PR	D	PR	D	PR	D	PR
None	-	2	-	6	-	15	-	26	-	38
11	6	3	4	7	2	15	1	27	1	38
12	15	5	11	8	7	16	4	27	3	39
13	37	9	34	13	27	20	20	30	14	41
14	53	12	50	16	44	24	35	33	26	44
15	71	16	69	20	65	28	57	38	48	48
16	79	18	78	22	75	30	70	40	62	51

Note: Mesh sizes are inside stretch measurements.

Table 69. Cetaceans and Turtles Found in Survey Area

Scientific name	Common name	Est. Minimum Number in Study Area	Endan-gered	Threat-ened
LARGE WHALES				
Balaenoptera physalus	fin whale	1,102	X	
Megaptera novaeangliae	humpback whale	684	X	
Balaenoptera acutorostrata	minke whale	162		
Physeter catodon	sperm whale	300	X	
Eubalaena glacialis	right whale	29	X	
Balaenoptera borealis	sei whale	109	X	
Orcinus orca	killer whale	unk		
SMALL WHALES				
Tursiops truncatus	bottlenose dolphin	6,254		
Globicephala spp.	pilot whales	11,448		
Lagenorhynchus acutus	Atl. white-sided dolphin	24,287		
Phocoena phocoena	harbor porpoise	2,946		
Grampus griseus	grampus (Risso's) dolphin	10,220		
Delphinus delphis	saddleback dolphin	17,606		
Stenella spp.	spotted dolphin	22,376		
Stenella coeruleoalba	striped dolphin	unk		
Lagenorhynchus albirostris	white-beaked dolphin	unk		
Ziphius cavirostris	Cuvier's beaked dolphin	unk		
Stenella longirostris	spinner dolphin	unk		
Steno bredanensis	rough-toothed dolphin	unk		
Delphinapteras leucas	beluga	unk		
Mesoplodon spp.	beaked whales	unk		
TURTLES				
Caretta caretta	logggerhead turtle	4,017		X
Dermochelys coriacea	leatherback turtle	636	X	
Lepidochelys kempi	Kemp's ridley turtle	unk	X	
Chelonia mydas	green turtle	unk		X

Source: University of Rhode Island 1982.

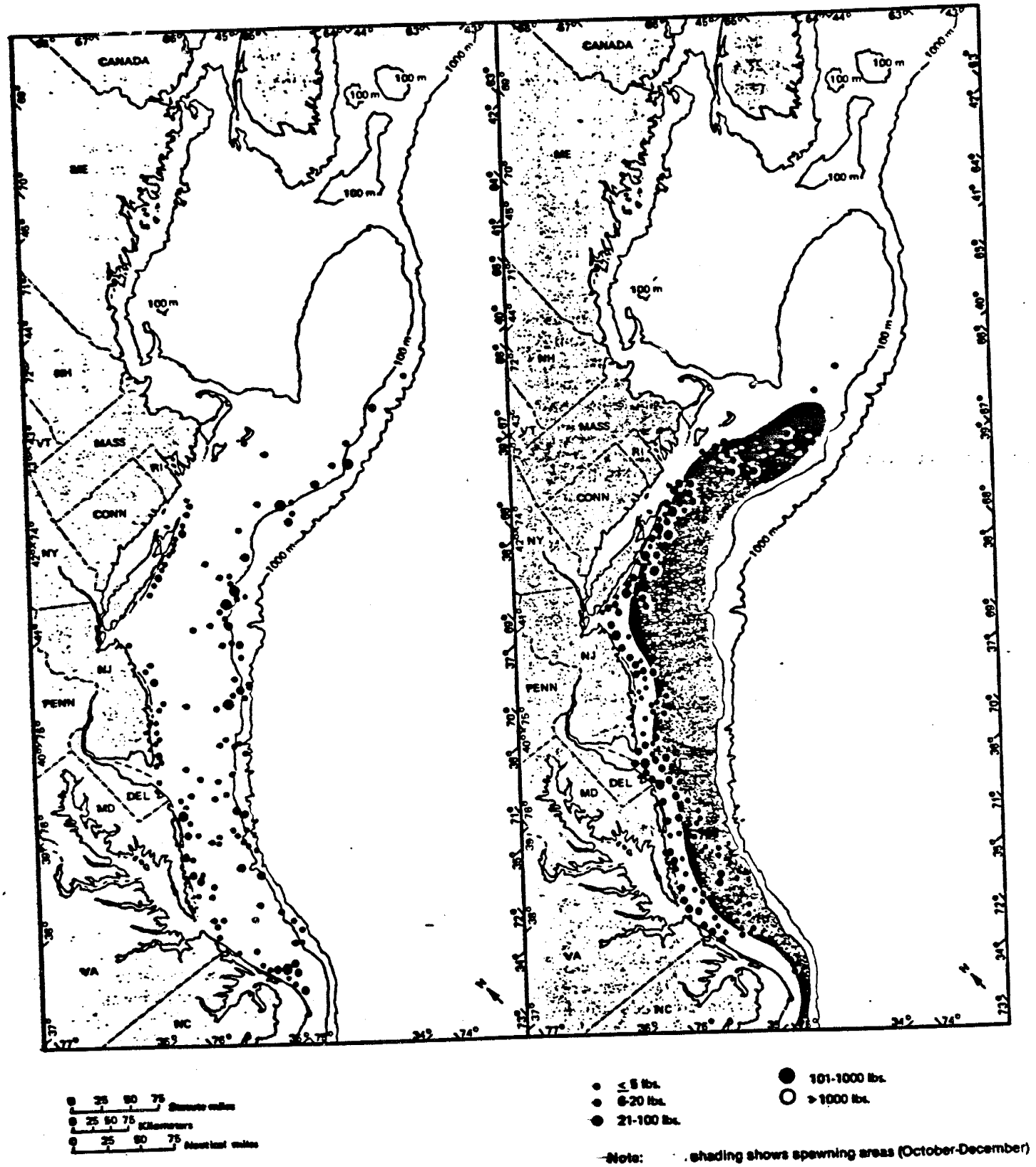


Figure 1. Seasonal Distribution of Summer Flounder Based Upon NEFC Surveys, 1973 and 1974. Spawning Areas Indicated by Shading. Left side is Spring Distribution and Right side is Autumn Distribution.
Source: Grosslein and Azarovitz, 1982.

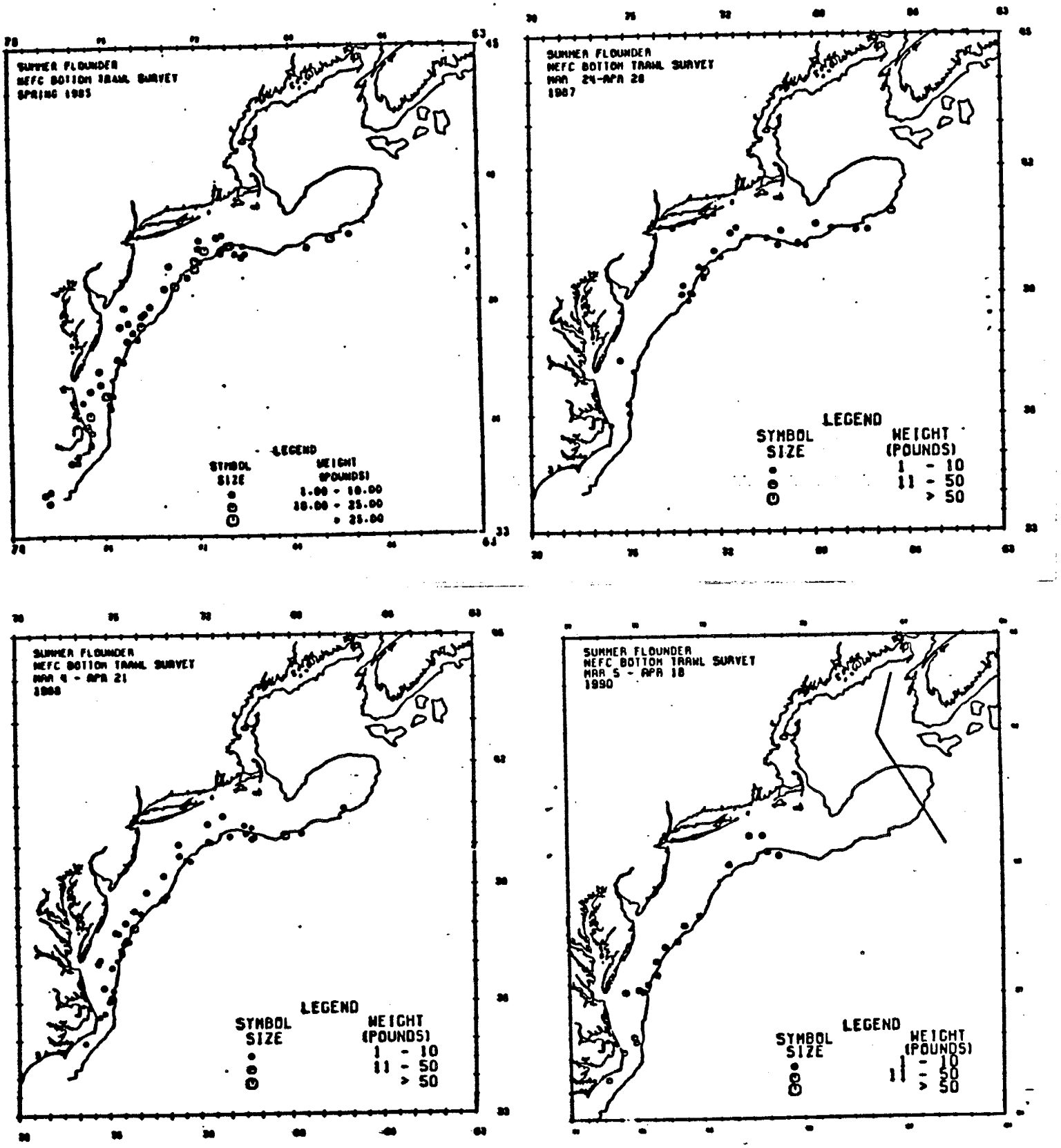


Figure 2. Summer Flounder Catch (lbs) Per Tow in NEFC Bottom Trawl Surveys, 1985.

Source: unpub. prelim. NMFS data.

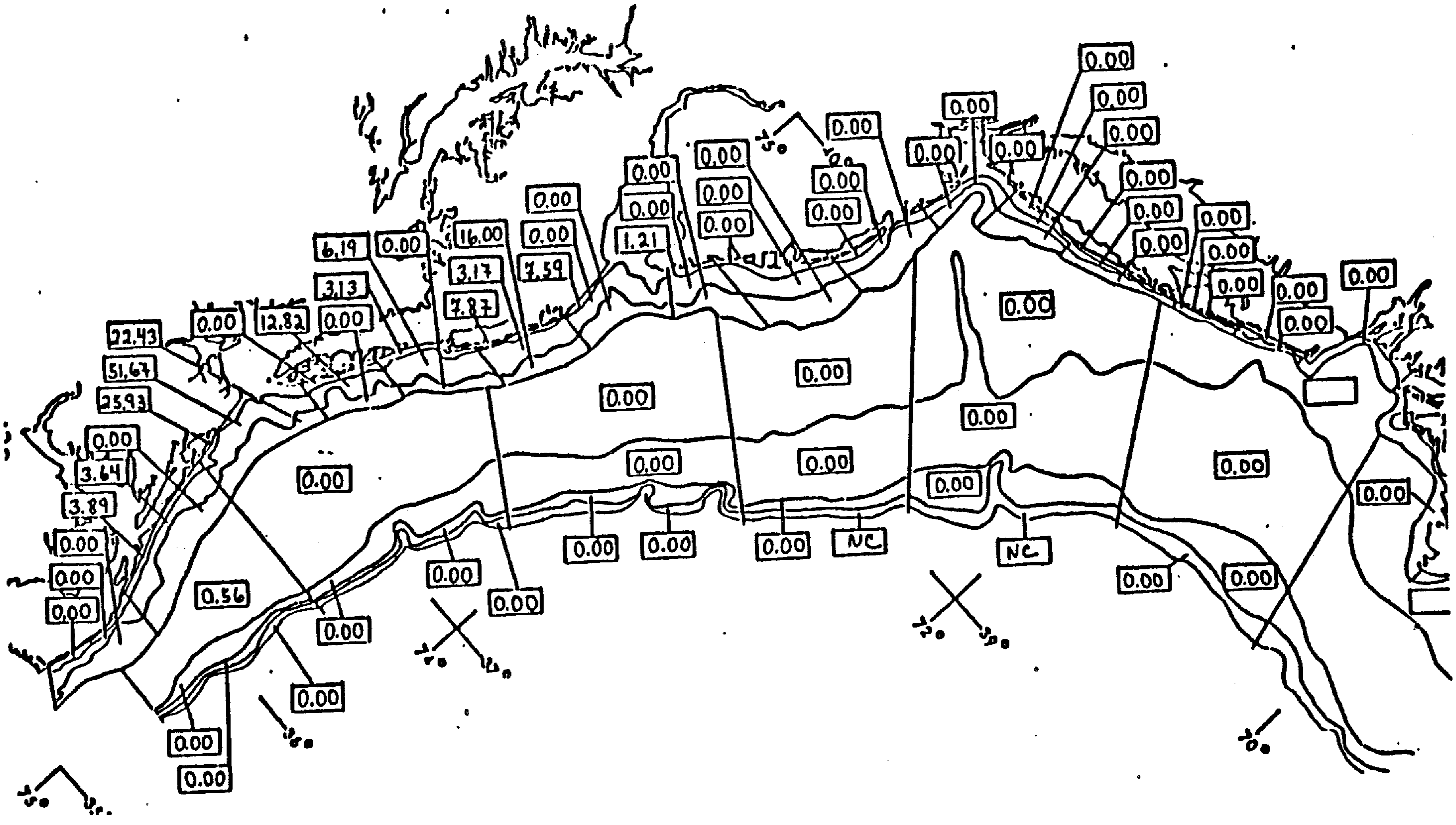


Figure 3. Percentage of Young of the Year Summer Flounder Caught by NEFC Trawl Survey During the Spring, 1968-1979.

Source: Azarovitz et al., 1980.

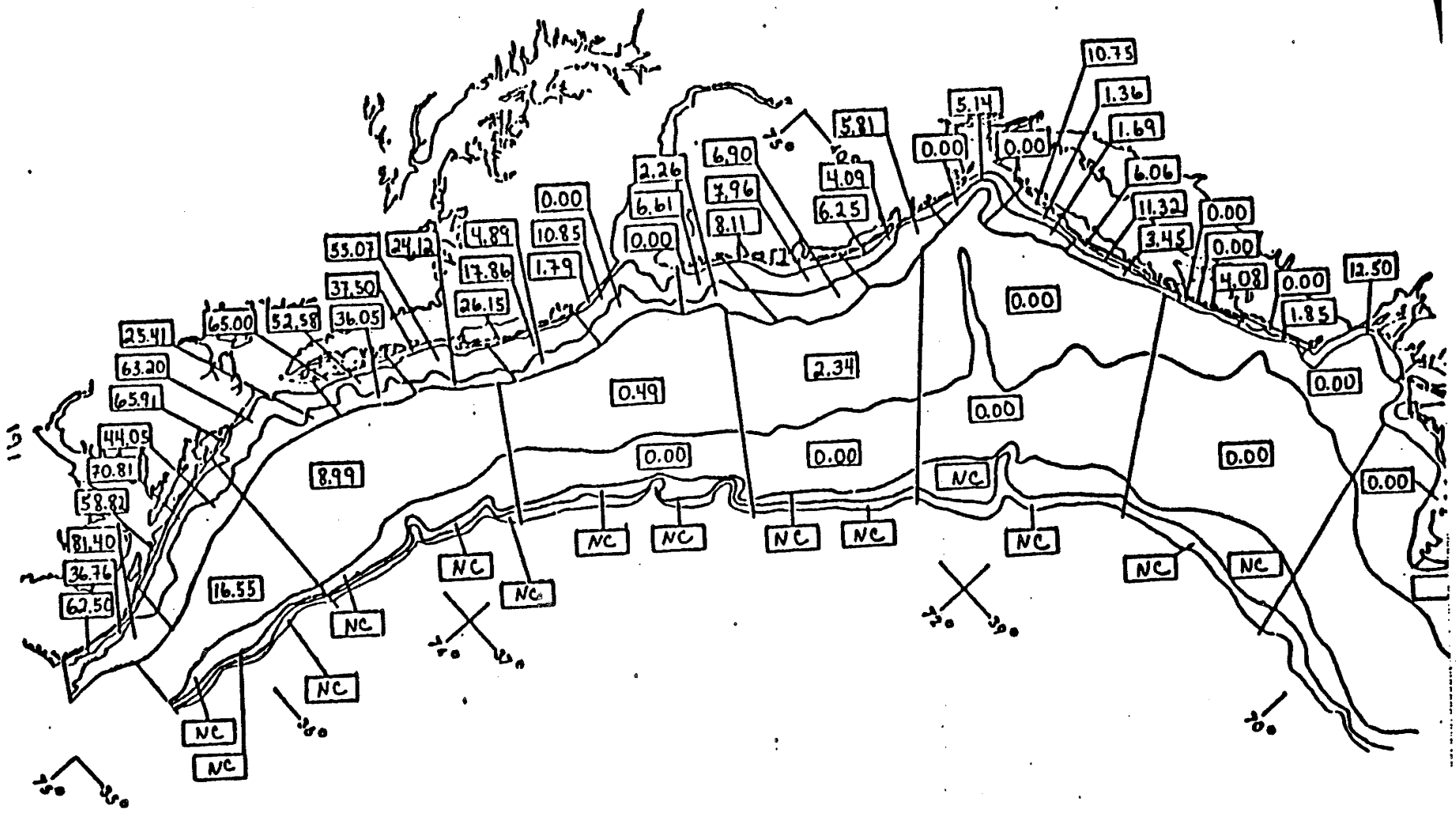


Figure 4. Percentage of Young of the Year Summer Flounder Caught by NEFC Trawl Survey During the Autumn, 1967-1979.

Source: Azarovitz et al., 1980.

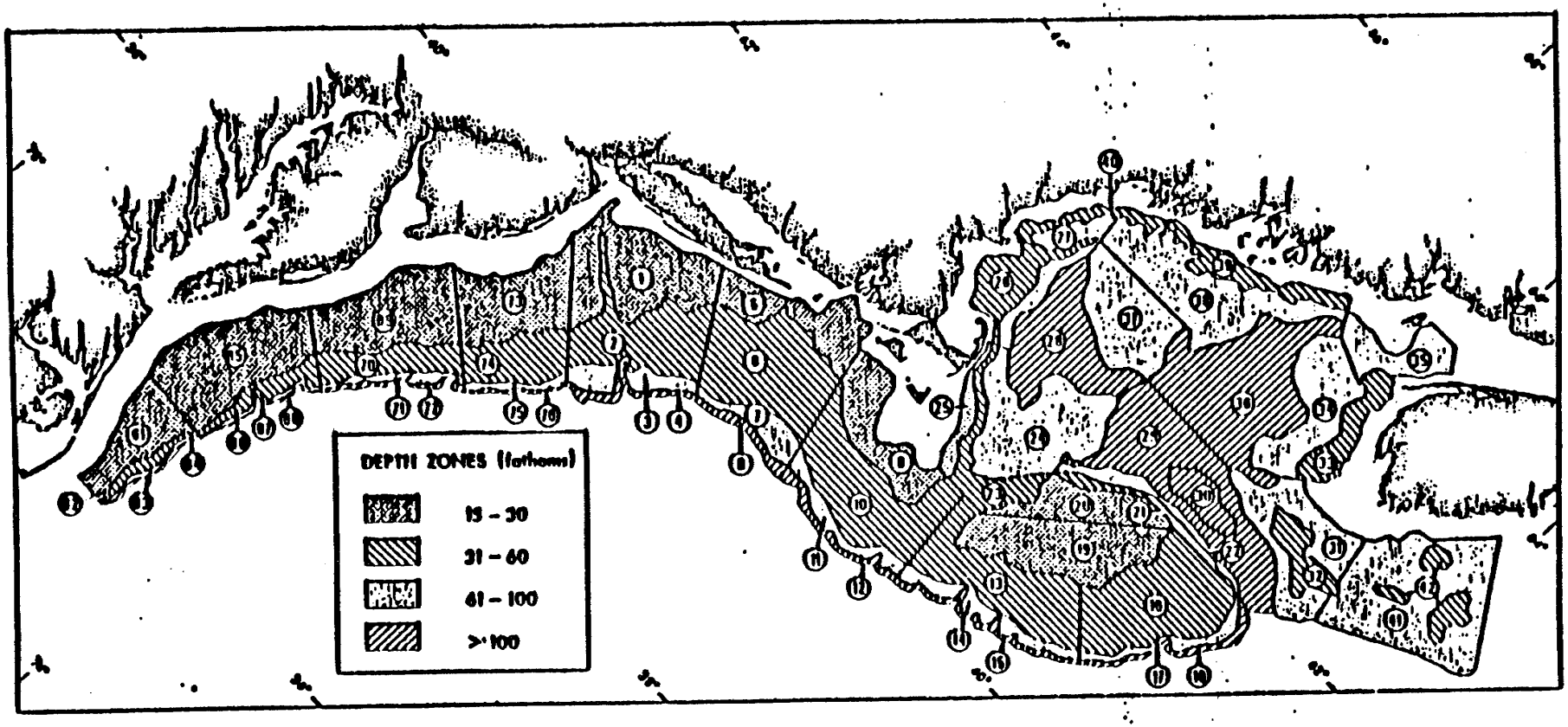


Figure 5. Northwest Atlantic NEFC Trawl Survey Strata.

Source: Clark, 1978.

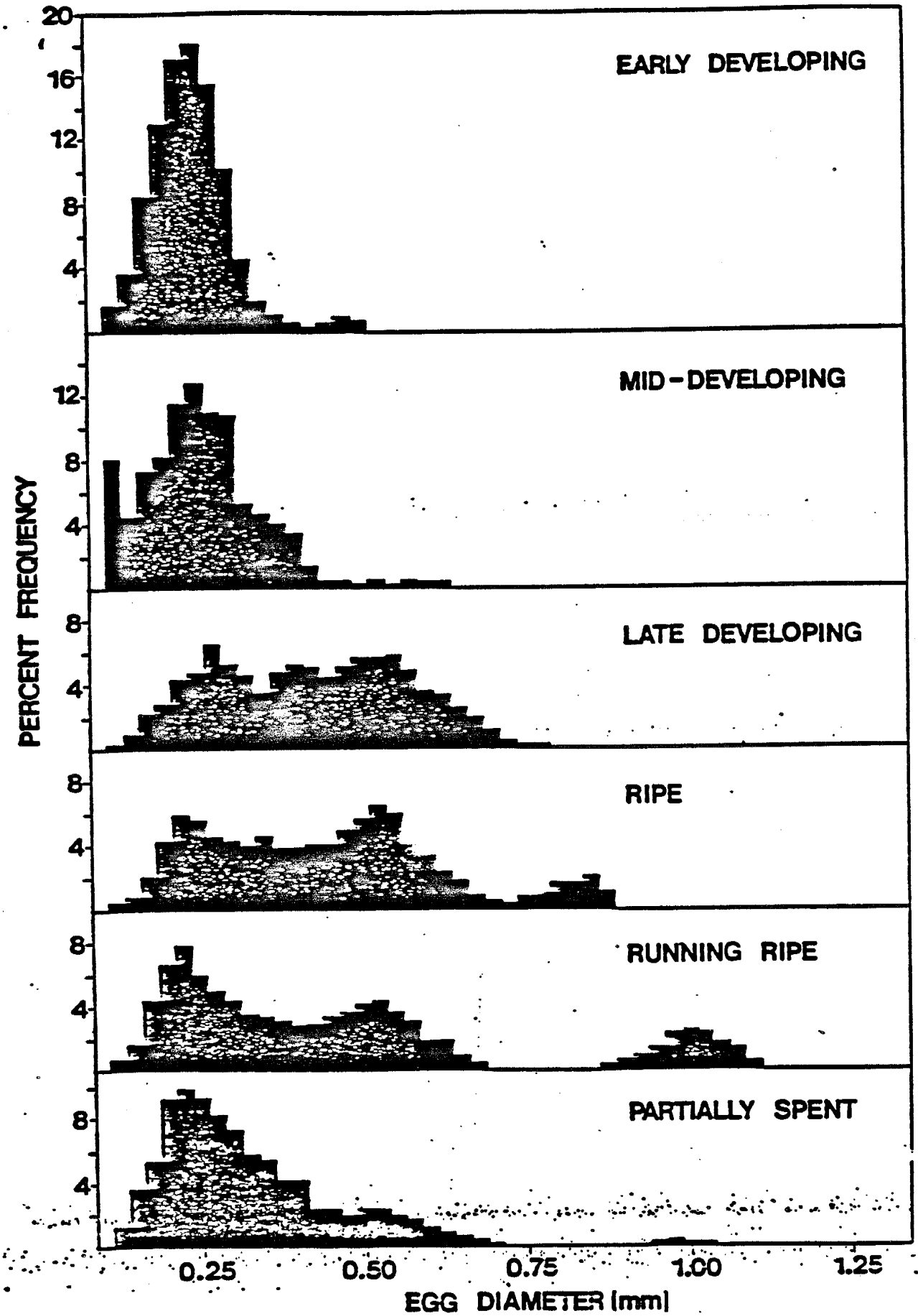
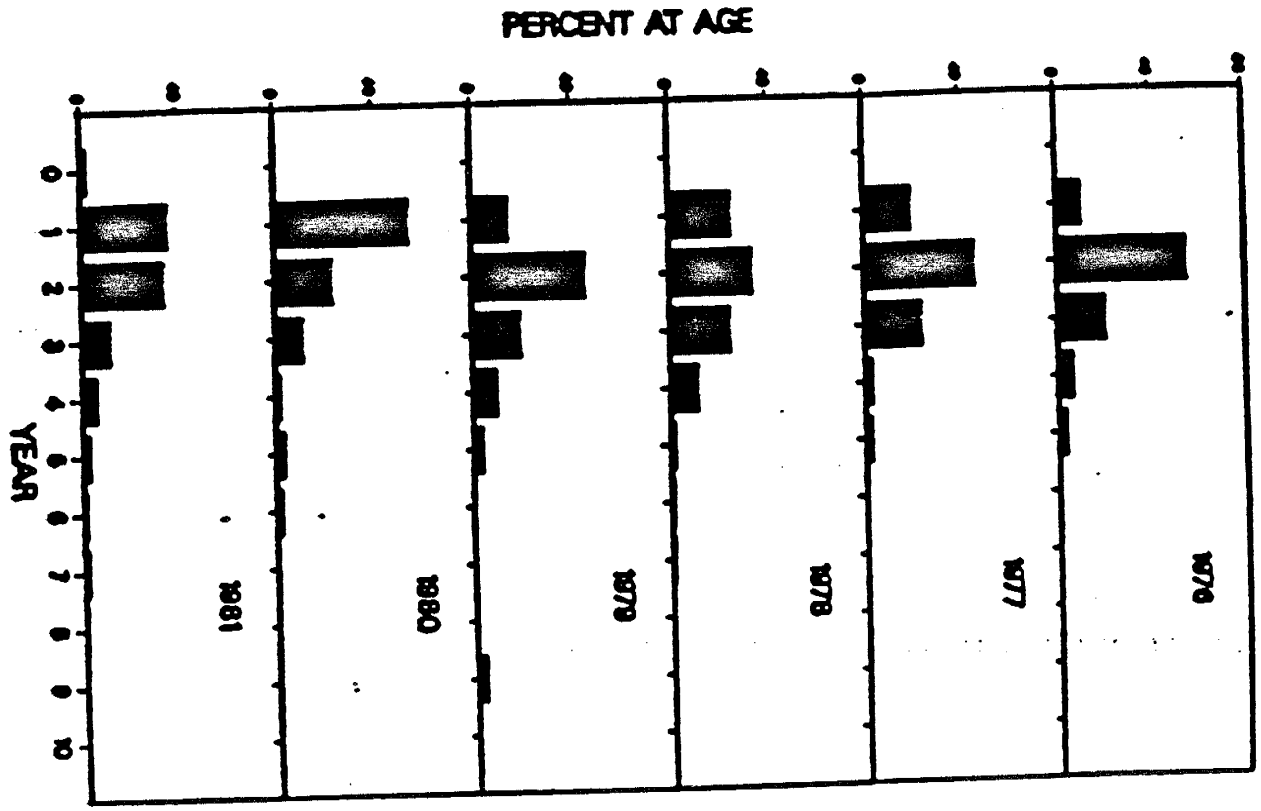


Figure 6. Egg Diameter Frequencies of Summer Flounder.

Source: Morse, 1981.



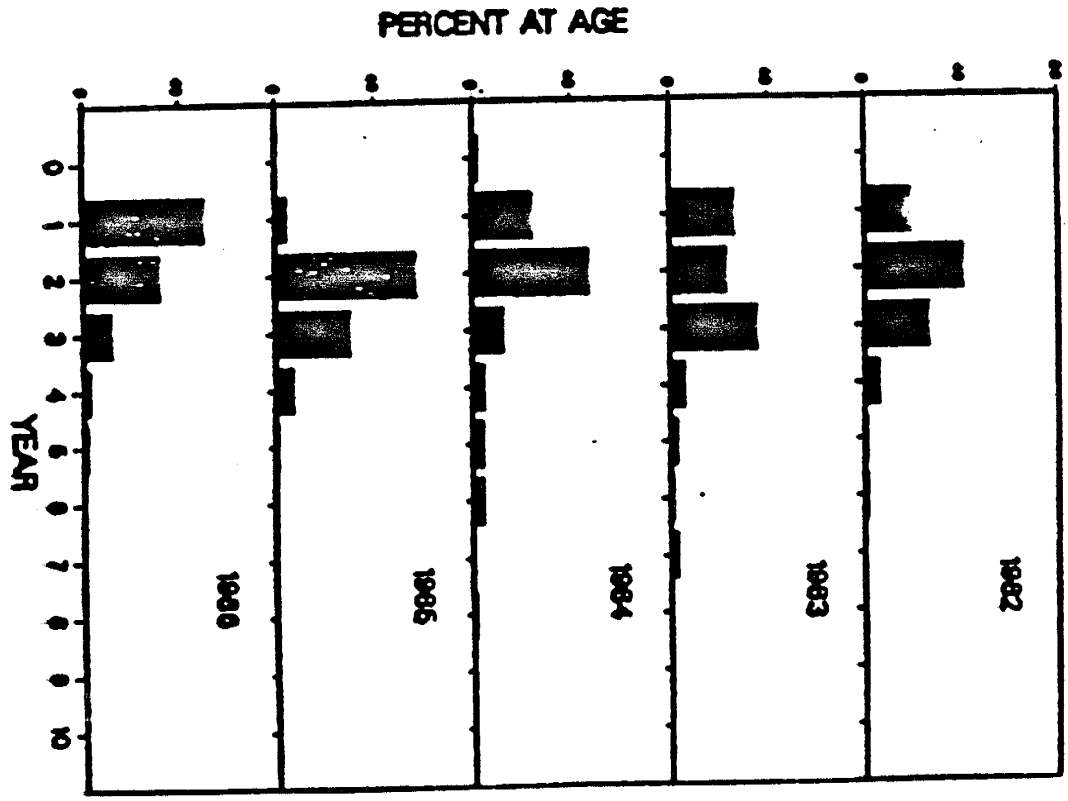


Figure 7. Summer Flounder Mean Number per Tow at Age (Expressed as Percent of Total) for NEFC Spring Offshore Surveys, 1976-1986. Source: USDC, 1986c.

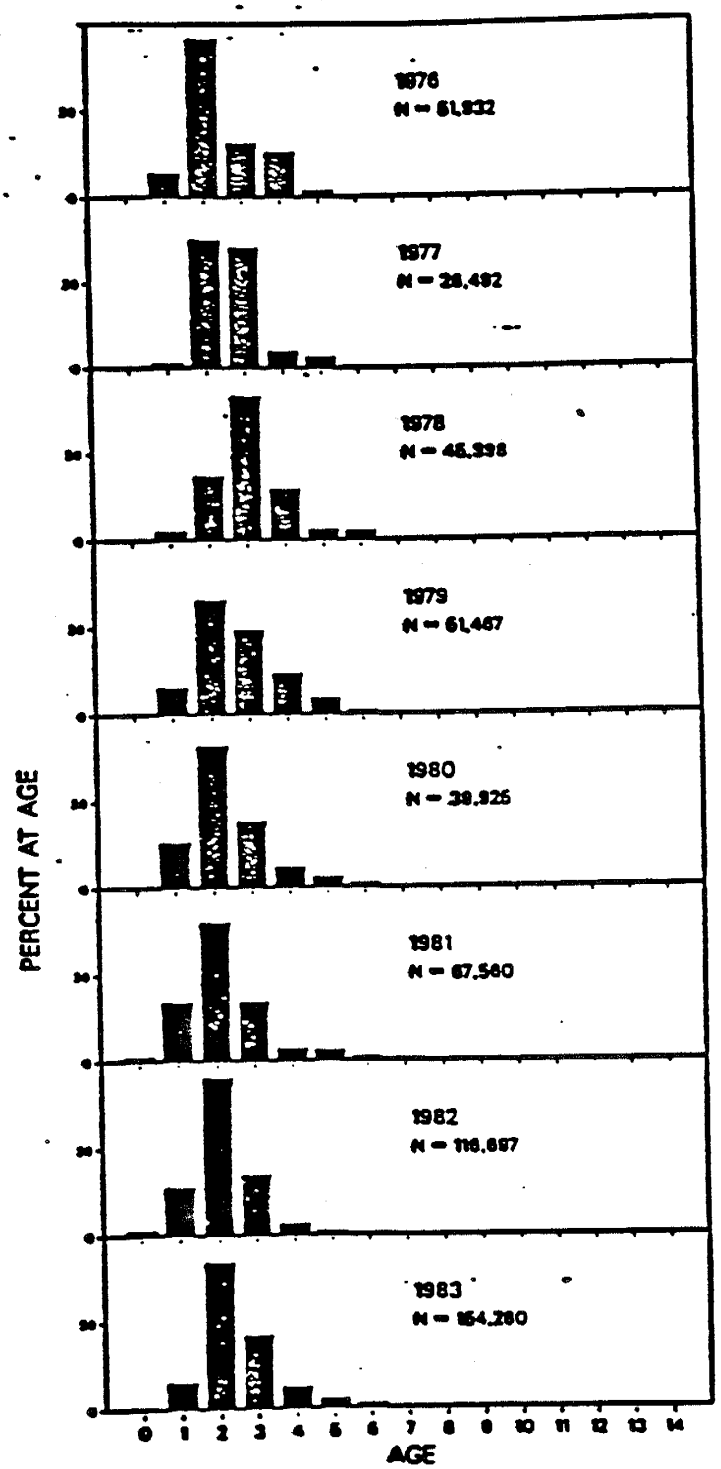


Figure 8. Percent at Age Composition of Commercial Summer Flounder Landings, 1976-1983.

Source: USDC, 1986c.

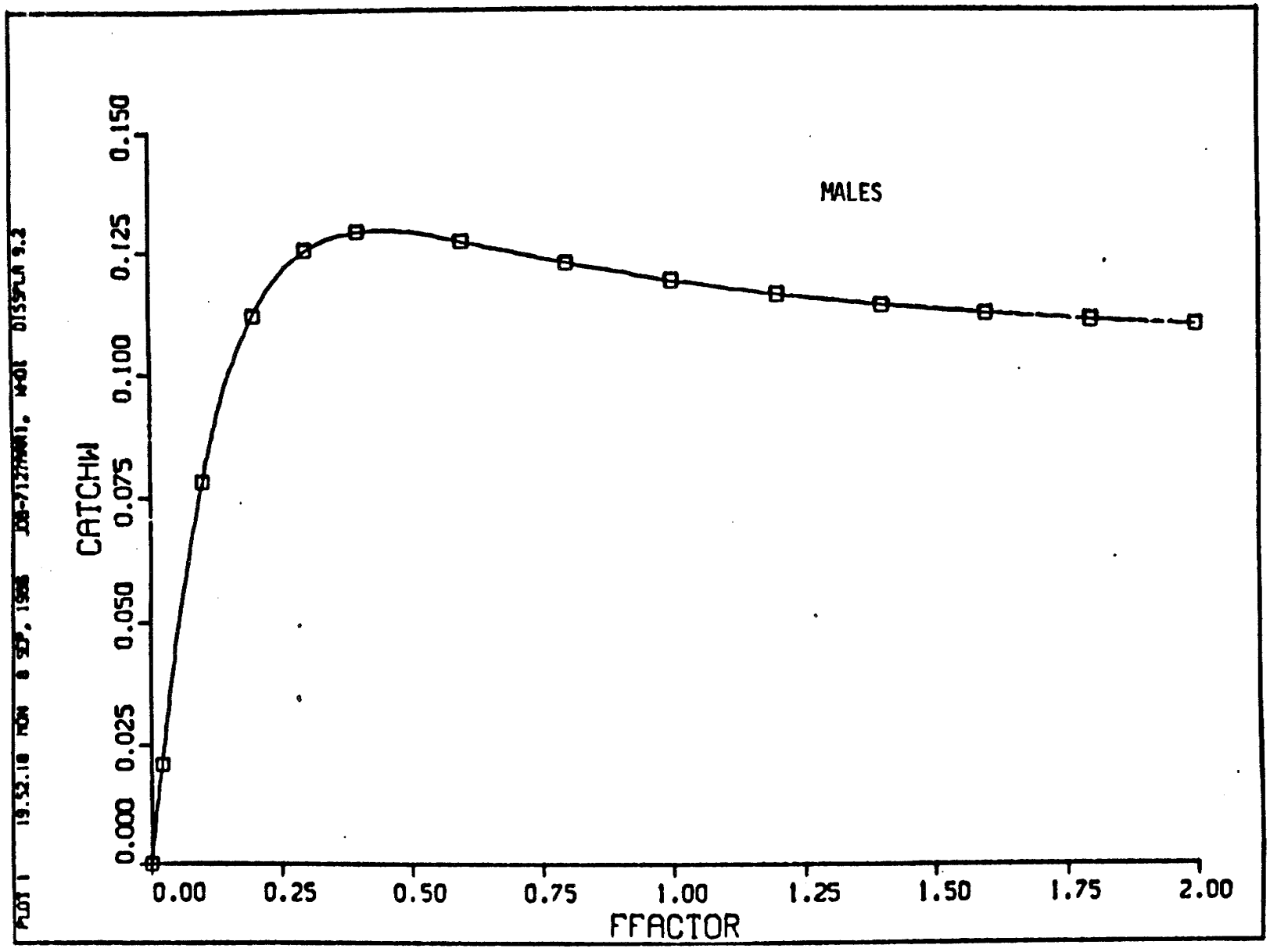


Figure 9. Yield per Recruit as a Function of Fishing Mortality (F) for Male Summer Flounder.

Source: USDC, 1986c.

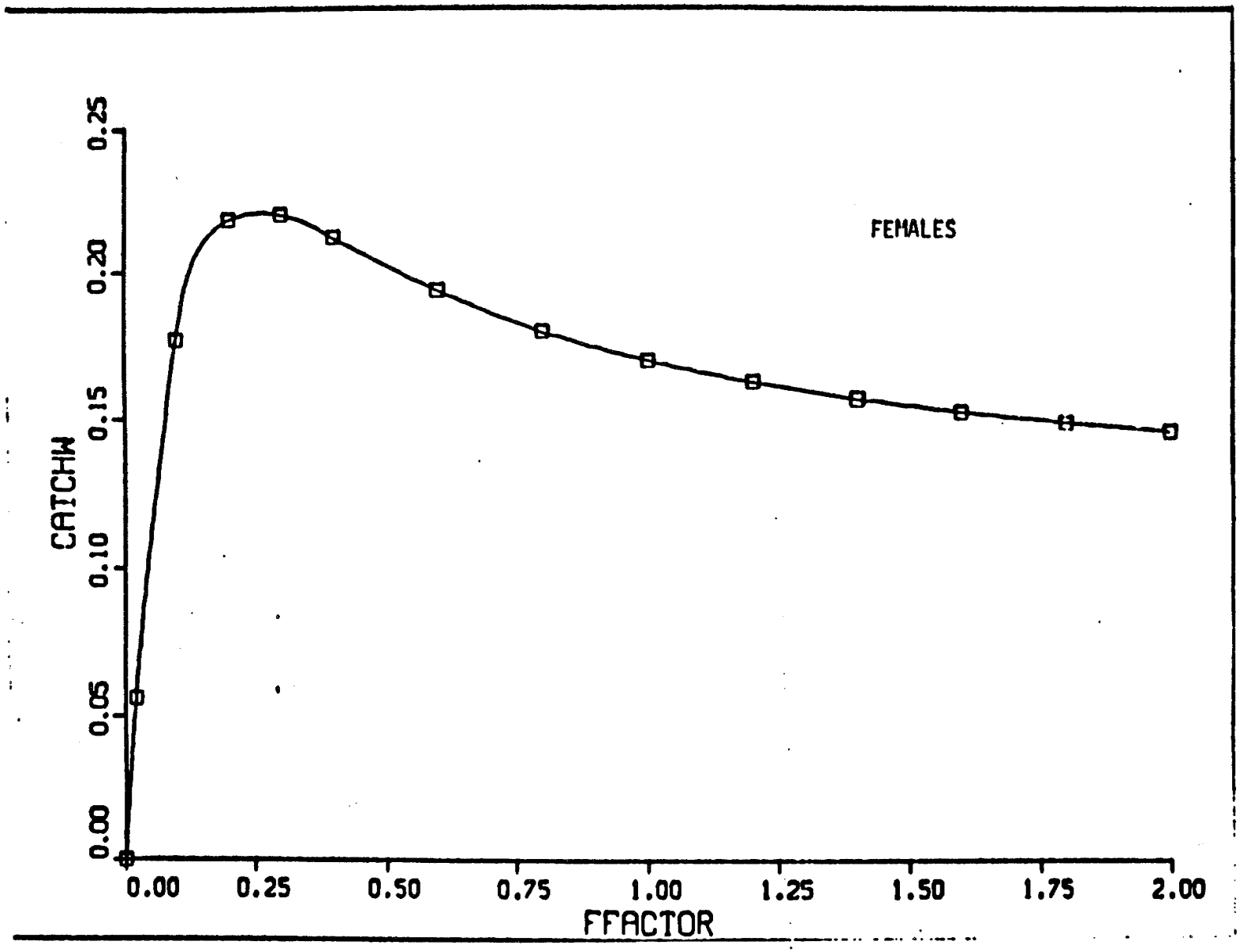


Figure 10. Yield per Recruit as a Function of Fishing Mortality (F) for Female Summer Flounder.

Source: USDC, 1986c.

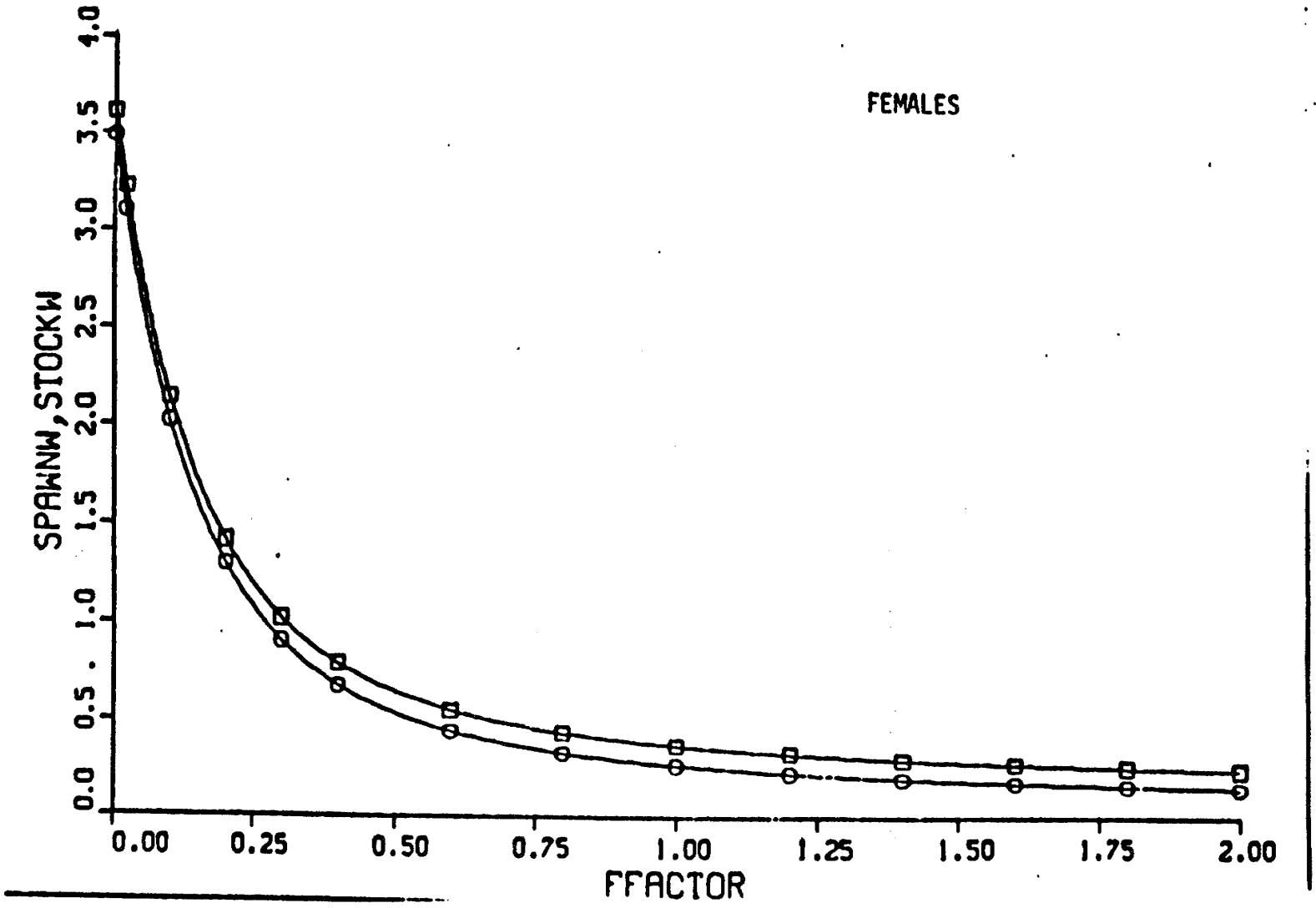


Figure 11. Spawning Stock Biomass per Recruit as a Function of Fishing Mortality (F) for Summer Flounder Females.

Source: USDC, 1986c.

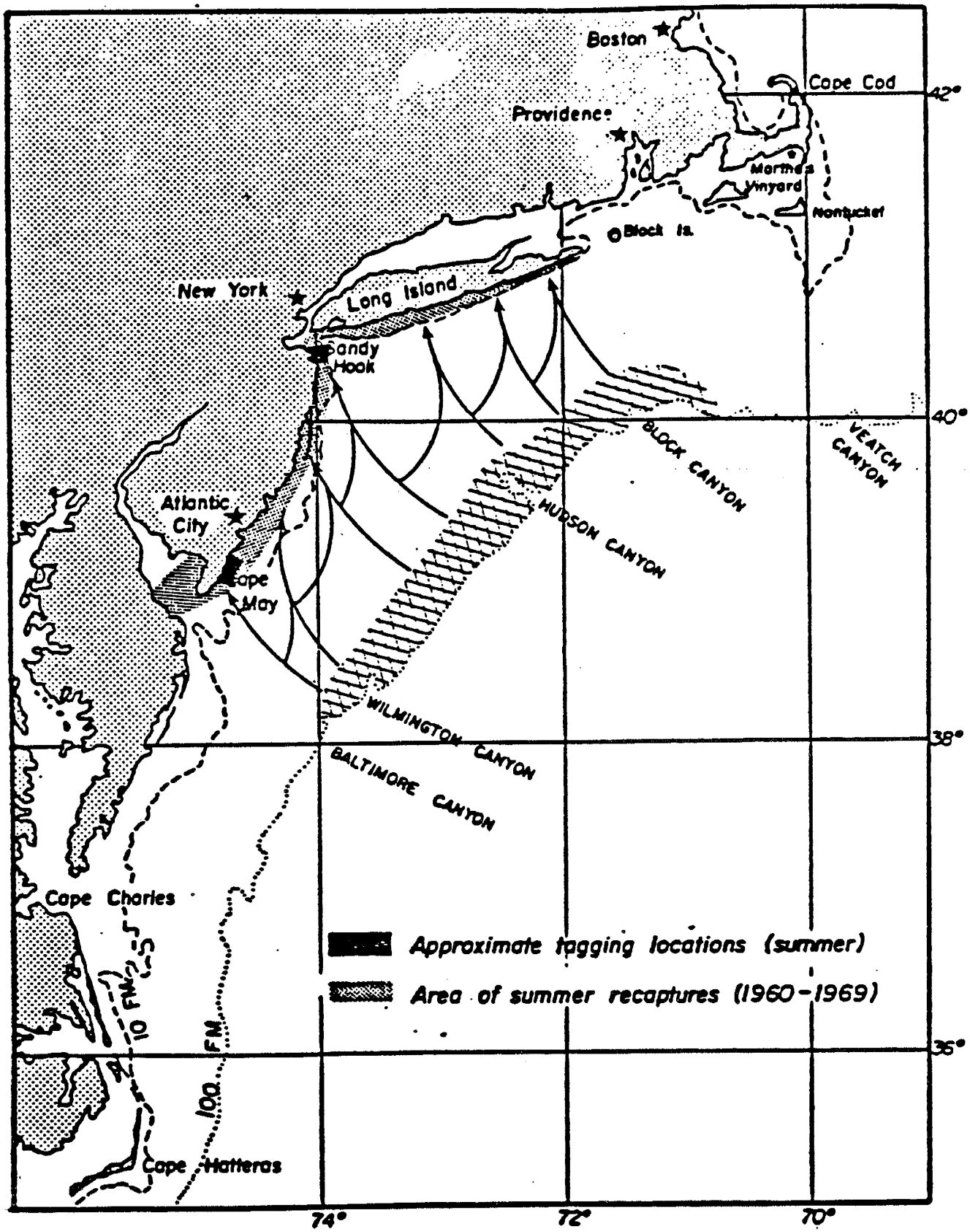


Figure 12. Summer Flounder Inshore Movements and Summer Flounder Distribution from Tagging Study by Murawski (1970).

Source: Freeman, pers. comm.

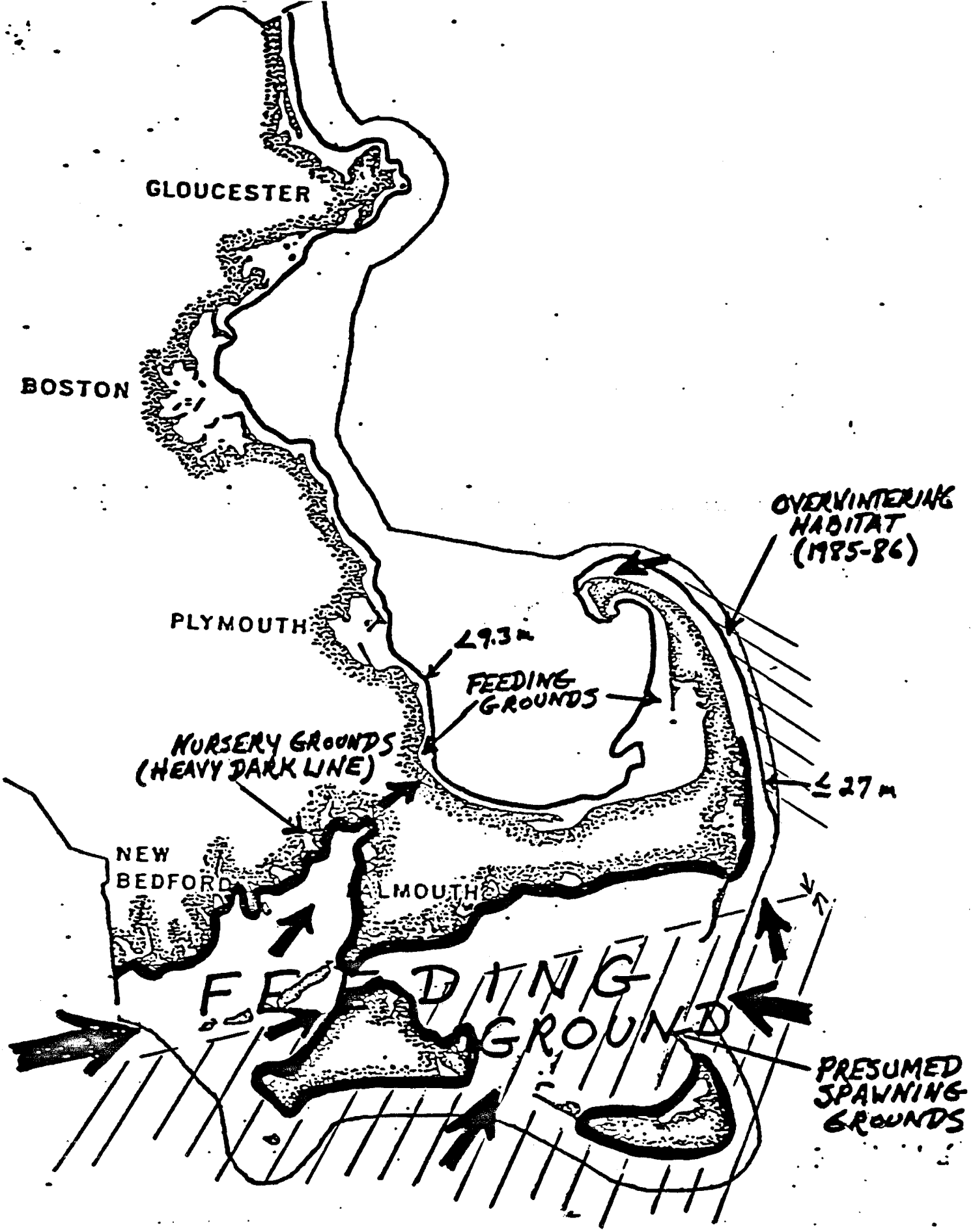


Figure 13. Summer Flounder Habitat in Massachusetts.
Source: Howe, pers. comm.

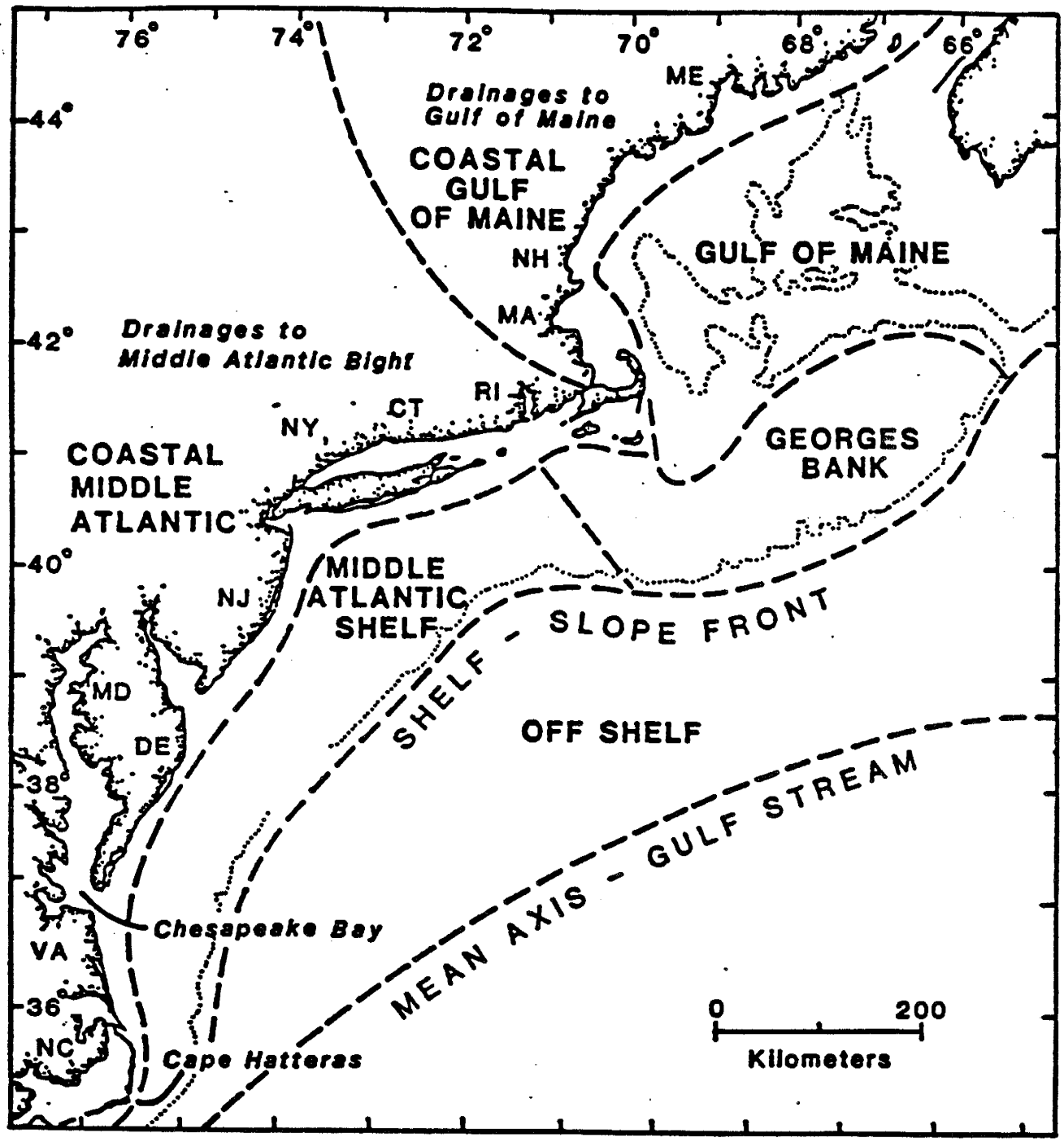


Figure 14. Northeast Regional Action Plan (RAP) Water Management Units.

Source: USDC, 1985 *b*

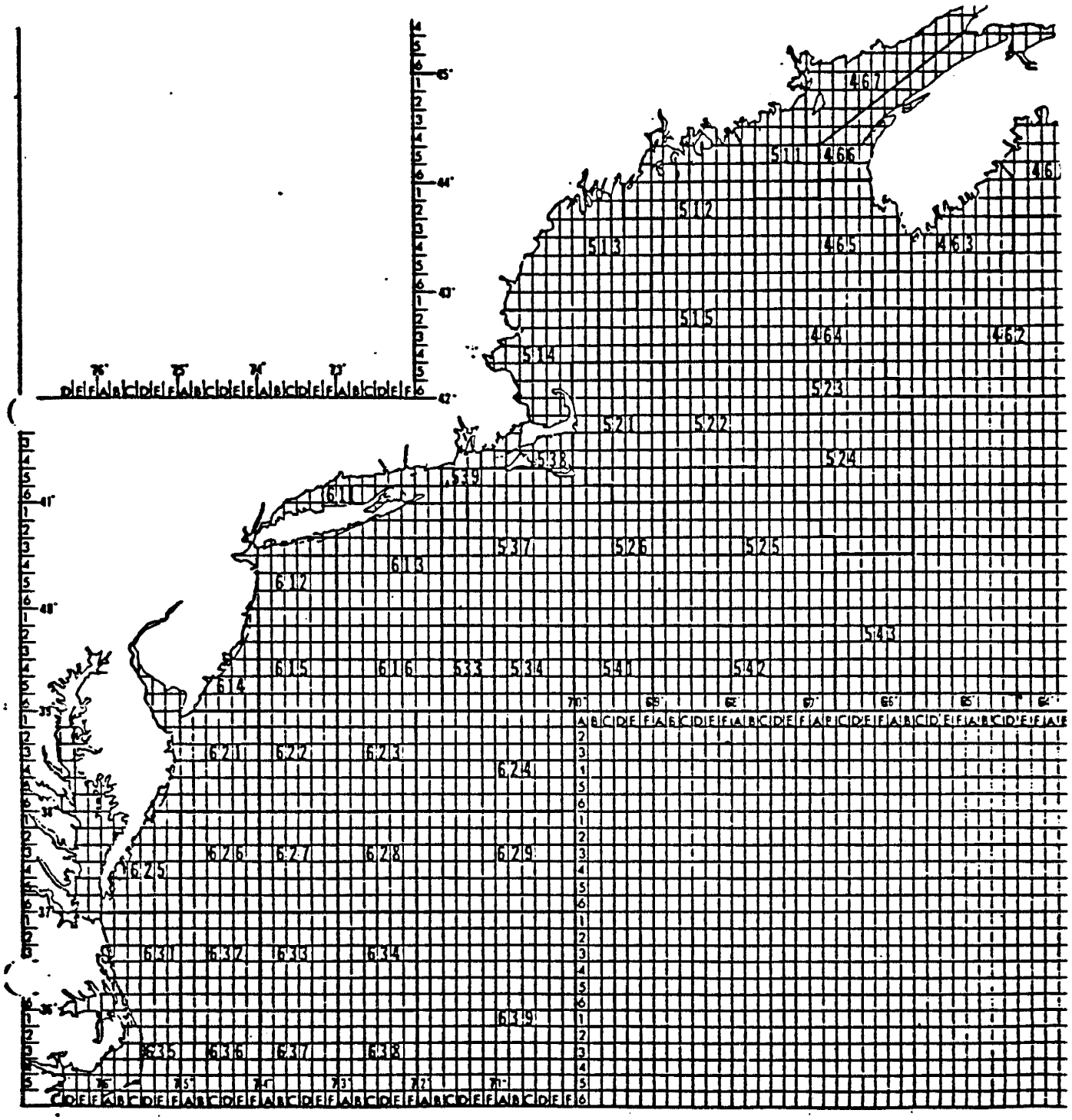


Figure 15. Northwest Atlantic Statistical Reporting Area.

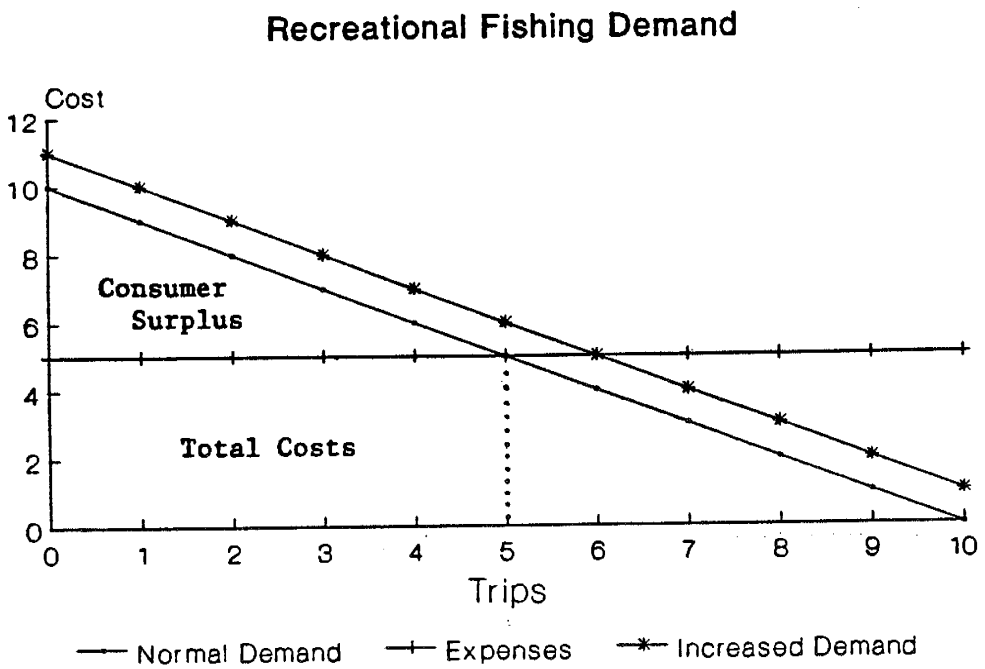


Figure 16. Theoretical Expenditures and Consumer Surplus Associated with Recreational Fishing

APPENDIX 1. HABITAT POLICY AND POSITION ON HABITAT AND THE ENVIRONMENT

HABITAT POLICY

Recognizing that all species are dependent on the quantity and quality of their essential habitats, it is the policy of the Mid-Atlantic Fishery Management Council to:

> Conserve, restore and develop habits upon which commercial and recreational marine fisheries depend, to increase their extent and to improve their productive capacity for the benefit of present and future generations. (for the purposes of this Policy, "HABITAT" is defined to include all those things, physical, chemical and biological that are necessary to the productivity of the species being managed.)

This policy shall be supported by three policy objectives which are to:

(1) Maintain the current quantity and productive capacity of habitats supporting important commercial and recreational fisheries, including their food base. (This objective will be implemented using a guiding principle of NO NET HABITAT LOSS).

(2) Restore and rehabilitate the productive capacity of habitats which have already been degraded.

(3) Create and develop productive habitats where increased fishery productivity will benefit society.

The Council shall assume an aggressive role in the protection and enhancement of habitats important to marine and anadromous fish. It shall actively enter Federal decision making processes where proposed actions may otherwise compromise the productivity of fishery resources of concern to the Council.

COUNCIL HABITAT RESPONSIBILITIES

The Council will assist in the development of each fishery management plan to insure that:

(1) Habitat significant to the species to be managed as well as its prey (where information is available) is adequately defined in the plan, and

(2) Recommendations to responsible agencies are included in the plan which identify habitat improvement or changes in Federal policies, which are necessary to achieve the objectives of the plan.

The Council will review those proposed habitat alterations, policy or other human actions which may have a significant adverse impact on those fisheries addressed in the Council's proposals and finding that adverse impacts will occur, the Council may file or present the Council's position to the Federal agency(s) responsible for the action which could (1) oppose the proposed action, (2) suggest project modifications or (3) seek full compensation for unavoidable fishery losses.

The Council may also recommend changes in the Federal statutes and their implementing regulations to protect marine fishery resources and their habitats in water development projects and policy.

GUIDELINES

The following guidelines could assist the Council in making its assessment of the proposed actions:

(1) The extent to which the activity would directly affect the production of fishery resources or their essential food base (e.g., as a result of dredging, filled marshland, pollution, reduced access, etc.);

(2) The extent to which precedent would be set in relation to existing or potential cumulative impacts of similar or other developments in the project area;

(3) The extent to which the activity would indirectly affect the production of fishery resources (e.g., alteration of circulation, salinity regimes, detrital export, etc.);

(4) The extent of any adverse impact that can be avoided through project modification or other safeguards (e.g., piers in lieu of channel dredging);

(5) The existence of alternative sites available to reduce unavoidable project impacts; and

(6) The extent to which the activity requires a waterfront location if dredging or filling wetlands is involved.

Project Review Process

(1) Significant projects shall be selected by Council using the following criteria:

(a) Judgment that significant adverse effects may occur; or

(b) Notification by the Council or staff of significant projects that should be considered.

(2) NMFS shall forward copies of public notices of significant Federally authorized projects or policy immediately to Council staff followed by special briefings, as appropriate, or by NMFS position statements, as developed.

(3) Council staff, when appropriate, shall catalog notices and forward copies to the Council. The staff shall request state and other Federal assessments (position statements) of project impact and forward them to the Council.

(4) When appropriate, Council shall develop a Council position.

(a) The Council may file adverse comments or recommended project modifications to reduce environmental damage with the Federal construction or regulatory agency (COE, FERC, etc.).

(b) Council staff or members may testify at publish hearings, as needed.

(c) Council may hold public hearings, as appropriate.

(5) The Council shall report on its actions at Council meetings as needed.

Criteria to Define Significant Projects

(1) Projects that may directly affect fisheries or habitat for which the Council has a management or research interest.

(2) Projects which significantly affect habitat important to species managed under the MFCMA or important to species upon which managed species are dependent for food.

(3) Projects that may be precedent setting or in unique or critical habitat areas.

(4) Projects having a substantial or significant indirect impact on surface water flow, detritus export, saltwater intrusion, isolating nursery areas, etc.

(5) Highly "controversial" projects, i.e., those which generate much publicity, strong opinions from user of the affected resource.

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL POSITION ON HABITAT AND THE ENVIRONMENT

Introductory Statement

On August 3 1989 the Mid-Atlantic Fishery Management Council (MAFMC) adopted the following position statement developed by the Habitat Committee to reverse the serious, constant decline in environmental quality, loss of habitat, and the concurrent decline of all the economically important fish stocks managed by the Council.

The dilemma faced by the Council relates directly to the apparent inability of the regulatory agencies to overcome the socioeconomic and political forces that would sacrifice the fishery for other economic considerations. The quantitative and qualitative loss of habitat through chemical, physical, biological, and social stresses has played a leading role in the depletion of fish stocks in the Mid-Atlantic Region and throughout the coastal United States.

The Council unanimously agrees that it is impossible to manage fisheries without the funding and staff needed to support the regulatory and review authorities charged with protection of aquatic habitats. The MAFMC will seek to promote greater interagency cooperation, improve procedures for involvement by the Council in the review of projects which may adversely affect fisheries, and foster cooperation in the monitoring of impacts to habitats, including enforcement of violations where legal remedy exists.

The MAFMC requests that the Assistant Administrator for Fisheries, National Marine Fisheries Service, arrange a meeting with the Environmental Protection Agency (EPA), Fish and Wildlife Service (FWS), and the Army Corps of Engineers (COE) to discuss their existing authority in the EEZ and to seek to develop a permanent interagency agreement to implement each agency's responsibility to eliminate or mitigate further adverse impacts on habitat and assure full enforcement of all mandates including appropriate action on violations of environmental law.

Preamble

The Magnuson Fishery Conservation and Management Act of 1976, as amended, (MFCMA) in Section 302(i) provides for the Council to comment on, or make recommendations concerning, any activity undertaken, or proposed to be undertaken, by any State or Federal agency that, in the view of the Council, may affect the habitat of a fishery resource under its jurisdiction. Further, that Section requires that within 45 days after receiving such a comment or recommendation from a Council, the Federal agency must provide a detailed response, in writing, to the Council regarding the matter. Section 303(a)(7) provides that any fishery management plan (FMP) prepared by any Council shall include readily available information regarding the significance of fishery habitat and an assessment of the effects which habitat modification may have upon the fishery.

Council members, when appointed and installed, are charged with responsibility to manage, conserve, and restore the fisheries of the territorial waters of the United States. The responsibility rests with each Council member to be knowledgeable, committed to the evaluation process, and demonstrate a willingness to support Council habitat and/or environmental positions. These positions may relate to existing or proposed projects that threaten the conservation/restoration objectives of the Council's fishery management planning activities.

Policy

The Mid-Atlantic Fishery Management Council opposes any loss of aquatic habitat or wetlands which contribute to the conservation of fish stocks. Where loss of habitat is unavoidable locally, the Council endorses recreation of quantitatively and qualitatively equivalent habitat. The Council recognizes the multiple resource base of our coastal areas and recognizes the need to accommodate other natural resource management objectives with special sensitivity to goals that may be contrary to the objectives of fishery management. The intent of the Council is to support no net loss of fishery habitat while minimizing all detrimental alterations to these essential habitats.

This policy will allow the Mid-Atlantic Fishery Management Council to optimize the management of fisheries in the Mid-Atlantic EEZ through a concerted effort to establish a quality habitat and to seek to reverse the serious problems affecting the reproduction, frequency, and distribution of fish. The Council will accomplish this through participation in the review of private and government projects which would adversely affect fish production. The Council will also become involved in review of activities which adversely affect the safety of fish products which are intended for direct or indirect human consumption.

(Note: Habitat is defined to include all physical, chemical and biological factors important to the success of species managed by the Council.)

Problem Statement

The rapid decline in fisheries directly attributable to the qualitative and quantitative loss of habitat has had a major impact on the majority of the fisheries in the EEZ. The loss of habitat has had the most devastating effect on the decline of fisheries, yet there is no well defined policy, plan, or national strategy to address this major problem.

In the view of the Council, the following statements identify significant factors contributing to the solution of the major problem:

1. The identification of a single agency to have the responsibility, authority, and resources to manage or have any control over the marine fishery habitat in the EEZ.
2. Enforcement of present environmental law .
3. Use of an ecosystem approach to environmental problem solving, improvement in ecosystem understanding, and improved coordination among all agencies involved in evaluation and interaction of aquatic and terrestrial systems.
4. Commitment of educators, managers, legislators, and citizens to establish a standard where environmental degradation becomes unacceptable and the public understands the economic cost of lost fishery habitat.
5. Commitment of funds for programs at Federal, State and Regional levels to implement known scientific solutions to habitat problems of the EEZ.
6. Provision of regulatory authority for NOAA Fisheries and the regional Councils to impact the condition of the marine environment, specifically to participate in the preservation and restoration of the habitat to an acceptable level of quality, consistent with good fishery management objectives.

   The Mid-Atlantic Fishery Management Council has heard environmental experts define the habitat problem and indicate that adequate research and technology exists to solve our current problems. Lack of funds and failure to effectively implement science and technology has played a key role in promoting the decline of resources and preventing restoration to some acceptable level of productivity.
7. Revision of laws now permitting calculated risks which jeopardize the quality of the marine environment, i.e., the *Valdez* incident and vessel hulls susceptible to major damage and large scale environmental consequences.

Recommendations for Action

A. The Council will seek a cooperative agreement whereby the regulatory authority of EPA and the Corps of Engineers will be responsive to the needs of fisheries habitat as determined by NOAA Fisheries and the Councils .

B. Review the existing regulations, including the 404(b)(1) guidelines, to ascertain their potential for use in preserving quality fisheries habitat. If appropriate, recommend legislative changes which will provide appropriate regulatory authority to facilitate the management of fish within a quality marine environment. Legislation should be consistent with the Magnuson Act and the attendant national standards. Legislation should provide NOAA Fisheries with the authority to achieve a quality marine environment through regulatory authority over the habitat.

   Alternatively, to recommend legislative changes consistent with the MFCMA and the national standards calculated to provide NOAA Fisheries with the regulatory authority to implement its mandated habitat responsibilities.

C. Participate in the development of a unified ecosystem approach to deal with the problems of qualifying and quantifying the environmental impacts on marine resources and habitat as they relate to the Council's responsibility to manage fish stocks.

D. Cooperate with the Regional Director and his staff, to thoroughly review and refine proposed action recommendations and then discuss, with the other Councils, the potential for the adoption of a common action policy.

E. Establish a procedure for the Council's comments and recommended actions on any specific habitat issues. Such procedures should emphasize the 45 day response provisions of the MFCMA. As part of this procedure, adopt a set of criteria establishing reasonable limits on the type and size of habitat alteration projects of interest to the Councils; these criteria should assure that significant projects are reviewed. Recognized areas of potential habitat damage are:

1. wetlands encroachment and mitigation proposals;
2. municipal and industrial liquid waste disposal;
3. nonpoint source and urban run off control;
4. ocean dumping of sewage and industrial waste;
5. oil and gas exploration and development;
6. accidental spills and breaks;
7. toxic chemical introductions; and
8. hydropower development.

F In conjunction with other interested agencies, develop specific guidelines to implement the "no net loss" policy.

G. Review all effective FMPs for improvement of the habitat statements.

H. Participate in the development of a meaningful education program, to include effective communications with the general public; regional advisory committees; and close liaison with private sector environmental interest organizations in cooperation with NOAA Fisheries and EPA.

I Initiate an effort to assemble the tidal land use profiles and fisheries related base line data necessary to monitor an effective habitat policy in cooperation with State Directors and NOAA Fisheries

J. Provide a catalyst to develop a cooperative Law Enforcement Program including a reporting system which includes public reporting as well as agency reporting of violations of wetlands, land fills, and other habitat users.

K. Develop reasonable and achievable objectives and time tables for achievement of the habitat policy, recognizing the needs for multiple use of our tidal waters.

Summary/Conclusion

It is the intention of the MAFMC to address its habitat responsibilities through the implementation of a meaningful and effective habitat policy. In the view of the Council, this intention may be accomplished through improved cooperative efforts with other government agencies or through legislative revisions and amendments necessary to meet the objectives of the Council.

In pursuit of this goal the Council intends to participate fully in the efforts of the NOAA Regional Director and the NOAA Assistant Administrator for Fisheries in a concerted effort to solicit the cooperation of other involved agencies and increased involvement in the regulatory processes which permit degradation of the aquatic habitat.

In adopting its habitat position the Council recognizes that the achievement of its long ranged goals cannot be realized by unilateral action. Therefore, it is the intention of the Council to implement and refine an acceptable and effective model habitat policy and share the document with the other Councils for discussion and eventual consolidation into a single, unified Council habitat document.

The Habitat Committee recommends that the Council, through the Chairman, request that the Regional Director make every effort to arrange a meeting of NOAA Fisheries and Council representation with the Administrator of EPA, the Corps of Engineers, and other appropriate Federal agencies for the purpose of implementing the action plan set forth in this document and soliciting full and continuing cooperation in the development and implementation of a long ranged, effective habitat policy.

APPENDIX 2. ALTERNATIVES FOR THE PROPOSED FMP

2.1. Take no Action at this Time

2.1.1. Description

This would mean that the FMP would remain in effect. The FMP currently has the following provisions:

It is illegal to possess summer flounder less than 13" total length (TL) and it is illegal to possess parts of summer flounder less than 13"to the point of landing.

Vessels with permits issued pursuant to this FMP are required to fish and land pursuant to the provisions of this FMP unless the vessels land in States with larger minimum fish sizes than those provided in the FMP. In this case, the minimum fish sizes would be required to meet the State limits.

Foreign fishermen are not permitted to retain summer flounder since US fishermen, by definition, would be harvesting the Optimum Yield (OY).

Vessels fishing commercially for summer flounder, either directly or as a bycatch in other fisheries, and vessels for hire in the recreational fishery (party and charter boats) are required to obtain annually renewable permits.

States with minimum sizes larger than those in the FMP and minimum mesh regulations are encouraged to maintain them.

After three years of Plan implementation the Council will begin to annually examine fishing mortality estimates of age 2 summer flounder to measure the effectiveness of the size limit relative to the FMP's objectives. If the Council finds that the fishing mortality of age 2 summer flounder has increased, based on the following adjustment criteria, and if the NMFS Northeast Regional Director concurs with the Council, the minimum fish length would be increased by the NMFS Northeast Regional Director to a minimum fish length of 14" TL.

The adjustment criteria are (1) estimated fishing mortality from the NEFC spring survey and (2) estimated fishing mortality from a virtual population analysis (VPA) which would be tuned using commercial and recreational fishery CPUE indices. If a three year trend of either of these mortality estimates increases, an increase in the minimum fish length would be required.

The trend in post-FMP fishing mortality rate (age 2 fish) estimated from the NEFC spring survey will be measured relative to the baseline level defined from pre-FMP fishing mortality rates (age 2 fish) from NEFC survey data (catch at age available from 1976-1989). Likewise, the trend in post-FMP fishing mortality rates (age 2) estimated from virtual population analysis (VPA) will be measured relative to the baseline level defined from pre-FMP fishing mortality rates (age 2) from VPA (catch at age also available from 1976-1989). Best estimates of discards will be incorporated into both the catch-at-age data and commercial catch per unit effort (CPUE) data. Catch per unit effort indices to be used to tune the VPA will be evaluated from standardized fishing power analyses of commercial and recreational fisheries data. Candidate data series for CPUE indices include (but are not limited to) NEFC commercial weighout (1976-1989), North Carolina winter trawl fishery (1982/83 - 1988/89) and Marine Recreational Fishery Statistics Survey (MRFSS) (1979-1989) data.

2.1.2. Analysis

Doing nothing would mean that the 1989 and 1990 year classes would not be protected as they migrate offshore from the estuaries. The fish that would be shorter than 13" would be caught, discarded, and wasted. If the estimates of the 1989 and 1990 year classes are accurate, then protection of these year classes is a critical part of rebuilding the resource. Given the current fishing mortality rate estimates (sections 4.2 and 5.4), every effort must be made to conserve these year classes.

2.2. Require that only otter trawl vessels fishing west of 71°30' west longitude with a 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh), inside measure, applied throughout the cod end of the net may retain more than 500 lbs of summer flounder, unless the fish are landed in a State with a larger minimum net mesh size, in which case the State limit would prevail. Require that only otter trawl vessels fishing east of 71°30' west longitude with a 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh), inside measure, applied throughout the cod end of the net may retain more than 15% of its catch as summer flounder.

2.2.1. Description

This alternative is intended to address the problem of the offshore winter mixed trawl fishery in the southern New England area. These vessels typically catch more than 500 pounds of predominantly larger summer flounder, yet summer flounder comprises a small fraction of total catch.

2.2.2. Analysis

This alternative was suggested by the New England Fishery Management Council.

Among the adverse impacts of a 5.5" mesh size (6" square) restriction for otter trawl trips would be the loss of marketable bycatch to fishermen who currently use smaller mesh in directed fisheries for other species, yet land 500 pounds or more of summer flounder. Many of these trips occur during the winter months off southern New England (areas 537 and 526, see Figure 15) when vessels target on squid, butterfish, and other species with small mesh.

An analysis of 39 trips landing at the Pt. Judith Fishermen's Coop between December 1989 and April 1990 indicated that the summer flounder landings totalled between 565 and 3,834 lbs, while accounting for between 1.5 and 21.5% of the fish on board (McCauley pers. comm.). A mesh of 5.5" would reduce total catch to the point where profits would be reduced. On the other hand, discarding summer flounder to reduce landings below the 500 pound threshold would be wasteful since the fish are generally large. "Large" and "Jumbo" categories comprised 75% of the landings of summer flounder in Rhode Island during the first quarter of 1990.

NEFC commercial weighout data were used to determine the length frequencies of summer flounder caught in northeast statistical areas that were entirely east of 71° 30' longitude. Based on combined 1985 to 1989 data, 99.8% of the summer flounder caught in these areas and landed by commercial fishermen were 13" or greater in length. A total of 84.7% were 15" or larger. These values were higher than the percentages for all other water areas combined, that is, 88.6% of the summer flounder landed from the other water areas were 13" or larger and only 50% were 15" or larger.

Under this alternative, vessels fishing east of 71° 30' longitude would be exempt from the mesh size requirement unless summer flounder comprised more than 15% of total catch. This would prevent vessels from targeting summer flounder with small mesh since most vessels land less than 15% summer flounder (McCauley pers. comm.). In fact, of the trips sampled, 72% landed 10% or less of their trips as summer flounder and 85% landed 15% or less of their trips as summer flounder. This alternative would also reduce waste by eliminating the need to discard summer flounder in order to avoid the mesh size requirement.

The mesh size requirement is designed to protect smaller summer flounder, which do not occur in these offshore areas in the winter months. The exemption is thus viewed consistent with the conservation goals of the FMP, while reducing discard waste in the summer flounder fishery.

2.3. Require that vessels fishing east of 71°30' west longitude obtain a special permit from NMFS in advance of doing so. Vessels with this special permit would be exempted from the minimum net mesh regulations, but would be prohibited from fishing west of 71°30' west longitude. NMFS would be authorized to establish procedural rules on time necessary to process applications for and cancellation of these special permits in order to facilitate enforcement.

2.3.1. Description

This alternative is intended to address the problem of the offshore winter mixed trawl fishery in the southern New England area. These vessels typically catch predominantly larger summer flounder, yet summer flounder comprises a small fraction of total catch. As long as a vessel has a permit to fish east of 71°30' west longitude, it may not fish west of 71°30' west longitude. There would be no minimum net mesh regulation east of 71°30' west longitude.

2.3.2. Analysis

The primary advantage of this alternative is that it is more readily enforceable than alternative 2.2. There would be no need to determine if 15% of the catch on board was summer flounder. The other impacts are the same as those of Alternative 2 (see section 2.2.2 of this Appendix).

2.4. Require that only vessels fishing with a 5.0" minimum mesh (diamond mesh) or 5.5" minimum mesh (square mesh), inside measure, applied throughout the cod end of the net may retain more than 500 lbs of summer flounder. If the summer flounder are landed in a State with a larger minimum net mesh size, the State limit would prevail.

2.4.1. Description

This alternative is similar to he preferred alternative, but would require a minimum net mesh 0.5" smaller than the preferred alternative.

2.4.2. Analysis

Available information (Tables 66 and 67) suggest that a 5.0" diamond mesh net will retain 50% of the 12.3" summer flounder entering the net, 75% of the 12.9" summer flounder entering the net, and 90% of the 13.2" summer flounder entering the net. A 5.5" diamond mesh net will retain 50% of the 13.5" summer flounder entering the net, 75% of the 14.29" summer flounder entering the net, and 90% of the 14.5" summer flounder entering the net. Given the 13" minimum size for summer flounder set in the FMP, the characteristics of a 5.5" net would allow more undersize summer flounder to escape than would a 5.0" net.

The size at which one half of the female summer flounder first spawn is 12.7".

The high retention of 12" summer flounder by a 5.0" mesh net means that these fish would be discarded. A significant portion of the summer flounder discarded in the commercial fishery die (80% or more). The 5.0" mesh net would not achieve the objective of the Amendment to protect the 1989 and 1990 year classes, since these are the fish that would be discarded.

2.5. Exempt the flynet fishery from the minimum mesh size requirement.

2.5.1. Description

A flynet is a trawl net using doors similar to an otter trawl, but rigged to fish about ten feet off bottom and taper from 16-64" mesh in the wings to 2" in the cod end.

2.5.2. Analysis

This alternative was suggested by the South Atlantic Council.

The use of fly nets occurs generally between Cape Henlopen, Delaware, and North Carolina (North Carolina 1990) in the fall - winter season. Atlantic croaker, weakfish, and Atlantic mackerel were the dominant species in the fly net catches made during successive fishing seasons from 1985 to 1988 (in 1987-88 several catches of large bluefish increased this species' relative importance). Limited amounts of summer flounder are traditionally harvested by this gear, with estimates of only 266 pounds (0.8% of the catch), 91 pounds (0.3%), and 58 pounds (0.2%) for the 1985-86, 1986-87, and 1987-88 fishing seasons harvested per trip. If one extrapolates the North Carolina sampled fly net catch to the total landings in North Carolina, it appears there are between 300 and 500 fly net trips per year.

2.6. Prohibit possession of summer flounder in the EEZ.

2.6.1. Description

The measure would apply to the entire fishery (commercial and recreational) and would remain in effect until the implementation of Amendment 2 to the FMP, currently being prepared by the Council, with the cooperation of the Atlantic States Marine Fisheries Commission, the New England and South Atlantic Fishery Management Council, and the National Marine Fisheries Service.

2.6.2. Analysis

Commercial and recreational landings occur in all the States between Maine and North Carolina. Commercial landings occur fairly evenly among all four calendar quarters (Jan - Mar = 34%, Apr - Jun = 15%, Jul - Sep = 18%, and Oct - Dec = 30%; Appendix Table 1). Thus, the enforcement costs associated with prohibiting the

possession of summer flounder would significantly increase since all States in all months would require enforcement.

If the retention of summer flounder was prohibited, it is assumed fishermen would modify their behavior significantly and attempt to not catch them. The problem, of course, is that summer flounder are caught as part of a mixed species fishery. Many of the other species (that is, *Loligo*, scup, silver hake, butterfish, etc.) could be more cost effectively caught if the trawl net was raised off the ocean floor and thus reduce significantly the catch of flounders. Summer flounder would continue to be caught as part of the species complex if yellowtail or winter flounder were targeted. It is, however, estimated that between 50 and 75% of the summer flounder mortality in the commercial fishery would be reduced because of fishermen's behavior modification resulting from this prohibition. This reduction in mortality would contribute significantly to more age classes in the fishery and thus the preservation of the stock.

Appendix Table 1. Weighout (excludes NC) total commercial summer flounder landings (Land, thousands of lbs) by fishing area and season, 1983-88 combined, all gear, and percent of annual (An %) and all area totals (Ar %)

	Season														
	Jan-Mar			Apr-Jun			Jul-Sep			Oct-Dec			Total		
Area	Land	An %	Ar %	Land	An %	Ar %	Land	An %	Ar %	Land	An %	Ar %	Land	An %	Ar %
464	-	-	-	*	100	*	-	-	-	-	-	-	*	100	*
465	*	27	*	*	72	*	-	-	-	-	-	-	*	100	*
511	1	100	*	-	-	-	-	-	-	-	-	-	1	100	*
512	7	37	*	4	24	*	7	37	*	*	1	*	19	100	*
513	13	20	*	25	37	*	22	34	*	5	7	*	66	100	*
514	10	2	*	260	51	1	62	12	*	171	34	*	505	100	*
515	16	45	*	1	4	*	16	43	*	2	6	*	37	100	*
521	9	4	*	66	36	*	44	24	*	63	34	*	184	100	*
522	13	8	*	47	28	*	63	38	*	40	24	*	164	100	*
523	4	16	*	13	49	*	2	9	*	6	23	*	27	100	*
524	34	9	*	98	26	*	39	10	*	194	52	*	366	100	*
525	2,494	53	5	2,077	44	10	5	*	*	127	2	*	4,705	100	3
526	4,317	44	9	1,427	14	7	307	3	1	3,637	37	9	9,689	100	7
533	1	100	*	-	-	-	-	-	-	-	-	-	1	100	*
534	-	-	-	-	-	-	-	-	-	28	100	*	28	100	*
537	7,580	41	16	2,591	14	12	2,137	11	8	5,953	32	14	18,262	100	14
538	5	*	*	2,127	29	10	4,803	65	19	363	4	1	7,299	100	5
539	91	2	*	1,071	34	5	1,329	42	5	660	20	1	3,152	100	2
561	-	-	-	2	67	*	-	-	-	1	32	*	3	100	*
562	3	11	*	18	65	*	2	8	*	4	14	*	27	100	*
611	*	*	*	576	26	2	1,231	56	5	379	17	1	2,188	100	1
612	76	1	*	971	22	4	2,342	53	9	1,017	23	2	4,407	100	3
613	381	6	1	1,849	29	9	2,144	34	8	1,919	30	4	6,296	100	4
614	*	*	*	283	8	1	2,219	66	9	847	25	2	3,351	100	2
615	313	16	1	893	47	4	45	2	*	614	32	1	1,867	100	1
616	4,912	71	11	995	14	4	1	*	*	1,008	14	2	6,917	100	5
621	1,276	8	2	1,159	8	5	6,487	45	26	5,342	37	13	14,266	100	11
622	12,352	78	27	1,208	7	5	5	*	*	2,077	13	5	15,644	100	12
623	17	49	*	18	50	*	-	-	-	-	-	-	35	100	*
624	-	-	-	1	100	*	*	*	*	-	-	-	1	100	*
625	217	5	*	371	8	1	999	23	4	2,745	63	6	4,334	100	3
626	6,809	67	15	1,496	14	7	1	*	*	1,772	17	4	10,079	100	7
627	26	100	*	-	-	-	-	-	-	-	-	-	26	100	*
631	484	4	1	1	*	*	4	*	*	10,701	95	26	11,191	100	8
632	3,000	79	6	667	17	3	-	-	-	110	2	*	3,778	100	2
635	120	42	*	-	-	-	-	-	-	162	57	*	283	100	*
636	13	100	*	-	-	-	-	-	-	-	-	-	13	100	*
700	-	-	-	-	-	-	-	-	-	*	-	*	*	-	*
Total	44,606	34	100	20,330	15	100	24,328	18	100	39,959	30	100	129,225	100	100

ENVIRONMENTAL ASSESSMENT ON AMENDMENT 1 TO THE SUMMER FLOUNDER FMP

1. INTRODUCTION

The FMP was based on a management plan drafted by the State/Federal Summer Flounder Management Program pursuant to a contract between the New Jersey Division of Fish, Game, and Wildlife and NMFS. The State/Federal draft was adopted by the Atlantic States Marine Fisheries Commission (ASMFC) at its annual meeting in October 1982. The Council adopted the FMP on 16 April 1988 and NMFS approved it 19 September 1988. Amendment 1 to the FMP is intended to impose a minimum net mesh regulation to address the problem set forth below.

2. PURPOSE OF AND NEED FOR ACTION

Summer flounder are over exploited. The best currently published indicators, on which the Amendment is based, show that instantaneous fishing mortality (F) is at least 1.0, while the rate which maximizes the harvest (F_{max}) is 0.35. Thus, fishing mortality is triple the rate which would produce the maximum yield per recruit. Preliminary analyses from an October 1990 workshop indicate that the summer flounder resource could be in much worse condition. A minimum fishing mortality estimate of 1.4 was developed and fishing mortality could be as high as 2.1. A reanalysis of the F_{max} level produced an estimate of 0.23 as opposed to the previous 0.35 estimate. Thus, the difference between the fishing rate which produces the maximum yield and the current level of harvest is at least 6 fold, rather than 3 fold. The instantaneous fishing mortality rate is easily translated into an annual survival estimate. With a fishing mortality rate of 1.4, only about 20% of all summer flounder that are alive now will be alive one year later. An annual survival estimate that corresponds to a fishing mortality rate of 2.1 is only 10%. The level that corresponds to the F_{max} rate is 65%. Obviously, gains in long term yield from the fishery and increases in stock size could be realized by significantly reducing fishing mortality from current levels.

Long term trends in abundance and recruitment of summer flounder were derived from several local and coastwide surveys at the October 1990 workshop. In general, these indices indicated that summer flounder were approximately 5 times more abundant in the mid to late 1970's than in the late 1980's. These surveys also indicated that the 1988 year class was poor and the 1989 and 1990 year classes "no better than average". In addition, the coastwide NEFC survey did not collect any summer flounder older than age 3 in the 1990 survey, although a decade ago summer flounder as old as 10 years were collected.

Spawning biomass per recruit declines markedly with increasing fishing mortality on females (Figure 11). An Fmax level (0.35) of fishing corresponds to a spawning stock biomass per recruit level of 20%. Maximum spawning stock biomass per recruit levels of 30% and 40% would correspond roughly with F levels of 0.25 and 0.20. Current levels of F (1.0) would be equivalent to a spawning stock biomass per recruit level of about 7% of the maximum. If the current F levels are as high as 2.0, then the spawning stock biomass per recruit level would be only 2 - 3% of the maximum level.

At present, as a direct result of high rates of fishing mortality, both commercial and recreational catches of summer flounder are comprised primarily of 0 to 2 year old fish. Individuals of this species have previously been known to live up to 20 years, yet older and larger fish are now infrequent in the landings. This indicates a severely compressed age composition of the summer flounder stock. Such age class compression poses a great risk to recruitment because the older, more fecund spawning adults are being too rapidly removed from the population and nearly all of the new fish are being spawned by individuals that only get to spawn once or at most twice before they are caught and killed by fishermen.

Summer flounder commercial landings for the first quarter of 1990 verify the fishery independent survey indices. Commercial landings in 1989 plummeted to only 21 million pounds, which was the lowest in the past 15 years and only 70% of the average landings for the 1980's. Landings for 1990 appear to be even worse; only 29% as many pounds were landed during the first quarter of 1990 as were landed in 1989. Coastwide average price for the first quarter of 1989 was $1.38/pound, whereas in 1990 the average had risen to $1.94/pound, partially offsetting the reduced landings.

3. MANAGEMENT OBJECTIVES

The objectives of the FMP are to:

1. reduce fishing mortality on immature summer flounder;

2. increase the yield from the fishery;

3. promote compatible management regulations between the Territorial Sea and the EEZ; and

4. minimize regulations to achieve the management objectives recognized above.

4. MANAGEMENT UNIT

The management unit is summer flounder (*Paralichthys dentatus*) in US waters in the western Atlantic Ocean from North Carolina northward.

5. ALTERNATIVES

The adopted management measures are presented in Sections 3 and 9.1 of the FMP. Other alternatives are presented in Appendix 2 to the FMP.

6. ENVIRONMENTAL IMPACTS

The impacts of adopted management measures are presented in Section 9.2 of the FMP. Other alternatives are evaluated in Appendix 2 to the FMP.

7. MANAGEMENT COSTS

The impacts of the adopted management measures are presented in Section 9.2 of the FMP. Other alternatives are evaluated in Appendix 2 to the FMP.

8. TRADEOFFS BETWEEN THE BENEFICIAL AND ADVERSE IMPACTS OF THE PROPOSED AMENDMENT

The impacts of the adopted management measures are presented in Section 9.2 of the FMP. Other alternatives are evaluated in Appendix 2 to the FMP.

9. EFFECT ON ENDANGERED SPECIES AND ON THE COASTAL ZONE

The adopted management measures, the preferred alternative for purposes of public hearings and review, and the alternatives do not constitute an action that "may affect" endangered or threatened species or their 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 on the Amendment.

The FMP was reviewed relative to CZM programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. Letters will be sent to all of the States listed above. The letters to all of the States except New Hampshire and Pennsylvania will state that the Council concluded that the FMP would affect the State's coastal zone and was consistent to the maximum extent practicable with the State's CZM program as understood by the Council. For New Hampshire, the evaluation was that the FMP might affect the coastal zone and was consistent. For Pennsylvania, the evaluation was that the FMP would not affect the coastal zone.

10. EFFECTS ON FLOOD PLAINS OR WETLANDS

The adopted management measures or their alternatives will 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.

11. LIST OF AGENCIES AND PERSONS CONSULTED IN FORMULATING THE PROPOSED ACTION

In preparing the Amendment, the Council consulted with NMFS, the New England Fishery Management Council, the South Atlantic Fishery Management Council, the Fish and Wildlife Service, the Department of State, and the States of New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia through their membership on the Council. In addition to the States that are members of this Council, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and North Carolina were also consulted through the Coastal Zone Management Program consistency process. A list of the agencies and persons sent copies of the FMP, including the EA and RIR, and notice of the public hearings is inclued as Exhibit A to the final version of this EA.

12. LIST OF PREPARERS OF ENVIRONMENTAL ASSESSMENT AND PLAN AMENDMENT

The FMP was prepared by a team of fishery managers and scientists with special expertise in the summer flounder resource including: the Mid-Atlantic Council Demersal Fisheries Committee (Mid-Atlantic Council members Gordon Colvin, Charlie Johnson, Richard Cole, Jack Travelstead, Bruce Freeman, Warren Hader, and Richard Christian; South Atlantic Council members Elaine Knight and Gerald Schill; and New England Council members Bob Smith and Dave Pierce) and MAFMC staff John C. Bryson, David R. Keifer, Thomas B. Hoff, Christopher Moore, Christopher W. Rogers, and Clayton E. Heaton.

13. FINDINGS OF NO SIGNIFICANT ENVIRONMENTAL IMPACT

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

_____ _____

Assistant Administrator for Fisheries, NOAA Date

APPENDIX 4. REGULATORY IMPACT REVIEW

1. INTRODUCTION

1.1. Purpose

The purpose of this document is to present an analysis of the proposed regulations for Amendment 1 to the Summer Flounder Fishery Management Plan (FMP). This document has been prepared in compliance with the procedures of the National Marine Fisheries Service (NMFS) to implement Executive Order (E.O.) 12291. The document also contains an analysis of the impacts of the Plan relative to the Regulatory Flexibility Act and the Paperwork Reduction Act of 1980.

1.2. Description of User Groups

The fishery is described in Sections 7 and 8 of the FMP.

1.3. Problems Addressed by the FMP

The problem to be addressed are discussed in Section 4.2 of the FMP.

1.4. Management Objectives

The objectives of the FMP are:

1. reduce fishing mortality on immature summer flounder;
2. increase the yield from the fishery;
3. promote compatible management regulations between the Territorial Sea and the EEZ; and
4. minimize regulations to achieve the management objectives recognized above.

1.5. Provisions of the FMP

The adopted management measures are presented in Sections 3 and 9.1 of the FMP. Other alternatives are presented in Appendix 2 to the FMP.

2. REGULATORY IMPACT ANALYSIS

The impacts of the adopted management mesures are presented in Section 9.2 of the FMP. Other alternatives are evaluated in Appendix 2 to the FMP.

3. DISCUSSION OF THE BENEFITS AND COSTS OF THE AMENDMENT

E.O. 12291 requires that a benefit-cost analysis of all proposed regulations be performed.

3.1. Costs

Management costs are discussed in section 9.2.

3.2. Benefits

The benefits of the FMP are discussed in section 9.2.

3.3. Benefit - Cost Conclusion

The benefits and costs of the FMP are discussed in section 9.2.

4. Other E.O. 12291 Requirements

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

1. Will the Plan have an annual effect on the economy of $100 million or more.
2. Will the Plan lead to an increase in the costs or prices for consumers, individual industries, Federal, State, or local government agencies or geographic regions.
3. Will the Plan have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of US based enterprises to compete with foreign based enterprises in domestic or export markets.

The FMP should not have an annual effect of $100 million or more. The total commercial exvessel value of summer flounder was $32 million in 1989.

The FMP is not expected to lead to an increase in costs or prices to consumers.

Recent upward trends in the real price per pound of commercially caught summer flounder indicate that the demand and/or supply factors may be shifting. The 1989 price per pound for all size categories was the highest in seven years in both nominal and adjusted dollars (Table 45). It is possible that increased demand for fish in general (e.g., due to health concerns) and summer flounder in particular (e.g. increases in income, Section 8.1.3) could be the cause for increased exvessel revenue. To the extent that these factors continue to influence the ex-vessel price, the FMP effects will be obscured.

It is expected that the reduction in landings and value attributable to this plan in its early years will not significantly increase overall exvessel summer flounder prices. To the extent that the supply of summer flounder is increased in future years by the reduction in mortality, higher average harvest weight, and stock stability, the price of summer flounder should stay steady or decrease only slightly, *ceteris paribus*.

In the short term, the proposed 5.5" minimum mesh (diamond) or 6" minimum mesh (square) size restriction will directly impact landings of summer flounder and certain species taken as bycatch. In the long term, stock recovery will result in higher sustainable catch rates of summer flounder, thus providing fishery participants with a return on investment in the stock. Costs and benefits to the industry, Federal government, and consumers of increasing mesh size to 5.5" (diamond) or 6" (square) are addressed in the following sections.

This amendment contains no new management measures pertaining to recreational fishing for summer flounder. The 13" size limit in the EEZ will be maintained. No adverse impacts to the recreational fishery will result from mesh size regulations in the commercial fishery. Long term benefits to recreational fishermen will be manifested through higher catch rates and a higher proportion of "keepers" as the summer flounder stock size recovers and older cohorts are re-established.

The proposed management measure of 5.5" minimum codend mesh (diamond) or 6" minimum square, will impact the costs and revenues of the directed summer flounder fishery. Landings of other species taken as bycatch to the directed summer flounder fishery will also be affected, as will landings of small mesh fisheries not directed at summer flounder but which will be subject to the mesh regulation due to summer flounder catches of 500 pounds or greater.

Weighout data indicate that 2,856 trips landing 500 lbs or more of summer flounder were made in 1989 (Table 62), by approximately 422 vessels. In order to account for vessels not covered by the weighout system (CT, DE, NC), approximately 500 vessels shall be assumed to be affected by the mesh size restrictions. Compliance costs to these vessels fall into the following categories: reduced catch of summer flounder; reduced bycatch of marketable species; and gear conversion and other costs related to altered fishing practices.

Reduced catch of legal sized summer flounder will likely be minimal. A 5.5" diamond mesh has a length of 50% selection (L_{50}) of 13.5" (Tables 63 and 64) and a 6 " square mesh is considered equivalent (section 9.2.2.3). All States currently have a minimum legal size limit for summer flounder at 13" or greater (Table 65) so small amounts of flounder which could be legally retained would in fact be lost due to the mesh restriction.

Bycatch of marketable species will be markedly affected, however, since an average of 40% of revenues from weighout trips landing 500 pounds or more of summer flounder were derived from other species during 1983-89. The extent to which marketable bycatch is reduced will depend on fishing practices (season, area, etc.) and the selection characteristics of a 5.5" mesh for the particular species. Without specific selectivity information, the magnitude of bycatch losses cannot be determined. The problem may be most acute in the southern New England area where other groundfish are relatively abundant and contribute a greater share of the catch. However, the 5.5" minimum mesh requirement is in Amendment 4 to the Multispecies FMP (NEFMC 1990) will significantly reduce the bycatch of many of these trips even before these proposed regulations become effective.

Cost increases associated with gear conversion are estimated to be about $1000 per codend. Full costs cannot be attributable to the mesh size restriction, however, since many fishermen would be replacing codends due to State regulations and the Multispecies FMP or to normal wear and tear form fishing activities. Costs of replacing a complete otter trawl are estimated to be about $8000 per net. Again, full costs cannot be attributable to the mesh size restriction since many fishermen would be replacing codends due to State regulations or the Multispecies FMP or to normal wear and tear form fishing activities. In addition, many fishermen commonly use larger mesh in the wings and body of the net in order to reduce drag and fuel consumption, and thus would not need to replace an entire net.

Benefits of mesh size restriction in the directed summer flounder fishery would result from reduced fuel consumption and increased summer flounder catches in future years. Studies on fishing net drag and fuel consumption indicate only marginal gains in fuel efficiency with small increases in mesh size, but in times of rising fuel prices savings can be more significant.

Greater gains will accrue to fishermen through protecting small summer flounder until they reach legal size. Discard mortality is extremely high (estimated at 80%) for trawl caught flat fish and the problem is particularly acute when new year classes are abundant. Recent evidence of strong recruitment indicates that a mesh size restriction at this time would enhance stock rebuilding efforts and reduce mortality of small flounder (Tables 66 and 67). The benefits of the proposed mesh size regulation will be manifested through a more balanced age structure of the summer flounder stock. Further, waste will be reduced due to lower total discards and lower mortality of net encounter.

Cost and benefit data are presented and analyzed in section 9.2.2 of the FMP.

The FMP should not have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of US based enterprises to compete with foreign based enterprises in domestic or export markets.

5. Impacts of the Plan relative to the Regulatory Flexibility Act and the Paperwork Reduction Act of 1980.

The Regulatory Flexibility Act requires the examination of the impacts on small businesses, small organizations, and small jurisdictions. The impacts of the FMP do not favor large businesses over small businesses.

The Paperwork Reduction Act concerns the collection of information. The intent of the Act is to minimize the Federal paperwork burden for individuals, small business, State and local governments, and other persons as well as to maximize the usefulness of information collected by the Federal government. The annual permit provision is evaluated in section 9.2.2 of the FMP.

APPENDIX 5. PUBLIC HEARING SUMMARIES

15 October 1990, Fairhaven, MA

The hearing began at 7:10 p.m. Hearing Officer Mr. Phil Coates opened the hearing and explained the procedures that would be followed. Mr. John Bryson presented a briefing on Amendment 1. Attendance was 15.

Chris Botelho (F/V *Wanderer)* questioned the mesh size. "Doesn't fluke start from down south and work its way up the New England coast? If so, what are they doing down south to preserve fluke. They can use any size mesh they want. They are catching most of them down there before it even reaches up here. New England gets whatever is left over, which is minimal." Mr. Bryson stated that this regulation would apply to all States from North Carolina all the way north, and in addition to that, North Carolina's regulation for a 5.5" mesh requirement goes into effect November 1.

Question: That means they will change the law where it will be all 14" minimum size? Mr. Bryson advised, not in this Plan, but look for it in the next one. Question: To try to preserve the fish, why not make it 14" all over? Mr. Bryson advised that right now we are trying to get an Emergency through to protect the spawning stock going out this winter. We're working with the States collectively on this Plan, that this fishery is not caught just in the EEZ. The Plan we hope to have out next May will have the 14".

Mr. Coates went through the preferred alternative.

Predominately the fishermen argued that they catch no small fish in New England, only large ones.

Brian Mello (F/V *T.T. Gillie)* stated he would like an observer on board to prove that the percentage of small fish are minimal. Mr. Mello presented a landing slip for his last trip. He said the mesh is fine; why change the nets? Mr. Bryson advised that if he is using square mesh, it has to be 6". If he is using diamond, it has to be 5.5". Mr. Coates told the men not to be surprised to see a 6" requirement on square mesh for yellowtail also.

Chris Botelho asked why this was not put in effect long ago? That they have to rebuild nets almost every year now. Mr. Coates advised that a Summer Flounder Plan has been in existence for almost ten years now, at ASMFC, and two provisions were for a 14" minimum size and a 5.5" minimum size mesh. That did not get implemented, mostly because the States down south did not agree with a larger size. Mr. Coates also advised that the fluke catchings declined almost 400% in one year.

Steve Gildae (F/V *Elizabeth C)* stated that he thought the main problem was in the waters where the fish breed; that they never get out to the ocean because they are dying in the back waters due to pollution. He said that New England is getting the blame for catching them and it is just not the case. Mr. Coates advised that fluke spawn offshore, not inshore, however the babies that are produced go back to the estuaries. Mr. Bryson advised that both Councils are very concerned about the environment, however the one factor that has to be controlled when we have a species problem is man's effort. He stated he realized the fishermen view this as unfair, but it is the only tool the Councils have to work with.

Kenny Daniels (Wanchese Fish Co.) asked what percentage of fluke is produced by recreational and commercial? Mr. Bryson advised that the percent of recreational has varied. In 1980 from 45%; it hit a high of 54% in 1983, and down to 13% in 1989. That commercial values dropped in 1989 to 21,338,000 while recreational dropped to 3,333. That there was only one year the recreational exceed the commercial and that was in 1983 when they hit 54%. Commercial has been ahead of recreational throughout. A 60/40 ratio would be about right. Mr. Daniels insisted that the commercial records were much more accurate than the recreational. Mr. Bryson said he felt our records were accurate. Mr. Daniels said that the 6" is "unreal." Mr. Bryson reiterated that the 5.5" diamond and a 6" square retains the same size flounder. Mr. Daniels still wants to remain with a 5.5" diamond mesh.

Kirk Larson (Barnegat Light, NJ) asked a question regarding scallopers; if they were going to be at the same 500 lb. limit? Mr. Bryson advised, "500 lb. or more, you will fall under this unless you are using a larger net." He advised that our records show that very few vessels catch more than 500 lb. unless they are directed.

Question: What is the biological data you have regarding the 13" fish? What do you know about why the large fish stay here and the smaller fish do not? They don't seem to come up beyond a certain point. Mr. Coates advised that there are more small fish in New England that the fishermen are accustomed to. That they probably fish in deeper water more offshore, than where a lot of inshore estuaries are. Mr. Coates introduced Steve Coreria, a Fishery Biologist from their Resource Assessment Program, who attested to the fact that they saw very few small fluke this fall.

Brian Mello asked what about the fish traps? They are inside three miles and they do catch fluke. Mr. Coates advised that since all the fish they catch are generally alive, they would be required to throw everything back under 14". Mr. Mello also advised that they do not "pick" fish.

Mr. Coates quoted the fishermen some landing statistics.

Warren Dugan (Martha's Vineyard) stated, "If what we're hearing is that there are no small fish in the waters of New England, and then we develop a Management Plan that is designed to protect small fish. It's like having no Management Plan at all." Mr. Coates reiterated that there are small fish in New England, that it is not as much a problem as in the south, but that we are here to protect the species as a whole. If we have to impose this type of mesh regulation to protect the small fish down south and it applies to the fishermen up here, for consistency's sake, that's what has to be done.

Mr. Bryson advised that by next May we should have a Plan combined with the States that will have quotas; that you cannot get a better protection plan for fish than having quotas. This will be a good Plan. It will take a lot of work by a lot of people, but the necessity is here for it.

Question: Why so stringent a penalty for the violation of the minimum mesh net regulation? Mr. Bryson replied that we are really going after the "double baggers" because it is an intentional violation.

Mr. Coates went over the alternatives. There were no comments regarding Alternative #1. There was "some level of support" for Alternatives #2 and #3. Alternative #4 did not receive much comment.

Howard Nickerson (Offshore Mariners Assoc.) said that when you buy a net it may be 5.5", but after you use it a few times, the meshes shrink. The Coast Guard wouldn't believe that. All Coast Guard men do not measure nets the same way. I thought there was a standard procedure for measuring cod ends. Mr. Coates replied that it is something the Coast Guard has worked on a lot. If we could iron out all the reasons for the inconsistencies and get some level of accountability in terms of good standards by the net makers, you might see that kind of thing in the future.

Alternative #5; not much comment. Alternative #6, no comment.

There was a statement made by one of the fishermen regarding violations. He knows of people who have been caught for undersized fish five or six times and are still fishing. Why is this? Mr. Nickerson said that the States are tougher on this issue than the Federal government. There was discussion by Mr. Coates and Mr. Bryson regarding this. Mr. Coates said they are speeding up the process and penalties are becoming more stringent. Mr. Bryson asked that any such violator be reported directly to Council.

Chris Botelho suggested that maybe somebody could come around and check mesh sizes on the day the boat sails in order to keep the fishermen honest. All fishermen and Mr. Bryson agreed this would be a good idea.

Hearing ended at 9:00 p.m.

16 October 1990, Galilee, RI

The hearing began at 7:10 p.m. Hearing Officer Dave Borden presented opening remarks and explained the hearing procedure. Executive Director John Bryson gave a briefing on Amendment 1. Attendance count was 31 including Jack Terrill (NMFS, NERO), Bob Smith (NEFMC), Doug Marshall and Pat Fiorelli (NEFMC staff), and John Stolgitis and Dick Sisson (Rhode Island Fish and Wildlife).

Bob Smith (NEFMC and commercial fisherman), on Management Measure 6, requested clarification on the definition of "permit." Mr. Bryson advised this was not really a violation for undersized fish, but is really geared at net violations, when a fishermen intentionally uses the wrong size net or is caught double bagging. The first time, you will lose your permit for six months.

Joe Rendeiro (Stonington Fishermens Assoc.), asked "are you saying a cod end does not retain 500 lbs of fish?" Mr. Bryson told him, no, that you cannot retain it with that cod end. Mr. Rendeiro said it was not very clear, that it doesn't say the boat can't have more than 500 lb, it just says that the cod end can't have more. Does this mean per day, per tow, or per trip? Mr. Bryson advised that it means, "otter trawl vessels with that net may retain more than 500 lbs summer flounder." It's very clear.

Jim McCauley (Pt. Judith Coop), said he feels this whole proposal, in general, does not apply to the fisheries in his area. This will take away flexibility. If you look at the landings, you can see where the problem really is. He said they realize that the small fish need to be saved, in fact, New England will probably be the biggest

beneficiary, but for what they are going to have to contribute to save them, they are going to be put through a lot of difficulty with no real help towards the situation.

Bob Smith, speaking on behalf of the New England Council, advised that they did not have a position at this time. They have not had a chance to take this before the Groundfish Committee, which they plan to do next month, and before their full Council in November. They will not be able to comment by the deadline suggested. They will have to comment through the comment process period in Washington.

Joe Rendeiro, speaking on behalf of the Southern New England Fishermen's Assoc., said that they were against this Plan also. They want to let the "people down south" know that they have no problem with small fish. The fish problem is in the south; all States south of Long Island. He also stated that "before the Mid-Atlantic Council can categorically come up here and propose some of these things to us, they should clean up their own act. The problem in conservation should start on your end." He also commented that if fishermen have no faith in the proposals that are being pushed on them, they are not going to abide by them. He said they can't enforce the regulations they have in southern New England right now. If regulations are made and pushed off on the fishermen, and there is nobody to enforce them, it will do no good.

Trevor Daley (F/V *Wallaby)*, stated that his boat is not capable of doing an extended fluke trip in the winter time, that he is one who survives exclusively on mixed trips. He supports all the fishermen who say they have no discard rate; no problem with small fish. He does not understand where the 10% and 11% figures came from, but they must have existed a long time ago. He said we are trying to tackle the whole problem as one area.

Jay Anderson (Wood River Jct., RI), said he felt everybody in the room was in favor of the objectives, however the Amendment as written is going to be non effective, simply because of the fact they do not catch small fish. It will only have a strong negative financial impact upon the small mesh fishery because they will not be able to have the versatility to do what they want.

Mr. Borden reviewed the alternatives.

Regarding #1, Bob Smith (speaking as a commercial fisherman) disagreed, for the reasons already stated in general comments. It is not necessary to have this type of management regime in the southern New England area for fluke fishing. It has already been shown in the document that states that only 11% of small fluke are caught and landed in Rhode Island. Mr. Bryson asked if he was only disagreeing for the New England area. Mr. Smith said his only concern was the New England area. Jay Anderson agreed with Bob Smith, and added that out of that 11%, no distinction was made as to whether the fish were from the EEZ or whether they came from the territorial waters. Chet Wescott (F/V *Iella)* agreed 100% with Bob Smith also.

Regarding #2, Bob Smith disagreed for the same reasons stated in #1. Trevor Daley agreed with Bob Smith. Jim McCauley agreed also. He also wanted to discuss the change of going to a 6" square mesh. The 6" square mesh may be in the same category as the 5.5", and at the present time New England is accepting the 5.5" square mesh, but there should be some kind of coordination on this. A lot of fish will be trapped in a diamond mesh that would not be trapped in a square mesh. Joe Rendeiro said that it will really be a hardship to change over to 6" square mesh. Most boats are just starting to recoup from having to discard cod ends that were perfectly good. Hal Loftus (F/V *Mary Elena)* agreed with Jim McCauley. He has used square mesh for years. If they are forced to go to 6" square mesh, he will go back to 5.5" diamond. They have far superior escapement with 5.5". You have to be concerned with all species of fish, not just fluke.

Regarding #3, Bob Smith agreed with wording of this proposal. It is in the Multispecies Plan, and is done mainly for enforcement purposes. The Coast Guard came up with this wording. If they had to go with one mesh on board, it would be the most terrible thing that could happen to the southern New England mixed trawl fishery. Referring to a., b., c., and d., under #3 (storage of nets), Joe Rendeiro said it will be impossible to live with this regulation and not be in violation at sometime during the season, that nobody has the room to stow nets as they are supposed to.

Mr. Borden reiterated that the public comment period was through October 22. He suggested that Jim McCauley get together with the boat captains and submit a formal proposal from the Coop, so that the Mid-Atlantic Council has their feelings in writing. Mr. Bryson asked them to submit their rationale for what they think is "workable." Mr. McCauley agreed to coordinate a response.

Bruce Loftes (F/V *Rhode Island)* said he only goes offshore about five or six times a year. When he goes offshore he may catch 2,500 lb. of fluke. If this Plan goes into effect, it will be detrimental to him because of the

500 lb. A mixed fishery is what he is fishing. This Plan will shut him out. It seems like everything is being designed to "keep the boats on the ground." This whole Plan is for the big boats, not little ones.

Regarding #4, Bob Smith is against this one. It really does not look at fishing mortality in the proper way. Joe Rendeiro is against it also.

Regarding #5, there was not much comment.

Regarding #6, Bob Smith was against this.

Mr. Borden asked for any other comments to be placed on the record.

Lucy Sloan referring to the hearing document, page 48, asked a question regarding National Standard 6. Why this indicates that the FMP takes into account and allows for variations and contingencies in the fishery when the biggest problem they have is that they feel they are variations and they do not believe this Plan takes that into account. Mr. Bryson explained that every fishery we manage is a variation. That the Plans have to be written to best fit the management areas totally, and you cannot always do what each area likes.

Hal Loftus expressed once again that the line should be 72°30'. That apparently it looks like they will end up with some sort of permit to be able to fish wherever. If that is the case, he hopes it can be handled somewhat like the whiting fishery is on Cultivator Shoals where they can expedite the transfer of license of back and forth so they are not locked into that for long periods of time.

Mr. Bryson made a comment on the line. He urged the fishermen to understand that just because the line is chosen by the Coop, do not feel it will go into the record. They should suggest it, it will part of the hearing process, and it will be considered by the Mid-Atlantic Council. However he cannot promise it will be used.

Mr. Borden reminded everybody that the public comment period ends on October 22nd.

Hearing adjourned at 9:00 p.m.

11 October 1990, Riverhead, NY

The Summer Flounder Amendment 1 public hearing at the Holiday Inn, Riverhead, NY, was called to order at 7:45 p.m. by hearing officer Warren Hader of the Mid-Atlantic Council. Also present from the Mid-Atlantic Council was John Mason. Staff present were Dave Keifer and Kathy Collins. Sixteen members of the public attended.

The opening statement was read by Warren Hader. Mr. Keifer presented a summary of the Plan. After the summary was presented, Mr. Hader opened the hearing for questions and comments.

Anthony Guessregen of A&G Fish, said that this Amendment would cripple them in the spring. He feels that there is no provision for the sports fishermen to be encompassed into the program. He said that the potential spawning areas and where the biggest landing areas are have not been identified. He thinks those areas should be more addressed. He said that as far as the alternatives, he cannot support no action because he knows that something has to be done. He said the Council has not dug deep enough to come up with a good plan.

Mr. Mason asked Mr. Guessregen if he preferred alternative 3, while you have the special permit you can't fish west of 71°30' or alternative 2 where it says you are allowed up to 15% and then you can still fish west of 71°30'.

Mr. Guessregen asked where the 71°30' line is really located. He added that the commercial end of the fishery is easily enforced and the recreational fishery is not.

Mr. Mason said the line is at Block Canyon.

Mr. Guessregen said that he thinks alternative #3 would be reasonable but some changes need to be made. He thinks that the 71°30' line needs to be reexamined. He thinks there needs to be more discussion as to where that line should be.

Robert Hamilton, *F/V Miss Nancy*, asked how statistics on landings are based. He said that he thinks the data are incorrect.

Mr. Keifer said that the statistics are from National Marine Fisheries Service.

Mr. Mason explained that the statistics do not depend on interviews on every single vessel. He said that it is a sampling procedure that uses different methods of collecting the data.

Mr. Guessregen asked if on alternative #3 for the special permit, how it would be administered.

Mr. Keifer replied by saying one would have to contact NMFS to get a permit to fish out there and if you had that permit, then you couldn't fish west of the line. He added that NMFS would set rules on how long one can have the permit.

Peter Wadelton asked how many permits would be issued.

Mr. Mason said that there would be no limit on permits issued.

Mr. Wadelton believes the line should be east of 72°30' instead of 71°30'.

Mr. Hader closed the hearing at 8:45 p.m.

10 October 1990, Rockville Centre, NY

The Summer Flounder Amendment 1 public hearing at the Holiday Inn, Rockville, Center, NY, was called to order at 7:40 p.m. by hearing officer Warren Hader of the Mid-Atlantic Council. Also present from the Mid-Atlantic Council was John Mason. Staff present were Dave Keifer and Kathy Collins. Seven members of the public attended.

The opening statement was read by Warren Hader. Mr. Keifer presented a summary of the Plan. After the summary was presented, Mr. Hader opened the hearing for questions and comments.

Charles Wertz, President of C&C Ocean Fisheries asked what the established range of summer flounder was.

Mr. Keifer replied that the range is from North Carolina to the Canadian border.

Bruce Larson of the Jone Inlet Packing, Ltd. asked if the size of fluke is directly in line with the age.

Mr. Keifer said that the jumbo and large may vary from port to port.

Anthony Sougstad of Neber Fisheries Inc. thinks that the size limit of the fish should be uniform and not vary from State to State.

Charles Wertz said that it has been his observation that effort for summer flounder has been greatly reduced. He said that the smaller fish seem to winter west of 71'30° line. He added that only 500 pounds would create a hardship on fishermen. He suggested leaving the fishermen in the north alone and concentrating on the southern fishermen.

Mr. Mason said that if the Coast Guard, because of problems with percentages, were to say if people were willing to box fish then they might be able to deal with something other than flat pounds.

Bruce Larson said that he doesn't believe in boats packing in the ocean. He said that about 75% of the enforcement is done on the docks. He added that summer flounder is not the main target fishery in New York. He said the area is too large to support every individual fishermen. He feels that 500 pounds is ridiculous and so is the 20%.

Mr. Wertz feels that everything has to be predicated on dock inspection. He said that there is no consideration for different sized nets. He said that cod end restrictions should correspond with end of the net. He said that they want to continue to use their 5" gear.

George Lightfoot of the *F/V Atlantic Queen* said that changing the size of the nets is not economically feasible because most nets are 5.0". If the complete net is 5.5" it would economically be difficult.

Mr. Mason said that what the Council and everyone is trying to find is if there is an area where you can fish the mixed fishery because there aren't many small fish in that eastern area and still allow everybody to keep fishing.

Mr. Wertz said that he would like to retain everything that is caught.

Mr. Wertz and Mr. Larson both supported Alternative #3. (Both supported this Alternative until a discussion off the record after the close of the hearing indicated they did not exactly understand where the 71°30' line was. They asked that their comments in support be dropped from the record.)

Mr. Hader closed the hearing at 8:50 p.m.

11 October 1990, Wall, NJ

The hearing began at 7:00 p.m. The fishermen were welcomed by Chairman Axel B. Carlson, Jr. Hearing Officer Dr. Roger Locandro opened the hearing and explained the procedures that would be followed. Executive Director John C. Bryson presented a briefing on Amendment 1. Attendance was 56 including Bob Lippson (NMFS) and Bruce Freeman (NJDMF).

Captain James Lovgren (*F/V Sea Dragon* and Ocean County Farm Bureau) stated that they should go along with the 5.5" bag mesh; that something has to be done to protect the resource. However he does not necessarily support the 5.5" throughout the whole of the bag because it will be very expensive to replace all the nets. He also wanted to know where the regulations are for the sportfishermen; that the commercial men were getting all the restrictions. How about a minimum hook size and limited catch per day? Regarding Alternatives 2 and 3, why does New England always seem to get their own way? ... that they have the largest waste of yellowtail flounder. Regarding a moratorium, how long would it have to last? He said he felt he was already on a moratorium because "it doesn't pay to catch fluke when you're paying $1.20 a gallon for fuel."

Mr. Bryson advised they would like to have four year classes in spawning stock to be assured of a healthy stock. At least two years; maybe more. Regarding the recreational, Mr. Bryson said that the catch reported in 1989 was down from 18 to 3.3 million pounds. That commercial was 87% of the catch.

Sherman Nelson (recreational fisherman.) questioned the data on the recreational fishermen and how it is achieved. He was in favor of the redesign of the hook in order to catch only larger fish. He would not support a moratorium for commercial or recreational, but does not see an alternative. However, if it comes down to a choice, the recreational should be dropped in order to support the commercial fishermen's livelihood. Mr. Bryson asked him to share his thoughts on what size hook should be used.

James Matthews (*F/V Jamie Mae)* was the most irate individual who gave testimony. He said a 6" bag is going to put them out of business. He insisted that fluke are a lot better this year than in past years. He said that the Council is operating on history and is not being updated. This measure is uncalled for.

Tom Fote (Jersey Coast Anglers) advised they have voted to support this Amendment.

Gary Dickerson (member of the Manasquan Fishing Club and Advisor for Mid-Atlantic Council) agrees with the science and biology, that the fluke are in fact in danger. He has learned that in NMFS's spring survey this year, that 90% of the fish they took were only one year old. He also asked if the fish "pick" will be eliminated from the commercial boats this year? Mr. Bryson advised not in this Amendment, however it will be considered for Amendment 2.

Thomas Brower (*F/V Viking Star* and Fishermen's Coop) stated that this Amendment should be null and void until there are recreational restrictions attached to it, not added later. Mr. Bryson said they already are, that the 13" minimum size limit has been in effect.

Ray Bogan (United Boatmen of New Jersey) stated that they do not favor a moratorium; that it would destroy both commercial and recreational fisheries. Also, they would urge separation of Plans regarding fluke, sea bass, and porgies. He did not have an opinion regarding actual mesh size, but reminded those present that if North Carolina, Virginia and New England had been more reasonable in the past and not argued for a 3.5" mesh size, the fishermen not be in this position now.

Hearing ended at 8:00 p.m.

22 October 1990, Cape May Courthouse, NJ

There was a public hearing held on 22 October at the Cape May County Extension Office in Cape May Courthouse, NJ on Amendment 1 to the Summer Flounder Fishery Management Plan. Hearing moderator and Council member Tom McVey convened the hearing at 7:00 pm. There were approximately 70 public members present, including Dr. Bob Lippson, National Marine Fisheries Service, Bruce Halgren, Division of Fish, Game and Wildlife for the State of New Jersey, and Stewart Tweed, New Jersey Marine Advisory Service. Mr. John Bryson represented the Mid-Atlantic Council staff and Carol Stevenson served as recording secretary.

After a brief introduction by Mr. McVey, Mr. Bryson summarized the contents of the Amendment and reviewed the Council's preferred alternative management measures. He indicated that prudent management measures were of paramount importance to protect the 1989 and 1990 year classes from overexploitation. In

addition to excessively high mortality rates, recent surveys have indicated that the abundance of summer flounder has declined. There has also been a severe decline in commercial landings.

Mr. Ralph Stork, recreational fisherman from Margate, NJ, commented that the fluke were almost gone and that management was necessary, but for both the commercial and recreational sectors. He disagreed with the 500 lbs. retention and thought it should be lowered to around 100 - 200 lbs.

Mr. Nils Stolpe, representing the New Jersey Commercial Fishermen's Association, appealed for a phasing in of the 5.5" mesh requirement throughout the body of the net. He stated that bags are expensive to replace, as much as $5,000, and that it would be easier for the fishermen to accept in the 3rd or subsequent year of this requirement, because by then their bags would need to be replaced anyway.

Mr. Michael Deckard, recreational fisherman from Atlantic City, NJ, stated that he had been fishing for 30 years and that currently the fluke fishing was horrible. He said that the Council should put forth the strongest methods available to them as quickly as possible. He thought that the catch should be limited, but for both the recreational and commercial fishermen.

Mr. Wayne Halbruner, commercial fisherman from Cape May, NJ, stated that a 5.5" mesh would be OK, but the fishermen could not tolerate anything larger than that. He said that a 5.5" mesh would allow 12" flounder to pass through the net.

Mr. Jim Harris, dragger operator from Cape May, NJ, said that he could live with a 5.5" or 6" cod end without much problem. He believed any larger than that would not be effective because the fishermen would be forced to use liners in order to make a living. He preferred a 5" bag and said that was what the majority of the Cape May fleet was currently using. He said that he could not afford a 5.5" net. He agreed that fluke were in trouble, but said that there were flounder out there, they were just more spread out. He felt that the government surveys were inaccurate to a certain degree in that the fish do not return to the same place year after year.

Mr. Kenneth Hand, trawler operator from Wildwood, NJ, commented that the rockfish were taken away from the commercial fishermen too. He said that the sports fishermen were shutting them out of business and wondered when the commercial fishermen were going to get something back for all they had to give up.

Mr. Rick Hoff, representing a couple of boats and owner of a dock in Wildwood, NJ, stated that management was needed for the fluke fishery. He said that if there was going to be a 5.5" bag requirement, then a 1-2 years phase in would be necessary. He commented that in the spring, he bought more fluke from recreational fishermen than he did from the draggers.

Mr. Jim Harris asked how fluke sold by recreational fishermen would be counted, as commercial catch, or as recreational catch?

Mr. Bryson responded that as far as the Council was concerned, it would be, and had always been, considered commercial catch. He said the recreational fishermen in New Jersey should lobby their state for a license to sell.

Mr. Harris commented that he thought it was important for the Council to continue to be involved in habitat issues, as well as loss of wetlands issues, in Amendment #1 to the Summer Flounder Fishery Management Plan.

The hearing was adjourned at approximately 7:55 pm.

10 October 1990, Dover, DE

A hearing was scheduled for 7:00 pm on 10 October at the Holiday Inn in Dover, DE. No members of the public attended, so the hearing was not held.

11 October 1990, Salisbury, MD

There was a public hearing held on 11 October at the Sheraton Inn in Salisbury, MD on Amendment 1 to the Summer Flounder Fishery Management Plan. Hearing moderator and Council member Mike Keene convened the hearing at approximately 7:15 pm. There were 11 public members present, including Mr. William Outten and Ms. Nancy Butowski of the Tidewater Administration for the State of Maryland. Dr. Chris Moore represented the Mid-Atlantic Council staff and Carol Stevenson served as recording secretary.

After a brief introduction by Mr. Keene, Dr. Moore summarized the contents of the Amendment and reviewed the Council's preferred alternative management measures. He indicated that prudent management

measures were of paramount importance to protect the 1989 and 1990 year classes from overexploitation. In addition to excessively high mortality rates, recent surveys have indicated that the abundance of summer flounder has declined. There has also been a severe decline in commercial landings.

Mr. Bob Jackson of the F/V *Marcella* from Ocean City, MD, felt that a size limit on webbing was OK, but that a 5.5 " mesh would restrict their catch too much and would put them out of business. He agreed, however, that the summer flounder stocks were becoming depleted and was in favor of some type of management. He asked if any thought had been given to the idea of regulating the sports fishermen.

Mr. Sam Harold, Captain of a trawler from Ocean City, MD, agreed that it would be difficult for him to survive in the industry with a 5.5" mesh regulation. He thought that time restrictions would be effective. His idea was to limit the fishing time, particularly in November, December and January when fluke were abundant offshore on the 50-60 fathom line, to 12 hour fishing periods from sunrise to sunset.

Mr. Jeff Eutsler favored Alternative #4. He also thought that a 5.5" mesh regulation would be too restrictive. He said he had experimented between various size meshes and felt that a 5" mesh would be an appropriate conservation measure. He also thought that fishermen should be able to retain everything brought on board to prevent waste. He thought the language regarding net strengtheners needed to be more clearly stated. He thought the way it was currently stated meant that the seams had to be 10.5 ". He asked if it was going to be legal to put chaffing gear around the 5.5" mesh, or if chaffing gear had been addressed at all in the Amendment.

Dr. Moore responded that chaffing gear was not identified in the Amendment.

Mr. Tony Martin, F/V *Teresa Dawn*, preferred a 5" mesh over a 5.5" mesh at least to start out with. He thought that maybe a 5.5" mesh could be implemented 2-3 years down the road. He was in favor of the mesh regulation in the cod end only. He spoke strongly against the idea of time limits because he felt at sea enforcement was impossible. He also was not in favor of a closed fishery for any period of time.

Dr. Charles Hocutt of the University of Maryland commented that the fishery should be closed down entirely during peak spawning periods such as November and December.

The hearing was adjourned at approximately 8:15 pm.

17 October 1990, Hampton, VA

The Summer Flounder Amendment #1 public hearing at the Radisson Hotel, Hampton, VA was called to order at 7:05 p.m. by hearing officer Jack Travelstead of the Mid-Atlantic Council. Also present from the Mid-Atlantic Council was William Wells. Jim Stone and Kevin Whitley of the US Coast Guard attended. Dr. Robert Lippson (NMFS, Oxford Lab) also attended. Staff present were Dave Keifer and Lynn Redding. Seven members of the public attended.

The opening statement was read by Jack Travelstead. Mr. Keifer presented a summary of the Plan. After the summary was presented, Mr. Travelstead opened the hearing for questions and comments.

Tim Daniels spoke on behalf of the fishermen at Wanchese Fish Company. He stated that they wanted to take no action until November 1991. They want 5" diamond mesh with 5.5" square mesh. The fishermen would like the webbing per pound and change base with small tail bags. Mr. Daniels said they wanted fly nets exempt with a 7000 pound exemption for vessels with fly nets the first part of the trip and fluke the last part of the trip. There was no way that they would want to accept Alternative #6. The fishermen wanted to raise the size limit from 13" to 18" on the sport and charter industry.

Mr. Daniels stated that they had 50,000 pounds of fluke this week and over half of them were over four pounds. He said this is the hardest selling fish they have. Sam Daniels and William Daniels, both of Wanchese Fish Company, stated that they agreed with what Tim Daniels had said and did not need to speak.

Mr. Wells asked where the 18" figure came from. Tim Daniels stated that he did not know. Mr. Wells asked what regulations had been placed on recreational fishermen in Virginia State waters relative to the ban on trawling by commercial fishermen Mr. Travelstead replied there was a ten fish bag limit on recreational fishermen in Virginia. The Virginia Marine Resources Commission also sent out literature trying to get them to go with a six fish limit voluntarily. Many fishermen said they would do this, but at the time, it was difficult to catch six flounder.

Mr. Wells asked what the restrictions were on fixed gear fishermen. Mr. Travelstead replied there were restrictions on the gear. No net can be over 1200'; there is a mesh size of 2" on the pound net head; they have

to abide by the same 13" minimum size; there is a distance of 300 yards that the gears have to be separated from one another when set.

Mr. Wells asked what the percentages were between the recreational catches in state waters and trawling prior to the prohibition. Mr. Travelstead said that recreational harvest was quite a bit larger than commercial harvest, before and after trawling prohibition. He stated that the opposite is true for the EEZ. Mr. Travelstead said considering the whole range, commercial is 60% and recreational 40%. He stated that 90% of the commercial landings are trawl nets. He indicated there was a very small commercial fishery in the bay for flounder. It is mostly limited to pound nets and their harvest is not that great.

Tim Daniels asked if there was anything in the summary about sport fishermen. Mr. Travelstead replied that there was nothing in Amendment 1 that pertains to sport fishermen and the regulations apply only to the EEZ. He stated that it is up to the individual States to govern their waters. ASMFC is working with the Council to develop regulations along that line.

Tim Daniels asked at what size female fish would reproduce. Mr. Travelstead replied that half of the females are sexually mature at 12.7". Mr. Daniels asked at what size all of them would be mature. Mr. Travelstead indicated this would probably be about 18" or 19".

Mr. Wells agreed with Mr. Daniels that the recreational catch in state waters needed to be considered. Mr. Travelstead stated that this hearing had nothing to do with State waters. Mr. Wells said the reason the recreational fishermen are not upset with the ten fish bag limit is probably because they cannot catch ten fish. Mr. Travelstead predicted that there would be an Amendment 2 with all of the Atlantic coast States being asked to do things that will greatly impact the recreational fishery in their State.

Mr. Keifer stated that based on what has been developed so far, discards of undersize summer flounder from the hook and line fishery is substantially lower than the mortality in the trawl net fishery. The prime objective of the 5.5" bag rule is to allow escapement of small fish before they are brought on board. Essentially it is to bring the commercial side up to the same level in terms of mortality of discards to where the recreational fishery has been.

Mr. Travelstead indicated that Virginia is the only Atlantic coast State to have a bag limit. He said this may not be entirely effective, but it would be when the stocks started responding. He stated a lot of other States needed to catch up to Virginia.

Mr. Wells commented on Virginia prohibiting trawling instead of regulating trawling with a mesh size. Mr. Travelstead said that decision was made because of the fact that Virginia has the Chesapeake Bay and their three mile limit is the migratory pathway for a number of species to get in and out of the Bay. He commented that trawling really started about ten years ago when the flounder were peaking. During that ten year period, the catches by the Bay fishermen went down while the trawlers went up. Mr. Daniels asked if the Bay fishing had picked up this year. Mr. Travelstead replied that he did not think it had picked up much, but the fisheries usually take a couple of years to respond.

Mr. Travelstead informed those attending that written comments will be accepted until October 22, 1990. The meeting adjourned at 7:40 p.m.

15 October 1990, Manteo, NC

The Summer Flounder Amendment 1 public hearing at the Elizabethan Inn, Manteo, NC was called to order at 7:15 p.m. by hearing officer Dennis Spitsbergen of the South Atlantic Council. There were six members of the North Carolina Division of Marine Fisheries present. Dr. Robert Lippson (NMFS, Oxford Lab) also attended. Staff present were Dave Keifer and Lynn Redding. Nine members of the public attended.

The opening statement was read by Dennis Spitsbergen. Mr. Keifer presented a summary of the Plan. After the summary was presented, Mr. Spitsbergen opened the hearing for questions and comments.

Jim Fletcher questioned the statistics used in Amendment 1. He said the statistics were contrary to the North Carolina Division of Marine Fisheries statistics. He requested copies of information on trawl net selectivity, the age of the fish when they spawn and the size of the fish. Mr. Spitsbergen replied that the statistics came from the *R/V Dan Moore* study and that the Division of Marine Fisheries would provide him with the information. Mr. Keifer remarked that the mesh selectivity work is summarized in the Plan. Mr. Spitsbergen commented that the Atlantic States Marine Fisheries Commission Plan has recommended a 5.5" mesh size and a 14" size limit based on this work.

Bill Hogarth read the North Carolina Division of Marine Fisheries statement (Attachment 1).

Mr. Fletcher read the Oregon Inlet Users Association comments (Attachment 2).

Mike Daniels stated that he agreed with Mr. Fletcher and that the industry could not take this. He said the Council was not listening to the industry. Mr. Daniels recommended to do nothing this year. He stated that the fishermen had to make a living and this would give them no option but to cheat.

Art Smith recommended to take no action at this time. He stated the fishermen needed to keep the smaller fish to pay their fuel bill. Mr. Smith thought the fishermen had policed themselves to a certain extent. He said that pollution was a problem. He commented that the fishermen needed both flounder and flynets. He requested that the 500 pound rule be eliminated. Mr. Smith recommended a 5" mesh instead of 5.5". He commented that alternative #6 favored the recreational fishermen.

Moon Tillett (Moon Tillett Fish Company) recommended to take no action at this time. He agreed with Mr. Daniels and Mr. Smith that the fishermen needed to keep all squid and other fish to pay for their trip. He would like to have flynets exempt from all fisheries. Mr. Tillett felt that Federal and State regulations should be the same. He commented that the 13" minimum size limit has helped some. Mr. Tillett stated we should hold off on implementing Amendment 1 for one more year. He said the fishermen could not afford to change their webbing. Mr. Tillett stated that the recreational fishermen should be regulated as well as the commercial fishermen. Mr. Spitsbergen indicated that the majority of summer flounder are being taken by the draggers. He anticipated that there would be rules on the hook and line fishermen in the future.

Billy Carl Tillett stated that the fishermen needed a combination of fish in order to afford the cost of fuel and new webbing. He said fishing off of North Carolina is not the same as fishing in the north. Mr. Tillett recommended doing more research on the gear. He did not think that the 5.5" mesh would work. He asked how the Plan would be enforced. Mr. Spitsbergen replied with very high penalties by the Coast Guard and the National Marine Fisheries Service. Mr. Tillett asked how many enforcement officers National Marine Fisheries Service had. Mr. Spitsbergen was not sure, he thought there were two in North Carolina. Mr. Tillett said a 13" minimum size limit would be better than a 5.5" tailbag.

Jim Fletcher stated that we needed to stop using chlorine to treat waste water and dumping it in the water. He recommended to stop ocean dumping of sludge. Mr. Fletcher stated that Amendment 1 should be phased in on the same timeframe as the ban on ocean dumping.

Mike Daniels asked what kind of testing the State did to protect the quality of water. Mr. Spitsbergen replied that the State had a Shellfish Sanitation group whose responsibility was to test pathogens in shellfish. He said there is also a Division of Environmental Management whose issue is testing the water. Mr. Daniels asked where they tested the water. Mr. Spitsbergen said they have a large number of stations that they sample regularly. Mr. Daniels stated that every county should monitor water on the coast every month.

Bill Hogarth commented that the North Carolina Division of Marine Fisheries had tried for three years to get a 5.5" tailbag mesh and for five years to get from 11" to 13" on flounder. Mr. Spitsbergen commented that he could go back to 1984 when they were trying to get a 5.5" and the fishermen said they couldn't live with it.

Art Smith asked what the procedure was after the public hearings. Mr. Keifer stated that the comment period would close October 22, 1990. The Council's Committee would meet on October 30, 1990 in Essington to review the entire public hearing record. The Council would consider Amendment 1 and possibly vote on some recommendation. If the Council takes some action on October 30, it would go to the National Marine Fisheries Service. NMFS would review it and determine if they wanted to approve it. There would also be a comment period during their review process also. Mr. Smith asked if it would be at least 1991 before the Plan was in effect. Mr. Keifer explained that there was a minimum of 65 days and a maximum of 90 days after being published in the Federal Register before it could be approved. If NMFS does not disapprove within 90 days, it is approved. There is a 30 day cooling off period when the regulations are published. Mr. Keifer stated that the Council did ask for emergency action and NMFS did not take that action. He did not know if the Council would ask for emergency action based on the public hearings. Mr. Smith asked if shorter towing time had been considered instead of smaller tow bags. Jeff Ross stated that this would be unenforceable.

The hearing adjourned at 8:20 p.m.

16 October 1990, Morehead City, NC

The Summer Flounder Amendment 1 public hearing at the Carteret College, Morehead, City, NC was called to order at 7:05 p.m. by hearing officer Dennis Spitsbergen of the South Atlantic Council. Six members of the

North Carolina Division of Marine Fisheries attended. Staff present were Dave Keifer and Lynn Redding. Eleven members of the public attended.

The opening statement was read by Dennis Spitsbergen. Mr. Keifer presented a summary of the Plan. After the summary was presented, Mr. Spitsbergen opened the hearing for questions and comments.

Rick Monaghan read the statement from North Carolina Division of Marine Fisheries (Attachment 1).

William Tate (Delores Marie, Inc.) commented that flynets fish from the bottom up about ten feet. He stated that the fishermen need the flynet exemption. Mr. Tate asked when the 5.5" mesh would go into effect. Mr. Keifer replied that it would go in the second year.

William Smith agreed with Mr. Tate that the flynet exemption was needed. He stated that they needed to stay with the 5.5" bag, whether it is square or diamond. Mr. Smith would like to see a bag limit considered for yellowtail.

William Cross (Pamlico Packing Company) stated that there was one law for North Carolina and the Federal law would not be into effect until the flounder season would be over for them. Mr. Spitsbergen commented that the Council had asked for an emergency rule. The Regional Director is the one who has to rule on this. He wanted to wait until after the public hearings to see if there was support for it. If there was support for an emergency rule, the Regional Director may reconsider. Mr. Cross stated that either an emergency rule should go into effect, or North Carolina should back down until both laws could go into effect at the same time. He said the fishermen should not be working under two sets of guidelines and North Carolina's fishery would suffer if this were to happen.

Mr. Cross commented that you would be able to save everything that came on board above 13" when using a 5.5" net. Mr. Spitsbergen stated this was not in Amendment 1. Mr. Cross said John Bryson had mentioned at other meetings that this would be one of the issues in Amendment 2. Mr. Spitsbergen replied that Amendment 1 is addressing the mesh size and the 13" would be maintained until another Amendment would be drafted and approved.

Sherrill Styron (Garland Fulcher Seafood) stated that he was opposed to the 5.5" mesh size. He believed that the fish go in cycles and will come back.

The meeting adjourned at 7:50 p.m.

APPENDIX 6. RESPONSES TO COMMENTS ON AMENDMENT 1 TO SUMMER FLOUNDER FMP

Questionnaires were distributed at all of the hearings soliciting comments on the proposed measures and the alternatives. Persons were encouraged to fill them out and hand them in or take them home and mail them in. The results are tabulated below. Please note that the number of answers exceeds the number of questionnaires since multiple responses were possible. Recall that alternative 1 was no action, alternative 2 was no minimum mesh east of 71°30′ west longitude until 15% of a vessel's catch is summer flounder; alternative 3 was a special permit declaration to fish east of 71°30′ west longitude to not need a large mesh; alternative 4 was a 5.0" minimum mesh (diamond mesh) or 5.5" minimum mesh (square mesh), net; alternative 5 was an exemption to the 5.5" mesh for the fly net fishery; and alternative 6 was a summer flounder possession prohibition in the EEZ until completion of Amendment 2.

It is interesting to note that the no action alternative was supported by only 10% of the respondents. On the original Summer Flounder FMP the no action alternative was supported by 24% of the respondents. Alternatives 3 and 5 are variants to the preferred alternative (exemptions for the offshore fishery in the northeast and for the fly net fishery); 52% of the responses favor the preferred alternative with these modifications.

Summer Flounder FMP Amendment 1 Questionnaire Summary

		Alternative					
	Preferred	1	2	3	4	5	6
Fairhaven, MA	1	-	-	2	-	-	-
Galilee, RI	-	-	-	-	-	-	-
Riverhead, NY	-	-	-	1	1	-	-
Rockville Center, NY				1	1	-	-
Wall, NJ	3	1	-	-	-	-	-
Cape May Court House, NJ	2	-	-	-	3	4	2
Dover, DE	-	-	-	-	-	-	-
Salisbury, MD	-	-	-	-	3	-	-
Hampton, VA	-	-	-	-	-	-	-
Manteo, NC	-	1	-	-	-	-	-
Morehead City, NC	-	-	-	-	-	-	-
Hearing total	6	2	-	4	8	4	2
Mail in questionnaires	2	1	-	-	2	-	-
Grand total	8	3	-	4	10	4	2
	26%	10%	-	13%	32%	13%	6%

A number of comment letters were also received by the Council. Five supported the preferred alternative and three supported alternative 6. One letter supported the permit sanctions, but recommended that they be applied across all Federal fisheries, not just the one in which the violation took place, so the vessel could not fish at all in the EEZ during the sanction period. Another advocated that only square mesh be allowed because it would allow for the release of more small flounder. One letter addressed the poor condition of the summer flounder resource, but did not suggest particular management measures.

The changes made by the Council in the final version of Amendment 1 should satisfy most of the commentors. The requirement for the entire net to meet the minimum mesh size beginning with the second year of implementation has been dropped from this Amendment. Exemptions have been included for the northeast offshore fishery and the fly net fishery. The northeast offshore exemption is to be implemented through a readily enforceable permit election system.

APPENDIX 7. DRAFT PROPOSED REGULATIONS

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR 625

[Docket No.]

Atlantic Summer Flounder Fishery

AGENCY: National Marine Fisheries Service (NMFS), NOAA, Commerce.

ACTION: Proposed rule.

SUMMARY: NOAA issues this proposed rule to require a minimum mesh size of 5.5 inches diamond mesh (or 6.0 inches square mesh) in the summer flounder fishery. Certain exemptions would apply to vessels using a fly net and those vessels fishing seaward of a certain line drawn in the northern range of the summer flounder fishery.

DATE: Comments on the proposed rule must be received on or before [insert date 45 days after publication in the FEDERAL REGISTER].

ADDRESSES: Comments on the proposed rule, the FMP, or supporting documents should be sent to Mr. Richard Roe, Regional Director, National Marine Fisheries Service, Northeast Regional Office, 14 Elm Street, Gloucester, Massachusetts 01930-3799. Mark the outside of the envelope "Comments on Summer Flounder Plan".

Copies of the Amendment, the environmental assessment, and the regulatory impact review are available from John C. Bryson, Executive Director, Mid-Atlantic Fishery Management Council, Room 2115 Federal Building, 300 S. New Street, Dover, DE 19901-6790.

FOR FURTHER INFORMATION CONTACT: Kathi Rodrigues, Resource Policy Analyst, 568-281-9423.

SUPPLEMENTARY INFORMATION:

BACKGROUND

The Amendment was prepared by the Mid-Atlantic Fishery Management Council (Council) in consultation with the New England and South Atlantic Fishery Management Councils. A notice of availability for the proposed Amendment was published in the FEDERAL REGISTER on [insert date] (FR). Copies of the Amendment are available from the Council upon request at the address given above. The Amendment revises management of the summer flounder (*Paralichthys dentatus*) fishery pursuant to the Magnuson Fishery Conservation and Management Act of 1976, as amended (MFCMA). The management unit continues to be summer flounder in US waters in the western Atlantic Ocean from North Carolina northward. The objectives of the FMP continue to be: (1) reduce fishing mortality on immature summer flounder; (2) increase the yield from the fishery; (3) promote compatible management regulations between the Territorial Sea and the EEZ; and (4) minimize regulations to achieve the management objectives recognized above.

Summer flounder are over exploited. Fishing mortality is triple the rate which would produce the maximum yield per recruit. Preliminary analyses from an October 1990 workshop indicate that the summer flounder resource could be in much worse condition. The estimated minimum current mortality rate results in only about 20% of all summer flounder that are alive now will be alive one year later. A mortality rate of one-third again as high as the minimum would result in only 10% of summer flounder alive now being alive in one year. Obviously, gains in long term yield from the fishery and increases in stock size could be realized by significantly reducing fishing mortality from current levels.

Long term trends in abundance and recruitment of summer flounder were derived from several local and coastwide surveys at the October 1990 workshop. In general, these indices indicated that summer flounder were approximately 5 times more abundant in the mid to late 1970's than in the late 1980's. These surveys also indicated that the 1988 year class was poor and the 1989 and 1990 year classes "no better than average". In addition, the coastwide NEFC survey did not collect any

summer flounder older than age 3 in the 1990 survey, although a decade ago summer flounder as old as 10 years were collected.

At present, as a direct result of high rates of fishing mortality, both commercial and recreational catches of summer flounder are comprised primarily of 0 to 2 year old fish. Individuals of this species have previously been known to live up to 20 years, yet older and larger fish are now infrequent in the landings. This indicates a severely compressed age composition of the summer flounder stock. Such age class compression poses a great risk to recruitment because the older, more fecund spawning adults are being too rapidly removed from the population and nearly all of the new fish are being spawned by individuals that only get to spawn once or at most twice before they are caught and killed by fishermen.

Summer flounder commercial landings for the first quarter of 1990 verify the fishery independent survey indices. Commercial landings in 1989 plummeted to only 21 million pounds, which was the lowest in the past 15 years and only 70% of the average landings for the 1980's. Landings for 1990 appear to be even worse; only 29% as many pounds were landed during the first quarter of 1990 as were landed in 1989. Coastwide average price for the first quarter of 1989 was $1.38/pound, whereas in 1990 the average had risen to $1.94/pound, partially offsetting the reduced landings.

The management measures for this Amendment are:

1. Only otter trawl vessels with 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh), inside measure, applied throughout the cod end for at least 75 continuous meshes forward of the terminus of the net may retain more than 500 lbs of summer flounder. If the fish are landed in a State that has a larger minimum net mesh size, the State limit would prevail. There are two exceptions to this rule:

a. Vessels fishing seaward of the line described below may obtain a special permit from NMFS in advance of doing so. Vessels with this special permit are exempted from the minimum net mesh regulations, but are prohibited from fishing west (landward) of the line. NMFS is authorized to establish procedural rules necessary to process applications for and cancellation of these special permits in order to facilitate enforcement.

The line follows 71°30' west longitude south to its intersection with Loran C 8860-Y-43750, thence northeasterly along Loran C 8860-Y-43750 to 41°00.0'N, 70°49.5'W, thence easterly to 41°00.0'N, 70°30.0'W, thence southerly to 40°50.0'N, 70°30.0'W, thence easterly to 40°50.0'N, 69°40.0'W, thence southerly to 40°33.5'N, 69°40.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°26.5'N, 70°40.0'W, thence northerly to 40°40.5'N, 70°40.0'W, thence southwesterly along Loran C 9960-Y-43600 to 40°30.0'N, 72°00.0'W, thence southerly to 40°17.8'N, 72°00.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°15.5'N, 72°20.0'W, thence southerly along 72°20.0'W, to the southern limit of the management unit.

b. Vessels fishing in the fly net fishery are exempt from the minimum mesh size requirement. A fly net is is a two seam otter trawl with the following configuration:

(1) The net has large mesh webbing in the wings with a stretch mesh measure of 8" to 64".

(2) The first body (belly) section of the net consists of 35 meshes or more of 8" (stretch mesh) webbing or greater.

(3) In the body section of the net the stretch mesh decreases in size relative to the wings and continues to decrease throughout the extensions to the cod end, which generally has a webbing of 2" (stretch mesh).

Vessels fishing in the fly net fishery under this exemption may catch no more than 500 lbs of summer flounder in any haul back of the fly net. This is necessary to assure that the exemption is not abused.

If the Regional Director determines after a review of annual data that the summer flounder catch in the fly net fishery exceeds 1%, he may rescind the exemption.

2. Otter trawl vessels retaining more than 500 lbs of summer flounder and subject to the 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh) regulation may not have available for immediate use any net, or any piece of net not meeting the mesh size requirements, or

mesh that is choked off. A net that conforms to one of the four following specifications and which cannot be shown to have been in recent use is considered to be "not available for immediate use":

a. nets stowed below deck; or

b. nets stowed and lashed down on deck; or

c. nets which are on reels and are covered and secured with the cod end removed; or

d. nets which are secured in a manner approved by the Regional Director. After review and approval, the Regional Director may specify alternative manner(s) of securing nets by notice in the Federal Register.

A net is considered to be stowed below deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck of the vessel. Towing wires (any wires including the "leg" wires), must be detached from the net.

A net is considered to be stowed and lashed down on deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck or the rail of the vessel. The towing wires (any wires including the "leg" wires), must also be detached from the net.

A net on a reel is considered to be "stowed and lashed down on deck" only if the entire surface of the net on the reel is covered with canvas or similar material which is securely bound, the towing wires (any wires including the "leg" wires), must also be detached from the net, and the cod end is removed from the net and stored below deck.

3. A fishing vessel may not use any means or device which would obstruct the meshes on the top of the regulated portion of a trawl net, except that one net strengthener may be attached (only at its outside edges) to the top of the regulated portion of a trawl net, if such net strengthener consists of mesh material similar to the material of the regulated portion of the net and has a mesh size of at least twice the authorized minimum mesh size. "Top of the regulated portion of the net" means the 50% of the entire regulated portion of the net which (in a hypothetical situation) would not be in contact with the ocean bottom during a tow if the regulated portion of the net were laid flat on the ocean floor.

4. States with minimum mesh regulations larger than those established in this FMP are encouraged to maintain them.

5. Since it will be difficult to detect a violation of the minimum mesh net regulation, the penalty for individuals detected of such a violation must be sufficient to provide an adequate deterrent. Therefore, it is recommended that penalty for the first offense be a six month loss of permit and the penalty for a second offense be a one year loss of permit. After imposition and expiration of such a penalty, if the individual fishes without penalty for three consecutive years, the earlier offenses are expunged from the record.

The Amendment also defines overfishing for summer flounder as fishing in excess of the F_{max} level.

The provisions of the existing FMP [for example, 13" minimum size limit as well as annual permits for commercial vessels and vessels for hire in the recreational fishery (party and charter boats)] continue in effect unchanged.

CLASSIFICATION: Section 304(a)(1)(D)(ii) of the Magnuson Act, as amended, requires the Secretary of Commerce (Secretary) to publish regulations proposed by a Council within 15 days of the receipt of the Amendment and proposed regulations. At this time the Secretary has not determined that the Amendment these rules would implement is consistent with the national standards, other provisions of the Magnuson Act, and other applicable law. The Secretary, in making that determination, will take into account the information, views, and comments received during the comment period.

The Council prepared an environmental assessment for the Amendment and concluded that there will be no significant impact on the environment as a result of this rule. A copy of the environmental assessment may be obtained from the Council at the address listed above.

The NOAA Administrator determined that this proposed rule is not a "major rule" requiring a regulatory impact analysis under Executive Order 12291. This determination is based on the draft regulatory impact review which demonstrates positive net short term and long term economic

benefits to the fishery under the proposed management measures. A copy of this review may be obtained from the Council at the address listed above.

The proposed rule is exempt from the procedures of E.O. 12291 under section 8(a)(2) of that order. Deadlines imposed under the Magnuson Act, as amended, require the Secretary to publish this proposed rule 15 days after its receipt. The proposed rule is being reported to the Director, Office of Management and Budget, with an explanation of why it is not possible to follow the procedures of the order.

The General Counsel of the Department of Commerce certified to the Small Business Administration that this proposed rule, if adopted, will not have a significant economic impact on a substantial number of small entities because of the reasons set forth in the regulatory impact review prepared by the Council, a copy of which may be obtained from the Council at the address listed above. As a result, a regulatory flexibility analysis was not prepared.

This rule does not contain a collection of information requirement subject to the Paperwork Reduction Act.

The Council determined that this rule will be implemented in a manner that is consistent, to the maximum extent practicable, with the approved coastal zone management programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina. For New Hampshire, the evaluation was that the Amendment might affect the coastal zone and was consistent. For Pennsylvania, the Council determined that this rule will not affect the coastal zone. As of 29 October 1990 the Council had received letters from Delaware, Pennsylvania, and new Hampshire agreeing with the Council's finding. No other responses had been received.

This proposed rule does not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under Executive Order 12612.

List of Subjects in 50 CFR Part 625

Administrative practice and procedure, Fish, Fisheries, Vessel permits and fees.

Dated:

Assistant Administrator for Fisheries

PART 625 -- [AMENDED]

1. The authority citation for Part 625 continues to read as follows:

AUTHORITY: 16 U.S.C. 1801 *et seq.*

2. Section 625.4 is amended to read as follows:

§625.4 Vessel permits and fees.

(a) *General.*

* * * * *

(m) *Mesh exemption permits.* A permit holder may apply to the Regional Director for a mesh exemption permit to fish exclusively east of the line specified in §652.24(a)(2) not subject to the mesh requirement specified in §652.24(a). Application must be made in accordance with paragraph (b) above. Any mesh exemption permit issued by the Regional Director is subject to the other provisions of this section.

(n) *Surrender.*

(1) A permit issued for a vessel may be surrendered by the owner thereof by certified mail addressed to the Regional Director.

(2) The Regional Director will reissue a permit which has been surrendered within 45 days from the date the reissuance was requested.

3. Section 625.7 is amended to read as follows:

§625.7 Prohibitions.

(a) In addition to the general prohibitions specified in §620.7 of this chapter, it is unlawful for any person owning or operating a vessel issued a permit under §625.4 to do any of the following:

* * * * *

(3) Fish seaward of the line specified in §625.24(a)(1)(i) without possessing a permit required in§625.4(m).

(4) Fish landward of the line specified in §625.24(a)(1)(i) while possessing a permit required in§625.4(m).

4. Section 625.24 is amended to read as follows:

§625.24 Gear restrictions.

(a) Owners or operators of otter trawl vessels using 5.5" minimum mesh diamond mesh (6" minimum mesh square mesh), inside measure, applied throughout the cod end for at least 75 continuous meshes forward of the terminus of the net may retain more than 500 lbs of summer flounder subject to the following exceptions:

(1) Vessel owners or operators issued a mesh exemption permit under §652.24(m) and fishing exclusively seaward of the line specified as follows:

(i) The line follows 71°30' west longitude south to its intersection with Loran C 8860-Y-43750, thence northeasterly along Loran C 8860-Y-43750 to 41°00.0'N, 70°49.5'W, thence easterly to 41°00.0'N, 70°30.0'W, thence southerly to 40°50.0'N, 70°30.0'W, thence easterly to 40°50.0'N, 69°40.0'W, thence southerly to 40°33.5'N, 69°40.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°26.5'N, 70°40.0'W, thence northerly to 40°40.5'N, 70°40.0'W, thence southwesterly along Loran C 9960-Y-43600 to 40°30.0'N, 72°00.0'W, thence southerly to 40°17.8'N, 72°00.0'W, thence southwesterly along Loran C 9960-Y-43500 to 40°15.5'N, 72°20.0'W, thence southerly along 72°20.0'W, to the southern limit of the management unit.

(2) Vessel owners or operators of fishing vessels catching less than 50 pounds of summer flounder per tow using a two seam otter trawl fly net with the following configuration:

(i) The net has large mesh webbing in the wings with a stretch mesh measure of 8" to 64".

(ii) The first body (belly) section of the net consists of 35 meshes or more of 8" (stretch mesh) webbing or greater.

(iii) In the body section of the net the stretch mesh decreases in size relative to the wings and continues to decrease throughout the extensions to the cod end, which generally has a webbing of 2" (stretch mesh).

(A) If the Regional Director determines after a review of annual data that the summer flounder catch in the fly net fishery exceeds 1%, he may rescind the exemption.

(b) Otter trawl vessels retaining more than 500 lbs of summer flounder and subject to the 5.5" minimum mesh (diamond mesh) or 6" minimum mesh (square mesh) regulation may not have available for immediate use any net, or any piece of net not meeting the mesh size requirements, or mesh that is choked off. A net that conforms to one of the four following specifications and which cannot be shown to have been in recent use is deemed "not available for immediate use":

(1) nets stowed below deck; or

(2) nets stowed and lashed down on deck; or

(3) nets which are on reels and are covered and secured with the cod end removed; or

(4) nets which are secured in a manner approved by the Regional Director. After review and approval, the Regional Director may specify alternative manner(s) of securing nets by notice in the Federal Register.

(i) A net is considered to be stowed below deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck of the vessel. Towing wires (any wires including the "leg" wires), must be detached from the net.

(ii) A net is considered to be stowed and lashed down on deck if it is fan folded (flaked) and bound around its circumference and securely fastened to the deck or the rail of the vessel. The towing wires (any wires including the "leg" wires), must also be detached from the net.

(iii) A net on a reel is considered to be "stowed and lashed down on deck" only if the entire surface of the net on the reel is covered with canvas or similar material which is securely bound, the towing wires (any wires including the "leg" wires), must also be detached from the net, and the cod end is removed from the net and stored below deck.

(c) A fishing vessel may not use any means or device which would obstruct the meshes on the top of the regulated portion of a trawl net, except that one net strengthener may be attached (only at its outside edges) to the top of the regulated portion of a trawl net, if such net strengthener consists of mesh material similar to the material of the regulated portion of the net and has a mesh size of at least twice the authorized minimum mesh size. "Top of the regulated portion of the net" means the 50% of the entire regulated portion of the net which (in a hypothetical situation) would not be in contact with the ocean bottom during a tow if the regulated portion of the net were laid flat on the ocean floor.

(d) If the fish are landed in a State that has a larger minimum net mesh size, the State limit would prevail.

(e) *Mesh measurements.* Mesh sizes are measured by a wedge-shaped gauge having a taper of two centimeters in eight centimeters and a thickness of 2.3 millimeters, inserted into the meshes under a pressure or pull of five kilograms. The mesh size will be the average of the measurements of any series of 20 consecutive meshes. The mesh in the regulated portion of the net will be measured at least five meshes away from the lacings, running parallel to the long axis of the net.

APPENDIX 8. ABBREVIATIONS AND DEFINITIONS OF TERMS

Act (MFCMA) - the Magnuson Fishery Conservation and Management Act of 1976, as amended, 16 USC 1801 et seq.

adjusted dollars - dollars standardized to a base year based on the Consumer Price Index.

Allowable Biological Catch (ABC) - the maximum allowable catch for a particular fishing year developed by reducing the maximum OY as necessary based on stock assessments.

ASMFC - Atlantic States Marine Fisheries Committion.

black sea bass - the species *Centropristis striata*.

CFR - Code of Federal Regulations.

Council (MAFMC) - the Mid-Atlantic Fishery Management Council.

CPI - Consumer Price Index; a comparitive ratio of a certain group of goods across time.

CPUE - catch per unit of effort.

Domestic Annual Harvest (DAH) - the capacity of US fishermen, both commercial and recreational, to harvest and their intent to use that capacity.

Domestic Annual Processing (DAP) - the capacity of US processors to process, including freezing, and their intent to use that capacity.

Exclusive Economic Zone (EEZ) - the zone contiguous to the territorial sea of the US, the inner boundary of which is a line coterminous with the seaward boundary of each of the coastal States and the outer boundary of which is a line drawn in such a manner that each point on it is 200 nautical miles from the baseline from which the territorial sea is measured.

Fishing mortality rate - the part of the total mortality rate (which also includes natural mortality) applying to a fish population that is caused by man's harvesting. Fishing mortality is usually expressed as an instantaneous rate (F), and can range from 0 for no fishing to very high values such as 1.5 or 2.0. The corresponding annual fishing mortality rate (A) is easily computed but not frequently used. Values of A that would correspond to the F values of 1.5 and 2.0 would be 78% and 86%, meaning that there would be only 22% and 14% of the fish alive (without any natural mortality) at the end of the year that were alive at the beginning of the year. Fishing mortality rates are estimated using a variety of techniques, depending on the available data for a species or stock.

Fly net - a trawl net using doors similar to an otter trawl, but rigged to fish about ten feet off bottom and taper from 16-64" mesh in the wings to 2" in the cod end.

$F_{0.1}$ - a calculated instantaneous fishing level that is defined as a fishing mortality rate less than F_{max} that reflects the diminishing returns in terms of yield per recruited fish from increasing fishing mortality.

F_{max} - a calculated instantaneous fishing mortality rate that is defined as "the rate of fishing mortality for a given method of fishing that maximizes the harvest in weight taken from a single year class of fish over its entire lifespan".

F_{rep} is the fishing mortality rate that results in a year class replacing the spawning biomass of its parents on average.

FMP - fishery management plan.

FR - Federal Register.

GIFA - Governing International Fishery Agreement.

GRT - gross registered ton.

ICNAF - International Commission for the Northwest Atlantic Fisheries (replaced by NAFO).

ICES gauge - International Council for the Exploration of the Seas (ICES) longitudinal mesh gauge set a 4 kg presure; as used in mesh selectivity studies.

internal waters - marine waters landward of the territorial sea.

L_{50} - length at which 50% of the fish are mature.

M - natural mortality; instantaneous rate of death attributable to all causes except fishing.

MSY - maximum sustainable yield. The largest average catch of yield that can continuously be taken from a stock under existing environmental conditions, while maintaining the stock size.

MRFSS - Marine Recreational Fishery Statistics Surveys, 1979 - 1988.

NAFO - Northwest Atlantic Fisheries Organization.

natural mortality - deaths from all causes except fishing, including predation, senility, epidemics, pollution, etc.

NEFC - the Northeast Fisheries Center of the NMFS.

NMFS - the National Marine Fisheries Service of NOAA.

NOAA - the National Oceanic and Atmospheric Administration of the US Dept. of Commerce.

OY - Optimum Yield.

Regional Director (RD) - the Regional Director, Northeast Region, NMFS.

recruitment - the addition of fish to the fishable population due to migration or to growth. Recruits are usually fish from one year class that have just grown large enough to be retained by the fishing gear.

SA - Subarea or Statistical Area.

scup - the species *Stenotomus chrysops*.

SSC - the Scientific and Statistical Committee of the Council.

Secretary - the Secretary of Commerce, or his designee.

serial spawners - species which have egg batches that are continuously matured and shed during a protracted spawning season.

Spawning stock biomass per recruit (SSB/R) - measures the average or expected contribution of any one young fish to the spawning stock biomass over it lifetime. A useful reference point is the level of SSB/R that would be obtained if there were no fishing. This is a maximum value for SSB/R which can be compared to levels of SSB/R calculated for different fishing levels.

state waters - internal waters and the Territorial Sea.

stock assessment - the NMFS yearly biological assessment of the status of the resources. This analysis provides the official estimates of stock size, spawning stock size, fishing mortalities, recruitment, and other parameters used in this Plan. The data from these assessments shall constitute the "best scientific information currently available" as required by the Act.

summer flounder - the species *Paralichthys dentatus*.

Territorial Sea - marine waters from the shoreline to 3 miles seaward.

TL - total length.

Total Allowable Level of Foreign Fishing (TALFF) - that portion of the Optimum Yield made available for foreign fishing.

USDC - US Department of Commerce.

year-class - the fish spawned or hatched in a given year.

Yield per recruit - the theoretical yield that would be obtained from a group of fish of one age if they were harvested according to a certain exploitation pattern over the life span of the fish. From this type of analysis, certain critical fishing mortality rates are estimated that are used as biological reference points for management, such as F_{max} and $F_{0.1}$.

Z - instantaneous rate of total mortality; the ratio of numbers of deaths per unit of time to population abundance during that time.