INTERIM FISHERY MANAGEMENT PLAN FOR

ATLANTIC GROUNDFISH

New England Fishery Management Council
Suntaug Office Park, 5 Broadway
Saugus, Massachusetts 01906

September 30, 1981

INTERIM GROUNDFISH PLAN

SUMMARY

Management Unit: All cod, haddock and yellowtail flounder in the Northwest Atlantic within the jurisdiction of the United States. For Plan purposes, the unit includes fish within the territorial sea; and States are encouraged to adopt complementary measures.

OY AND CONSERVATION MEASURES

Optimum Yield: The amount of fish actually harvested by U.S. fishermen in accordance with the measures listed below. TALFF and JVP = 0.

Mesh Size/Large Mesh Area: A large-mesh area is defined which includes shoreward portions of the Gulf of Maine west of Penobscot Bay, and Georges Bank. This encompasses the area where historic data indicate that about 90% of the commercial catch of cod, haddock and yellowtail flounder takes place. Within this area, all vessels using otter trawls, pair trawls, beam trawls, Scottish seines and mid-water trawls must use cod ends measuring at least 5 1/8" during the first year under the Plan, and 5 1/2" after that. The Regional Director may expand the types of gear subject to this regulation, if he finds that other types of gear are taking significant amounts of groundfish.

Optional Settlement: As an exception to the area/mesh program, vessels may declare for small mesh species. While in the program, a vessel's total catch of cod, haddock and yellowtail may not exceed 15%; and at least 50% of its catch must be comprised of species on a list maintained by the Regional Director. The list will initially include silver hake, red hake, squid, herring, mackerel, northern shrimp and dogfish; but the Regional Director may add species to the list, if he finds that small-mesh gear is necessary for that species and that it will not result in significant harvest of cod, haddock or yellowtail. The percentages are not applied on a trip-by-trip basis, but rather over the entire period.

Minimum Length: Seventeen inches for cod and haddock caught commercially; 15" for cod and haddock caught recreationally; 11" for yellowtail flounder.

Spawning Area Closures: Traditional haddock spawning area closures are maintained, with slight modification to Area I.

Permits and Enforcement: Permits are required on a no-fee basis. Requirements for enforcement assistance are continued unchanged.

Data Collection: The Plan adopts the voluntary collection provisions of the 3-tier system, but requires that vessel identifiers (where provided) be maintained, though masked.

Measures Not Included: The Plan does not include trip limits, a "braking" or "fail-safe" mechanism, trip limits, nursery area closures, or independent cod spawning closures.

STATUS OF THE RESOURCE

Cod: The recent data for the Georges Bank resource is unclear, but the last four year classes are, overall, of average strength. Fishing mortality is high, however, and may be approaching the intensive levels of 1964-1970. In the Gulf of Maine, although fishing mortality has been in excess of F_{max} for three years, abundance indices remain relatively high. The last four years have seen two strong and two average year classes.

Haddock: On Georges Bank, the large 1978 year class is the principal spawning stock component; although, the apparently average-sized 1980 year class will begin to recruit in 1982. Overall, stock size is midway between the long-term historical average (1935-1960) and the very low levels of the early 1970's. The Gulf of Maine stock is composed largely of average-sized 1976 and 1978 year classes, but the 1980 year class may approach the strength of the strong 1975 year class.

Yellowtail Flounder: In Southern New England, surveys indicate relatively low abundance and high fishing mortality. The situation is similar for the Mid-Atlantic, and these fisheries could become dependent almost completely on incoming recruitment. Abundance indices for Georges Bank are higher, suggesting an improvement in the condition of that resource component. However, the Georges Bank resource is still highly dependent on annual recruitment. The Cape Cod and Gulf of Maine resource areas have shown a moderate increase in abundance over the last decade and remain stable.

PROBLEMS AND OBJECTIVES

Truly effective groundfish management should address the individual needs of a large number of interrelated stocks and a wide array of fishing practices. Thus, the major species of the overall groundfish complex, about ten species in all, must be managed over the long term in close coordination. Although the New England Council has recognized this management need since it first addressed groundfish, its original management program, as an initial step, only addressed the three species which were particularly vulnerable to fishing pressure. This initial program has not worked well, primarily because it used single-species strategies in a multi-species context. In fact, it has worked so poorly that the management process has become preoccupied with short-term problems, rather than getting on with devising an acceptable long-term program for the management of the Atlantic groundfish complex. It is, therefore, necessary to get out from under the current unworkable and ineffective management program in order to address long-term concerns through what has come to be called the ADF (Atlantic Demersal Finfish) Plan.

The Interim Plan, therefore, adopts only limited biological objectives on the theory that the resources have improved to a point where they can sustain relaxed management while a long-term, comprehensive program is being devised and implemented. The Plan has no specific economic goals. One objective, however, is to improve the quality of fisheries data to assist in preparation of the ADF Plan.

The objectives of the Interim Plan are to:

1. Enhance spawning activities

2. Reduce the risk of recruitment overfishing of cod, haddock and yellowtail flounder.

3. Acquire reliable data, in support of the development of ADF, on normal fishing patterns of the industry and the biological attributes of stocks as determined by commercial activities.

ALTERNATIVES

Strategy Alternatives: As strategies to achieve its objectives, the Plan considers effort control, catch control, control of fishing practices, and modification of the current plan. The Plan adopts controls on fishing practices as its strategy.

Alternative Supporting Measures:

Measure	Alternatives	Selection
Area	4 Options (See Figure 702.1)	Option 2 (Figure 702.1), is the best balance between protection to cod, haddock and yellowtail with least affect on other species fisheries.
Spawning Area	3 Options (No change, slight change, addition of areas potentially addressing cod.)	Slight modification of current area.
Mesh	4 3/4"; 5 1/8"; 5 1/2"; 6" (synthetic)	5 1/8 for first year, 5 1/2 after that.
Size		Cod and Haddock - 17" Commercial; 15" Recreational. Yellowtail - 11".

IMPACTS

Although it is difficult to assess with specificity the likely harvests under a program such as this, the Council's analysis indicates that the aggregate catch of cod, haddock and yellowtail would likely increase to about 110,000 tons in 1982 and 115,000 tons in 1983. Under the principles and methodology that have been used in the past, the 1982 quota for the three-species aggregate would have been about 95,000 tons. These harvest levels are in excess of F_{max} for all three species and may result in some discernible stock reduction. However, long-term stock problems will be preceded by measurable indices of overfishing such as a continuing downward trend in spawning stock size and annual recruitment, increased variability in annual recruitment, a succession of poor year classes and fewer year classes contributing to the spawning stock. These stocks are currently strong enough to allow for increased fishing mortality for an interim period while the ADF Plan is prepared and implemented. While preparing the ADF Plan, the Councils and the Secretary will continually monitor the condition of the resource and will address resource problems as they arise.

INTERIM FISHERY MANAGEMENT PLAN FOR

ATLANTIC GROUNDFISH

SUMMARY TABLE OF CONTENTS

DETAILED TABLE OF CONTENTS

Page

Page

§101 Overview

This fishery management plan, the Interim Fishery Management Plan for Atlantic Groundfish (Interim Plan), has been prepared under and in conformance with the Magnuson Fishery Conservation and Management Act (FCMA, or, Magnuson Act) and other applicable law. It has been prepared by the New England Fishery Management Council (the Council), in consultation with the Mid-Atlantic Fishery Management Council. The plan provides for the management of the Atlantic cod, haddock and yellowtail flounder fisheries while a long-term, comprehensive management program for a broader range of demersal finfishes, as utilized by the multi-species trawl fishery, is prepared. The Plan basically moves away from quota management and provides for relaxed regulation of the cod, haddock and yellowtail flounder fisheries by the use of more effective mesh size regulations, minimum fish size, spawning area closures and data collection.

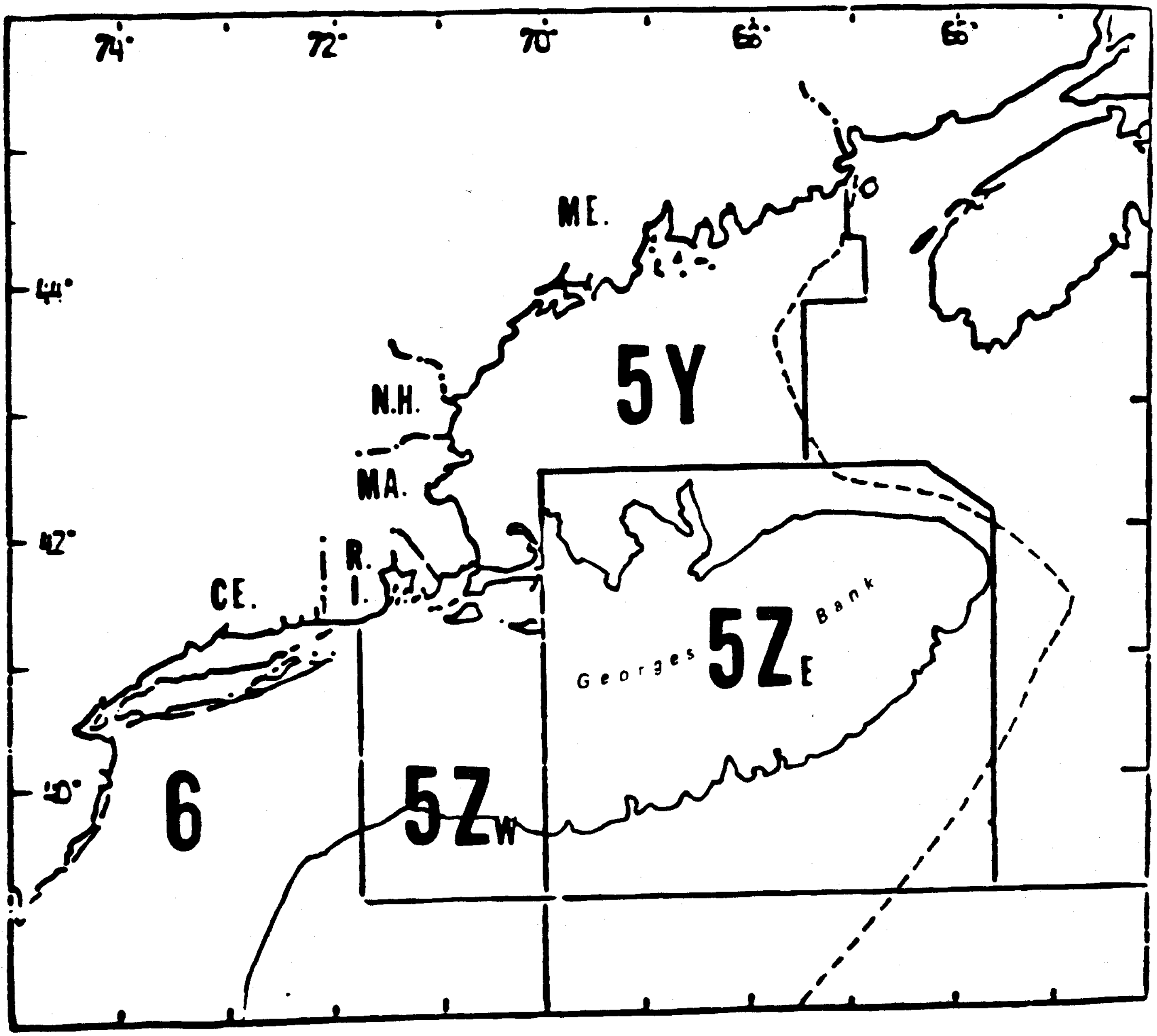
Development and preparation of this Plan has taken two years. During that time, the Council's Groundfish Oversight Committee has met nineteen times, almost always with members of its Advisory Panel. The Plan has been the subject of two sets of public hearings, one in the summer of 1980 and another in the summer of 1981. After extensive and careful consideration, extended debate and much opportunity for public input, this Interim Plan was adopted by the Council at it's regular monthly meeting in September, 1981, in Portland, Maine.

The descriptive and analytical material in this Plan has been compiled from a number of sources, and in many cases is a distillation of more extensive documents. Detailed discussions of many of these references are contained in "Resource Document for the Interim Groundfish Plan", which is available at the Council's office during regular business hours. Figure 101.1 shows the principal areas covered by this Plan.

The Atlantic groundfish fishery is one of the oldest and most valuable in the United States, dating back to the earliest days of settlement of the continent. A large number of species comprise the groundfish complex, although less than ten account for the vast majority of groundfish landings. Prior to 1960 this was essentially a domestic fishery, shared only with Canadian fishermen. However, in the early 1960's, distant water fleets began intensively harvesting the groundfish resources of Georges Bank. There can be little doubt that greatly increased levels of fishing effort by foreign vessels through the early 1970's resulted in a significant reduction in groundfish stock abundances, productivity and yield.

By the early 1970's, the Atlantic groundfish stocks, particularly on Georges Bank, were in serious difficulty. A management program was implemented under the aegis of the International Commission for the Northwest Atlantic Fisheries (ICNAF), but resource abundance remained low. The resulting hardships in the domestic fishing industry were one of the major

Figure 101.1: Overview of management areas established under the International Convention for the Northwest Atlantic Fisheries (ICNAF), and continued under the Northwest Atlantic Fisheries Organization. In this document, "Gulf of Maine" generally refers to Area 5Y; "Georges Bank and South" generally refers to Areas, 5Ze, 5Zw and 6; and "Southern New England" generally refers to Area 5Zw.



----- Approximate U.S. Fishery Conservation Zone Boundary factors leading to the passage and implementation of the Fishery Conservation and Management Act of 1976, P.L. 94-265. In February, 1977, the Council, with assistance from NMFS, prepared and submitted to the Secretary of Commerce (the Secretary) the Fishery Management Plan for Atlantic Groundfish. This plan provided for management of only the Atlantic cod, haddock and yellowtail flounder species of the overall groundfish complex, since these were most in need of management from the standpoint of biological condition and likely intensity of harvest. However, it was recognized from the outset that broader issues of groundfish management, including other species to be included in the management unit, needed to be addressed.

From the beginning management under the Groundfish Plan was unsatisfactory. The Council was increasingly faced with the need to make short-term adjustments to the management program. Gradually, trip limits, quarterly quota guidelines and vessel class allocations were added to the program in order to fine tune the control of fishing effort. The management program continued to operate poorly, since these changes were developed in a piecemeal manner to address problems as they arose, rather than deal with the overall nature of a highly complex and variable fishery. Newer and larger vessels entered the fishery, and recruitment to the stocks improved from levels of the late 1960's and early 1970's, more rapidly than the management system could keep up with. The problem of tailoring this program were complicated by a lack of specified objectives to give direction.

While attempting to deal with these problems, the Council had also acknowledged the need for preparing a more comprehensive groundfish management regime. The original groundfish plan attempted to manage a multi-species fishery with single-species approaches. The ADF Plan will treat the entire resource complex as it is harvested by the industry. During 1979, however, the Council came to the conclusion that the management environment was unsatisfactory for making effective long-term decisions regarding the comprehensive management of the Atlantic groundfish complex.

This plan, therefore, represents a short-term management program designed to free fisheries decision makers from the need to constantly address the problem of the current management program so that they may address long-term management issues. A variety of management issues and problems relating to the biology and economics of this fishery must be addressed as soon as possible. Implementation of this Interim Plan is necessary for that to happen most effectively. Although there is an element of risk to the resources from relaxed management, the resources are currently strong enough to withstand reasonably expected fishing mortality while the ADF Plan is being prepared.

§102 The Fishery Management Unit

The fishery management unit for this plan is composed of Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and yellowtail flounder (*Limanda ferruginea*) as they are found within the territorial sea and fishery conservation zone of the United States. The policies, recommendations and measures contained in this plan are applicable to any activity which may result in the harvest of any of these species. This Plan considers these species, throughout their entire range, and not just within the FCZ. The various states are urged to apply complementary measures within State waters.

Cod, haddock and yellowtail flounder are broadly distributed bottom fishes. Within the fisheries jurisdiction of the United States, they inhabit the continental shelf off New England, and to a lesser extent, the Mid-Atlantic states. Their similarity of habits, vulnerability to fishing gear, and their suitability as human food make them attractive to the commercial and recreational groundfish fisheries. They are marketed in the same network and can be considered as components of one fishery. The very high relative values of these species maintain the likelihood that they will continue to be the principal targets of fishing activities in the mixed trawl fishery in the near future. The fishery management unit, therefore, is not changed from that which is in the current fishery management plan.

PART 2: DESCRIPTION OF THE RESOURCE

SUBPART A: DESCRIPTION OF STOCKS

§201 Species and their Distribution

Atlantic cod (*Gadus morhua*), the haddock (*Melanogrammus aeglefinus*), and yellowtail flounder (*Limanda ferruginea*), are demersal species which inhabit the continental shelf off the Northwest Atlantic Coast, as well as other areas. Cod are heavy bodied North Atlantic fish that range widely across the continental shelf from the shoreline to the shelf edge. The maximum length for cod is about 183 cm (72 inches). Maximum age is in excess of 20 years, although commercially caught cod are generally from 2-15 years old. In New England waters cod concentrate over hard bottom and in areas where food is most plentiful at depths between 5 and 75 fathoms. The most productive fishing grounds are found on the eastern part of Georges Bank, the South Channel Region from Cultivator Shoals to Cape Cod, and on the smaller banks and ledges around the western periphery of the Gulf of Maine. Cod apparently do not migrate extensively in New England waters, although they do exhibit a seasonal pattern of movement into shoaler water in the spring, and retreat to deeper, but warmer, waters in the winter. In the southern part of their range cod migrate from summer grounds off southern New England to wintering grounds off the coast of New Jersey.

The haddock is a smaller member of the cod family which attains a maximum length of 112 cm (44 inches) and a maximum age of approximately 18 years. Haddock live at depths typically deeper than cod, but less than 50 fathoms. They are less widely distributed than cod, but exhibit concentrated abundance in some areas. They are most abundant on the eastern part of Georges Bank, in 27-87 fathoms, but also occur in commercial concentrations from the South Channel to eastern Nantucket Shoals and in southwestern Gulf of Maine. Haddock are not found significantly in Mid-Atlantic areas. Most haddock migrations are of short duration; and are primarily seasonal adjustments of depth distribution associated with spawning, feeding and temperature conditions. The most extensive seasonal migration of haddock appears to be a movement from wintering areas in the southwestern Gulf of Maine to summer grounds along the Maine coast east of Mt. Desert.

The yellowtail flounder is a medium sized, small-mouthed flounder belonging to a family of flatfishes (*Pleuronectidae*) that are "right-eyed", that is, the eyes and the viscera are on the right side as the fish lies on the bottom. It is a demersal species that prefers sandy mud bottoms and occurs abundantly in fairly distinct geographic areas. Concentrations of yellowtail flounder are found in three areas which support the heaviest yellowtail fishing: the southern New England ground, extending from the South Channel to Long Island and as far south as New Jersey in waters of 14 to 30 fathoms; the southeast part of Georges Bank in depths of 25 to 41 fathoms; and along the outer edge of Cape Cod to Massachusetts Bay in 5 to 36 fathoms. Lesser concentrations are found along the western periphery of the Gulf of Maine. Yellowtail are not migratory, although some seasonal shifting of the Southern New England and the Georges Bank stock does occur. The Cape Cod stock does not seem to be seasonally migratory, but there may be a northward dispersal of yellowtail along the western Gulf of Maine.

§202 Ecological Relationships

Four important environmental factors which influence the distribution of cod, haddock and yellowtail flounder are: temperature, light intensity, food availability and bottom conditions. Temperature is a primary factor that influences the distribution of groundfish species; it determines, either directly or indirectly, their range and seasonal distribution patterns. Diurnal vertical migrations are common for cod, and to a lesser degree for haddock and yellowtail. Food and bottom conditions affect the spatial distribution of groundfish. Aggregations of haddock, and occasionally cod, are associated with the distribution of the macroinvertebrate fauna. Yellowtail have a strong preference for sand and sandy mud bottoms.

Adult cod are primarily active, piscivorous predators, a habit they share with silver hake and pollock. Haddock consume primarily sedentary or slow moving benthic or epibenthic invertebrates. The yellowtail is, like haddock, characteristically a consumer of benthic and epibenthic invertebrates.

Competition between groundfish species inhabiting the same waters may affect the productivity and availability of these species, but these relationships are difficult to discern and evaluate. The potential for interspecies competition can be determined by the degree to which their diets overlap and the extent to which their distributions coincide.

§203 Historic Fluctuations

Cod. Cod has a long history of commercial harvest and has generally exhibited smaller population fluctuations than some of the other commercial species. The commercial fishery for cod expanded considerably in the latter part of the 1960's due to intense fishing pressure by Russian, Canadian, and Spanish vessels. The population declined as a result of this heavy exploitation, patricularly in the more southerly areas of its range during the winter. In the late 1970's, with the reduction of foreign fishing and the entry of a strong 1975 year class, the cod stocks began to rebuild. Catches, now made primarily by the U.S. commercial fishery, began to increase. The strong 1975 year class remained a significant portion of the commercial harvest through 1979.

Haddock. The haddock population on Georges Bank appears to have been quite stable from 1930 to the early 1960's; although year class strengths varied considerably (a ratio of 20 to 1, including the exceptionally large 1963 year class). Haddock in the Gulf of Maine generally followed the same trends as those on Georges Bank. An average of 50,000 metric tons was harvested annually throughout this period. The stock collapsed during the late 1960's as a result of a succession of poor year classes coincident with extremely heavy removals by the foreign fleets. The spawning stock was reduced to roughly one-tenth of prior levels during the late 1960's and early 1970's. The population remained at low levels with a series of poor year classes recruiting to the fishery through the early 1970's. An extremely strong 1975 year class recruited to the fishery in 1977 and greatly increased the harvestable stock. A strong 1978 year class, though not as strong as 1975, recruited to the fishery in 1980.

Yellowtail Flounder. The yellowtail flounder stocks have fluctuated somewhat since the fishery first peaked in the early 1940s. The catch declined during the 1950's. There was a significant foreign catch during the later 1960's and early 1970's particularly in 1969. The Cape Cod stock exhibited the greatest stability of the three stocks and has maintained steady harvest levels. The Georges Bank and Southern New England stocks appear to have fluctuated more and, during the early 1970's reached a historic low in abundance.

§204 Present Condition

The condition of the cod, haddock and yellowtail flounder stocks are given in Serchuk and Wood (1981), Clark, Mayo and Lavik (1981) and Clark, O'Brien and Mayo (1981). These represent the most recent assessments of the groundfish stocks. The primary source of data was indices of abundance from research vessel survey catches.

Cod - Georges Bank and South. Recent resource surveys show a consistent pattern in relative year class strengths. The 1975 year class, which has sustained the fishery in recent years, has been replaced as the dominant year class by the 1977, which is of average strength. The 1978 year class is above average, but not as strong as the 1975, while the 1979 is poor in strength. Preliminary estimates of the 1980 year class indicate that it is of average strength. The spring and fall, 1980, surveys are inconsistent in estimating 1980 abundance. The current assessment indicates that the Georges Bank and South cod stock biomass may have declined from the relatively high levels observed in 1978 and 1979, but definitive conclusions will have to wait until subsequent survey data are available.

Conflicting abundance indices for Georges Bank cod stocks from the most recent research surveys leave the assessment of stock biomass in some doubt. However, relative exploitation rates on Georges Bank cod have increased since 1978 and are now within the range of the 1964-1970 period of high fishing levels. This implies that, if current catch levels continue, discernible stock size reductions could be observed on Georges Bank, unless there is above-average recruitment.

Cod - Gulf of Maine. The results of offshore and inshore resource surveys in the Gulf of Maine have shown relatively high abundance indices of cod in the Gulf of Maine since 1977. Except for the 1980 summer offshore data, all of the 1980 survey indices reflect a high Gulf of Maine stock size. The age distribution of Gulf of Maine cod from the 1980 survey indicates that the 1978 and 1979 year classes may be the strongest ones since the 1973 year class, and that the 1977 and 1980 year classes are of at least average strength. The results of the present assessment indicate that the Gulf of Maine cod stock biomass has continued to remain at the relatively high levels noted during 1977-1979.

In the Gulf of Maine, increases in harvestable biomass should continue in 1981 and 1982. If fishing mortality levels (as indicated by relative exploitation rates) remain as low as they have in the past few years, the stock biomass of cod should remain at relatively high levels for the next few years.

Haddock - Georges Bank and Gulf of Maine. As a result of the recruitment of the strong 1975 and 1978 year classes, the Georges Bank and Gulf of Maine haddock stocks have increased markedly from the historically low levels prior to 1977. Four sets of data from 1977-1980 indicate that the haddock stock is substantially larger than it was in the late 1960's and early 1970's.

The haddock stock on Georges Bank is now primarily dependent on the 1978 year class. The 1976, 1977, and 1979 year classes appear to be very weak. Preliminary evidence suggests that the 1980 year class is of at least average size. The 1981 stock biomass is estimated to be about midway between the long-term (1935-1960) average and the very low levels observed in the early 1970's.

The haddock stock in the Gulf of Maine is composed largely of average-sized 1976 and 1978 year classes. Although recent research vessel survey data indicate that haddock biomass levels in the Gulf of Maine declined in 1980 and 1981, the 1980 autumn survey indicated that the abundance of 0 age haddock (1980 year class) was highest since 1963.

Yellowtail - Southern New England and Mid-Atlantic. Research survey data indicate a pronounced decline in abundance between the late 1960's and mid 1970's, which has leveled off since then. Currently there is some disparity between the recent Spring and Fall 1980 research surveys regarding prospects for future recruitment. The NMFS survey indicated that abundances of age 1 and 2 fish have been substantially lower during 1977-1980 than in former years, although the 1976 and 1977 year classes appeared somewhat stronger than other recent year classes. However, a special cooperative survey using commercial vessels in Southern New England indicates that overall stock abundance may be significantly higher than suggested by the NMFS research survey indices. Nonetheless, both surveys indicate that relatively low abundance continues, and that recent fishing mortality levels have been high. The Southern New England yellowtail fishery could become dependent almost completely on incoming recruitment. The situation in the Mid-Atlantic appears comparable to that observed for Southern New England.

Yellowtail - Georges Bank. In contrast to the situation in Southern New England, 1980 survey abundance indices for Georges Bank have increased sharply over 1977-79 levels. Although recent year classes have been weaker than those that recruited in the late 1960's, the 1977 and 1978 year classes appear to be the strongest in recent years. There is a possiblity that recent apparent increases in abundance levels may be in part due to changes in distribution that make yellowtail relatively more vulnerable to capture.

Yellowtail - Cape Cod and Gulf of Maine. Survey indices for the Cape Cod yellowtail stock indicate relatively constant levels of abundance during 1978-1980 at approximately historic average levels. This stock seems to be more stable than those on Georges Bank or in Southern New England. The abundance in the Gulf of Maine appears to have increased in recent years.

SUBPART B: DESCRIPTION OF HABITAT

§211 Bathymetry

The continental shelf on the U.S. east coast is narrowest off Cape Hatteras, North Carolina, where the 100 fathom contour is only about 20 miles offshore. As one travels northward, the shelf extends out considerably further with the 100 fathom contour located about 80 miles off Cape May, New Jersey, and about 100 miles off Cape Cod.

Between Cape Cod and Nova Scotia is the expansive Gulf of Maine, enclosed to the seaward by Brown's Bank and Georges Bank. The topography of the Gulf, scoured by glaciation, includes many deep basins and shallow banks and ledges. Water exchange with the Atlantic Ocean takes place primarily through the deep Northeast Channel region and the shallow Great South Channel.

Georges Bank is a large, relatively shallow bank located between the Great South Channel and the Northeast Channel. The shallowness of the water makes it a rich fishing ground.

§212 Sediments

From Cape Hatteras north to Cape Cod, the bottom sediments of the shelf are mostly sand, with areas of mud and gravel. Gulf of Maine sediments vary considerably, from rocks to silt, gravel, and sand. Georges Bank is primarily sand, with pockets of gravel and sand-gravel, and large rocky areas on the Northeast peak.

§213 Hydrography

Nearshore surface circulation from Cape Cod to Cape Hatteras is generally southwesterly throughout the year. Further offshore, the Gulf Stream flows northeasterly. Shelf waters along the coast are strongly influenced by the extensive estuaries of the region, including Chesapeake Bay, Delaware Bay, Hudson River, Narragansett Bay, and the estuaries behind the barrier beach systems.

The Georges Bank plateau is largely responsible for the circulation patterns of water in the Gulf of Maine. On the Bank itself, currents result in well-mixed water. Surface circulation in the Gulf of Maine is basically counterclockwise. Slope water enters through the Northeast Channel and shelf water enters over the Scotian Shelf and Brown's Bank. Water flow continues to the Bay of Fundy. During the winter, a southerly flow exists along the western side of the Gulf, and streams out through the Great South Channel. Several eddies develop near the center of the Gulf at this time. In the spring, the Gulf of Maine eddy develops into a strong counterclockwise gyre, and then starts to break down in early summer. By late autumn the currents are weak, and water flows out over Georges Bank.

There is very slow (0.1 miles/day) movement of water, primarily shoreward, in the deeper parts of the Gulf. Pronounced upwelling of nutrient-laden bottom waters occurs, particularly in the eastern and northeastern edges of the Gulf, as a result of tidal forces and circulation patterns.

Surface water temperatures in shelf waters of the mid-Atlantic Bight vary from less than 3°C in February in the northern region to 27°C off Cape Hatteras in late summer. The annual temperature range of shelf waters may exceed 20°C. Water temperatures vary at different depths, especially in the summer. Salinity of the region is lowered by large estuarine fresh water inflow in the spring. Intrusion of offshore saline water eventually raises salinity to maximum again in the winter. Salinities in this area average 32 parts per thousand.

Frequent vertical mixing of waters at the eastern edge of the Gulf of Maine and Georges Bank minimizes vertical salinity and temperature gradients in those regions. The western part of the Gulf is stable in summer, resulting in warm temperatures and low salinities at the surface, and little vertical mixing. Water temperatures range from 2°C to 17°C at the surface of the Gulf and Georges Bank, while the cold deeper waters of the Gulf range from 4°C to 9°C. Surface temperatures decrease easterly and northeasterly across the Gulf in summer, while deep water temperatures and salinities generally increase easterly and northeasterly at all seasons. Average salinity is 32 parts per thousand.

§214 The Biotic Assemblage

Zoogeographically, the Gulf of Maine region is boreal, and the fauna is typically Acadian. South of Cape Cod to Cape Hatteras is warm temperate, and the fauna is Virginian. Although Cape Cod is the general dividing line, many species are found throughout the region from the Gulf of Maine to Cape Hatteras. Gulf of Maine fauna may include subtropical, tropical, temperate, and arctic immigrants at various times of the year.

The Plankton. The plankton are microscopic plants and animals that drift in the water column. The annual cycle of the plankton community is typical of the temperate zone. Nutrients are abundant in the winter but plankton abundance is low because productivity is suppressed by low levels of solar radiation and temperature. The level of solar radiation increases as spring approaches, and causes an intense phytoplankton bloom which is comprised primarily of diatoms. This level of productivity results in a decrease of inorganic nutrients, and as summer approaches, phytoplankton abundance begins declining.

Zooplankton feed predominantly on phytoplankton and fish larvae, but fish larvae commonly feed on copepods.

During summer, zooplankton reach maximum abundance, while the phytoplankton decline to near winter levels. Dinoflagellates and other forms, apparently more suited to warm, nutrient-poor waters, become abundant during summer. Bacteria in the sediment actively mineralize nutrients because of vertical temperature and salinity gradients, but nutrients may not be returned to the euphotic zone where they contribute to primary productivity. On Georges Bank and the eastern and northeastern edge of the Gulf of Maine, vertical mixing of the water column occurs during the summer, thereby recirculating nutrients and maintaining high plankton productivity. Water column stability may be affected by severe storms, and anomalies in temperature may disturb the timing between annual cycles of interacting species. In the autumn, decreasing water temperatures result in breaking down of the vertical temperature gradient, and nutrients are again circulated to the euphotic zone. Another phytoplankton bloom results, and lasts until low solar radiation levels inhibit photosyntheses. Phytoplankton and zooplankton levels then decline to the winter minimum, and nutrient levels increase to their winter maximum.

The Nekton. The nekton are animals that swim in the water column. They are predominantly fish, but also include other animals such as squid, whales and porpoises. The ability to swim allows nektonic organisms to migrate between locations or to maintain a specific breeding location with some consistency year after year.

The feeding habits of nekton vary by species, by the size of the individual, and probably by season and food availability. Adults of many commercially important species of the region feed on either fish or invertebrates, but small fish, including the young of some large species, often feed on plankton. Adults of some large species, such as various whales, basking sharks, and ocean sunfish, are plankton-eaters throughout life.

The Benthos. The benthos are animals that live on or within the bottom substrate. They are predominantly invertebrates, although strongly bottom-oriented fishes are considered benthic. Benthic organisms are extremely diversified, and include species from several phyla. They can be classified by size (meiobenthos, macrobenthos), by their location in the substrate (epifauna, infauna), by the type of bottom in which they live (sand, mud, gravel, rock, etc.), by feeding type (deposit feeders, suspension feeders, herbivores, carnivores), and by the type of community with which they are associated

§215 Habitats Of Concern

Groundfish are heavily dependent on the bottom for food and living space, and therefore the integrity of the benthic environment is of prime concern in areas where there is a high density of groundfish. This is particularly true of haddock and yellowtail. Both species are fairly specific in their habitat requirements, yellowtail to particular bottom substrates and haddock to areas of high food concentration. Areas that have been described as harboring concentrations of groundfish should be considered prime habitats, and any alteration or contamination of these environments should be minimized. Likewise, spawning areas, particularly of cod and haddock, should be considered sensitive habitats during the time that the fish are concentrating for spawning.

PART 3: DESCRIPTION OF THE FISHERY

SUBPART A: FISHERY ACTIVITIES

§301 History of Exploitation

Of the three regulated species, fishing for cod has the longest history. The fishery was conducted with handlines from the early 17th century through the late 19th century. Trawl lines and dory fishing were introduced to the fishery about 1850 and by 1879 the harvest had reached abount 41,700 metric tons. Annual landings during the first half of the 20th century were erratic, averaged about 15,000 metric tons per year, and exhibited a general declining trend through the 1950's.

Beginning around 1950 there were numerous technological advances in vessels and gear employed in the cod fishery by U.S. fishermen. A substantial number of distant-water foreign vessels also started fishing in the western North Atlantic during the 1960's. Domestic and foreign landings of cod from the Gulf of Maine and Georges Bank and South increased to more than 68,000 metric tons in 1966 and subsequently declined to about 45,000 metric tons annually from 1970 through 1979.

The haddock fishery began during the mid-1800's with most of the landings directed to the fresh fish market near the major New England ports. Annual landings prior to 1921 averaged about 31,000 metric tons; but subsequent improvements in refrigeration, markets and fishing methods increased the importance of this species. Domestic landings peaked in 1929 at over 131,000 metric tons.

The haddock fishery was fairly stable from 1935 to 1960, with average total landings of about 52,000 metric tons. Sharp increases in abundance in the early 1960's attracted substantially increased foreign and domestic fishing effort, which resulted in a brief period of very high landings. Total haddock catches peaked in 1965 at 154,725 metric tons and then rapidly declined. With sharply reduced stock abundance during the early 1970's, catches reached a low of only 5,100 metric tons in 1974.

Yellowtail flounder were relatively unexploited prior to 1935 but, concurrent with a decline in the abundance of winter flounder, the Southern New England yellowtail fishery developed rapidly. This fishery has exhibited two apparent cycles, with peaks in the 1940s and 1960s of about 35,000 metric tons, and low catches during the 1950's and 1970's of only about 2,000 - 3,000 metric tons. The Georges Bank fishery developed more slowly and large catches were not made prior to 1961. This fishery expanded rapidly during the 1960's, peaking at over 21,000 metric tons in 1970 and subsequently declining through the late 1970's. The catch from the Cape Cod grounds has been consistently low and fairly stable since 1935, at about 2,000 - 3,000 metric tons.

§302 Recent Commercial Domestic Catch

The recent commercial catch of cod, haddock and yellowtail flounder are provided in Table 302.1. The 1977 through 1980 reported landings data are believed to underestimate actual commercial catch, due to unreported catch and discards.

Table 302.1: Recent U.S. Commercial Catch (metric tons)3/

	Cod		Haddock		Yellowtail Flounder 2/		
Year	Georges Bank	Gulf of Maine	Georges 1/ Bank	Gulf of Maine	Georges Bank	GOM & Cape Cod	So. New Eng. and Mid-Atl.
1976	14,906	10,172	2,904	1,865	12,100	4,000	2,100
1977	21,138	12,426	7,934	3,296	9,700	3,700	3,500
1978	26,579	12,426	12,160	4,538	5,000	4,500	3,000
1979	32,639	11,679	14,275	4,622	6,100	5,000	6,600
1980	39,045	11,997	17,448	7,270	7,100	6,200	7,000

Source: NEFC Lab. Ref. Doc. #81-05, 81-06, and 81-10. Data qualifications are provided in these documents.

1/ICNAF 5Z-SA6.

2/Gulf of Maine and Mid-Atlantic yellowtail flounder landings were less than 1,000 MT in each of the years reported in this table.

3/Includes undertonnage vessels.

§303 Recreational Fisheries

There is substantial recreational fishing for cod and haddock from Maine to New York principally from private boats, party and charter boats, and, to a lesser extent, by shore-based anglers. (See Table 303.1) There is no significant recreational effort for yellowtail flounder though occasionally a few may be caught by anglers.

Table 303.1: Total Recreational Catch Estimates (metric tons)

Species	1960 1/	1965 1/	1970 1/	1974 2/	1979 3/
Cod	14,016	13,565	16,292	12,368	3,857
Haddock	767	9,702	1,147	NA	406 4/

1/ Salt Water Angling Surveys
2/ Northeastern Regional Survey of Recreational Fishing in Saltwater (1973-1974)
3/ 1979 Marine Recreational Fishery Statistics Survey. Catch estimates based on pre-1979 surveys must be viewed with caution because of acknowledged problems with sample design and recall bias which were incorporated in the methodology. Although the 1979 National Survey avoided many of the previous survey methodology problems subsequent survey data will be necessary to verify its reliability.
4/ Unpublished data from 1979 Survey found in NEFC Ref. Doc. 81-05

Data on the total recreational catch of cod and haddock in recent years are imcomplete and not directly comparable to data from past years due to varying estimation techniques. Data from the 1979 National Survey indicate that 96% of the total number of recreationally caught cod was from boats. Approximately 25% of the total number of cod caught was from party and charter boats. There is little published information on the substantial private boat recreational fisheries for cod and haddock.

About 507 commercial sportfishing vessels (headboats and charter boats) from Virginia to Maine were licensed to fish for cod and haddock in March of 1979. Ninety-two percent of these licensed vessels were located from New York to Maine. Commercial sportfishing vessels north and east of Montauk, New York, are likely to be dependent on cod and haddock during some portion or all of their operating season. The 1978 reported catch of commercial sportfishing boats was approximately 1101 metric tons of cod and 279 metric tons of haddock. The substantial decrease in the reported 1979 (cod 423 metric tons, haddock 61 metric tons) and 1980 (cod 669 metric tons, haddock 51 metric tons) catches by these vessels may be somewhat attributable to confusion in reporting requirements, which were changed in 1979.

§304 Foreign Harvest

Recent foreign harvests of cod, haddock and yellowtail flounder from the Gulf of Maine and Georges Bank and South areas are provided in Table 304.1.

Table 304.1: Recent Foreign Harvest (includes Canadian) (metric tons)

	Cod		Haddock		Yellowtail Flounder
Year	Gulf of Maine	Georges Bank and South	Gulf of Maine	Georges Bank and South	Georges Bank[1] and South
1976	16	5,020	91	1,420	200
1977	106	6,229	26	2,909	200
1978	384	8,904	641	10,179	100
1979	379	6,011	257	5,182	100
1980	138	6,636	157	9,520	100

Source: NEFC Lab. Ref. Docs. 81-05; 81-06; 81-10.

1/ Includes Mid-Atlantic

Foreign harvesting of cod in the Gulf of Maine was historically less than the U.S. harvest. With the arrival of the foreign fishing fleets on Georges Bank, the overall percentage of cod harvested by the domestic fleet decreased steadily from almost 100% in 1960 to a low of only 23% in 1966. After 1966, the U.S. share of the cod harvest began to increase again, reaching 75% in 1976. The percentage has remained about 75-76% since 1976, with the foreign catch being taken almost exclusively by Canadian fishermen fishing in disputed waters. In the earlier years the foreign catch on Georges Bank was shared primarily among the U.S.S.R., Spain and, to a lesser extent, Poland.

Historically, the U.S. shared the total commercial catch of haddock in the Gulf of Maine with Canada and, to a lesser extent, Spain. During the last 20 years the Canadian catch has fluctuated from less than .01% to 25% of the total catch in 1966. 1978 Canadian haddock landings in the Gulf of Maine were about 14% of the total.

The foreign catches of haddock from the Georges Bank area have been considerably greater than those from the Gulf of Maine. The increased fishing by foreign fleets on Georges Bank during the mid 1960's occurred at the same time as a dramatic reduction of the haddock stock. The U.S.S.R. and Canada were the principle foreign nations harvesting haddock during this period, with much smaller harvests by Spain, Poland and Romania. Since 1977, Canada is the only foreign country that has caught significant quantities of haddock on Georges Bank. In 1978 Canadians landed about 45% of the total harvest; but in 1979 their share declined to 25%.

In the 1960's the foreign share of the total yellowtail flounder catch increased from zero in 1962 to a maximum of 21,700 MT in 1969, or about 33% of the total yellowtail landings from the Georges Bank and South resource area. In Southern New England, foreign catches accounted for almost 50% of the harvest in 1969. The combined domestic and foreign catches for 1969 in this area were the highest since 1942; but total catches for the following years declined reaching a record low in 1976. Foreign catches declined to 100 tons or less for the 1974-76 period. On Georges Bank the reported foreign catches of yellowtails also peaked in 1969. But they accounted for less than 12% of the total landings that year, and dropped to 100 tons or less by 1975. There were never any reported foreign landings of yellowtails from the Cape Cod or Gulf of Maine grounds.

§305 Interaction Between Participants

There are three (3) major harvesting groups, with numerous subdivisions possible for each, sharing the cod, haddock and yellowtail flounder: mobile trawl gear fishermen; fixed gear fishermen; and recreational fishermen. Fisherman from each group often fish on the same grounds at the same time. Gear conflict problems can and do exist, particularly during peak fishing times and on popular fishing grounds.

In recent years there has been significant growth in the use of gillnets. Because gillnets obstruct the use of other commercial and recreational gear, numerous problems have developed between fishermen using gillnets on the one hand, and mobile gear and recreational fishermen on the other.

SUBPART B: ECONOMIC CHARACTERISTICS

§311 Overview

The Atlantic groundfish industry is comprised of fishermen, processors, wholesalers and retailers that harvest, process and distribute cod, haddock and yellowtail flounder as well as other groundfish species. This industry is diverse and complex with subsectors ranging from eastern Maine through the Mid-Atlantic states. New England is the center of the harvesting and processing sectors of the groundfish industry. Fresh fish are distributed through New England and the Mid-Atlantic. Frozen fish are distributed from New England to the entire United States, partially through New York, Philadelphia and Baltimore. Domestic landings of cod, haddock and yellowtail flounder cannot entirely meet the needs of processors. Many New England and Mid-Atlantic processors (90 to 100) rely to some extent on imports of fresh groundfish from Canada. Other large processing firms, with high capacity plants and national markets, rely on imported frozen blocks (primarily cod, pollock and haddock) from Canada and Europe.

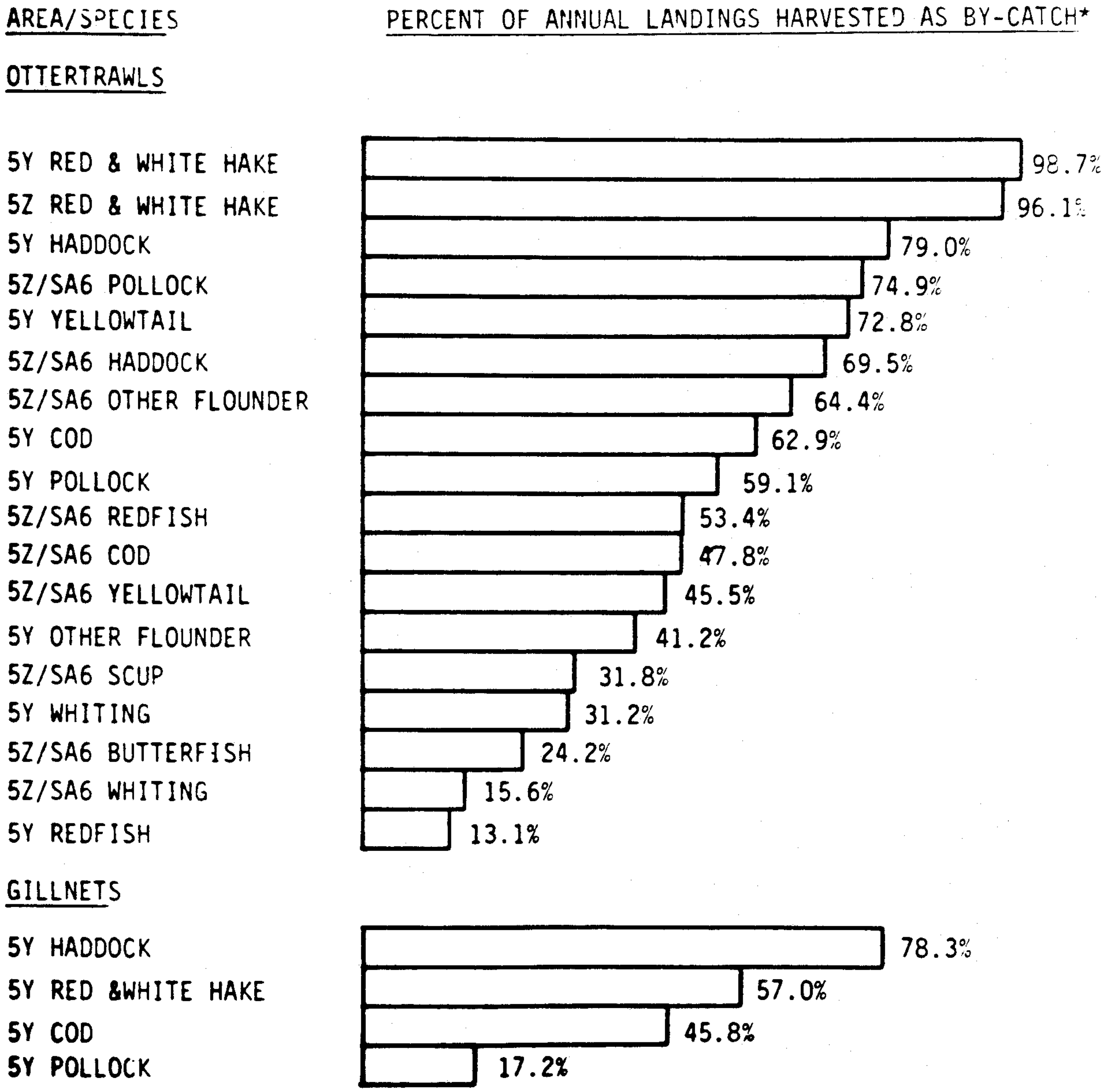
Supply and demand interactions are difficult to explain in the groundfish industry largely due to fluctuating supply. Economic interactions such as substitutability create rapidly changing conditions that often appear to happen at random.

§312 Multi-Species Fishery

Cod, haddock and yellowtail flounder belong to a group of economically interrelated species harvested in a mixed trawl fishery. The other most important species of this resource are: pollock (Pollachius virens); silver hake (Merluccius bilinearis); true hakes [principally (Urophycis chuss) and (U. tenuis)]; ocean perch, or redfish, (Sebastes marinus); summer flounder, or fluke, (Paralichthys dentatus); winter flounder (Pseudopleuronectes americanus); American plaice (Hippoglossoides platessoides); and witch flounder (Glyptocephalus cynoglossus).

Joint harvesting relationships (commonly referred to as bycatch relationships) exist because demersal finfish gear does not selectively harvest individual species. Cod and haddock, for example, are harvested together and thus are bycatches of one another. The extent of these relationships becomes clear with examination of the distribution of species in the catch. A large proportion of the total catch of many species is bycatch. (See Figure 312.1.) The mix of species varies greatly from trip to trip because of the unpredictable relative abundance of species in the areas being fished.

Figure 312.1: Proportion of Total Landings of Individual Groundfish Species Harvested as By-catch during 1978.



*Traditionally the term "by-catch" has applied to the harvesting of a species when the species accounts for 50 percent or less of an individual trip's catch. Using this criterion, for example, 69.5% of the total haddock catch from the Georges Bank area is caught as by-catch.

When a fisherman expects the price of one species to increase relative to that of another, he will shift his fishing effort, partially or entirely, in an attempt to harvest greater quantities of the more desirable species. Seasonal availability and abundance of individual species may lead to changes in effort as a means of improving the economic returns.

Substitution of species in the marketplace occurs as a result of price differences between groundfish species. Round-bodied finfish are generally substitutable for each other; and the same applies among flatfishes. Economic demand studies have shown that the price of cod is partially dependent on the price or landings of haddock.

§313 Harvesting Vessels and Gear

The number of vessels participating in the New England fishery for cod, haddock and yellowtail has increased substantially since 1976 (Table 313.1).

Table 313.1: Number of New England Vessels Landing Cod, Haddock and Yellowtail by GRT (All gear; 1976-80)

Year	5-60 GRT	61-125 GRT	125+ GRT	Total
1976	385	175	81	641
1977	395	190	99	684
1978	459	200	114	772
1979	566	232	198	996
1980	N.A.	N.A.	N.A.	N.A.
Percent Increase 1976-1979	47%	75%	144%	55%

From 1976 to 1979 the total number of vessels landing cod, haddock or yellowtail flounder increased by almost 55%. As indicated by Table 313.1, the greatest relative increase within the individual vessel classes has occurred in the 125+ GRT vessel class, which has more than doubled since 1976. From 1970 (569 vessels) to 1975 (606 vessels), a comparable 5-year period, the total number of vessels landing cod, haddock and yellowtail increased by only 6%.

The primary gear used to harvest groundfish is mobile net gear. (See Table 313.2). Mobile net gear, principally the otter trawl, accounted for approximately 80.0% of the catch of cod; 92.7% of the catch of haddock; and 98.4% of yellowtail in 1980. (See Table 313.3)

Table 313.2: Number1/ of New England Vessels by Size and Gear Type Landing Cod, Haddock or Yellowtail Flounder During 1980.

GRT	5Y		5Z-SA6	
	Mobile Gear	Fixed Gear	Mobile Gear	Fixed Gear
5-60	312	96	116	18
61-125	75	*	186	*
125+	52	*	232	*

1/ Number of vessels represents highest number of vessels landing in any quarter of 1980. The total number of individual vessels fishing during the year is probably greater since all vessels are not likely to participate during all four quarters.

* During the years 1970 through 1979 no more than 4 vessels greater than 60 GRT reported landings of groundfish using fixed gear. 1980 data on fixed gear vessels greater than 60 GRT is not available.

Table 313.3: Percent of 1980 Total New England Landings* in metric tons of Groundfish by Major Gear Types and Vessel Class

	MOBILE GEAR		FIXED GEAR	
	Total Landings by Vessel Class	Percent of Grand Total	Total Landings by Vessel Class	Percent of Grand Total
Cod:				
5-60	7155.9	13.9	2848.1	5.6
60-125	11729.5	22.8		
125+	22324.2	43.3		
TOTAL		80.0		
Haddock:				
5-60	1803.4	7.6	1237.9	5.2
60-125	6198.5	26.1		
125+	13977.5	59.0		
TOTAL		92.7		
Yellowtail:				
5-60	4848.4	29.1	15.3	0.1
61-125	6568.5	34.8		
125+	6496.1	34.5		
TOTAL		98.4		

*For cod, undertonnage vessels landed 14.5% of the grand total; haddock, 2.1%; and yellowtail flounder, 1.6%. Of the 14.5% cod landings by undertonnage vessels 70.5% were landings by fixed gear vessels from 5Z-SA6.

Other types of mobile gear include mid-water trawls and Scottish seines, the latter only recently introduced into New England groundfish fisheries.

The primary fixed gear currently used to harvest cod, haddock and yellowtail is the sink gillnet. In 1978 there were approximately 66 fixed gear vessels landing groundfish from the Gulf of Maine, and this number increased dramatically to 108 in 1979. During the second quarter of 1980, 96 fixed gear vessels landed groundfish from this area. Fixed gear in 1980 accounted for only 5.2% of the haddock landings. Other fixed gear which is used includes longline (tub or automated) and jigs.

§314 Landings, Prices, Revenues and Costs

Landings of cod, haddock and yellowtail flounder have generally increased since 1976. Table 314.1 gives the New England landings of the three species by area and vessel class for 1976 to 1980. Undertonnage vessel landings (under 5 tons) are excluded because data is inadequate. The landings of all three species were highest in 1980. Landings of haddock from the Gulf of Maine and Georges Bank and of cod from Georges Bank and South increased substantially (247%, 508%, and 166% respectively) from 1976 to 1980. With the exception of yellowtail from Georges Bank and South, the landings showed a fairly consistent increase each year. Yellowtail landings in Georges Bank and South decreased to a low point in 1978, but returned to close to the 1976 level in 1980.

In 1978, the combined landings of Gloucester, Boston and New Bedford accounted for about 74 and 81 percent of the total otter trawl landings of cod and haddock respectively (See Table 314.2). New Bedford and Provincetown accounted for about 60% of the total otter trawl landings of yellowtail flounder during that year.

Although many vessels based in the Mid-Atlantic land fish in New England, landings of cod, haddock and yellowtail flounder in the Mid-Atlantic have been considerably smaller than those in New England (See Table 314.3). Most of the landings are made in New York and New Jersey ports. Cod and haddock historically have not been landed in great quantities in the Mid-Atlantic because the principal stock distribution of the species is to the north and requires extended trips from Mid-Atlantic ports. Yellowtail flounder, however, have been landed in Mid-Atlantic ports in the past in substantial quantities. Landings in the early 1970's reached 14% of the total (approximately 4,000 MT tons) and resulted from abundant supplies of yellowtail in Southern New England and Mid-Atlantic fishing grounds. Subsequent declines in the yellowtail stock reduced Mid-Atlantic landings by 1976 to relatively low levels (approximately 250 MT).

Table 314.1: New England Landings from the Gulf of Maine and Georges Bank & South (metric tons)

	1976	1977	1978	1979	1980
Area 5Y:					
Cod:					
5-60	3776.8	4650.0	4634.5	4433.4	4749.0
61-125	2505.8	3033.4	2321.0	2211.6	2307.3
125+	304.9	504.4	802.2	811.4	1044.2
Fixed Gear	1532.0	2033.0	2473.2	2225.1	2387.9
TOTAL	8119.5	10220.8	10230.9	9681.5	10488.4
Haddock:					
5-60	646.9	1136.6	1101.4	1012.4	1324.6
61-125	705.6	1096.4	1477.8	1379.0	1715.8
125+	169.2	277.0	934.2	950.2	1737.1
Fixed Gear	174.8	491.9	630.1	630.6	1114.7
TOTAL	1696.5	3000.9	4143.5	3972.2	5892.2
Yellowtail:					
5-60	1903.2	1886.7	1792.9	2295.4	2466.2
61-125	286.9	419.3	281.8	140.1	234.6
125+	1.5	24.2	51.6	15.9	61.5
Fixed Gear	7.2	3.1	8.7	4.0	14.9
TOTAL	2198.8	2333.3	2135.0	2455.4	2777.2
Area 5Z & SA6					
Cod:					
5-60	880.9	1904.1	2420.7	1991.6	2406.9
61-125	6132.2	9425.9	9138.9	9759.3	9422.3
125+	5502.3	7954.6	10851.2	15420.1	21280.0
Fixed Gear	104.9	41.9	98.6	184.6	460.1
TOTAL	12620.3	19326.5	22509.4	27355.6	33569.3
Haddock:					
5-60	114.6	463.4	378.5	315.7	478.8
61-125	1411.5	3903.1	4923.1	5175.1	4482.7
125+	1319.2	3476.2	6670.6	8648.9	12240.4
Fixed Gear	2.3	5.9	19.8	18.1	123.2
TOTAL	2847.6	7848.6	11992.0	14157.8	17325.1
Yellowtail:					
5-60	1478.8	1648.3	1151.1	1669.6	3020.7
61-125	9157.4	7300.7	3838.5	5707.7	6333.9
125+	3937.3	4691.6	3701.2	5269.3	6434.6
Fixed Gear	*	*	2.0	0.1	0.4
TOTAL	14573.5	13640.6	8692.8	12646.7	15789.6

* less than .05 metric tons.

Table 314.2: Percent of Total Landing of of Cod, Haddock and Yellowtail Flounder by Major Port Areas in 1978

Port	Cod	Haddock	Yellowtail
Eastern Maine	0.1	0.0	0.0
Rockland & County	1.0	1.8	0.1
Boothbay Area	1.3	0.6	0.9
Portland & County	3.3	6.4	0.4
York County	0.9	0.3	0.6
Gloucester & County	27.1	36.2	7.3
Boston & County	14.8	20.2	1.7
South Shore	4.3	2.8	10.3
Provincetown	7.1	2.7	15.6
So. Cape Cod	1.8	0.7	1.9
New Bedford & County	31.6	25.0	44.1
Newport & County	4.0	3.2	12.1
Narragansett Bay	0.0	0.0	0.0
Pt. Judith & County	2.5	0.0	5.1
Total	100.0	100.0	100.0

Table 314.3: Mid-Atlantic Landings in metric tons of Cod and Haddock and Yellowtail Flounder

	1976	1977	1978	1979	1980
Cod	412	285	231	257	233
Haddock	4	3	0 1/	34	64
Yellowtail Flounder	271	242	248	454	906

Source: Northeast Fishery Center (Personal Communication). Landings include New York and South.

1/ No recorded landings in 1978.

Exvessel prices of groundfish can be determined by annual statistics provided by NMFS or by the public records of daily auction prices at Boston and New Bedford. Table 314.4 shows the exvessel prices of Boston cod and haddock, and of New Bedford yellowtail during 1979 resulting from the Boston and New Bedford auctions. The notable feature of these data is extreme seasonal fluctuations that occur. Prices for Boston cod ranged from 25¢ to 87¢ per pound; Boston haddock from 40¢ to $1.15 per pound; and New Bedford yellowtail from 35¢ to $1.18 per pound. Seasonally high prices generally occurred in the winter when landings were low; and seasonally low prices occurred in the late spring when landings were high.

Over the past 13 years, the exvessel prices of cod, haddock and yellowtail flounder have increased considerably (Figure 314.1). Relative to 1967, the exvessel price of haddock has increased by 185%, the exvessel price of cod by 225%, and the exvessel price of yellowtail by 338%. As a comparison, food prices in general have increased by 154% since 1967, and the price of retail fuel oils has increased by 456%.

Table 314.5 reviews the gross revenues to vessel classes by gear type and resource areas from landings of cod, haddock and yellowtail flounder. These revenues have been determined using the average annual prices of the species.

The dependency of the New England otter trawl fleet on cod, haddock and yellowtail as a source of annual vessel income has increased gradually in the last decade. The number of vessels in the otter trawl fleet which derive 20 percent or more of their annual gross revenues from the regulated species increased from 300 in 1970 to 430 in 1977 (See Figure 314.2). Simultaneously, the less dependent vessels have decreased substantially. In 1977, over 40 percent of the vessels in the otter trawl fleet depended on cod, haddock and yellowtail for 50 percent or more of their annual gross revenues. In general, the revenue dependency on cod, haddock and yellowtail flounder increases with vessel size.

Table 314.6 shows cod, haddock and yellowtail revenues by major New England ports in 1978. From this table it is clear that cod and haddock revenues are very important to ports such as Boston, New Bedford, York County (Maine) and Gloucester. Yellowtail flounder revenues make up a significant portion of the total revenues of ports such as Provincetown, New Bedford, South Shore (Massachusetts) and Newport.

Table 314.4: Ex-Vessel Prices in dollars, Boston and New Bedford (1979)

Bi-Weekly Wednesday Price	Boston Cod 2/	Boston Haddock	New Bedford Yellowtail
January 4 1/	.87	1.15	1.08
January 17	.45	.47	.59
January 31	.46	.85	.80
February 8 1/	.80	.85	1.18
February 21	.81	.76	1.07
March 7	.35	.50	.57
March 21	.60	.70	.55
April 4	.32	.45	.45
April 18	.35	.50	.62
May 2	.39	.65	.35
May 16	.28	.55	.35
May 30	.28	.44	.60
June 3	.25	.42	.45
June 27	.36	.47	.65
July 11	.37	.40	.53
July 25	.30	.50	.48
August 8	.40	.55	.45
August 23 1/	.45	.48	.65
September 5	.35	.40	.45
September 19	.32	.68	.75
October 3	.48	.50	.53
October 17	.55	.94	.67
October 31	.38	.47	.48
November 14	.45	.57	.36
November 28	.38	.52	.35
December 12	.72	1.01	.60
December 26	NA	NA	NA

1/Thursday, due to no landings on Wednesday

2/Prices are for market cod. Other sizes would have different prices.

Source: U.S. Department of Commerce, National Marine Fisheries Service, Fishery Market News Report, 1979.

Figure 314.1: Exvessel Price Indices for Cod, Haddock and Yellowtail Flounder using the 1967 Price of Haddock as the Base Price.

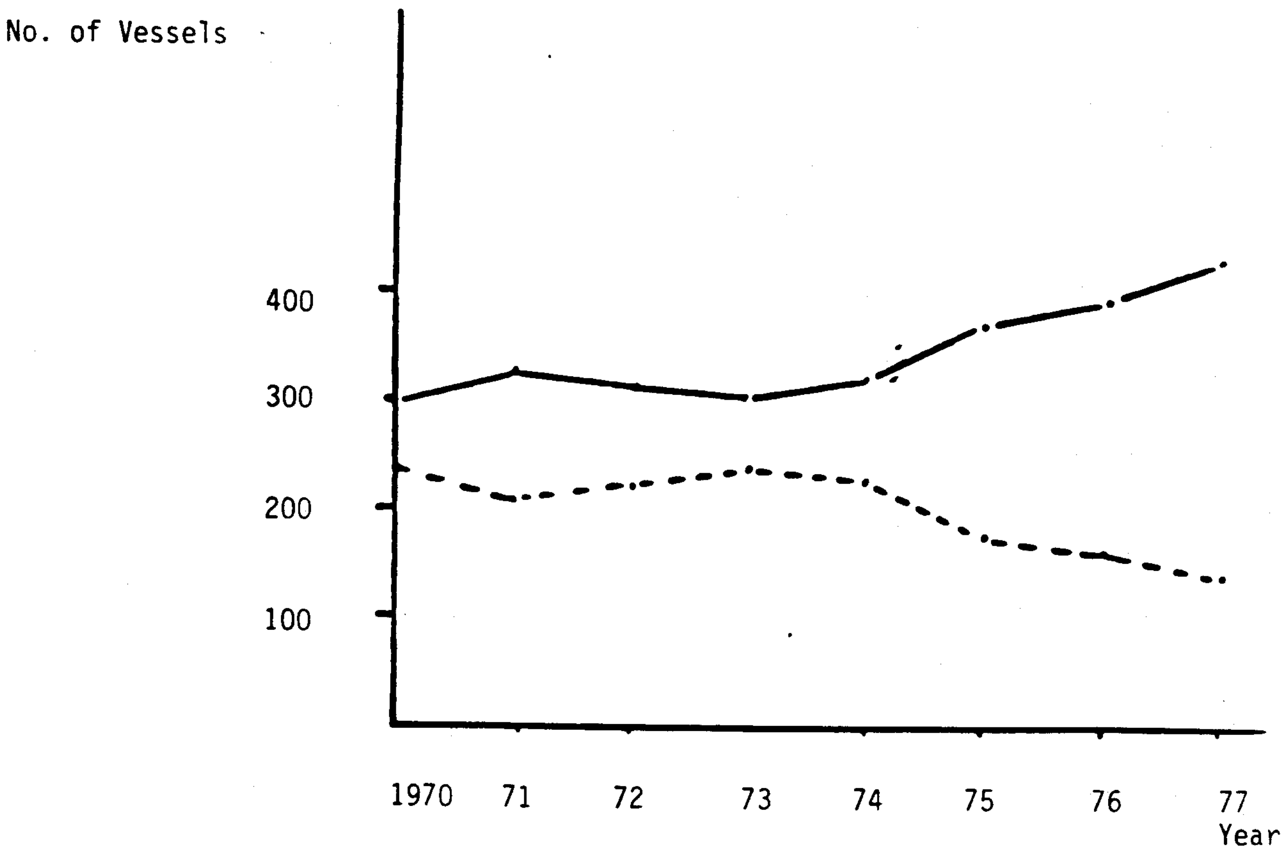
Source: U.S. Department of Commerce, "Fisheries of the United States, 1980."

Table 314.5: Cod, Haddock and Yellowtail Flounder
Gross Revenue by Vessel Class/Gear Type and Area.

	1979	1980
Area 5Y		
Cod:		
5-60	$ 2,814,876	$ 2,826,804
61-125	1,404,200	1,373,402
125+	515,178	621,552
Fixed Gear	1,412,771	1,421,378
TOTAL	$ 6,147,025	$ 6,243,136
Haddock:		
5-60	$ 944,109	$ 1,133,043
61-125	1,285,981	1,467,669
125+	886,105	1,485,889
Fixed Gear	588,063	953,497
TOTAL	$ 3,704,258	$ 5,040,098
Yellowtail:		
5-60	$ 2,540,340	$ 2,533,635
61-125	155,050	241,015
125+	17,597	63,182
Fixed Gear	4,427	15,307
TOTAL	$ 2,717,414	$ 2,853,139
Area 5Z & SA6		
Cod:		
5-60	$ 1,264,516	$ 1,432,688
61-125	6,196,422	5,608,549
125+	9,790,604	12,666,750
Fixed Gear	117,207	273,871
TOTAL	$17,368,749	$19,981,858
Haddock:		
5-60	$ 294,405	$ 409,558
61-125	4,826,018	3,834,433
125+	8,065,495	10,470,252
Fixed Gear	16,879	105,383
TOTAL	$13,202,796	$14,819,626
Yellowtail:		
5-60	$ 1,847,762	$ 3,103,297
61-125	6,316,764	6,507,092
125+	5,831,583	6,610,545
Fixed Gear	111	411
TOTAL	$13,996,220	$16,221,345

Based on average annual prices as follows: For 1979 prices were: cod, $0.288; haddock, $0.423; and yellowtail, $0.502. For 1980, prices were: cod, $0.27; haddock, $0.388; and yellowtail, $0.466. Source: U.S. Department of Commerce, "Fisheries of the United States, 1980".

Figure 314.2: Dependence of otter trawl fleet on cod, haddock and yellowtail flounder as sources of gross revenue. Source: Northeast Fisheries Center, NMFS.



________ Otter trawl vessels with 20% or more of total annual gross revenues derived from cod, haddock or yellowtail flounder.

-------- Otter trawl vessels with less than 20% of total annual gross revenues derived from cod, haddock and yellowtail flounder.

Table 314.6: Annual Cod, Haddock & Yellowtail Flounder Revenues and % of Total Port Revenues in 1978 by Major New England Port Areas

	Cod	%	Haddock	%	Yellowtail	%
Eastern Maine	$ 15,123	22.3	$ 1,160	1.7	$ 43	0.1
Rockland & County	170,812	4.8	228,987	6.4	6,293	0.2
Boothbay Area	142,952	8.6	74,120	4.5	97,203	5.9
Portland & County	456,108	8.2	733,468	13.2	35,752	0.6
York County	161,373	20.6	52,698	6.7	56,392	7.2
Gloucester & County	4,392,679	19.3	4,293,382	18.9	855,109	3.8
Boston & County	2,617,684	32.8	2,762,060	34.6	193,200	2.4
South Shore	758,997	14.3	313,638	5.9	1,451,356	27.3
Provincetown	1,239,538	19.1	321,828	5.0	2,214,596	34.1
So. Cape Cod	346,058	16.1	79,225	3.7	284,540	13.2
New Bedford & County	5,353,447	24.2	2,471,006	11.2	6,627,986	30.0
Newport	690,612	10.5	334,094	5.1	1,662,599	25.3
Pt. Judith	363,253	4.8	3,468	0	684,458	9.0

§315 Costs

Landings and revenues per vessel by otter trawls in New england are presented in Table 315.1. For all vessels classes, average revenues (both in current and real dollars) peaked in 1978, and have steadily declined through 1979 and 1980. Average landings also declined during that period. These averages have recently declined despite increases in net revenues and total landings due to an increase in the number of otter trawl vessels for all classes.

Table 315.2 indicates the relative net and gross revenue positions of otter trawl vessels in New England from 1976 to 1980. Full-time otter trawls (greater than 100 days absent from port) were used in order to prevent vessels participating in the fishery only incidentally from distorting the averages. The two lower vessel classes (5-60 GRT and 61-125 GRT) from Table 315.1 were partially combined in Table 315.2 (50-125 GRT), since reliable costs data were not available for otter trawls under 50 GRT.

A comparison of the gross and net revenue indices for both vessels classes shows that although both indices peak in 1978 and then decline, the net revenue index declines more rapidly. This trend may be due to increasing fuel costs and possibly to trip limits imposed on these vessels during this time.

The other costs indices include contribution to fixed costs (such as gear and repair, interest, income tax), average captain's share, and average crew share. All of these are given in both current and constant dollars. These latter indices all demonstrate peaks in 1978, with subsequent declines. The constant dollars indices are actually lower in 1980 than in 1976 for contributions to fixed costs, average captain's share and average crew's share.

Table 315.1: Average Landing and Revenues, New England Otter Trawl Fleet by Vessel Class, 1976-1980

Year	# Vessels	Average Pounds1/	Average Gross2/ (Current)	Average Gross2/ (Deflated)3/
		5-60 GRT		
1976	343	217550	49124	26844
1977	320	248922	61478	31690
1978	356	217250	67685	32385
1979	436	188919	59787	27425
1980	463	166172	54038	21878
		61-125 GRT		
1976	175	589857	169827	92802
1977	188	631964	168760	86990
1978	185	657614	195717	93645
1979	211	591695	194480	89211
1980	241	496066	164354	66540
		126+ GRT		
1976	72	916456	251728	137556
1977	86	969209	273611	141037
1978	83	1230949	383367	183429
1979	110	996497	361663	165900
1980	142	850052	296470	120028

1/ Average catch per vessel, all species.

2/ Average gross revenue per vessel, all species.

3/ 1967 is used as the base year.

Source: Personal Communications, Northeast NMFS, Regional Office.

Table 315.2: Full-Time New England Otter Trawl Fleet1/ Indices

Year	Catch Per Vessel (1000 lbs.)	Gross Revenue Per Vessel ($1,000)	Net Revenue Per Vessel ($1,000)	Contribution to Fixed Costs		Average Captain's Share		Average Crew Share	
				Current ($1,000)	Constant2/ ($1,000)	Current ($1,000)	Constant2/ ($1,000)	Current ($1,000)	Constant2/ ($1,000)
				50-125 GRT					
1976	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1977	1.14	1.08	1.07	1.08	1.02	1.10	1.04	1.07	1.01
1978	1.13	1.21	1.23	1.31	1.14	1.24	1.08	1.21	1.06
1979	1.04	1.21	1.17	1.22	1.02	1.19	.99	1.14	.96
1980	.97	1.12	1.01	.96	.70	1.10	.80	1.00	.73
				126-600 GRT					
1976	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1977	1.22	1.24	1.27	1.38	1.29	1.26	1.15	1.25	1.11
1978	1.26	1.44	1.53	1.72	1.50	1.65	1.38	1.56	1.33
1979	1.07	1.47	1.47	1.64	1.37	1.56	1.23	1.50	1.22
1980	.97	1.25	1.18	1.28	.97	1.26	.92	1.19	.89

1/ greater than 100 days absent from port.
2/ 1967 is used as the base year.

Source: Personal Communications, NMFS, Northeast Regional Office, Otter Trawl Cost Files.

§316 Processing and Marketing

Most fish landed at New England ports has been kept on ice since being caught and has only a limited shelf life remaining. The first purchaser, as a result, faces a decision on whether to sell the fish immediately or freeze it. Freezing requires storage and packaging the frozen product and will eventually bring a lower price. As a result, production of fresh fillets dominates the activities of processing plants purchasing domestic landings of cod, haddock and yellowtail flounder. Table 316.1 provides the number of processors of fresh cod, haddock and flounders in major New England ports.

Table 316.1: Number of Processors Using Fresh Groundfish in New England Major Ports, 1978

Port	# of Processors
Portland	9
Gloucester	4
Boston	21
Provincetown	1
Chatham	3
New Bedford	15
Newport	3
Point Judith	1
TOTAL	56

The functions of processing and wholesaling in New England are frequently, if not predominantly performed by the same organization. In Boston, for example, almost every processor is also listed by NMFS as a wholesaler. The total number of New England processors and wholesalers along with employment averages in 1979 is provided in Table 316.2.

The wholesaling function involves sorting, packing, shipping and selling of unprocessed fish, mostly to other New England processors/wholesalers or retailers. Processing of groundfish is somewhat specialized among New England ports. The bulk of cod, haddock and yellowtail flounder processing takes place in Boston, New Bedford and Gloucester. Boston, which landed 14% of the cod in 1977 processed some 65% of the total cod landings. Boston landed 24% of the haddock but processed 79%. New Bedford landed 53% of the flounder and processed 70%.

Major changes have been taking place recently in the processing sector. Significant investments in new facilities have been made in all of the major ports. New Bedford has seen some expansion, and Portland is in the process of expanding.

Table 316.2: New England Total Processing and Wholesale -- Establishments and Employment, 1979 1/

State	PROCESSING			WHOLESALE			TOTAL		
	Plants	Employment Average Season	Employment Average Year	Plants	Employment Average Season	Employment Average Year	Plants	Employment Average Season	Employment Average Year
	-NUMBER-								
Maine	94	3,984	2,688	122	349	286	216	4,333	2,974
New Hampshire	14	490	452	--	--	--	14	490	452
Massachusetts	114	5,455	4,569	95	997	864	209	6,452	5,433
Rhode Island	18	461	332	16	84	70	34	545	402
Connecticut	3	17	13	4	26	24	7	43	37
TOTAL	243	10,407	8,054	237	1,456	1,244	480	11,863	9,298

1/ Employment is reported by each plant for each month for the payroll period that includes the 12th of the month. Employment for the season is based on the greatest number of employees working during the payroll period that included the 12th of each month. Average employment for the year is obtained by adding the number of employees recorded as working during the payroll period that included the 12th of each month, and dividing by 12.

Source: U.S. Department of Commerce, NMFS: "Processed Fishery Products, Annual Summary -- 1979."

Table 316.3 provides information on the quantity and value of processed cod and haddock in 1979 for New England and the Mid-Atlantic. This Table also provides data on flounder, which includes an unknown amount of yellowtail flounder. Processed cod and haddock products in New England had a value of almost 76 million dollars in 1979. In the Mid-Atlantic processed cod products were valued at over 2.3 million dollars in 1979.

Table 316.3: Processed Fishery Products, 1979

	State	Quantity (millions of pounds)	Dollars (millions)
NEW ENGLAND			
Cod (Fresh & frozen)			
Fillets & Steaks	ME & MA	29.886	40.763
Salted	ME	.142	.153
Dried	ME	.030	.030
Haddock (fresh & frozen fillets)			
Raw	ME & MA	19.278	33.275
Breaded, raw and cooked, batter coated cooked, and form pressed	ME & MA	.917	1.477
Flounders (Fresh & Frozen Fillets)			
Raw	ME, MA, RI	27.976	53.578
Breaded, raw and cooked, batter coated cooked, and form pressed	ME & MA	2.109	2.878
MID-ATLANTIC			
Cod			
Fresh & Frozen Fillets & Steaks	NJ, NY, PA	1.316	2.347
Flounders			
Fresh & Frozen Fillets	NJ, NY, PA, VA	6.396	12.250

Source: U.S. Department of Commerce, NMFS, "Processed Fishery Products, Annual Summary -- 1979".

§317 Imports

New England fishermen compete with imports of fresh and frozen groundfish products. Figure 317.1 represents the major product flows of Atlantic groundfish and illustrates the market role of imports. Between 1960 and 1977 U.S. imports of frozen fish blocks expanded from 40,000 MT to 175,000 MT, for a total 1977 value of close to $300 million. This increase is directly related to changes in eating habits in the United States. Prior to 1953 most fish was marketed as fresh and frozen fillets. Since then, the production of prepared fish sticks and frozen fish dinners has grown rapidly and now comprises a substantial portion of the total market supply of groundfish. The expansion of the U.S. market for groundfish, and especially for fish sticks, produced an opportunity for low-priced imports. Canadian export suppliers were able to favorably compete in the U.S. market because of low ex-vessel prices supported by liberal subsidies given to the Canadian fishing industry, and also because of substantial fish abundance in Canadian waters.

In terms of percentages, U.S. consumption of fresh and frozen groundfish fillets and steaks has become increasingly dependent on imported supplies. Some 30 years ago imports accounted for 30% of total supplies available for consumption. During the 1970's the share of imports has reached over 70%. In absolute terms imports of fillets and steaks has risen by 67% between 1968 and 1977. During the same period, annual U.S. production of fillets and steaks increased by only 10%.

In 1980 over 182 million pounds of cod and haddock fresh and frozen fillets and over 191 million pounds of cod and haddock fish blocks were imported into the U.S. (See Table 317.1). The 1980 cod and haddock import totals represent a decrease of almost 10% from the 1979 levels. The extent to which increased domestic cod and haddock landings, increased interest rates or decreased restaurant consumption in 1980 may have contributed to this decline in imports is not known. In 1980 Canada accounted for almost 36% of the U.S. imports of blocks and slabs (See Table 317.2).

Figure 317.1: Major Product Flows in the Atlantic Groundfish Industry.

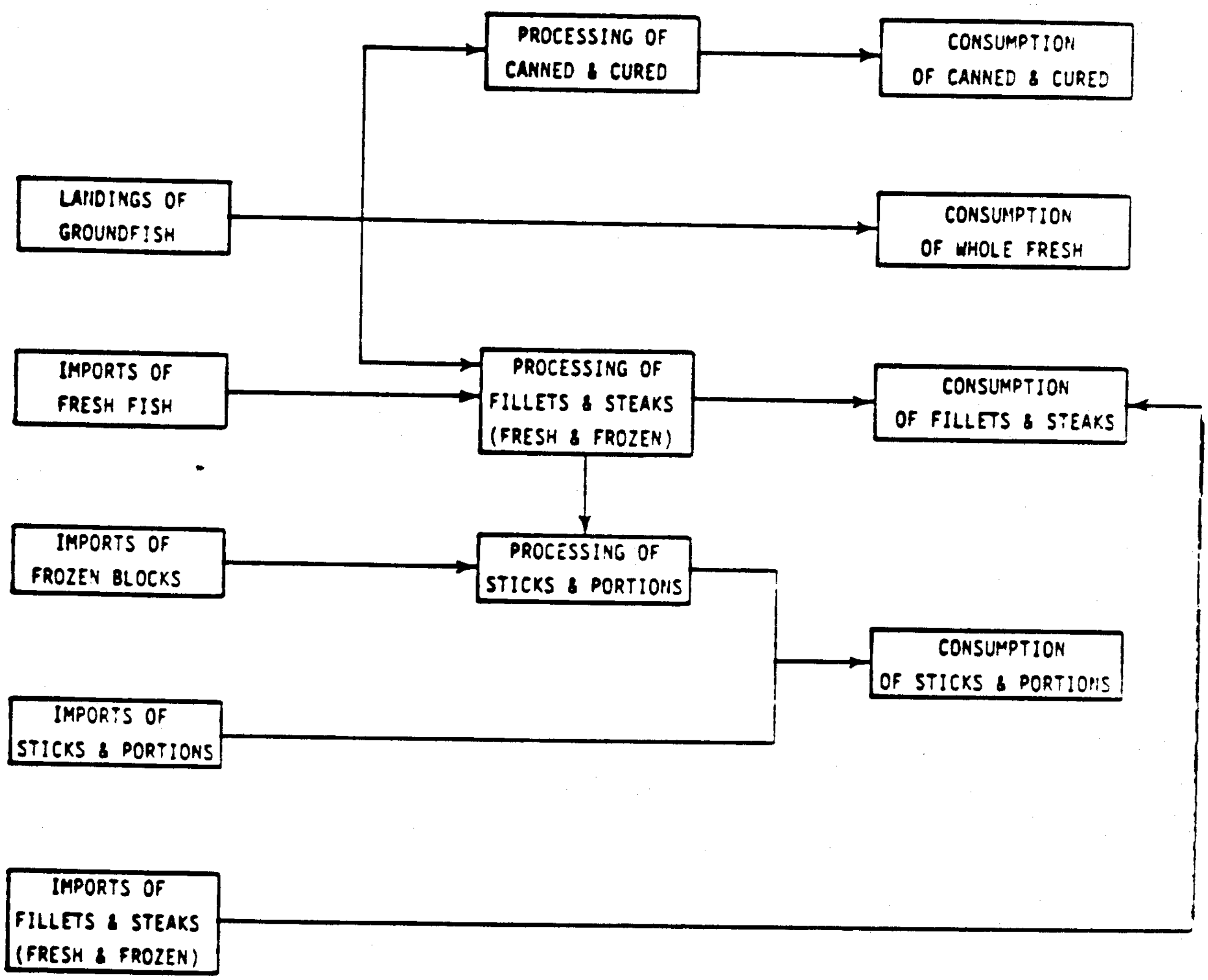


Table 317.1: U.S. Imports of Groundfish and Groundfish Products in 1979 and 1989 and Their Value[1/]

Item	1979 Millions Pounds	1979 Millions Dollars	1980 Millions Pounds	1980 Millions Dollars
Fresh and Frozen Fillets and Steaks:				
Cod	144.657	173.217	131.412	163.987
Haddock	55.520	58.888	51.175	58.331
Pickled or Salted Cod, Haddock, Hake, Etc.:	39.683	43.293	33.015	35.992
Fish Blocks and Slabs:				
Cod	192.954	187.050	160.418	156.714
Haddock[2/]	18.308	18.439	31.281	36.155

1/ Source: U.S. Department of Commerce, NMFS, "Fisheries of the United States, 1980".
2/ Includes some quantities of cusk, hake and pollock fillets.

Table 317.2: Imports of Regular and Minced Fish Blocks and Slabs, by Country of Origin, 1980

Country	Millions Pounds	Millions Dollars
Canada	120.506	111.874
Iceland	59.220	55.295
Republic of Korea	42.333	26.618
Norway	20.759	22.009
Denmark	18.121	18.684
Greenland	13.248	11.001
Poland	15.503	10.878
Argentina	15.846	10.598
Other	30.581	21.957
Total	336.117	288.914

Source: U.S. Department of Commerce, SESA.

SUBPART C: SOCIAL/CULTURAL FRAMEWORK

§330 Overview

Groundfish fishermen in New England are a diverse group of harvesters who fish for cod, haddock and yellowtail flounder as well as other demersal finfish species. For the most part, these harvesters are independent, family-controlled single-unit enterprises. Any management plan for groundfish needs acceptance by these fishermen; and their acceptance will depend in part on attitudes and prejudices acquired from their cultural background, age, education and the local community in which they live and work.

Fishing for groundfish in New England is concentrated in Rockland and Portland in Maine; Gloucester, Boston and New Bedford in Massachusetts; and Point Judith and Newport in Rhode Island. These ports have major landing and processing facilities and large vessels that are capable of extended trips. Many of the fishermen in these ports fish full-time, year-round for groundfish. There are many other smaller ports scattered from Maine to Connecticut that offer a home port and point of sale for smaller groundfish vessels. There are at least sixteen such ports along the Maine and New Hampshire coast, and about twelve in Massachusetts, Rhode Island and Connecticut. The groundfish fishermen in these ports generally fish inshore on short trips or day trips and harvest groundfish seasonally, switching to other types of fishing or to non-fishing occupations during the off season.

§331: Ethnicity

Ethnicity is important because it determines in part the style of fishing that a fisherman engages in, his access to markets and financial/technical information, and his understanding of and response to fisheries management policies.

Most of the groundfish fishermen in all parts of Maine and New Hampshire and in most smaller southern New England ports are Yankees, that is they are of British extraction and from families that have been in America for several generations. The larger ports of southern New England offer more ethnic contrasts. Boston is a mixture of cultures, but the mixture is diverse, with no group dominant. Point Judith represents a "melting pot" of groundfish fishermen who are of Yankee, Italian, Portuguese, German, Dutch and Norwegian extractions, but most all are at least second or third generation Americans and therefore retain less of the social/cultural traditions of the country from which their families emigrated than Gloucester and New Bedford where strong enclaves of Italian, Portuguese and Norwegian fishermen are found. Gloucester has a strong Italian community that is tightly knit and has a definite commitment to fishing. New Bedford has strong Portuguese and Norwegian fishing communities. In many cases, groundfish fishermen in these ports have immigrated to join family members from their countries of origin.

§332: Age, Education and Innovation

Age and education influence a fisherman's style of fishing and the amount of innovation that he is willing to try. Age has a particular influence on how willing he is to adapt his style of fishing to new technologies, market potentials or management policies in order to maximize his returns. Generally, New England groundfish fishermen between the ages of thirty-five and fifty are at the high point of their careers and are the most innovative. The older men are winding down their careers and the younger men do not yet have the skill and financial resources to radically change their style of fishing. Representative age distributions (based on 1978 surveys) of groundfish fishermen for northern New England (Maine and New Hampshire) and southern New England (New Bedford and Pt. Judith) are given below in Table 332.1. These data suggest that the potential for future innovation will be high in the groundfish fishery.

Table 332.1: Age Distributions of Groundfish Fishermen for Northern New England and Southern New England

	Northern New England*		
	Under 35 Years	35-50	Over 50
Size of Sample	57	84	48
% of Total	30%	44%	25%

	Southern New England*		
	Under 35 Years	35-50	Over 50
Size of Sample	71	37	13
% of Total	59%	30%	11%

*These figures are not directly comparable because of difference in the sampling methods. Southern New England data included crew members.

Source: Acheson, et. al. (1978); Poggie and Pollnac (1978)

Formal education has little bearing on the success of a fisherman or his propensity to change or innovate. This does not mean that fishing requires no skill, but that practical experience and inherent abilities are more important for success. Formal education has been shown to influence to some degree the type of fishing a man prefers. There is a tendency for the more educated fishermen to prefer day fishing or short trip fishing to long trips.

§333: Employment Patterns

A decision to fish for groundfish as an occupation is primarily the result of kinship ties. Entry into the fishery and subsequent training is often a father-son or uncle-nephew relationship. In the ethnic ports of New Bedford and Gloucester immigrants from Europe are often brought to the family fishing business. Men without kinship ties are also recruited from schools that offer courses in fishing technology.

The career cycle in fishing for groundfish varies throughout New England. In the larger ports, it can be a full-time occupation throughout a man's career. This is not characteristically true in many of the smaller new England ports, particularly in northern New England. In Maine, for instance, 70% of the value of the total commercial catch is lobster and other shellfish, as opposed to Southern New England, where about 60% of the total catch is finfish. Fishing for groundfish in Maine is generally conducted by men who began their careers harvesting shellfish. They generally begin as lobster fishermen, gradually work into fishing for groundfish during their prime fishing years and then return to lobster fishing at the end of their careers. An important factor determining whether a lobster fisherman will move into fishing for groudfish is the type of fishing that his father does. Another is previous net fishing experience. Many current groundfish fishermen were former lobstermen who gained experience in the winter shrimp fishery and moved on to groundfishing.

Full-time, year-round fishing for groundfish is characteristic of the larger, offshore, long trip vessels that fish from the major ports. In contrast, there are strong seasonal patterns in the small boat, inshore fishing for groundfish that is scattered along the New England Coast. In northern New England, there is considerable shifting between summer fishing for groundfish and winter lobstering. In Southern New England, almost 50% of the people engaged in small boat fishing for fish for groundfish are part-timers and have training in other jobs which they use to supplement their income. Most of these men are active in fishing for groundfish from April until October.

§334: Economic Dependence and Employment Opportunities

Economic dependence of groundfish fishermen on the fishery is generally greater in the smaller ports, where fishing is a larger part of the local economy. This is particularly true in eastern Maine, where alternate employment is limited and one of the most common options is unemployment. A representative distribution of the non-fishing jobs that have been held by groundfish fishermen in northern and southern New England are given below:

Northern New England (190 Fishermen Sampled)

Alternate Occupation	%
Military	23
Laborer	21
Construction	17
Maritime (non-fishing)	8
Fishery Related	7
Small Business	5
Professional	4
Technical	3
Sales	3
Administrative	2
Clerical	2
Government	1
Farmer	1
Other	5

(Source: Acheson, et. al., 1978)

Southern New England (236 Fishermen Sampled)

Alternate Occupation	%
None	27
Trade and Service	26
Construction	19
Marine Oriented	17
Manufacturing	6
Retired	5

Source: U.S. Department of Commerce, County Business Patterns, Massachusetts (1977); Rhode Island Department of Employment Security, State of Rhode Island Employment Bulletin (March, 1970).

PART 4: FISHERIES MANAGEMENT JURISDICTION, LAWS AND POLICIES

§401 Federal Jurisdiction and Regulatory History Under the Magnuson Act

The United States exercises exclusive fishery management authority over all fish within the fishery conservation zone (FCZ) except highly migratory species of tuna. The FCZ has as its inner boundary the seaward limit of the territorial sea of the United States, and as its outer boundary a line drawn parallel to, and 200 nautical miles from, the baseline from which the territorial sea is measured. Fisheries in the FCZ are managed pursuant to fishery management plans prepared by Regional Fishery Management Councils, and approved and implemented by the Secretary of Commerce. In some instances, fishery management plans may be prepared by the Secretary of Commerce.

The harvest of cod, haddock and yellowtail flounder by domestic fishermen in the FCZ has been regulated under the Fishery Management Plan for Atlantic Groundfish (the Plan) since March 14, 1977. Under the Plan, no foreign fishing for these species has been allowed. The Plan was prepared by the Council, with assistance from NMFS, in consultation with the Mid-Atlantic Fishery Management Council, and approved by the Secretary.

The Plan originally specified annual commercial and recreational catch quotas, minimum size restrictions for haddock and cod, closed areas and seasons to protect haddock spawning, mesh size regulations, and trip limits.

Harvest rates during the spring and summer of 1977 were higher than expected due to expansion in the fishery and the predominance of the 1975 year classes which were recruiting to the fishery at that time. Therefore the annual quotas were exhausted quickly and the fisheries closed before many user groups had any opportunity to conduct their traditional fisheries. During 1977 and early 1978, in response to this problem, the Council embarked on a series of revisions to the plan which were intended to make it work better. Generally these were in the nature of increasing optimum yield in response to improved resource conditions, spreading fishing out over longer periods to avoid lengthy periods of fishery closure, and attempted allocation of resource benefits to various fleet sectors.

During 1978, landing limits were changed from trip allowances to daily allowances, and later to weekly allowances. Annual quotas were subdivided into quarterly quotas, and later into quarterly quota guidelines. Landing restrictions were continually being adjusted downward because of high harvest rates, but harvest rates continued to climb in spite of the continued downward adjustments. Quotas were subdivided among four vessel classes on the basis of shares during four recent years, and different quotas and landing limits established for each class.

Near the end of 1978, the Secretary approved and implemented an amendment to the plan which established a fishing year with still higher optimum yield levels. This constitutes the basic plan as it currently exists. In the summer of 1979 a temporary amendment increasing optimum yield responded to changes in resource conditions indicated by the 1979 stock assessment. A long-term amendment responding to that assessment was not finally prepared, approved and implemented until August 5, 1981. No amendment has been made to the plan specifically addressing the 1980 and 1981 stock assessments.

The current program for the management of the Atlantic groundfish fishery under the Plan is as follows:

(1) Optimum Yield and Quotas:

	Optimum Yield (MT)	Commercial Quota (MT)	Recreational Quota (MT)	Canadian Commercial Allocation (MT)
Cod--Gulf of Maine	12,000	9,500	2,500	0
Cod--Georges Bank & South	35,000	29,620	(2/)	5,380 2/
Haddock--all areas	32,500 1/	25,250 1/	2,000	5,250
Gulf of Maine	(9,750)	(7,575)	---	---
Georges Bank & South	(22,750)	(17,675)	---	---
Yellowtail Flounder:				
East of 69°W	5,000	5,000	---	0
West of 69°W	5,000	5,000	---	0

1/ OY and commercial quotas allocated 30 percent to Gulf of Maine and 70 percent to Georges Bank and South.

2/ Includes unspecified U.S. recreational allocation.

(2) Closed Areas: Two areas are closed during the months of March, April and May to protect haddock spawning. See Fig. 703.1.

(3) Mesh Size: The minimum mesh size for a trawl net is 4-1/2 inches in the body and 5-1/8 in the cod end. The minimum mesh size for a gillnet is 5-1/2 inches. Vessels using smaller mesh are limited to an incidental catch.

(4) Catch Limitations: The quotas referred to above are subdivided among three vessel classes for mobile gear based on size, and one for all fixed gear vessels. For each of these vessel classes, weekly catch limitations for cod and haddock are assigned; and a "per trip" limitation applicable to all vessel classes is assigned for yellowtail flounder. A vessel is allowed to land fish in accordance with the limitation for any one vessel class and area for each species.

(5) Closures and Trip Limit Adjustments: The Regional Director may adjust trip limits for any vessel class/species/area in order to reduce landings levels, and is required by the regulations to close the fishery for any vessel class/species/area when the respective annual quota is taken.

(6) Permits: Every vessel fishing for groundfish is required to have a permit from the Regional Director, which is given without charge.

(7) Vessel Identification and Enforcement: Vessels are required to display official numbers and take certain actions to facilitate boarding and inspection of the vessel.

(8) Reporting: Fishermen are technically required to maintain and submit logbooks on forms supplied by the Regional Director. However, implementation of this requirement has been suspended. Fish dealers and processors are required to report their purchases of all fish on a weekly basis on forms supplied by the Regional Director.

Data reporting, however, is in a state of change. In order better to meet current FMP requirements as well as the needs of its own assessment program, NMFS is in the process of implementing a new data collection system commonly referred to as the "three-tier system." This includes an expansion of the current dealer information collection program, voluntary logbooks from fishermen, and sea sampling. The program is voluntary, and specifically aimed at improving the quality of stock assessment data which has deteriorated under the current management program. Virtually all of the types of data currently collected will continue to be collected under the three-tier system.

§402 Relationship to Existing or Proposed Fishery Management Plans

Atlantic Demersal Finfish:

The Council has always recognized the need to develop a comprehensive long-term groundfish management plan to address virtually all of the important groundfish species. In recognition of the limitations and problems associated with the existing management system, the Council began developing the Fishery Management Plan for Atlantic Demersal Finfish (the ADF Plan) in May, 1978 by establishing management objectives. Between July, 1978, and the following spring, the Council's Groundfish Oversight Committee examined the possibility of expanding the range of species within the management unit. The fishery management unit as currently proposed, will include cod, haddock, yellowtail flounder, silver hake, red hake, white hake, ocean perch, and pollock. The Council accepted both the objectives and the redefined management unit on June 29, 1979. (Both the plan objectives and the management unit are, of course, subject to revision as plan preparation proceeds.)

The basic philosophy of the ADF Plan requires that management measures be established with full recognition of their impacts on the harvesting and utilization of all jointly harvested or optionally harvested species. A wide range of potential ADF management systems can be designed to meet the above requirement. Evaluation of alternatives for the ADF Plan will require that management strategies be considered, either quantitatively or qualitatively, within the context of a multi-species fishery.

The structure and behavior of the North Atlantic mixed-trawl fishery should be evaluated by the Council, with the assistance of the Mid-Atlantic Council, in developing a meaningful ADF management system. A real need exists in connection with the development of the ADF Plan, for the acquisition of accurate fisheries data which can be utilized to analyze the operations of the mixed trawl fishery.

The Interim Plan is intended to be the mechanism by which the cod, haddock, and yellowtail flounder fisheries are managed until such time as a meaningful ADF management system can be prepared, approved and implemented. In fact, a major concern of the Council in preparing this Interim Plan was the creation of a management environment which would facilitate the preparation of the ADF Plan. It may be that the ADF Plan will evolve from this Plan. The Interim Plan should be viewed in the context of, and as a step toward, the preparation of the ADF Plan.

Preliminary Management Plans

Since 1977, foreign fisheries for silver hake and red hake and the general foreign trawl fishery of the Northwest Atlantic have been regulated under two preliminary fishery management plans prepared by the Secretary. Under these preliminary plans, foreign fishermen have not been permitted to retain any cod, haddock or yellowtail flounder caught incidental to fishing for species for which allocations have been made. This Interim Plan and these preliminary plans are mutually consistent.

Other Fishery Management Plans

Fisheries in the areas covered by this plan which are currently under regulation by other fishery management plans include Atlantic herring, surf clams and ocean quahogs, squid, mackerel and butterfish. A plan for Atlantic sea scallops will be submitted by the Council for Secretarial review shortly. The Council has completed drafting major portions of a lobster plan. A plan for bluefish is under preparation by the Mid-Atlantic Council.

Fishermen fishing for cod, haddock and yellowtail flounder are subject to these other plans if their activities are likely to result in the harvest of any of these other species. Similarly, fishing for any of these other species will subject a fisherman to the provisions of this plan if his activities are likely to result in the harvest of cod, haddock or yellowtail flounder.

§403 Relationship to State Fisheries Programs

Cod, haddock and yellowtail flounder are distributed within territorial waters as well as within the FCZ. Lack of proper coordination between state and federal management has been a problem in the past. Some States have failed to implement complementary regulations or have failed to do so on a timely basis. The management unit under this Plan includes cod, haddock and yellowtail flounder when they occur within the States' waters as well as within the FCZ; and the management policies, measures and recommendations contained in the Plan are appropriate for application in State waters. Therefore, the coordination of the States' policies towards cod, haddock and yellowtail with those contained in this Plan is important to the implementation of an effective and sound regional groundfish management policy. States are therefore urged to adopt complementary measures.

Maine

The State of Maine at present has no specific management program for cod, haddock or yellowtail flounder that is stated in a state fishery management plan. Some general fisheries laws and regulations effect the groundfish fishery within Maine's waters. Non-resident commercial fishermen are required to report to the Department of Marine Resources, upon entering into the State's territorial waters; and when leaving, to report information concerning the areas where they have fished, the type of gear used and the amount of fish, by species, taken. Resident commercial fishermen are required to be licensed with the Department of Marine Resources. Several areas of Maine's inshore waters have restrictions on otter trawling. Trawling for lobster is prohibited.

New Hampshire

Landing and possession restrictions are in effect for groundfish caught in New Hampshire territorial waters. Fishing vessels are limited to 2,500 pounds of cod, 1,500 pounds of haddock and 2,500 pounds of yellowtail flounder per vessel per day. Gear restrictions include a minimum mesh size of 5-1/2 inches for gillnets and 5-1/8 inches for otter trawls when taking or possessing cod, haddock or yellowtail. New Hampshire law also prohibits the use of a purse seine, beam trawl or otter trawl towed from the side or stern of any vessel for the taking of cod, haddock, pollock, hake, flounders, striped bass, coho salmon or crustaceans from the State's marine waters within two miles of the shore.

Massachusetts

Under Massachusetts regulations it is unlawful to possess or land more than 2,500 pounds of cod, 1,500 pounds of haddock or 2,500 pounds of yellowtail flounder taken from Massachusetts waters per vessel fishing trip. It is, however, lawful to possess or land cod, haddock or yellowtail in excess of that amount if the excess has been lawfully taken in the FCZ. State waters may be closed to the possession of cod, haddock or yellowtail in the event that there is a closure in the FCZ. The State's closure is not automatic, however, and will depend on a review of the FCZ closure, including public hearings. A permit issued by the Division of Marine Fisheries is required to fish for or possess cod, haddock or yellowtail for commercial purposes.

Rhode Island

The fisheries for cod and haddock in Rhode Island waters remain open and unlimited until area/period quotas in the FCZ have been reached. In the event of an FCZ closure, the Rhode Island Marine Fisheries Council, after emergency public meetings, selects from two options: (1) the fishery may remain open and unlimited in Rhode island waters; (2) the fishery in State waters may be limited to bycatch provisions in the categories of mobile gear fishery, fixed gear fishery, and rod and reel fishery. Other provisions provide for licening of out-of-state vessels and multiple gear harvesting.

The fishery for yellowtail flounder is under a landing or possession limit of 3,000 lbs. or the combined total of the legal limit from Massachusetts waters, plus one legal limit from one zone of the FCZ (east or west of 69° longitude, whichever is greater). A state trial court in Rhode Island has held that the yellowtail flounder regulations exceed the authority granted the Rhode Island Council by that State's legislature. However, the case is on appeal and the regulations are being enforced in the meantime.

Connecticut

The Commissioner of Enviromental Protection is authorized by statute to promulgate regulations facilitating uniform fisheries management in accordance with fishery management plans. Regulations prohibit the landing of quantities of groundfish in excess of amounts allowed from the FCZ or other states. Reporting requirements are in effect for Connecticut finfish trawlers, as is a minimum size limit of 10 inches for commercially caught cod.

Mid-Atlantic States

All of the Mid-Atlantic states require a permit or license for the commercial harvest and sale of finfish. The criteria for defining "commercial" harvest and sale, however, vary among the states. It is impossible to gauge the degree to which such requirements may affect domestic harvests, since fees for such permits and the enforcement of the applicable regulations also vary among the States.

All of the states have various regulations which prohibit or restrict the use of various kinds of commercial (and sometimes recreational) fishing gear within certain portions of state waters during all or parts of the year. For example, New Jersey prohibits all trawling within 2 miles of shore. Mayland prohibits the use of otter and beam trawls within 1 mile of shore. Delaware prohibits fishing with trawls, dragnets, and dredges operated by any power vessel within 3 miles of shore. Virginia prohibits fishing with trawl nets or 'similar devices' within the 3 mile limit of the Virginia Atlantic shoreline (with limited exceptions).

In addition, several states restrict and/or regulate commercial harvesting within their jurisdictions by non-residents. Such regulations may or may not inhibit the magnitude of the commercial and recreational harvests of these species. It is probable, however, that these kinds of restrictions, particularly on trawling, serve to maintain or increase the proportion of the commercial catch which is harvested from the FCZ. This should support the effectiveness of the management measures in this Plan, since it would be difficult in many states for individuals to circumvent the regulations accompanying the Plan by falsely reporting their harvests of these species as having been caught in the territorial sea. Several states also have mesh size specifications which may affect the quantity of and/or the sizes of the fish in the catch.

§404 Relationship to International Fisheries Programs

Prior to the initial enactment of the Magnuson Act, fisheries for cod, haddock and yellowtail flounder were managed, along with other fisheries, under the auspices of the International Commission for the Northwest Atlantic

Fisheries (ICNAF). That organization established management policies and allocated allowable harvests among member nations, but implementation and enforcement was left to the individual member nations. The United States withdrew from ICNAF on December 31, 1976. There is no current international management program applicable to these fisheries.

Significant fisheries for cod and haddock are pursued by Canadian fishermen under regulation by that country. Much of this fishery is conducted on the same stocks being fished by United States fishermen. There is currently no bilateral fisheries agreement between the United States and Canada. In recent years Canada has established quotas for its fisheries in area 5Ze keyed to calculations made by the United States for its fisheries. During the past few years, fishery management decisions have been made by the Canadian government in response to changes in the management program in the United States. It is not known how the Canadian government will react to the management program contained in this Interim Plan.

§405 Other Special Management Programs

OCS Leasing

During the summer of 1981 exploratory drilling for oil and gas began on Georges Bank. Other sections of Georges Bank are currently proposed to be leased under the Outer Continental Shelf Act. Oil and toxic discharges from drilling rigs could, in certain seasons, cause significant mortality of cod and haddock larvae from the Georges Bank spawning stocks. The Council is represented on the Biological Task Force established by the Departments of Commerce and Interior and the Environmental Protection Agency. The Council is also represented on the Bureau of Land Management's North Atlantic Regional Technical Working Group Advisory Committee. Through participation in these groups, the Council monitors OCS activities and advises concerning ways of minimizing impacts on fishery resources.

Marine Mammals and Endangered Species Acts

Numerous species of marine mammals occur in the Northwest Atlantic, although the definitive species composition is unknown. The most numerous species in the area are the common (saddleback) dolphin (*Delphinus delphis*), harbor porpoise (*Phocoena phocoena*), and harbor seal (*Phoca vitulina*). Data on population abundance for various species are sketchy at best, and non-existent for some species, although current studies are gradually improving the information base. Marine mammal feeding behavior and food preferences are not well understood. These factors make it extremely difficult to assess, even qualitatively, the potential impact of any Atlantic groundfish management program on marine mammal populations.

Whenever fishing and marine mammals occur in the same area, there exists a potential for an incidental take of marine mammals. However, the number of animals killed is relatively small in comparison to the total population size. Incidental mortalities of harbor seals and harbor porpoises are known to take place in the Gulf of Maine fixed gear fisheries; preliminary estimates place this mortality at about 100 animals per year.

Of the numerous marine mammal species which frequent the Gulf of Maine, Georges Bank and southern New England waters, six have been classified as endangered. These are the finback whale (Balaenoptera physalus), the humpback whale (Megaptera novaeangliae), the right whale (Eubalaena glacialis), the blue whale (Balaenoptera musculus), the sei whale (Balaenoptera borealis), and the sperm whale (Physeter catodon). The finback, humpback and right whales sometimes frequent nearshore waters. All whales inhabit the area only on a seasonal basis and "critical habitats" have not been designated in the Northwest Atlantic. Data on population abundance and occurrence is sparse, typically gathered through "sightings."

In addition to certain marine mammals, the only other threatened or endangered species occurring in the Northwest Atlantic are shortnosed sturgeon (Acipenser brevirostrum) and several species of sea turtles. There has been no documented mortality of shortnosed sturgeon as a result of fishing operations for groundfish. Because data on occurrences of shortnose sturgeon are vital to understanding its current status, the Council urges fishermen to report any incidental catch of this species to the Sturgeon Recovery Project of the National Marine Fisheries Service.

Available data appear to indicate that several species of sea turtles are regularly found in New England waters. These turtles are the Kemp's Ridley, (Lepidochelys kempi), the leather back (Dermochelys coriacea), and the loggerhead (Caretta mydas). In addition, hawksbill turtles (Eretmochelys imbricata) occasionally stray into the area. The Kemp's Ridley turtle, while probably the most endangered reptile on earth (total population estimated at several thousand adults), is also the most frequently observed sea turtle in New England waters, especially in Cape Cod Bay.

Although Kemp's Ridley turtles have in past years been found stranded or dead along the beaches of Cape Cod Bay, there is no solid evidence to indicate that fishing operations were responsible. Based on inquiries to fishermen conducted by the National Marine Fisheries Service and the Massachusetts Division of Marine Fisheries, the general conclusion can be drawn that the occasionally numerous deaths of Kemp's Ridley turtles in Cape Cod Bay do not occur as a result of normal commercial fishing operations. Yet, because of the extremely tenuous status of the population of the Kemp's Ridley turtle, NOAA and the New England Fishery Management Council remain concerned about the mortalities in Cape Cod Bay. The Council and NMFS believe that monitoring of turtles in New England is necessary.

No habitat areas where fishing for groundfish is conducted have been identified as critical areas for any endangered species.

Implementation of this plan will have no effect upon populations of marine mammals and endangered species in the area. As additional understanding of the status and dynamics of marine mammals and sea turtle populations become available, the Council will integrate this information into its examination of potential impacts upon the environment as a result of fishery management programs.

Coastal Zone Management

Most of the States in the areas affected by this Plan have approved Coastal Zone Management programs. Since this fishery management plan does not specifically authorize any physical change in the coastal zone, it will not have any direct impacts to measure against standards set in the various State programs. Nonetheless, these programs have been reviewed, and no inconsistencies between them and the measures, policies and provisions of this Plan have been found.

PART 5: OBJECTIVES

§501 Statement of Problems and Issues

There are a number of serious problems relating to biological and economic factors in the Atlantic Groundfish fishery. The best way to handle these is through development of a long-term program addressing as much of the groundfish complex as possible. But this plan is a short-term program designed to create an environment within which the ADF Plan can be prepared. As such, problems the Interim Plan addresses are not only those relating directly to the fishery, but more particularly those relating to the management of the fishery. Some of these problems are set forth here to give perspective as to why a relaxed program of management is necessary.

Foremost among these is that the Plan lacks specified objectives. Management decsions under the current plan have been made without the benefit of a broad statement of policy directions, and have therefore lacked cohesiveness and do not always appear to fit well together. The Plan's optimum yield is not being achieved. The current optimum yields are fixed numbers, which have been exceeded virtually every year. Experience has shown that in the groundfish fishery, there is no way to insure that any fixed number harvest level will be achieved with reasonable exactitude. This is because these three species are harvested in conjunction with other species which are either unregulated, or regulated through another plan. This can result in an unpredictable and often unmeasurable fishing mortality.

The existing management program does not reflect consideration of the current status of the resources. Two annual stock assessments have been produced (1980, 1981) which the plan does not consider. These tend to indicate a level of stability in the resources after recovery from their exceedingly unhealthy condition of the late 1960's and early 1970's. A quota-based management program no longer appears necessary for the rebuilding of the resources.

The plan does not reflect the current status of the industry. Since 1977 the New England fishing industry has changed dramatically. There has been a large influx of new vessels, including great growth in the large vessel class; and a range of shoreside development. New Bedford and Portland have grown as groundfish ports. Fixed gear has become more important in both the Gulf of Maine and Cape Cod areas. But in spite of these changes allocations among vessel classes are still based upon historic averages from the early 1970's, rather than on current distribution of effort within the fishery.

The administrative process for making revisions to the plan based upon new biological or fishery information is too cumbersome for making decisions that can be timely responses to new developments. The current system of trip allocations and quota guidelines by species, area, vessel class and season forces a very complex fishery into overly simple and artificial boxes. Dividing the groundfish fishery into segments, in the belief that the parts will make sense when pulled together, creates the impression of addressing variations in the fishery, but actually fails to take account of the variety within the industry.

Because of the inflexibility of the FMP process, the fishery has not been managed according to the plan for much of recent history. Quotas have been exceeded without action being taken under the plan to close fisheries because of the realization that closures would not be effective and that the target harvest levels were unrealistically low. NMFS and the Council have usually agreed on these actions; but they have not been management of the fishery according to the plan. The effect of these actions over time has been further to erode confidence in and respect for the quota-based management regime.

The current plan is not reasonably, practically and efficiently enforceable. Many fishermen have offloaded fish without reporting; made multiple offloadings from the same trip to avoid detection of overages; landed fish where there was reasonable certainty that enforcement agents would not be present; and falsely stated species or amounts of species being landed. The mesh size regulation cannot be practically enforced since a fisherman is allowed an incidental catch with a small mesh net, and can claim that fish were caught with a large mesh simply by carrying one on board. The effective average mesh in the otter-trawl fishery today is almost universally acknowledged to be significantly less than the 5 1/8" required by the existing plan.

The data base for management has been seriously eroded. Fishermen have reported where and how much fish have been caught in such a way as to avoid a violation of the regulations, rather then to convey accurate information. Because of limited enforcement resources and an unwillingness by fishermen to testify against others, data evasion could not be prevented. This erosion of the data base has skewed data important for stock analysis, and if unchecked will seriously impair the Council's ability to prepare an effective, comprehensive management plan for the groundfish fisheries.

There is, therefore, a need for a management program that is simpler, less restrictive, and that allows the fishery to operate in response to its own internal forces rather than in response to complex and confusing regulations.

§502 Approaches to Management

One of the principal lessons of groundfish management since 1977 is that a fishery management program for groundfish which does not reflect the multi-species character of the mixed trawl fishery, and which does not start with a clear sense of direction, will simply not work. The fishery is too varied, too widely distributed and too interrelated with other species. Given this, a number of general approaches to management can be evaluated.

Not enough is known about the interactions of the various fleet sectors with domestic and international markets for fish to specify achievable objectives relating to the distribution of benefits from the fishery, nor to specify measures that are efficient and fair. This plan, therefore, does not contain an economic objective, reflecting the judgement that for the time being, the optimal distribution of benefits within the fishery is achieved by natural economic forces operating within the industry.

Total deregulation of the fishery at this time is not warranted. These resources are clearly sensitive to pressure from overfishing. Although the intense pressure from foreign fleets is gone, the tremendous growth in the domestic fleet over the past five years and its potential for overfishing, must be considered. But, the capacity and capability of the current domestic fleet cannot be accurately evaluated since most of the growth has come during a period when vessel performances and statistical data have been skewed by fishermen's responses to the management program.

Although the resource is in relatively good condition compared to the late 1960's and early 1970's, it still deserves cautious treatment. One or two strong year classes tend to predominate, and recruitment for the past two years has been less than average. Some level of continued protection for the resource is clearly appropriate. Providing more protection than is absolutely necessary, however, might well just continue the problems of the current management program. It is important at this time to let the fishery proceed with as little restriction as possible so that it may be better understood as the Council prepares a long-term comprehensive management program.

The most significant factor to consider in establishing objectives for this plan is the need to create a favorable management environment for the preparation of the ADF Plan. Groundfish management will make the most sense only when all of the major species comprising the groundfish complex are managed in coordination with each other. But preparation of the ADF Plan cannot proceed in an environment where the Council and NMFS are continually distracted by the need to address short-term problems which arise principally from the present plan's inability to react to the dynamic nature of the fishery. Perhaps most important is the need to implement a system of management which will encourage the industry to report accurate fisheries catch data which is vital for preparation of the ADF Plan. It is, therefore, necessary to take a signficiant step back from the current management program and observe and analyze the fishery in order to make coherent, cohesive, and informed decisions about the optimal long-term management and utilization of these resources.

§503 Statement of Objectives

The objectives of the Interim Plan are to:

(1) enh nce spawning activities;

(2) reduce the risk of recruitment overfishing of cod, haddock and yellowtail flounder; and

(3) acquire reliable data, in support of the development of ADF, on normal fishing patterns of the indsutry and the biological attributes of stocks as indicated by fishing.

Comment. A major difficulty of the original Atlantic Groundfish Plan was that it had no stated objectives, although it was apparently based on the implied objective of restoration of depleted stocks. That implied objective evolved into less perceptible objectives which were more concerned with economic or socio-cultural problems. The resulting difficulties were partly the consequences of an original failure to identify, define and adhere to reasonable, practical and attainable management objectives.

Three points concerning the first two objectives should be noted. The first is that the term "recruitment overfishing" is intended to mean the reduction of a spawning stock by fishing to a point where reproduction holds poor potential for future recovery of the stock. The second is that the objectives of this plan and the measures that are recommended are intentionally limited. They will provide a degree of stock conservation, but not total protection; they will reduce the risk, but not necessarily prevent or eliminate recruitment overfishing; they will enhance, but not guarantee adequate spawning. The success in attaining the objectives that concern spawning and recruitment overfishing will be measured relative to what would take place if no regulations were in effect. The third point is that the objectives do not directly address the overall level of stock removals in the immediate future years. There is an element of biological risk associated with this approach, which this Plan accepts. In order to concentrate on long-range management of the fishery, the possibility of a decline in stocks over the short-term must be lived with. However, serious damage to the stocks would be the result of cumulative impacts over time. These impacts would be observable in time to allow Council response before critical overfishing occurs.

The plan sets as a final objective the aquisition of reliable fisheries data in order to facilitate preparation of the ADF Plan. The Council recognizes that these data are essential to understand the conditions of the stocks and the normal workings of the industry, and to conduct responsive management. The mangement measures imposed under the original groundfish plan have seriously distorted essential landings data and weakened the information base supporting stock assessment reports. Furthermore, inaccuracies in landings data have distorted vital management information on species dependency, bycatch, switching and seasonal fishing patterns of vessels in the New England and Mid-Atlantic mixed trawl groundfish fisheries. This plan is deliberately intended, in part, to remove those restrictive regulations which induced the data distortions and thereby restore largely unregulated fishing operations from which more reliable data may be obtained for both stock assessment and a broad range of analysis to support future mangagement program development.

This Interim Plan does not seek to attain any objectives other than those stated here. It recognizes that, at this time, credible mnagement depends upon setting limited but relevant and attainable objectives which are readily understood and accepted by large segments of the fishing industry.

PART 6: ALTERNATIVES FOR MANAGEMENT

§601 Basis for Identifying Management Strategy Alternatives

Several reasonable strategy alternatives listed below and considered in this Part were carefully considered by the New England Fishery Management Council in selecting a preferred management strategy and adopting the elements of this management plan for Atlantic cod, haddock and yellowtail flounder. The four strategies discussed in the following sections are primarily defined in terms of the kinds of control measures that they would employ to enhance spawning activities and reduce the risk of recruitment overfishing. The analysis of each strategy alternative in this Part evaluates the generalized approach in relation to management objectives (Part 5). As related to objectives 1 and 2, the analysis considers implications of these strategies for the fish stocks. The strategies are also considered from the perspective of minimizing costs to industry and administrative costs.

The four alternative strategies considered by this Plan are:

1. Control on the catch of the regulated species (e.g., through species quotas), see §602.

2. Control on the fishing effort directed at the regulated species (e.g., through limits on vessels or fishing time), see §603.

3. Control of fishing practices which affect the vulnerability of the regulated species to fishing (e.g., through gear restrictions or closed area/seasons), see §604.

4. Controls which represent some modification to the existing management program and thus contains elements of all of the above, see §605.

The Table at the end of this Part (Table 606.1) presents a judgemental evaluation of these strategies in relation to each other.

§602 Control on Catch

This general strategy for managing the cod, haddock and yellowtail flounder fisheries was previously adopted for the existing groundfish management plan. The strategy most often employs quotas as the primary control measure. Quotas could be geared toward either 1) achieving a desirable harvest rate (associated with the long-term productivity of the resources), or 2) achieving a desired stock level at the end of a quota period. In either case, quotas would rely heavily on current stock assessment information in order to avoid unnecessarily penalizing the industry and the nation in the short run.

Although the capability presently exists to calculate short-term levels of allowable catch corresponding to either a specified harvest rate or a stock size goal, the objectives of this Interim Plan do not identify either a desired harvest rate or stock size goal. The administrative costs of controls on catches can be very high, particularly in a fishery with a large number of participants. The administrative problems are exacerbated when large segments of the industry have little faith in the management program and look for loopholes or ways to avoid enforcement.

Additionally, catch control is most efficient in a single species fishery. Where various species of fish are caught together in a mixed-trawl fishery, species-specific catch limits may artificially constrain the harvest of associated species, or keep other species quotas from being achieved (both of which impose costs on the industry), or be ineffective in controlling any removals.

Finally, in a situation where vessel entry and exit are not controlled, the existence of quotas may induce undesirable behavioral changes in the fishery. The potential for a fishery closure has in the past encouraged vessels to scramble for a share of the management quota. Such a "scramble" phenomenon often results in operating inefficiencies, negative price effects and reduced net revenues to the industry, followed by product scarcity and elevated prices during extended fishery closure periods. In addition, concern for a pending fishery closure can lead to misreporting of catch and increased monitoring/enforcement costs.

§603 Control on Fishing Effort

Controlling fishing effort is designed to increase long-term resource productivity by limiting the rate at which the resource is harvested. This strategy implies the use of management measures such as a limit on the number of fishing days available in a given year or a limit on the number of participating vessels. Such effort control measures are generally considered to be more efficient than quota measures at limiting exploitation of the resource. In effect they provide a more direct control on the rate of harvest without acting to deny the opportunity for the industry to take advantage of increased catches that come with natural fluctuation in resource abundance.

Effort control, like catch control, limits the extent to which fish are harvested before they can contribute to the spawning potential of the stock. However, as noted for catch control, a specific "appropriate" level of effort in the current groundfish fishery is not consistent with the goals of this Plan. An overly restrictive specification of effort control can result in an undesirable loss of short-term benefits to the industry, even though long-term benefits to the resource may be enhanced.

Implementation of effort control measures in the cod, haddock and yellowtail flounder fisheries would run into several important problems. Direct vessel effort represents only one of the factors which influence biological resource exploitation; vessel/gear efficiency and age-at-first-capture must be simultaneously considered. Development of a meaningful relationship between nominal fishing effort and exploitation is complicated by changes in vessel/gear efficiency that cannot be readily accounted for, inability to associate effort with any one species (as opposed to the collection of species taken on the same trip), and the unavailability of effort data for all sectors of the fishery or all vessel/gear groups.

§604 Control on Fishing Practices

Like controls on catch and effort, the general strategy of adopting control measures which affect fishing practices also attempts to increase long-term resource productivity by constraining exploitation of the stock or of certain age groups within the stock. However, this strategy relies on measures such as gear restrictions (e.g., mesh size or net configuration), or closed areas and seasons, which selectively reduce the vulnerability of the stock to capture. Measures of this type have been used extensively over the past decade in management programs for cod, haddock and yellowtail flounder. Seasonal closures of haddock spawning areas and cod-end mesh restrictions were established under ICNAF and continued under the original groundfish management program for the cod, haddock and yellowtail flounder fisheries.

In the context of the management objectives, control measures affecting resource vulnerability are very useful because they permit intervention prior to the fishing activity. Concern for recruitment overfishing can be addressed by measures (e.g., minimum mesh or minimum fish size) which focus the fishery away from sexually immature fish to permit those age groups to remain in the population long enough to contribute to the spawning stock. Enhancement of spawning activities can be addressed through fishery closures during periods when fish are spawning and/or in traditional spawning areas. In addition to recruitment and spawning considerations, measures of this type which control age-at-entry into the fishery also have significant implications for the total production that can be derived from year classes recruiting to the cod, haddock and yellowtail flounder fisheries. In combination with area closures these measures may enhance the long-term productivity of the fishery resources.

There are, however, two major limitations to this general strategy. First, because the overall exploitation of the cod, haddock and yellowtail flounder resources is greatly influenced by the level of applied effort, measures controlling fishing practices typically offer only loose control over resource exploitation. Second, such measures are often inefficient from an industry perspective because in the short run they increase the per unit cost of catching fish. That is, catch (revenue) per day fished in the short run is initially reduced by decreasing the efficiency of a fishing day.

§605 Modification of Existing Control Measures (No Action)

The modification of the control measures in the existing FMP, as an alternative strategy, refers to either a respecification of the values of those measures or a change in the manner in which they are implemented. In either case it is understood that the basic combination of measures (quotas, trip limits, mesh sizes, spawning closed areas) would remain intact, and are therefore as close to a "no action" alternative as could reasonably be contemplated. None of the previous attempts at plan modification in the past have satisfactorily addressed problems of resource conservation, industry benefits, and accurate data reporting. As a consequence, this alternative holds little promise for the effective management of the regional cod, haddock and yellowtail flounder resources, while the Council moves ahead with a long-term multispecies (mixed-trawl) management program.

§606 Selection of Preferred Management Strategy

Selection of a preferred management strategy in this Interim Plan has been based upon a subjective evaluation of the relative merits of the four general strategy alternatives discussed above. The evaluation, represented by Table 606.1, was conducted with reference to the following five criteria:

1) compatibility with Objectives 1 and 2 (resource considerations).
2) feasibility for implementation (management considerations).
3) minimization of costs and regulatory burdens to industry (economic considerations).
4) quality of data reporting (resource and administrative considerations).
5) minimization of administrative and enforcement effort (administrative considerations).

The alternatives are rated qualitatively [i.e., poor (P), fair (F), and good (G)] for each of the above criteria.

An examination of the analysis contained in Table 606.1 indicates that controls on fishing practices should be the preferred management strategy. These provide protection to the resource most consistent with the objectives of this plan and the current status of the resource. They have great advantages in minimizing costs to industry and improving the quality of data reporting. Administratively, they are clear and easy to deal with, requiring the exercise of little discretion or balancing between competing interests to run the management program.

This Interim Plan, therefore, adopts controls on fishing practices as its strategy. Various type of alternative control measures are further specified and analyzed in Part 7.

TABLE 606.1: EVALUATION OF STRATEGY ALTERNATIVES

Generalized Strategy	Criteria	Rating[1/]	Comment (see text for further elaboration as required)
1. CATCH CONTROL:			
	Compatibility w/Objectives 1 & 2	F	·Although quota control is relevent to the objectives, it is not possible to specify an appropriate level of catch that meets the objectives.
	Feasibility for Implementation	G	·Quota levels can be calculated and related to status of resource, although hindered by recent quality of reported catch data. (Objective 3)
	Min. Cost to Industry	F	·Uncertainty in stock assessment is reflected in quota and may result in some short-term loss of revenue; ·Quotas encourage "scramble" behavior, result in economically inefficient use of resource. ·Quotas are problematic in a mixed species fishery.
	Quality of Data Reporting (Objective 3)	P	·Experience has shown that quotas imposed on an open fishery encourage underreporting and misreporting.
	Min. Admin./Enf. Effort	F	·Monitoring of vessel landings imposes reasonable costs.
2. EFFORT CONTROL:			
	Compatibility w/Objectives 1 & 2	F	·Effort control is a powerful management tool and relevent to the objectives, but there is no "appropriate" level of effort that meets the objectives.
	Feasibility for Implementation	F-P	·Although standardized effort units may be calculable, effort cannot be operationally related to all vessel/gear groups or easily reconciled with a subset of species in a mixed species fishery. (Objective 3)
	Min. Cost to Industry	G	·Effort control allows vessels to take advantage of resource availability, and depending on the form, encourages efficient use of the resource.
	Quality of Data Reporting (Objective 3)	G	·Effort control should encourage accurate reporting of species landings data; accurate effort data may be problematic.
	Min. Admin./Enf. Effort	F	·Monitoring of vessel effort imposes reasonable costs.
3. CONTROL ON AVAILABILITY:			
	Compatibility w/Objectives 1 & 2	F	·Candidate measures (mesh size, minimum fish size, closed area/seasons) are particularly suited to objectives; specification of measures still requires a partially subjective judgement of appropriateness.
	Feasibility for Implementation	F-G	·Sufficient data exist to permit specification of most measures. However, the mixed-trawl nature of the fishery implies trade-offs in the degree of effectiveness for individual species.
	Min. Cost to Industry	F-G	·Candidate measures allow vessels to maximize catch per trip, but gear related measures may impose short-term costs at the points of implementation or respecification.
	Quality of Data Reporting (Objective 3)	G	·Candidate measures should encourage accurate reporting of all fishery data.
	Min. Admin./Enf. Effort	F	·Monitoring of compliance with measures imposes reasonable costs.
4. MODIFICATION OF EXISTING MEASURES (No Action):	Compatibility w/Objectives 1 & 2	F	·The justification of a quota management system is strained in relation to the objectives. ·The existence of a vessel-class trip limit scheme is not justified by the objectives.
	Feasibility for Implementation	F	·Although quota level calculations are technically valid, accuracy has been compromised by data quality. ·Trip limit program is operationally insensitive to changes in fleet structure, nor is it responsive to changes in vessel efficiency.
	Min. Cost to Industry	P	·Quota system with associated vessel class allocation and trip limit measures has been costly to the industry: excessive regulatory burden; imposed constraints on trip catch and the quota "scramble" phenomenon have resulted in lost profits and inefficient resource utilization.
	Quality of Data Reporting (Objective 3)	P	·Induced misreporting and nonreporting degraded the effectiveness of the management system, undermined ability for biological resource assessment.
	Min. Admin./Enf. Effort	P	·Incremental cost of enforcing trip limit system was high.

1/G = Good, F = Fair, P = Poor; These ratings are relevant only to the management of the cod, haddock and yellowtail flounder resources

PART 7: IDENTIFICATION AND ANALYSIS OF MANAGEMENT MEASURES

§701 Withdrawal of Existing Management Measures

§701.1 Introduction

This Interim Plan's management objectives (See §503) and strategy (control of fishing practices) signifies withdrawal of limitations designed to achieve quotas and intended to equitably distribute benefits from the fishery. Withdrawal of the quota system will have implications for the amount of the cod, haddock and yellowtail flounder which is likely to be landed. This section discusses these implications to establish a frame of reference for analyzing the various alternative management measures.

§701.2 Expected Catch and Economic Impacts

This analysis was approached in three steps. First, the expected catches of cod, haddock, and yellowtail in the absence of quotas were estimated looking at trends in catch, abundance and effort. Second, these estimates were compared with 1) the target catch levels that would have been recommended under some modification of the existing quota system, and 2) a catch estimate which looks only at recent levels of fishing mortality and current prospects for recruitment. Finally, the economic impacts of elimination of the seasonal quotas/vessel class allocations are discussed in relation to the expected change in catch.

The catches of cod, haddock and yellowtail flounder in the Gulf of Maine and Georges Bank and Southern New England were projected for calendar years 1982 and 1983. The methodology for this analysis is described in NEFMC Res. Doc. 81 GF 1.1, revised. The projections are based in general upon an analysis of the relationship between seasonal landings from the two resource areas over the period 1970-1979, and trends in vessel effort and relative species abundance over the same period. "Effort" includes information on days fished by vessels in various tonnage classes and seasonal periods, taking into consideration the vessels' input costs at that time. "Species abundance" is a relative index based upon catch per tow information from the NMFS autumn bottom trawl surveys. Using this model, projected 1980 aggregate catches of cod, haddock and yellowtail flounder were 85,500 MT. This value compares favorably with the actual reported aggregate catch for 1980 of 85,800, though the annual catch of individual species varied by as much as 5,000 MT. In projecting 1982 and 1983 catch by species and resource area, the analysis uses species abundance information (catch per tow data) from the 1980 autumn bottom trawl survey.

Aggregate cod, haddock and yellowtail flounder landings of 109,700 MT are projected for 1982, and 115,600 MT for 1983. (See Table 701.1) Because of the difficulty in partitioning fleet effort among species, these projections should only be made in the aggregate. The catch projection for 1982 (A) is compared with the total expected catch (B) that might be considered reasonable in 1982, considering recent levels of fishing mortality and current recruitment prospects, and the level (C) that would likely have been recommended under some continuation of the existing groundfish management.

Projected catch for 1982 is within a range of catch values that might be expected considering the current status of the resource, prevailing fishing mortality rates, and recruitment prospects. Further, the 1982 projection exceeds by only 15% the total catch quota that might have been recommended for 1982 using the more conservative fishing mortality policies in the existing FMP. (The catch projection for 1983 is based on that for 1982, and is used in the economic evaluation of alternative management measures; see 702.4.)

Table 701.1: Projected Total Catch of Regulated Species Following Quota Withdrawal

A.	1982 Projected catch 1/ based on trends in catch, abundance and effort.	109,700 MT
B.	1982 Expected catch 2/ based on recruitment prospects and recent levels of fishing mortality	101,000 MT - 108,000 MT
	and a 20% increase in fishing mortality.	119,000 MT - 126,000 MT
C.	1982 Catch 3/ based on current quota management policies ($F_{0.1}$, F_{max}) and recruitment prospects.	95,000 MT
D.	1983 Projected catch 1/ based on trends in catch, abundance and effort.	115,600 MT

1/ Projection based upon catch analysis detailed in NEFMC Resource Document 81 GF 1.1 (revised).

2/ Expected catch based upon personal communication with NMFS/NEFC assessment personnel.

3/ Quota which would likely be recommended for 1982, under some modification of the current quota management program.

Projected catch for 1982 and 1983 exceeds reported landings of cod, haddock and yellowtail flounder for 1980 (about 85,000 MT). Because of the high elasticity of ex-vessel demand for cod, haddock and yellowtail flounder, these increases can be expected to result in increased short-term returns to the industry. The management measures contained in the Plan will have additional beneficial effects.

§701.3 Implications for the Resource

Georges Bank Cod and Haddock. Considering the apparent decline in the abundance of Georges Bank cod in relation to the expected increase in the abundance of haddock from the same resource area, and in view of the joint harvesting relationship for these two species, the projected aggregate catch level carries the potential for resource exploitation in excess of F_{max} for cod and $F_{0.1}$ for haddock. (These fishing mortality indices were used as target values in setting quotas under the existing FMP). For Georges Bank cod, exploitation in excess of F_{max} may imply further stock reduction, depending on the strength of the recruiting 1979 and 1980 year classes, which currently appear poor and average, respectively, in the 1981 Georges Bank cod assessment. For Georges Bank haddock, exploitation in excess of $F_{0.1}$ will moderate any expected increase in stock abundance from growth of recent recruiting year classes.

The residual biomass of both Georges Bank stocks will be comprised of only one or two principal year classes in 1982. As noted in NMFS/NEFC Resource Document 81-09, the spawning potential of these stocks will be dependent on only a few cohorts, rather than a heterogeneous mix of age groups.

Gulf of Maine Cod and Haddock. The 1981 assessment for the Gulf of Maine stocks of cod and haddock indicate that 1) recent recruiting year classes have maintained cod abundance at among the highest levels observed over the past decade in spite of heavy fishing pressure, and 2) recent, relatively weak, recruiting year classes of haddock have contributed to a decline in abundance from previous, relatively high levels. Catches of cod and haddock at the level projected for 1982 can be expected to result in maintenance of cod abundance and further reduction in haddock abundance. The absolute abundance of the Gulf of Maine haddock resource entering 1983 will depend significantly upon the strength of the recruiting 1980 year class, which currently appears to be average in strength. At current and projected 1982 levels of catch, the Gulf of Maine cod abundance can be expected to remain stable going into 1983.

Yellowtail Flounder: Recent reported yellowtail flounder catch levels (approximately 20,000 MT in 1980) have generated fishing mortality levels significantly in excess of F_{max} in the major resource areas. Such levels of fishing mortality result in year classes being harvested rapidly as they enter the yellowtail fishery, and as a consequence, the fishery becomes increasingly dependent on annual recruitment, and thus subject to variability inherent in annual recruitment. Catches at the levels projected for 1982 and 1983 in the absence of quotas will likely maintain this trend in the fishery for the forseeable future.

§701.4 Management Implications and Administrative Costs

The effectiveness of any managment program should be measured in terms of the degree to which its objectives are achieved and its management measures complied with. The objectives of this Interim Plan suggest the use of management measures which have the broad support of the industry. Measures such as mesh size and area closure are easily understood and regarded by industry as being of significant value for resource conservation. Further, in the absence of quotas, implementation of such measures would improve the quality of fishery data collected under the Plan since the information being supplied would not prove or disprove any violation of the regulations. Further, in public comment on the Interim Plan the industry has indicated support for this approach.

Withdrawal of the current quota management system should reduce the administrative costs of implementing a groundfish plan, since there will be fewer routine management decisions to be made in carrying out the program. It is important to note that administrative cost elements such as NMFS enforcement agents, port agents, Coast Guard surveillance and much of NMFS' data collection system (weigh-out and interview) pre-date the Magnuson Act, and relate to functions under other plans as well. The Plan does not require data collection beyond that which NMFS is already planning to do.

§702 Fish Size, Mesh Size and Area of Coverage

§702.1 Introduction

Given knowledge of the relationship between the size of the mesh openings and the size of fish which such gear will capture, described by fish selection curves, an appropriate mesh size may be chosen such that the majority of fish of a given species in the catch will be larger than a specified size. The biological basis for establishing minimum fish sizes to meet the objectives of the Interim Plan is principally related to size at sexual maturity. To the extent that only fish larger than those at sexual maturity to be caught, the spawning potential of the stock will be enhanced and the likelihood of recruitment overfishing reduced.

Reducing the risk of recruitment overfishing implies that some limits should be applied to fishing mortality on fish which have not yet spawned. A target minimum fish size may be attained in fishing operations by choosing a mesh size which corresponds to the size at which sexual maturity is attained. A selection curve for a particular species of fish caught by a mobile trawl net is typically in an S-shaped form which expresses the cumulative percent of fish over a range of lengths which are retained in the net.

Although there is not a well-defined stock-recruitment relationship for most species of groundfish, evidence from the world's cod and haddock fisheries suggests that strong spawning stocks enhance the likelihood of continued, stable, strong recruitment. On the other hand, relatively depleted spawning stocks exhibit much more erratic recruitment. Therefore, since an adequate spawning stock must be maintain, minimum fish and mesh sizes should at a minimum ensure that a sufficient number of juvenile fish survive to contribute to the spawning potential of the stock. This determination must be made in consideration of the level of effort in the fishery.

The majority of groundfish landings are taken with mobile trawl gear. However, a significant catch is made with fixed gear such as longlines and gill nets. On the basis of available information from the New England groundfish fishery (Clark, 1978), it appears that gill nets select for groundfish at least as large as those retained in mobile trawls with the same size meshes in the cod end. Hence, until more information becomes available it may be appropriate to treat the two types of gear in a substantially similar manner. Very little information is available relative to the selection of fish by hooks (longlines), thus analysis of this gear type should await accumulation of sufficient data.

A criterion which may be useful as a benchmark for an effective minimum size in groundfish management is the size at 50% maturity; i.e., the size at which 50% of all similarly sized fish of a given species may be expected to be sexually mature and capable of spawning. Table 702.1 provides available data regarding the size and age at which six groundfish species become sexually mature.

Mobile trawl net selectivities are often expressed in terms of the 50% retention length; i.e., at least 50%, by number, of a given species of fish which enter the net and are that length or larger are retained in the cod-end. Table 702.2 gives the estimated 50% retention lengths (and corresponding ages) of six groundfish species, by four alternative mesh sizes, calculated on the basis of information obtained in mesh trials conducted by NMFS (Smolowitz, 1978) using synthetic mesh cod ends.

Information from the two tables suggests that the size at 50% maturity for cod most closely corresponds to the 50% retention length of a 6-inch mesh, while that for both haddock and yellowtail flounder appears to fall near the 50% retention length of 5 1/8 inch mesh. Pollock and winter flounder, by the 50% maturity criteria, would be harvested with a 6-inch mesh, whereas dabs (mature by their third year) could be taken with a 4 3/4 inch mesh. Thus, the choice of a single mesh size for the mixed trawl groundfish fishery must involve a number of compromises. Noting these facts, and in recognition of established small mesh fisheries within the overall groundfish complex (such as silver hake and redfish), it seems necessary to examine mechanisms whereby small mesh fisheries may be accommodated within the overall management scheme for New England groundfish.

Table 702.1: Comparative Age (Size) at Maturity Data For Six Groundfish Species

Species	Age at First Maturity (Years)	Age at 50% Maturity (Years)	Size at 50% Maturity (Inches)
Cod	3	3-6	Male: 21.1 Female: 19.5
Haddock	2	3	Male: 16.3 Female: 16.9
Yellowtail Flounder	2	3	Male: 9.6 Female: 10.8
Pollock	*	5-6	Male: 19.7-25.6 Female: 21.7-27.6
Winter Flounder	2-3	*	*
Dabs	2	2-3	Undifferentiated: Less than 11"

* Not known

Source: Pierce, 1980.

Table 702.2: Estimated 50% retention length (inches) for six species of groundfish at four levels of cod-end mesh size. Numbers in brackets indicate approximate age in years.

Species	4 3/4	5 1/8	5 1/2	6
Cod	16.1	17.3	18.6	20.3
(Gulf of Maine)	(3.1)	(3.4)	(3.6)	(4.0)
(Georges Bank)	(2.1)	(2.3)	(2.6)	(3.0)
Haddock	15.3	16.6	17.8	19.4
	(2.0)	(2.4)	(2.7)	(3.2)
Yellowtail Flounder	10.4	11.2	12.0	13.1
(Georges Bank)	(2.0)	(2.3)	(2.5)	(3.0)
Pollock	15.7	16.9	18.2	19.8
	(2.8)	(3.1)	(3.4)	(3.8)
Winter Flounder	9.9	10.7	11.5	12.5
	(1.9)	(2.1)	(2.3)	(2.5)
Dabs	11.1	12.0	12.9	14.0
	(3.0)	(4.3)	(4.7)	(5.2)

§702.2 Identification of Management Options

Because of their relationship to recruitment of juvenile fish to the spawning stock, mesh size and minimum fish size are key measures in achieving the Interim Plan's objectives. The choice of an appropriate mesh size should be made in relation to the expected size ranges of fish which would be captured by the fishing gear. These interrelationships imply that the first step in determining an appropriate mesh size is to examine minimum fish size.

Minimum Fish Sizes and Mesh Size Options

The size at 50% maturity for haddock and yellowtail flounder is probably about 17 inches and 11 inches, respectively. (See Table 702.1) These sizes also correspond to the 50% retention length for 5 1/8 inch mesh. (See Table 702.2) Although 17 inches also corresponds to the 50% retention length for cod using a 5 1/8 inch mesh, the size at 50% maturity for cod is about 20-21 inches. A mesh size which would select for cod at the 50% maturity level (6 inches) would corespond to the 50% retention level for haddock at 19 inches and yellowtail at 13 inches. Thus, if the size at 50% maturity is to be used as a criterion for minimum fish size, certain tradeoffs will be required. Because joint harvesting relationship makes a single mesh size the only practical option, it must be decided whether the relative protection to be afforded should favor cod on the one hand, or haddock and yellowtail on the other.

From a biological perspective and in consideration of the current status of the resource, a 17-inch minimum size for cod may be adequate as a measure to reduce mortality on juvenile fish. In the current overall resource context it may not be biologically justifiable to require the larger size limit for haddock and yellowtail flounder (i.e., 19 inches and 13 inches, respectively) if the intent of management is to allow a majority of (but not necessarily all) juveniles to survive and recruit to the spawning stock.

Minimum fish size relates to mesh size in two ways. First, the combination of minimum sizes should be selected for the three regulated species keeping in mind that they are all going to be caught with a single mesh size. Second, to be an effective measure in addressing the management objectives, the chosen mesh size must exhibit a retention curve such that the majority of fish retained in the net will be larger than the chosen minimum fish sizes. Since the minimum fish sizes are largely determined by criteria relating to size at maturity, any possible future increases in mesh size will not require sumultaneous adjustments in the minimum fish sizes.

In order to achieve a minimum fish size consistent with the 50% sexual maturity size, some mesh size between 5 1/8" and 6" appears appropriate. However, for purposes of the analysis contained in this Part, 4 3/4" is included to demonstrate the relative impacts of a smaller mesh size.

Large Mesh Area Options

If the intent were to manage the fisheries for cod, haddock and yellowtail flounder without regard to the other species in the overall mixed trawl fishery, then control measures specifiying a uniform minimum mesh size would be made to apply to the entire management unit. Although the primary thrust of the management program described in this Plan concerns the fisheries for cod, haddock and yellowtail flounder, recognized "small-mesh" fisheries for unregulated species within the mixed trawl complex should be accommodated to the extent possible. Accordingly, a series of "large mesh" area options were defined on the basis of detailed historical catches by area. To achieve an appropriate balance, alternative "large mesh" area specifications were designed with the intent of maximizing the mesh coverage of the total annual landings of cod, haddock, and yellowtail flounder, while minimizing the impact on fisheries for which small mesh nets are necessary, most importantly, redfish and silver hake.

The four major options which were examined are illustrated in Figure 702.1 are described in Table 702.3. All area options are concerned only with the western Gulf of Maine and Georges Bank within statistical areas 5Y and 5Ze, since these are the primary areas of cod and haddock catches.

Over 90% of the annual historical landings of each of cod, haddock and yellowtail are encompassed by Option 1. Option 2 provides slightly lower coverage of cod, haddock, and yellowtail flounder than does Option 1, but has a significantly lower impact upon redfish. This was accomplished by subtracting a portion of the area encompassed by Option 1, located in the northern approaches to the Great South Channel, to more closely conform to the 50 fathom curve (see Figure 702.1, Options 1 and 2). Option 3 covers the same area as Option 1 except that the more northerly portions of both Georges Bank and the western Gulf of Maine would be opened to a small mesh fishery (redfish) during January - April (see Figure 702.1, Option 3, hatched area). Option 4 again covers the same area as Option 1 but with a small mesh fishery allowed during July - October for silver hake in a specified area of the western Gulf of Maine and on Georges Bank in the Cultivator Shoals area (see Figure 702.1, Option 4, hatched area).

Options 1 and 2 are alternative specifications for a "large mesh" area with no specific provision for seasonal "small mesh" fisheries. Options 3 and 4 are variations on Option 1 which include specifically defined seasonal/area provisions for the "small mesh" fisheries. Options 3 and 4, with very specific time/area provisions, may lend themselves to an effective enforcement effort, but are rigid and may be unresponsive to small mesh fish availability on a year-to-year basis.

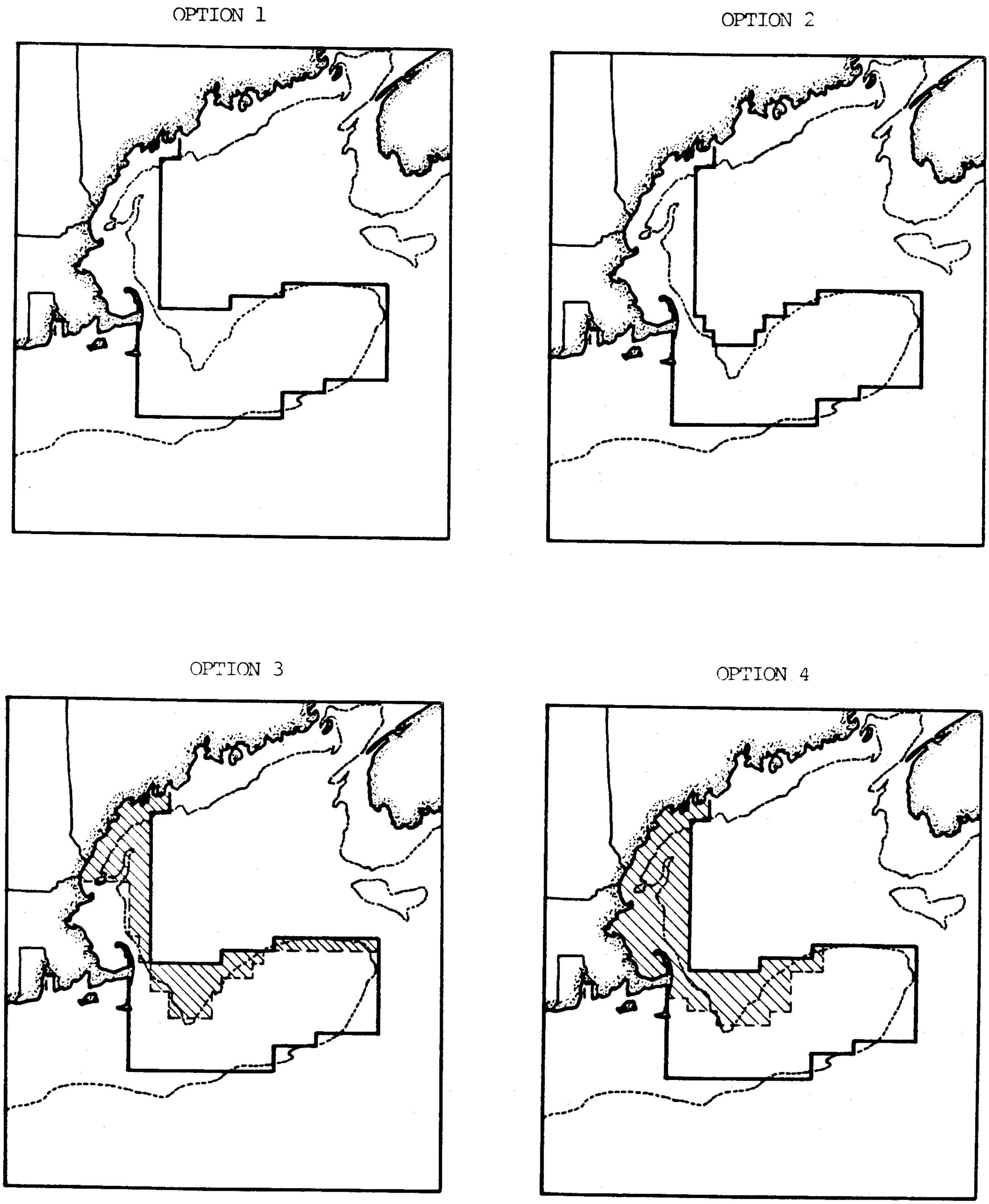


Figure 702.1 Large mesh area options. Crosshatching indicates area exemptions for small mesh fisheries.

Table 702.3: SUMMARY OF AREA/MESH OPTIONS

Option	Description	Percent of[1/] Annual Catch Encompassed	Comments
1	- Annual large-mesh area - No seasonal exemption	COD 93.4 HAD 90.3 YT 90.1 RF 19.2 SH 77.5	Directed, declared single mesh, silve hake fishery possible. (See Fig. 702.1)
2	- Annual large-mesh area - No seasonal exemption	COD 88.0 HAD 81.3 YT 89.9 RF 10.9 SH 76.4	Directed, declared single mesh, silver hake fishery possible. (See Fig. 702.1)
3	- Annual large-mesh area - Seasonal exemption	COD 89.0 HAD 84.3 YT 90.0 RF 14.8 SH 74.0	Jan. - Apr. exemption directed at concentrations of redfish landings. (See Fig. 702.1)
4	- Annual large-mesh area - Seasonal exemption	COD 74.3 HAD 72.9 YT 80.8 RF 14.7 SH 15.4	Jul. - Oct. exemption directed at concentrations of silver hake landings. (See Fig. 702.1)

[1/] Based upon average landings over the period 1974-1978. The percentages in Options 3 and 4 are reduced because of the seasonal exemptions.

An alternative approach to meeting the concerns of the "small mesh" fisheries is to establish an system whereby vessels could be permitted to target their fishing effort on specified small mesh species with the specific approval of the NMFS Regional Director.

The identified management options are presented in Table 702.4. The specification of the various options for management of cod, haddock, and yellowtail flounder is comprised of three elements. These are: 1) options with respect to the areal/temporal description of the "large mesh" area; 2) options which allow accommodation of recognized "small mesh" fisheries; and 3) options with respect to an appropriate mesh size for "large mesh" nets specific for cod, haddock, and yellowtail flounder.

Table 702.4: MESH SIZE/AREA MANAGEMENT OPTIONS

Large Mesh Area Options*	Optional Settlement/ Mesh Exemption	Large Mesh Size Options
1.a.	With Optional Settlement No Area/Mesh Exemption	4 3/4 in., 5 1/8 in., 5 1/2 inc., 6 in.
b.	No Optional Settlement No Area/Mesh Exemption	Same as above
2.a.	With Optional Settlement No Area/Mesh Exemption	Same as above
b.	No Optional Settlement No Area/Mesh Exemption	Same as above
3.	Redfish Area/Mesh Exemption No Optional Settlement	Same as above
4.	Silver Hake Area/Mesh Exemption No Optional Settlement	Same as above

* See Figure 702.1 and Table 702.3

§702.3 Implications for the Resource

The Beverton-Holt yield per recruit analysis was used for assessing the relative expected biological impacts of changes in cod end mesh sizes upon the cod, haddock, and yellowtail flounder fisheries. It is assumed in the analysis that for the first year following implementation of the Interim Groundfish FMP (1982) mesh size will be continued at 5 1/8 inches. Further, mesh size will be changed to 5 1/2 inches one year after implementation (1983).

The theoretical basis for the analysis makes it most useful for calculating the long-term resource effects (catch benefits) of the various mesh sizes under consideration. The analysis makes no assumptions with respect to the actual level of recruitment in future years, but assumes that fishing mortality will remain constant. The latter assumption is made for simplicity and convenience and is valid for the purposes of the analysis so long as actual fishing mortality in the furture is independent of the mesh size selected.

The analysis is also useful for evaluating impacts of various mesh sizes on short-term yield from the fishery. However, the results must be interpreted in the context of recent recruitment because they are based on constant (not varying) recruitment conditions. Table 702.5 provides information on the relative strengths of recent year classes of cod and haddock to assist in this interpretation. Table 702.6 provides estimates of recent fishing mortality rates in the cod, haddock and yellowtail flounder fisheries. These values are used in the analysis.

The results of the analysis appear in Table 702.7. Both long and short-term values are expressed in terms of the expected percentage change in total catch resulting from implementation of various cod end mesh sizes relative to a 5 1/8 inch mesh size. The results assume that the entire catch would be affected by changes in the mesh size, and, therefore, do not take into account the relative degree of coverage offered by the atlernative "large mesh area" options described in §702.2. The actual long-term changes in catch will depend on long-term recruitment prospects and acutal fishing mortality levels over time. The actual short-term changes in catch will depend upon current recruitment prospects in relation to stock size in 1982.

Table 702.5: Relative Strengths of Recruiting Year Classes of Cod and Haddock

Gulf of Maine

Year Class	Cod	Haddock
1975	strong	strong
1976	poor	above average
1977	average	poor
1978	above average	poor
1979	above average	poor
1980	average	average

Georges Bank

Year Class	Cod	Haddock
1975	strong	strong
1976	poor	poor
1977	average	poor
1978	above average	strong
1979	poor	poor
1980	average	average

Table 702.6: Projected Fishing Mortality Rates, 1983[1]

	F
Cod	
Gulf of Maine	0.4
Georges Bank	0.6
Haddock	
(Both Areas)	0.3
Yellowtail Flounder	
Georges Bank	0.9

[1]These fishing mortality rates are based upon recent levels of catch and resource conditions.

Table 702.7: Short-term[1] (first year) and Long-term[2] (equilibrium) Percentage Changes in Yield of Cod, Haddock, and Yellowtail Flounder Relative to 5-1/8" Mesh Size[3]

Species		Alternative New Large Mesh Size (Inches) 4-3/4	5-1/2	6
Cod, Gulf of Maine,	short-term	+5.42	-6.59	-16.10
	long-term	-5.59	+5.42	+12.25
Georges Bank,	short-term	+7.97	-9.69	-22.98
	long-term	-7.39	+7.32	+16.82
Haddock	short-term	+7.12	-9.10	-23.35
	long-term	-2.62	+1.85	+2.66
Yellowtail Flounder	short-term	+12.86	-16.92	-40.04
	long-term	-9.45	+9.75	+22.89

1 The actual first year impact will be highly dependent upon strengths of the recruiting year classes.

2 The long-term equilibrium calculation assumes that annual recruitment and fishing mortality are constant and independent of stock size. Mesh is the only variable element in the analysis.

3 Impacts have been calculated assuming that entire catches would be affected by mesh changes and do not take into account relative degrees of coverage under the various large mesh area options described in §702.2.

It is clear that reduction of the cod end mesh size from 5-1/8 inches to 4-3/4 inches would provide short-term increases in total catch but would also lead to long-term catch reductions and increase the potential for recruitment overfishing. The data in Tables 702.1 and 702.2 indicate that a 6 inch mesh size may be appropriate for cod in consideration of the management objectives, whereas for haddock and yellowtail flounder the most appropriate size is 5-1/8 to 5-1/2 inches. On the other hand, the short-term impacts upon the catch of cod (a 16-23% reduction) associated with going to a 6 inch mesh (from 5-1/8 inch mesh) in a single step are substantial.

Looking at actual current year class strengths (See Table 702.5), with two above-average year classes (1978 and 1979) currently in the Gulf of Maine cod fishery, the projected 16% reduction in catch in 1983 is probably an overestimate. Conversely, with uncertain prospects for recruitment in the Georges Bank cod fishery, the mesh size impacts are more likely to be as stated in Table 702.7. For haddock, the situation is similar, but reversed. If the strong 1978 year class in the Georges Bank haddock fishery is still a significant portion of that population in 1983, the projected 23% short-term loss associated with changing to a 6 inch mesh may be an overestimate; but mesh size impacts on haddock in the Gulf of Maine should, because of uncertain prospects for recruitment, approximate those stated in Table 702.7. With regard to yellowtail flounder, it is unknown whether future recruitment effects could reduce the projected short-term impact (40%) because information regarding the strength at recruitment of recent yellowtail flounder year classes is unavailable.

With the exception of yellowtail flounder, all projected catch reductions in the first year (1983) associated with going to a 5 1/2 inch mesh are less than 10%. Moreover, as discussed above, consideration of the above average year classes present in the fishable stock suggests that short-term impacts upon the fisheries for Gulf of Maine cod and Georges Bank haddock may be substantially less than estimated because the latter estimates were made assuming average strength year classes. Yellowtail flounder may remain as the most highly impacted species, although the exact level of relative impact upon 1983 catches will be highly dependent upon the strength of the 1980 and 1981 year classes.

Given the fact that any increase in mesh size may result in some short-term losses in total yield, it is possible that the industry response would be to increase fishing effort in order to minimize such projected losses. Computer simulations, illustrated in Figure 702.2 using Gulf of Maine cod examined a scenario whereby the mesh size was increased from 5-1/8 inches to 5-1/2 inches. Recruitment was held constant to isolate the effects of increases in fishing mortality rate (F) as a consequence of increased effort. In general it was observed that if F was increased in the year following the mesh change, but held constant thereafter, then projected short-term losses in yield could be avoided but at the expense of slight reductions in the projected long-term yield gains. Nevertheless, significant increases in the level of long-term average yield are still possible. Under all conditions, however, the increase in mesh size would be expected to result in more young fish (by number) reaching sexual maturity and contributing to the spawning stock. It must be emphasized that the absolute shape of the curves presented in Figure 702.2 would be highly dependent upon the actual levels of recruitment (which was held constant in this analysis), especially during the earlier years following the change in mesh size.

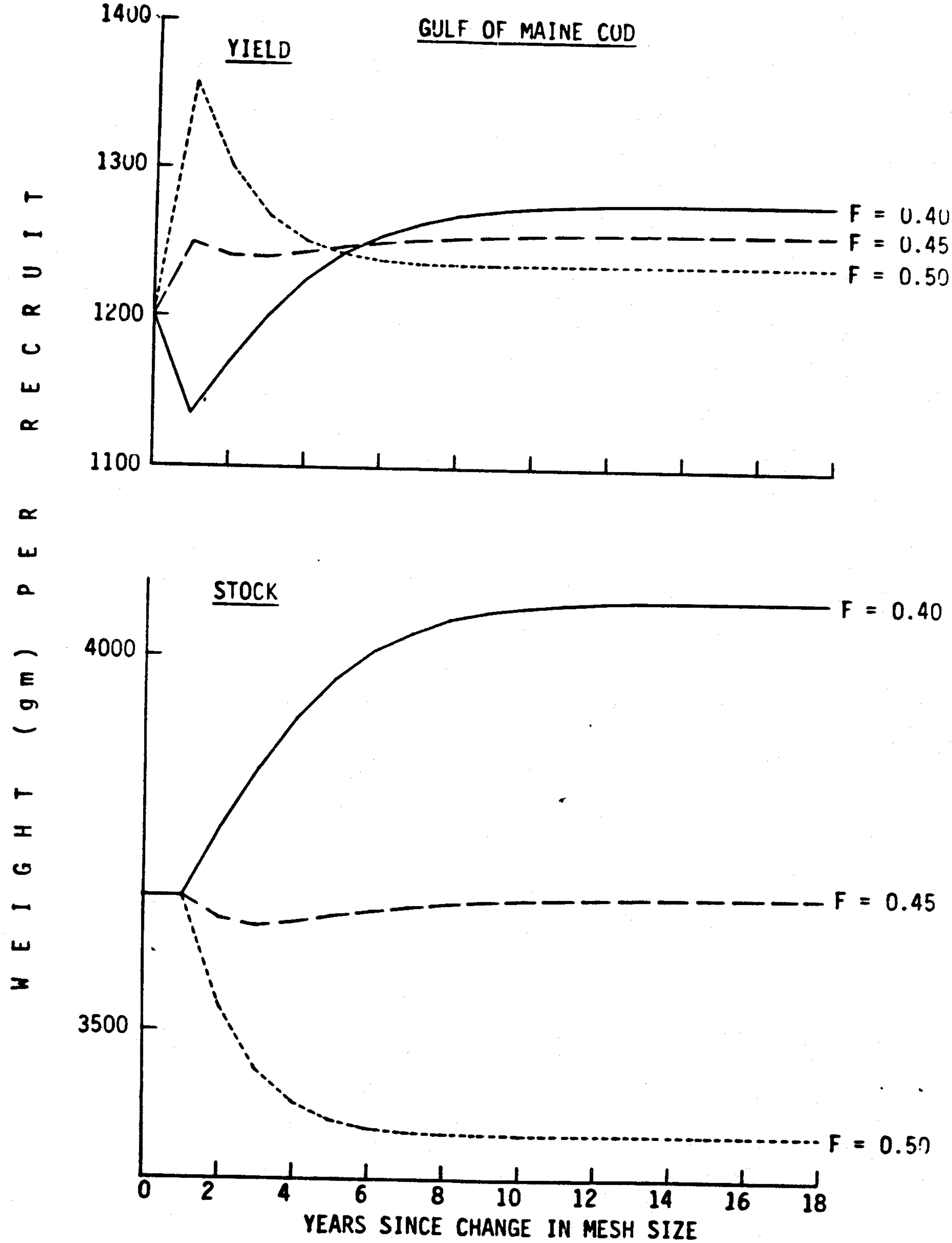


Figure 702.2: Effects of increasing fishing mortality rate (F) following a change in mesh size from 5 1/8 in. to 5 1/2 in. for Gulf of Maine cod. Solid lines indicate yield and stock size with constant F = 0.4 in all years. Dashed (dotted) lines show effect of increasing F by 12.5% (25%) to F = 0.45 (F = 0.50) in year 1, constant thereafter. Recruitment held constant for all cases.

In summary, the following conclusions may be drawn from the mesh analysis:

1) In the short run, an increase in cod end mesh above 5 1/8 inches will be accompanied by a reduction in catch and vice versa.

2) In the long run, an increase in cod end mesh above 5 1/8 inches will result in proportionally increased catch, and vice versa.

3) Absolute short-term impacts may be increased or lessened for a given cod end mesh, depending upon fishing effort and the strengths of year classes in and recruiting to the fishery at the time of implementation. But the relative ordering of mesh sizes vis-a-vis yield benefits is not expected to change.

4) Absolute long-term yield benefits for a given cod end mesh will vary with actual effort and recruitment over time. But again, the relative ordering of mesh in relation to benefits is not expected to change.

5) Increased mesh size tends to buffer long-term yield from the fishery to moderate increases in effort over time, although stock size may decline.

§702.4 Implications for the Industry

The economic impacts of the various alternative specifications of the fish size, mesh size and large mesh area measures will be dealt with in the following sequence:

a) the present value analysis of changes in gross revenues to the harvesting sector due to changes in landings resulting from the various area/mesh options;

b) the qualitative impacts on the expected gross revenues [from (a) above], of increases in fishing mortality (F) in this fishery;

c) the qualitative impacts on operating costs in the cod, haddock and yellowtail harvesting sector;

d) the qualitative impacts on small-mesh fisheries;

e) the relationship of minimum fish size to the area/mesh analysis.

Initially, there are several possibilities for changes in vessel operations due to changes in mesh size in this fishery. Two extreme cases for any given year are:

Case 1. Assume that such costs remain constant in order to catch the same number of (larger) fish; that is, profits are positive because vessels operate exactly as before the imposition of a minimum mesh size (same fishing areas, same time fishing) and simply catch all larger fish (and small fish passing through the net).

Case 2. Assume that the costs of catching the same number of fish with a larger mesh size (due to more steaming and towing time) equal or exceed the extra revenues (profits are zero or negative) generated by the increased unit value and weight of catching all larger fish.

The Case 2 situation does not permit quantitative analysis since cost responses to the management measures cannot be predicted. Therefore, in the following discussion, the present value and gross revenue analyses assume constant costs. However, these are followed by a qualitative analysis of impacts on operating costs, based on Case 2.

Present Value Analysis. The present value analysis of various area/mesh options in the cod, haddock and yellowtail fisheries assumes constant costs and is presented as relative changes in gross revenue for the various area/mesh options. The analysis starts with projected landings for the fishery for 1983 (NEFMC Res. Doc. 81 GF 1.1, revised), because the 5-1/8" mesh size is expected to be maintained through 1982. The total period for the present value analysis is taken to be twenty-five years, assuming that changes in catch over time are represented by the data in Table 702.7. Utilizing price coefficients from cod, haddock and yellowtail demand models, a 25-year stream of changes in gross revenue to the harvesting sector for each area/mesh option may be generated from changes in expected landings over time relative to continued catch at the projected 1983 level, Table 701.1 (D).

The present value (at the current Water Resources Council discount rate of 7-3/8%) of the area/mesh options relative to 5 1/8" is presented in Table 702.8.

Table 702.8: Present Value of Gross Revenue Associated with Change in Mesh Over 25 Years

	MESH SIZES		
Area Options	4 3/4"	5 1/2"	6"
1	-$153,154,000	+$139,487,000	+$324,640,000
2	- 153,154,000	+ 136,077,000	+ 317,062,000
3	- 153,154,000	+ 136,764,000	+ 318,506,000
4	- 153,154,000	+ 119,199,000	+ 276,836,000

These results show that:

1) A decrease in mesh size from 5-1/8" to 4-3/4" results in a 153 million dollar decline in present value. (This present value is the same for all area options, because a reduction of the mesh size would be expected to affect the entire fishery.)

2) As mesh size increases, so does the present value of changes in gross revenues.

3) For any mesh size, the differences in present value among the four area options do not appear to be great.

The declines in relative present value associated with decreasing mesh size involve positive changes in gross revenues in the harvesting sector for the first few years, and negative changes thereafter; while the increases in relative present value (increasing mesh size) represent negative changes in gross revenue initially, and positive changes for the remainder of the period. For example, changing to 5-1/2" mesh from 5 1/8" mesh involves a first year (1983) loss of approximately 20 million dollars to the harvesting industry; whereas changing to a 6" mesh size, involves a first year loss of about a 45 million dollars for any area option. This changeover from short-term to long-term impacts is always two or three years in duration.

Given the high price elasticity of demand for cod, haddock and yellowtail at all market levels, the impacts on the upper market levels, including consumers, should be similar to the results presented here for the harvesting sector (i.e., increased productivity due to increased mesh size, resulting in lower relative prices and thus increased benefits).

Finally, increasing the discount rate to 10% and 12% reduces (increases, in the case of 4-3/4") the absolute amounts of the present values presented for each mesh towards zero change, but does not change the relative comparison among area/mesh options described above.

Gross Revenues. These results must be looked on as a best case scenario. The biological analysis in §702.3, which is the basis for this present value analysis, is conducted under the simplifying assumption that fishing mortality remains constant throughout the study period. In addition, the analysis assumes that fishing costs are unchanged for all of the area/mesh options in which case profitability in the cod, haddock and yellowtail fishery will necessarily improve (as indicated by the present values in Table 702.8 above) with an increase in mesh size. This increased profitability may be expected to encourage increased effort (either more days fished or more vessels) in the fishery, and thus potentially dissipate any gains in gross revenues for the harvesting sector. The increased effort not only increases costs of catching the extra fish but also increases the fishing mortality rate. Thus, not only are any profits dissipated, but the increased production (and the protection of the stocks from excessive removals) and consequent gross revenues may be partially eroded.

Operating Costs. There currently are no empirical models that would permit analysis of fishing costs quantitatively relative to any changes in fishing operations due to the area/mesh options. If, for instance, increasing mesh size caused operating costs to increase, then the increased costs would have effects similar to those resulting from increased effort (i.e., diminishing the gains in gross revenues). If it is assumed that operating costs (such as towing and steaming costs) would increase at a faster rate than mesh size productivity, then options which may appear superior (e.g. 6" vs. 5-1/2" mesh size) using present value of gross revenues may not appear so using net revenues. However, such costs would have to increase by more than 100 percent in order to make the 5-1/2" preferrable to the 6" mesh size. Alternatively, assuming that operating costs (such as buying a new net) were a one-time increase and the same for any change in mesh size, then the relative comparison among area/mesh options in the present value analysis would not change. However, because most fishermen generally buy at least one new net each year, this problem would be mitigated in the Interim Plan by postponing the changeover to a different mesh size (from the current 5-1/8" average) for one year after implementation.

Small Mesh Fisheries. The purpose for establishing a specific area for large mesh is to minimize the negative impacts on small mesh fisheries while providing adequate protection to cod, haddock and yellowtail. (See §702.2.) It can be assumed that less catch in the small mesh fisheries due to increases in mesh size will mean reduced gross benefits from these fisheries. Therefore, creating a large mesh area eliminates these negative impacts on all small mesh fisheries which exist outside that area. Further, establishing exemptions or optional settlements within the large mesh area would further reduce those negative impacts. In fact, an optional settlement program may eliminate all of the negative impacts on small mesh fisheries within the large mesh area.

Minimum Fish Size. With respect to fish size, the foregoing analysis generally assumes that all fish caught by a specific mesh will be retained and landed. Where a minimum allowable fish length is also specified in a management program, that minimum allowable fish length should, as much as possible, correspond to a fish length which is only minimally retained by the mesh (say the 10% retention value) in order to reduce fish handling and discarding. Specification of a minimum allowable fish length at some higher value (say the mesh's 50% retention length) will necessarily result in increased discarding, lost harvestable production, and lost benefit to the stock, which may be substantial during years when recruiting year classes dominate the resource.

Summary. A larger mesh size gives a greater present value based on changes in gross revenues to the harvesting sector for the cod, haddock and yellowtail flounder fishery; means a larger short-run (1983) loss in these gross revenues; and may increase effort and operating costs, which could dissipate these gross revenues. Negative impacts on small-mesh fisheries may be mitigated through establishing large mesh areas, exemptions, and optional settlement programs.

§702.5 Administrative Costs

The implementation of a fish size/mesh size/large mesh area option would not be expected to affect administrative costs. NMFS and the Coast Guard, have informally indicated that the costs of monitoring will not change due to current budgetary constraints. Existing Coast Guard patrols and assignment of NMFS enforcement personnel will continue, encompassing additional responsibilities within available resources. Monitoring minimum fish size will replace enforcing trip limits and may be accomplished either at sea or ashore. Those costs would not be affected by choices maong the alternatives considered in this section.

The inclusion of "seasonal exemptions" or "optional settlement" fisheries to mitigate the impact of the area/mesh program on small mesh fisheries would be expected to affect administrative costs differently. Seasonal exemptions should not increase the costs described above. However, an optional settlement prorgram would involve increased costs due to developing contact points (offices, toll-free telephones) and extra recordkeeping. Because the number of vessels which would opt for the program cannot be anticipated, these costs cannot be adequately estimated at this time.

§703 Spawning Area Closure

§703.1 Introduction

The existing groundfish management program contains two major seasonal spawning closed areas. Those closed areas were first defined in 1969 under ICNAF for the purpose of protecting spawning aggregations of haddock on Georges Bank. These two areas are presently closed for three months each year (March-May), and the closures directly prohibit to the use of all bottom-tending trawl gear. The issue of whether these area closures should be continued, modified, or expanded addresses the objective of enhancing spawning activities.

§703.2 Spawning Closure Options

Three major options for defining a spawning area closure measure can be identified. These options are discussed below.

Option 1. Continuation of existing spawning closed areas.

The current spawning closed areas are illustrated as Areas I and II in Figure 703.1. Areas I and II are located on Western Georges Bank (primarily encompassing depths between 50 and 100 fathoms) and on the Northern Edge and Northeast Peak of Georges Bank, respectively. These areas have historically been characterized by concentrations of spawning haddock during the March-May period, and have been closed annually since 1969 during that three-month period. When these area closures were instituted, the haddock stock on Georges Bank was severely depleted and protection for spawning activity was deemed essential. During the closure period these areas also encompass some cod and yellowtail flounder spawning activity, although the specific sites for this activity are not well defined.

The coordinates of Areas I and II are as follows:

Area I:	69°55'W, 42°10'N
	69°10'W, 41°10'N
	68°30'W, 41°35'N
	68°45'W, 41°50'N
	69°00'W, 41°50'N
Area II:	67°00'W, 42°20'N
	67°00'W, 41°15'N
	65°40'W, 41°15'N
	65°40'W, 42°00'N
	66°00'W, 42°20'N

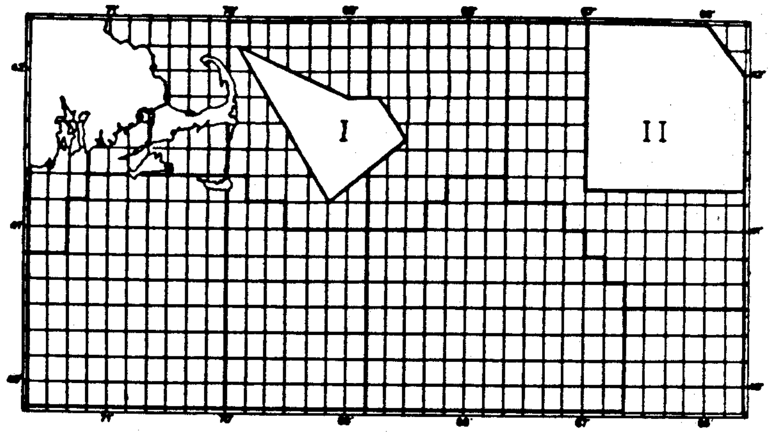
Figure 703.1 SPAWNING AREA CLOSURE OPTIONS 1/

Option 1.

Continuation of existing spawning closed areas:

Area I March-May

Area II March-May



Option 2.

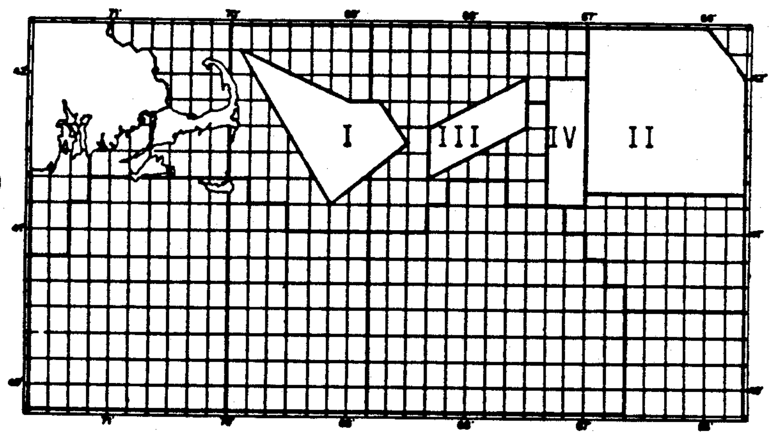
Continuation of existing spawning closed areas plus closure of additional area(s)

Area I March-May

Area II March-May

Area III Feb-Mar or Dec-Apr

Area IV Feb-Mar or Dec-Apr

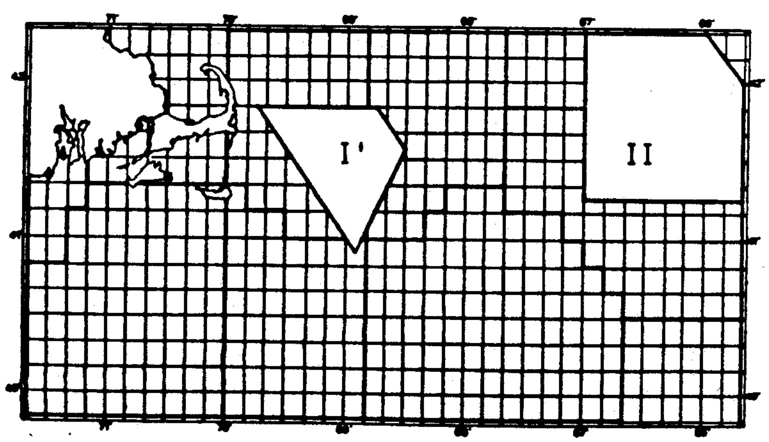


Option 3.

Modification of existing spawning closed areas

Area I' March-May

Area II March-May



1/ Area coordinates are given in the text

Option 2. Continuation of existing spawning closed areas plus closure of additional areas

In addition to Option 1, this option considers the possibility of defining additional area/periods to enhance spawning activity for cod. Area III, encompasses the area between Cultivator and Georges Shoals. Consistent late winter spawning has been reported for that area. Analysis of commercial catch data (by 10 minute area squares) indicates that Area III coincided with concentrated commercial activity during February and March from 1964 to 1974, and this was assumed to corroborate the presence of concentrations of cod during the spawning season. Commercial catch data for the period 1975-1978, however, do not indicate a concentration of commercial fishing activity in Area III.

The Northeast Fisheries Center identified Area IV as being of equal size to Area III but encompassing considerably more commercial activity during the suggested closure period. The Cen r also suggested the possibility of closing Areas III or IV for a 5-month period, December-April, during which time there are indications that cod spawning occurs, based upon recent ichthyoplankton data.

The coordinates of Areas III and IV are as follows:

Area III: 68°20'W, 41°40'N
68°20'W, 41°20'N
67°30'W, 41°40'N
67°30'W, 42°00'N

Area IV: 67°20'W, 42°00'N
67°20'W, 41°10'N
67°00'W, 41°10'N
67°00'W, 42°00'N

Option 3. Modification of existing spawning closed areas.

Public input during preparation of this Interim Plan indicated that some area adjustments to Area I would be appropriate to refocus the closure on concentrations of spawning haddock and lessen the incidental impact of the existing Area I on fisheries for other species. Area I' in Figure 703.1 addresses this comment, responding to a reported shoalward shift in haddock spawning activity to the Southeast, into the shallower water between Little Georges and Cultivator Shoals. No modification to Area II has been suggested.

The coordinates of Area I' are as follows:

Area I': 69°45'W, 41°50'N
68°55'W, 40°55'N
68°30'W, 41°35'N
68°45'W, 41°50'N

§703.3 Implications for the Resource

The closure of spawning grounds during periods of concentrated spawning activity has long been considered an appropriate conservation and management technique. Operationally, the measure terminates the fishery at a time when fisn are highly aggregated and vulnerable to capture. From a resource perspective, the closure allows the fish to spawn without disturbance, and thus may enhance proposects for future recruitment. A spawning closure reduces exploitation directly on the spawning stock, and thus may help to maintain the spawning potential of the resource.

The resource "benefits" of adopting a spawning closure measure cannot be quantified. However, the qualitative expectations regarding benefits that will accrue to the stocks are founded upon past experience and the widely held belief, fully shared by the affected fishermen, that a relationship does exist between a spawning stock and subsequent recruitment, particularly at low spawning stock levels.

For the above reasons, all of the spawning closure options, singularly or in combination, are biologically appropriate to the extent that they can reasonably be expected to coincide spatially and temporally with actual spawning activity. Based upon information derived largely from the industry, Areas I or I' and II appear relevant for haddock spawning. These areas also encompass some cod and yellowtail flounder spawning activity.

Regarding Areas III and IV, however, the NMFS/Northeast Fisheries Center has reported that there is little evidence to support the theory that a significant component of the Georges Bank cod stock spawns on well-defined spawning grounds or during a consistent time period. As a consequence, the areas of concentrated cod fishing activity on Georges Bank (supporting the definition of Areas III and IV) may not have any direct association with cod spawning. Nonetheless, although a closure to fishing may not coincide with spawning in that area, overall spawning activities would be enhanced if the closure (presumably in areas where fish are concentrated) reduced the total mortality applied to the spawning stock.

§703.4 Implications for the Industry

Spawning area closures may be economically desirable if the present value of the increased future production from recruitment exceeds the opportunity costs of inefficiently catching the current production. If fishermen are profit maximizing (or cost minimizing), and if their most efficient mode of operation includes fishing in a spawning area, then closing that area reduces their efficiency, because either they expend the same effort and catch less fish, or they expend more effort to catch the same amount as before.

As mentioned in §702.4, there are currently no empirical cost models available that would make possible the quantitiative estimation of the effects of removing fishing areas/periods from the cod, haddock and yellowtail fishery. More importantly, neither can the increased future production from spawning closures be quantified, because of the lack of a well-defined stock-recruitment relationship for these groundfish species. Therefore, the costs of inefficiencies imposed on the fishery are minimized to the extent that the number, size and duration of spawning area closures include only those areas and time in which spawning activity is most likely to occur.

In relation to the management measures adopted in this Interim Plan, the possible continuation of the current spawning area closures (§703.2) would have no measurable economic impact on the industry relative to the period from 1969 when spawning closures were instituted. An increase in the areas or periods would increase costs but possibly also increase future production benefits. A reduction in the areas or periods subject to closure would decrease costs and quite possibly decrease any potential production benefits from those areas and periods. Thus, if evidence of spawning activity in an areas is weak, costs of inefficiencies may be minimized by eliminating the area.

§703.5 Administrative Costs

The inclusion of spawning area closures in the Interim Plan could affect administrative costs. The costs of Coast Guard surveillance at sea may be expected to increase if the number of closed spawning areas is greater than present and vice-versa. For example, Option II with three areas would likely cost more to monitor than either Options I or III, which contain only two areas. Data collection and shoreside enforcement costs would not be impacted.

§704 Nursery Area Closures

§704.1 Introduction

Dense concentrations of juvenile cod, haddock, and yellowtail flounder which are below marketable size can occur on grounds being fished by groundfish vessels, particularly during years when recruiting year classes are relatively abundant. If concentrations of new recruits (juveniles) are particularly widespread, especially during years when larger size classes of fish are relatively scarce, then very significant mortality may be inflicted upon the juvenile fish as a consequence of normal fishing behavior. Timely identification of such concentrations, however, may offer an opportunity to institute appropriate closures which could reduce mortality on juvenile fish and thereby directly address the issue of recruitment overfishing. Unfortunately it is not possible to anticipate where or when such concentrations may occur. Hence, fixed area closures (such as spawning area closures) cannot be predetermined, and as a result, must necessarily be established on an ad hoc basis.

A system for initiating ad hoc nursery area closures could be based upon identification of areas with concentrations of juvenile fish from fishermen's reports. Closure of the smallest possible area of fishing grounds necessary to protect the identified concentration would be implemented by the NMFS Regional Director. This closure would be based on verification procedures and follow consultation with the Council. The closure would be for a two-week period and apply to all mobile bottom tending gear and mid-water trawls. If, at the end of a two-week closure period verification criteria are still met, then a subsequent two-week closure could be instituted over the same or a somewhat redefined area.

§704.2 Implications for the Resource

The protection of juvenile fish through the closure of nursery areas to mobile gear fishing is potentially a very effective measure to aid in avoidance of recruitment overfishing. However, as with spawning closures, the benefits cannot be quantified. In addition, concentrations of juveniles are not static and movements of such concentrations while in search of food or to avoid predators may be very rapid. Practical considerations for implementing nursery area closures have led to the conclusion that ad hoc closure action would require a minimum of five (5) working days for completion, which is impractical considering the mobility of juvenile fish concentrations. Therefore, it appears that effective nursery area closures would provide little if any real protection to the resource given the current state of knowledge.

§704.3 Implications for the Industry

The impacts of nursery area closures on the industry would be very similar to those described for spawning area closures (see §703.4), but on a reduced scale. An increase in the number of areas and time periods closed would reduce efficiency and increase costs but would also increase future production benefits, neither of which can be quantified.

In addition, nursery area closures may actually increase fishing efficiency for cod, haddock and yellowtail, if some portion of the catch from those area/periods would have been discarded or left unsold. Knowing that an area contained high percentages of small fish, fishermen might then avoid it rather than unwittingly tow their nets through small fish which they then would not utilize.

§704.4 Administrative Costs

Nursery area closures would involve heavy administrative costs. The costs of monitoring activity at sea would likely increase in proportion to the size, duration and number of nursery areas closed and vice versa. Further, the proposed ad hoc nursery area closures would involve increased administrative costs due to the establishment of contact points (offices, toll-free telephones), verification and monitoring procedures (state biologists and vessels), extra recordkeeping, etc., for each closure.

§705 Trip Catch Limits

§705.1 Introduction

There is great concern within some sectors of the fishing industry over the immediate impact of potentially substantial increases of cod, haddock and yellowtail flounder landings under the Interim Plan. These articulated concerns are a) to protect the fishable stocks from excessive removals during transition to the appropriate mesh size, and b) to prevent depressed prices due to landings gluts, and thus protect somewhat the existing distribution of income to sectors within the fishery.

In seeking public comment, the Council offered the possibility of including in the Interim Plan an intial 60,000 pound trip limit consisting of any combination of cod, haddock and yellowtail flounder, except that yellowtail flounder would not exceed 33% of the trip limit in force. Trip limits would be increased by 5,000 lbs. every three months. All trip limits would be removed with the implementation of the 5 1/2 mesh size (i.e., one calendar year from implementation of the Interim Plan).

Possible variations of this measure include: a 60,000 pound trip limit throughout the year (no incremental increases of 5,000 lbs.); Council action at the end of the year to determine whether to continue the trip limit for another year; combination of the two; etc. The species impacts of these variations are not significant.

§705.2 Discussion

Attempting to raise ex-vessel prices by controlling total supply through trip limits would result in a decrease in total gross revenue to the industry, due to the high elasticity of ex-vessel demand for codfish. Further, ex-vessel demand for cod, haddock and yellowtail have all been found to be highly price elastic, implying that for all these species an increase in landings results in an increase in industry gross revenue in spite of the fact that price can be expected to decline. However, with prices depressed, individual vessels or sectors (i.e., small vessels) may lose revenues if other sectors (i.e., large vessels) catch a disproportionate share of the fish available. Nor can it be assumed that such trip limits will support prices to fishermen. In the past, gluts have occurred even with very restrictive trip limits.

Trip limits carry with them an implicit vessel quota, which may have some value in constraining the catch of juvenile or spawning fish; the lower the trip limits, the lower the expected overall removals. However, trip limits also carry heavy opportunity costs to the industry. That is, trip limits set low enough to have the desired effects on the harvest of immature fish, will necessarily and proportionally reduce the harvest of older, sexually mature fish in the harvestable stock.

In their general application, trip catch limits are specified in terms of some level of acceptable catch, and as such are desirable if the present value of the increased future production (resulting from the catch effect) outweighs the costs of foregone catch today. Under the Interim Plan it is unknown whether a one-year imposition of trip limits would improve future production at all. If fishermen are profit maximizers (or cost minimizers), then their individual allocation of inputs into the fishery will be efficient. Trip limits would likely alter such an allocation of inputs, causing inefficiencies or increased costs. As a consequence of being faced with restrictive trip catch limits, fishermen would require fewer days per trip, and might well increase the total number of fishing trips. Thus, total catch might not be affected at all.

Trip catch limits would involve administrative costs similar to those involved in the current management program. Costs of monitoring and analyzing landings, and subsequently taking administrative action to adjust trip limits or close fisheries, have generally been considered to be high.

Therefore, it cannot be demonstrated that trip limits would have any net beneficial impact on the resource or the industry. On the other hand, the proposed trip limit of approximately 60,000 pounds for all vessels may have significantly greater impacts on large vessels, since catch per trip generally increases as vessel size increases. In fact, the very largest vessels (i.e., greater than 125 gross tons) might be affected on most trips, while very small vessels (less than 60 gross tons) would never be affected.

PART 8: SPECIFICATION OF THE MANAGEMENT PROGRAM

§801 Introduction

The Sections in this Part select from among the alternatives contained in Part 7 and constitute the management program under this Interim Plan. Sections 805 through 811 are the conservation and management measures of the Plan. For Sections 802, and 805 through 811, the Plan provision is stated first, followed by a comment. These comments elaborate on the plan provisions, explain why a particular alternative was selected, and generally indicate Council intent. However the comments are not a part of the actual provisions and measures, and are not specifically binding.

§802 Optimum Yield

The maximum systainable yields (MSY) for the species regulated by this Plan, stated in metric tons, are as follows:

Cod, Gulf of Maine	8,000
Cod, Georges Bank	35,000
Haddock, Gulf of Maine	8,000
Haddock, Georges Bank	40,000 - 50,000
Yellowtail Flounder, Georges Bank	16,000
Yellowtail Flounder, Southern New England and Mid-Atlantic	23,000

The optimum yield for cod, haddock and yellowtail flounder in the Northwest Atlantic subject to the jurisdiction of the United States (including territorial seas) is the amount of those species harvested by the United States fishermen under the conservation and management measures specified in this Part.

Comment. Maximum sustainable yield estimates were generally taken from a summary status of marine fisheries in the Northwest Atlantic prepared by the Northeast Fisheries Center for the Northeast Fishery Management Task Force. Recent cod harvests have tended to exceed MSY slightly; while haddock and yellowtail harvests have been below MSY. For each species current harvest levels reflect the current stock abundance levels.

There are no substantial ecological factors indicating that MSY should be modified one way or another to arrive at OY. However, there are substantial factors relating to the current management program which require that OY be specified descriptively. These problems have been detailed elsewhere in this Plan and will be specifically addressed in the development of the ADF Plan. There is currently a need to relax the management of the fishery to improve the enviroment within which decisions on ADF must be made, and to allow the fishery to be better analyzed and understood. Harvests under the Interim Plan will begin at a slightly higher level than current harvests, but will subsequently depend on overall stock abundance. Stock abundance may decline somewhat, but it is not likely that the decline will jeopardize recruitment.

The management measures specified in this Part are consistent with the Council's limited objectives, will allow the fishery to operative relatively freely, and are justified by current resource levels. They strike a balance between providng protection to the resource, avoiding overregulation of the industry, and providing an atmosphere conducive to the development of the ADF Plan.

§803 Domestic Annual Harvest (DAH) and Total Allowable Level of Foreign Fishing

By definition, the domestic fisheries will harvest the entire optimum yield and there is no surplus to be allocated to foreign fishing. Domestic fleets have demonstrated for the past four years that they are capable of harvesting these three species at levels near or in excess of MSY. Current resource abundances, although improved, do not support a surplus for foreign harvest. These stocks have each demonstrated sensitivity to fishing pressure. Therefore, adoption of a descriptive optimum yield statement that limits harvests to domestic fishermen is appropriate.

Numerical DAH values can be predicted annually by specifically examining then current resource levels, harvest potential and market conditions.

§804 Domestic Annual Processing and Joint Venture Processing (JVP)

United States processors are capable of utilizing the entire harvest of cod, haddock and yellowtail flounder by domestic fishermen. Continuing imports of fresh as well as frozen product by United States processors indicates that they have a demand for fresh fish beyond what domestic fishermen are currently landing. It is reasonable to conclude that domestic processors will be able to utilize fully any likely increase in domestic harvest. JVP, therefore, equals 0.

§805 Large Mesh Area

The mesh size regulation contained in §806 shall be applied within an area from the shore and bounded by straight lines connecting the following points:

The point at which a line drawn on long. 69°20'W intersects the baseline from which the territorial sea is measured; 43°40'N, 69°40'W; 41°50'N, 69°40'W; 41°50'N, 69°30'W; 41°40'N, 69°30'W; 41°40'N, 69°20'W; 41°30'N, 69°20'W; 41°40'N, 68°40'N; 41°40'N, 68°30'W; 41°50'N, 68°30'W; 41°50'N, 68°10'W; 42°00'N, 68°10'W; 42°00'N, 67°40'W; 42°10'N, 66°40'W; 42°10'N, 66°00'W; 41°00'N, 66°00'W; 41°00'N, 67°00'W; 40°50'N, 67°00'W; 40°50'N, 67°40'W; 40°30'N, 67°40'W; 40°30'N, 70°00'W. The point where a line drawn on long. 70°00'W intersects the baseline from which the territorial sea is measured on Nantucket Island.

Comment: This measure is Option 2 discussed in §702.2 and illustrated in Figure 702.1. It would be operative all year long, with no seasonal exemptions. An option providing for seasonal exemptions is not included. It would be virtually impossible to determine which fisheries should and should not specifically be provided for. Therefore, rather than seasonal exemptions, an optional settlement program has been provided. See §808.

The area selected gives up some protection for regulated species in order to have less incidental impact on redfish fisheries. The redfish fishery has been particularly impacted by the closing of Canadian waters to United States fishermen. Selection of this area option, therefore, balances the need for some protection for cod and haddock, while minimizing impacts on the redfish fishery. The level of protection for cod and haddock is still appropriate given current resource levels.

§806 Minimum Mesh Size

Vessels using otter trawls, pair trawls, beam trawls, Scottish seines or mid-water trawls in the large-mesh area described in §805 must use nets having cod ends with mesh of at least 5-1/8" during the first year of this Plan, and 5 1/2" thereafter. The Regional Director may specify further gear to be subject to this measure if he finds that any such gear may take significant quantities of groundfish. Vessels using gill nets in the large mesh area must use nets with at least 5-1/2" mesh.

Comment. Selection of a minimum mesh size involves balancing short-term costs against long-term benefits. The analysis contained in §702 shows that the present value of long-term net benefits is greatest with a mesh size in excess of anything considered to date. On the other hand, short-term costs are very high both in terms of equipment investment and foregone catches while fish currently in the population grow to the point where they will be harvested by the larger meshes. It is entirely inappropriate to consider any reduction in the current regulated mesh size since the anlysis shows that this would not return any long-term benefits. Further, since this is a critical control mechanism in the Plan for resource conservation, some degree of caution is appropriate. A 5-1/2" mesh size will improve protection for juvenile fish and balances short-term costs and long-term benefits consistent with this Interim Plan's limited objectives and short-term nature.

Allowing a year to phase in a 5 1/2" mesh further balances these interests. The Plan therefore continues the current mesh size for one year, and moves to 5 1/2" thereafter. However, it is expected that there will be immediate resource benefits even during that first year. The effective size of mesh that is currently being used in the fishery should increase immediately toward the regulated size since this regulation is more enforceable than the current mesh size regulation in that it does not have an incidental catch allowance built in. Furthermore, as cod ends are replaced during the phase in period, it can be expected that fishermen will order and utilize the larger mesh size before it becomes mandatory. The "one year" begins on the first day of implementation of this program, whether it be by final regulation under §305(c) of the Act or emergency regulation under §305(e).

The mesh sizes are specified on the basis of synthetic twine, or equivalent. It is expected that the measurement of meshes will, by regulation, be accomplished in the traditional manner, i.e., measurement wet, after use, using a wedge-shaped gauge having a taper of two cm. in eight cm., and a thickness of 2.3 mm.; inserted into the meshes under pressure or pull of five kg. The mesh size of the net shall be the average of the measurements of any series of twenty consecutive meshes measured at least ten meshes from the lacings, beginning at the after end and running parallel to the long axis.

§807 Minimum Fish Size

The minimum size for any cod, haddock and yellowtail shall be as follows: for commercially caught cod and haddock, 17 inches; for recreationally caught cod and haddock, 15 inches; for yellowtail flounder, 11 inches.

Comment. Recognizing that the gear which is required by §806 will harvest some juvenvile fish, and that gear will not be regulated outside the area specified in §805, a minimum fish size is appropriate to impose a disincentive for setting on known concentrations of juvenile fish. The minimum size for commercially caught species closely corresponds to the 50% retention length of 5 1/8 inch mesh. When 5 1/2 inch mesh becomes effective, the minimum fish sizes will be below the mesh's 50% retention lengths, thereby reducing discards.

The selection of an appropriate minimum fish size balances the need to reduce the catch of immature cod, haddock and yellowtail flounder with the constraint of a single mesh regulation. In the first year of implementation, this balance means that for haddock and yellowtail the 50% retention length of the mesh will correspond to the length at 50% maturity; whereas for cod the 50% retention length of the mesh will be less than the length at 50% maturity, so that a larger percentage of immature cod would be landed relative to the other two species. As mesh size increases in the second year of implementation, the 50% retention lengths will increase to approximately match the length at 50% maturity for cod, and exceed those for haddock and yellowtail, and thereby further decrease the impact of catch on the immature stages of these species. To the extent that the minimum fish size is satisfactorily specified in view of maturity considerations, it does not have to be changed as mesh size increases. In fact, as the difference between minimum fish size and the 50% retention length of the mesh increases, the need for discarding immature, undersized fish decreases.

In response to public comment, a special provision for recreational fishing is provided. Recreational vessels do not catch significant amounts of juvenile groundfish. A 15" size limit for cod and haddock corresponds to the minimum size of fish which are currently caught by commonly-used gear. A higher size would impose costs without measurable benefits. "Recreational fishing" here is intended to apply only to catches for personal use using hand-held hook and line gear.

Minimum lengths are intended to apply to total lengths. It may be necessary to establish appropriate conversion factors by regulation.

§808 Optional Settlement Program

As an exception to the mesh size (see §806) required in the specified large mesh area (see §805), the Regional Director shall design and implement an optional settlement program to allow fishermen to prosecute legitimate small mesh fisheries within that area. As a minimum the program shall include the following elements: The program shall be available for fisheries which legitimately require small mesh gear. The Regional Director shall establish a list of such species, to include at least silver hake, red hake, redfish, squid, Northern shrimp, herring, mackerel and dogfish. The list may be expanded to include other fisheries upon a finding that such fisheries 1) must use small mesh gear; and 2) do not result in a significant harvest of cod, haddock or yellowtail flounder. A vessel participating in the program must, during the period of its participation, land at least 50% of its total catch by weight, in the listed small-mesh species. Not more than a specified percentage of its total catch by weight during the period of its participation may be regulated species (any combination of cod, haddock or yellowtail flounder). The initial specified percentage shall be 15%, but may be revised by the Regional Director if he finds that a different percentage is necessary to conduct the small mesh fisheries. Vessels declaring to enter the program may be required to wait up to five days to begin participation, and may be required to give a minimum notice before leaving. Vessels in the program may, at the discretion of the Regional Director, be subject to special reporting requirement necessary for the operation of the program. Entry into or continuation in the program may be denied by the Regional Director based on violations of the Atlantic Groundfish regulations.

Comment. Given the mixed nature of the groundfish fishery, it is clear that any management program, even though targeted at only a few species will unavoidably have incidental effects on the harvest of other species. Since it is not the intent of this Interim Plan to directly regulate fishing for species not currently included in the management unit, some steps to ameliorate the incidental effect of the Plan's conservation and management measures on such fishing is appropriate. An optional settlement program has been chosen rather than establishing specific exemptions for a variety of related fisheries because the latter approach would have been too complex to design and enforce, and might have created loopholes.

It is the Council's intent to allow the Regional Director as much flexibility as possible in carrying out the optional settlement program. Generally, it is envisioned that fishermen will declare their intent to engage in small mesh fisheries with the Regional Office by phone. However, the ultimate decision on the best method of notification and verification for both entry and exit will be determined by the Regional Director in implementing the program. Minimum waiting periods for entry and exit should be as short as administratively possible to allow fishermen as much flexibility as possible in prosecuting fisheries for both regulated species and small mesh species. The Regional Director should strive to require not more than two days wait for entering the small mesh fishery after notifying the Regional Office. However, it should be noted that this program is an exception to the principal control mechanism of the Plan, and as such is only a limited exception which must be implemented in a fashion that is administratively practicable and does not detract from the overall effectiveness of the area/mesh program. For informational purposes only, the Regional director may inquire regarding the general areas in which the vessel will fish.

§809 Spawning Area Closures

The following areas shall be closed to all harvest of groundfish during the months of March, April and May:

Area I: An area bounded by straight lines connecting the folloiwng points: 41°50N', 69°45'W; 40°55'N, 68°55'W; 41°35'N, 68°30'W; 41°50'N, 68°45'W.

Area II: An area bounded by straight lines connecting the following points: 42°20'N, 67°00'W; 41°15'N, 67°00'W; 41°15'N, 65°40'W; 42°00'N, 65°40'W; 42°20'N, 66°00'W.

However, the following gear may be used in these areas during these times: hooks having a gape of not less tha 1.18 inches (Area I only); pot gear designed and used to take lobster; or dredges designed and used to take scallops.

Comment. This measure is Option 3 discussed in §703.2. The possibility of providing some specific protection for cod spawning (Option 2) is too questionable to be adopted at this time. This measure decreases the size of the current Area I, and moves it slightly to the southeast. In this regard it is consistent with the best recent information concerning where haddock spawning is concentrated, and provides some protection to cod and yellowtail flounder spawning.

§810 Permits and Enforcement Assistance

Any vessel which catches cod, haddock or yellowtail flounder in the FCZ must first obtain a permit from the Regional Director, which shall be available at no cost. Regulations should continue existing vessel identification and enforcement assistance requirements as appropriate.

Comment. The permit requirement is continued to keep track of vessels and to give NMFS and the Council a way to keep vessels interested in groundfish informed of the operation and development of and changes to the management program. It is not expected that vessels currently holding permits will be required to apply for new permits under the Interim Plan. The permit program has been computerized by NMFS. No fee for the permit is authorized by this Interim Plan; therefore, costs to the industry and NMFS are minimal. It is expected that NMFS may require appropriate information from permit applicants such as that required in the past.

§811 Data Collection

The Regional Director shall implement and carry out a program of data collection in the groundfish fisheries which includes an expansion of the current weighout system, vessel logbooks and sea sampling. All or parts of this program may be implemented through voluntary or mandatory measures as the Regional Director, in consultation with the Council finds necessary to insure the completeness, accuracy and integrity of the data. The information shall be maintained with vessel identifiers, appropriately masked to the extent practicable, so that vessel-specific performance analysis can be performed.

Comment. Efforts of the Regional Director over the past two years have resulted in the design of a data collection program which has an optimal chance of providing for the collecton of the scientific data necessary for stock assessments and the preparation of the ADF Plan. This program known as the "three-tier system," is currently being implemented. The data collection aspects of the three-tier system are adopted as the data element of this Plan . However, the language of this section is purposely general to provide flexibility in adapting the program to the data needs of NMFS and the Council as they develop.

By design, future data needs can be accommodated within the three-tier system. No further specific information needs to be specified for collection at this time. Further, the essentially voluntary nature of the program can reasonably be expected to provide the best quality data at the least cost. It is inappropriate at this time to specify any further mandatory reporting. Such a specification would result in needless regulation and unjustifiable administrative expense; and jeopardize the quality of the information which is being collected. However, should the Regional Director or the Council find that the three-tier system is not working or can be impoved upon, it is expected that they will consult regrading further data to be collected, or making all or some aspects of the program mandatory. It is intended that this be done by regulation, and not require a Plan amendment.

This Interim Plan adds to the three-tier system in the area of data maintenance and availability to the Council staff. As NMFS intends to implement it, the trip files in the three-tier system would have all vessel identifiers removed. It may be that for stock assessment purposes this is a valid approach. However, it severely handicaps planning for future management, particularly in analyzing the operations of a mixed-trawl fishery. The routine data collection system is clearly the easiest and most cost effective way to acquire necessary management information. Coordinated management of multiple and closely interrelated species will be unsophisticated and therefore, unworkable without a good handle on the number of vessels catching different species, the extent to which greater or lesser numbers of vessels are dependent on various species, the likelihood of vessels switching from species to species or probable responses of individual vessels to management proposals. The data problems of the current management program have not stemmed so much from a lack of understanding the stocks as from a lack of understanding how the fishery operates. Furthermore, costs to the industry of management proposals cannot be estimated without analyzing how they affect individual vessels (small businesses) operating in the fishery. Administrative costs of management proposals cannot be estimated without a reasonable expectation of how many vessels will be impacted. Vessel identifiers are necessary to answer any of these questions. For the Council's purposes, only its staff needs access to this information.

§812 Measures Not Included

Nursery Area Closures A system of ad hoc nursery area closures (discussed in §704) has not been selected for inclusion in the management program at this time. It is too complex administratively to be imposed without much more study. The concept of nursery area closures is considered valid for management, but would best be handled within the context of the preparation of ADF.

Trip Limits. Trip limits are not included in this Plan. The Plan's objectives were specifically drafted to exclude economic considerations. It is not likely that the proposed trip limit would have any significant impact on fish prices since it would not be constraining against any but the very largest vessels. In that case, it would be unduly discriminatory. The trip limit would not reduce overall harvests since fishermen would simply run more shorter trips. This would add costs to fishermen, without returning sufficient benefits.

Braking Mechanism. During consideration of this Interim Plan it was suggested that, since the Plan involves some risk to the resource, it should include a mechanism to curtail fishing mortality if the stocks reached a certain minimal point. This has been variously referred to as a "braking" or "fail-safe" mechanism.

Despite considerable attention to the issue, the Council has been unable to identify either a point at which such a mechanism should be triggered; or measures which could be effective. This Interim Plan is intended to be a short-term management program, and harvests are not expected to be that much greater than if the current management program were continued. It can also be expected that before any serious harm is done to the resources, various indicators of resource problems will be observable. These include a) major downward trends in spawning stock sizes and average annual recruitment; b) increased variability in annual recruitment, c) major shifts to younger year classes in the fishery; and d) the presence of fewer year classes in the spawning stock. As part of its continuing management effort, and in developing the ADF Plan, the Council intends to follow these factors closely and will change its program to meet problems as appropriate when they arise.

Therefore, because the need for a braking mechanism is not clear and because the specifics for any such mechanism have not yet been identified, the Council believes that the Interim Plan should be implemented as soon as possible without a braking mechanism. However, the Council has established continuing consideration of this matter as its first priority in addressing long-term management of the groundfish complex and an appropriate mechansim might be implemented even before a full transition to the ADF Plan.

§813 Continuing Fishery Management

This Interim Plan is only a step toward arriving at a viable long-term management program for the groundfish complex. The Council has already begun the development of ADF, and in so doing will carefully and continually study the operation of the fishery under this Plan.

With specific reference to the Interim Plan itself, trip limits and a possible braking mechanism in the event of undue resource decline are not included (See §812); nor are nursery area closures, spawning area closures directed principally at cod or gear conflicts provisions. However, all of these will continue to be looked at by the Council. Further, additional data requirements may be necessary if it turns out that more information than is currently anticipated is required in the preparation of the ADF Plan.

It may be that the Interim Plan will evolve into the ADF Plan. Species (such as pollock or redfish), measures (such as a braking mechansim or nursery closures) or data requirement may be added by amendment to the Interim Plan before an identifiable "ADF Plan" emerges. The National Marine Fisheries Service generally provides annual updates of resource assessments which will be studied by the Council, its staff, Scientific and Statistical Committee and Advisory Panel. Conclusions from these analyses could be applied to either the Interim Plan or the ADF Plan, or both. What is important for now is that this Interim Plan be implemented as soon as possible so that development of these issues may take place in a favorable management environment.

PART 9: CONSISTENCY WITH OBJECTIVES AND NATIONAL STANDARDS

§901 Consistency with Objectives

The measures and provisions of this Interim Plan are consistent with its objectives in the following manner. The objectives of the Plan are to:

(1) Enhance spawning activities;

The plan enhances spawning activities for haddock by continuing the traditional haddock spawning closure areas (slightly modified) during the months of March, April and May. Insufficient information is known about the spawning of cod and yellowtail flounder to isolate discrete areas for closure for these purposes. However, it has been believed for some time that the haddock closed areas have some ancillary benefit for cod and yellowtail flounder spawning. Additionally, the mesh size and minimum size regulations will provide protection for juvenile fish of all three species and thus contribute to recruitment to the spawning stock.

(2) Reduce the risk of recruitment overfishing of cod, haddock and yellowtail founder;

The plan reduces the risk of recruitment overfishing by the minimum fish size which will provide a disincentive for catching small fish. In addition, the minimum mesh regulations which will provide a signficiant degree of escapement for juvenile fish and thus contribute to spawning and improve prospects for future recruitment. The area subject to the mesh size regulations encompasses fishing grounds from which by far the majority of commercially caught cod, haddock, yellowtail flounder are taken. The minimum fish size and mesh size measures in this Plan will not guarantee good recruitment to the spawning stock, and the Council is aware of and accepts the risk of this kind of program. But, based on anticipated harvest levels, these measures will provide some protection to the resource which is consistent with its current condition. More stringent regulation is neither required to meet the Plan's objectives, nor necessary given the current conditons of the resource. Ongoing monitoring programs of the Northeast Fisheries Center will provide a warning of significant declines in resource abundance to which the Council will respond when they become apparent.

(3) Acquire reliable data, in support of the ADF Plan, on normal fishing patterns of the industry and the biological attributes of stocks as determined by commercial activities.

Adopting the three-tier data collection system currently being implemented by NMFS will provide the Council with the data it needs to prepare the ADF Plan, so long as that data is maintained and available to the Council staff consistent with the specification in Section 811. Reliability of the data will be greatly improved by the overall simplification of the management program, which eliminates the incentives for misreporting which have plagued groundfish management for four years. The voluntary nature of the program will also significantly improve the accuracy and reliability of the information since fishermen can be expected to cooperate more fully.

§902 Consistency with National Standards

The measures and provisions of this Interim Plan are consistent with the National Standards contained in Section 301(a) of the Magnuson Act in the following manner:

National Standard No. 1: Optimum Yield and Overfishing

The objectives of the Plan are directly related to recruitment overfishing. While these groundfish stocks were at one time clearly overfished to a point that might have jeopardized recruitment, they have recovered to a point where domestic fishermen can conduct a fishery under substantially less regulation. It is expected that stock abundance will decline somewhat during the first year of this Plan. However, there is no reason to believe that the expected fishing mortality under this Plan will jeopardize the ability of the stocks to maintain adequate recruitment. If common indicators of overfishing begin to develop, (See §812), the Council will re-examine the Plan to determine whether overfishing is taking place and decide on an appropriate course of action. In effect, the Council's objectives specifically relate National Standard No. 1 to the particulars of the groundfish fishery and resource in their current condition. Further, by limiting optimum yield to domestic harvest, the possibility of intense foreign exploitation which resulted in overfishing which led to difficult stock conditons in the late 1960's and early 1970's will be avoided.

In view of the difficulties the previous management program had with achieving a numerical OY, the Plan uses a descriptive optimum yield statement. This is more conducive to the preparation of the ADF Plan, since it allows the fishery to operate with a minimum of regulation so that it can be better analyzed and understood as a comprehensive long-term management program is developed.

National Standard No. 2: Scientific Information

All of the most recent scientific information available has been used in preparing this plan. The NMFS three-tier system will provide the necessary information for management and for preparation of ADF, provided that information is maintained and available to the Council as provided in this Plan. (See § 811) In arriving at this determination the Council has considered the need for the information, the quality of information needed and the effort required to obtain it.

National Standard No. 3: Management Units

The Plan maintains the management unit as it existed under the previous groundfish plan. It expressly recognizes that more species ought properly to be included in the management unit, but that, in the interim, management should be limited to the three most signficant species. Because of past exploitation, it would not be appropriate to totally deregulate any of these species at this time. The unit encompasses the three species totally as they are found in the FCZ and territorial sea of the United States, and States are urged to adopt complementary measures.

This management plan will have incidental effects on fishing for other species to the extent that those activities could result in the harvest of cod, haddock and yellowtail. However, the design of the program, specifically the area within which mesh size is regulated and the optional settlement program, is geared to minimize the impact on fisheries for other species.

National Standard No. 4: Allocations

This plan does not discriminate between any of the various user groups in the groundfish fisheries, much less on the basis of state of residence. Nor does it have any allocations between various user groups. In order to achieve the Plan's third objective (data on how the fishery operates in the absence of overregulation), all such discriminations and allocations in the previous management program were eliminated in preparing this Interim Plan.

National Standard No. 5: Efficiency

By allowing fishermen to select their own preferred fishing strategies, rather than select strategies based on a need to comply with or get around regulation, this Plan will increase efficiencies at the firm level relative to the current trip limit system. Costs associated with lost fishing time due to closures or weekly trip limitations, or with excess usage of fuel in extra steaming time or in seaching for less harvestable or less profitable species, will be avoided.

Limited access is not selected as an interim measure but saved for analysis as part of the overall comprehensive, long-term management program for the groundfish complex. The plan contains no allocations, much less any that are based on economic factors alone.

National Standard No. 6: Variations and Contingencies

One of the basic reasons the Interim Plan was formulated was to deal with problems the previous management program had under this national standard. The regime under the Interim Plan is designed specifically to create an environment wherein the Council can analyze and plan for management of a fishery exhibiting a wide range of uncertainties. Many of the uncertainties and variations in the fishery were created by the previous plan. Acquisition and analysis of data under the Interim Plan will help develop management measures which compensate for variation, and which reduce the need for multiple changes to the management program.

National Standard No. 7: Costs and Benefits

Some regulation of fishing for these species is necessary because they have demonstrated sensitivity to fishing pressure in the past. These fisheries are among the most valuable to the New England region, and because of the number of variations in the fisheries and management jurisdictions involved, require federal management. Removal of the most disruptive and burdensome aspects of the previous management program will reduce both costs to fishermen and administrative costs in running the program.

Draft

Environmental Impact Statement

for the

Interim Fishery Management Plan

For Atlantic Groundfish

New England Fishery Management Council

October 30, 1981

COVER SHEET

RESPONSIBLE AGENCIES:

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

New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, MA 01906

PROPOSED ACTIONS:

Adoption, approval, and implementation of the Interim Fishery Management Plan for Atlantic Groundfish (Atlantic cod [Gadus morhua], haddock [Melanogramus aeglefinus] and yellowtail flounder [Limanda ferruginea]).

FOR FURTHER INFORMATION CONTACT:

Douglas G. Marshall, Executive Director
New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, MA 01906
(617) 231-0422

TYPE OF STATEMENT:

(X) Draft ( ) Final

ABSTRACT:

The New England Fishery Management Council and the Assistant Administrator for Fisheries (NOAA) propose to adopt, approve and implement pursuant to the Magnuson Fishery Conservation and Management Act of 1976 an Interim Fishery Management Plan for Atlantic Groundfish Interim Plan.

The Interim Plan provides for regulation of the cod, haddock and yellowtail flounder fisheries on the basis of effective mesh size regulations, minimum fish sizes, spawning area closures and data collection. These measures are consistent with the current status of the resource and the need for development of a long-term, comprehensive management program for a broader range of demersal finfishes, which has been referred to as the Fishery Management Plan for Atlantic Demersal Finfish (the ADF Plan). The measures of the Interim Plan are intended to achieve the intentionally limited management objectives to:

(1) Enhance spawning activites;

(2) Reduce the risk of recruitment overfishing of cod, haddock and yellowtail flounder; and

(3) Acquire reliable data, in support of the development of the ADF Plan, on normal fishing patterns of the industry and the biological attributes of stocks as determined by commercial activities.

DATE BY WHICH COMMENTS MUST BE RECEIVED: ____________________

SUMMARY

The New England Fishery Management Council and the Assistant Administrator for Fisheries (NOAA) propose to adopt and implement an Interim Fishery Management Plan for Atlantic Groundfish (Interim Plan) to completely replace the management program which has been in effect since March of 1977. The objectives of this new management program for Atlantic Groundfish are as follows:

(1) To enhance spawning activities;

(2) To reduce the risk of recruitment overfishing of cod, haddock and yellowtail flounder; and

(3) To acquire reliable data, in support of the development of the Atlantic Demersal Finfish FMP, on normal fishing patterns of the industry and the biological attributes of stocks as determined by commercial activities.

The Interim Plan sets limited biological objectives in light of generally improved resource conditions. The Council believes that relaxed management will facilitate the acquisition of quality fisheries data and create a favorable management environment, both of which are essential for the development of a successful long-term comprehensive management program (i.e., ADF Plan). The current Atlantic Groundfish FMP has numerous and serious shortcomings, primarily because it uses single-species management strategies in a multi-species context. The Interim Plan addresses some of these management shortcomings by eliminating the vessel class/seasonal quota system. The Interim Plan has no specific economic objectives. The management program is intended to apply to all cod, haddock and yellowtail flounder in the Northwest Atlantic within the jurisdiction of the United States. The affected New England and Mid-Atlantic states are encouraged to adopt complementary measures.

Alternative management strategies considered for inclusion in the management program are:

1. Control on the catch of the regulated species (e.g., through species quotas);

2. Control on the fishing effort directed at the regulated species (e.g., through limits on vessels or fishing time);

3. Control fishing practices which affect the vulnerability of the regulated species to fishing (e.g., through gear restrictions or closed area/seasons); and

4. Controls which represent some modification to the existing management program which contains elements of all of the above.

The Council selects as its "Preferred Alternative" controls on fishing practices (Section III.B. of this Statement). Management measures, consistent with this general strategy and adopted by the Council for implementation are minimum mesh size, minimum fish sizes and closure of resource areas. These

measures attempt to increase long-term productivity by constraining exploitation of certain age groups within the stocks and reducing the overall vulnerability of the stock to capture.

Numerous alternative specifications of the selected measures are considered and analyzed in this Statement (Section V) and in the FMP (Section 7). Three measures considered but ultimately not adopted (trip limits, nursery area closures and a "braking" mechanism) are also analyzed in this Statement and the FMP. The specification of the selected measures represents a proper balance between providing protection to the resource, avoiding overregulation of the industry and providing an atmosphere conducive to the development of the ADF Plan. The measures are summarized below.

Mesh Size and Large Mesh Area: A large mesh area is defined which includes shoreward portions of the Gulf of Maine west of Penobscot Bay, and Georges Bank. (See Figure on Page 10) This encompasses the area where historic data indicate more than 80% of the commercial catch of cod, haddock and yellowtail flounder takes place. Within this area, all vessels using otter trawls, pair trawls, beam trawls, Scottish seines and mid-water trawls must use cod ends measuring at least 5 1/8" during the first year under the Plan, and 5 1/2" after that. Four specific alternative areas were considered along with four alternative mesh sizes.

Minimum Fish Size: Seventeen inches for cod and haddock caught commercially; 15" for cod and haddock caught recreationally; 11" for yellowtail flounder. The biological basis for establishing minimum fish sizes relative to the objectives of the Interim Plan is principally related to the size at sexual maturity. By allowing only fish larger than those at sexual maturity to be caught, the spawning potential of the stock will be enhanced and the likelihood of recruitment overfishing reduced. The minimum fish sizes are established in light of these factors and with consideration of interrelationships with the mesh measure.

Spawning Area Closures: Traditional haddock spawning areas are maintained with slight modification to Area I (See Figure III.C.1). Spawning closures allow fish to spawn without disturbance and thus, enhance the prospects for further recruitment. Three major options for defining a spawning area closure measure were identified and considered. All spawning closure options are biologically appropriate to the extent that they coincide spatially and temporally with actual spawning activity. Modification of the traditional closures responds to a reported shoalward shift in reported haddock spawning activity.

Data Collection: The Plan adopts the voluntary collection provisions of the NMFS 3-tier system, but requires that vessel identifiers (where provided) be maintained. Adopting NMFS's newly developed data collection system is the most practical and efficient means of acquiring essential data for the development of the ADF Plan.

The Council's analysis of the impacts of the proposed management program indicates that the aggregate catch of cod, haddock and yellowtail flounder would likely increase to about 110,000 tons in 1982 and 115,000 tons in 1983.

Under the principles used in the past, the 1982 quota for the three-species aggregate would have been about 95,000 tons. These harvest levels are in excess of F_{max} for all three species and may result in some discernible stock reduction. However, long-term stock problems will be preceded by measurable indices of overfishing such as a continuing downward trend in spawning stock size and annual recruitment, increased variability in annual recruitment, a succession of poor year classes and fewer year classes contributing to the spawning stock. It is the Council's judgement that these stocks are currently strong enough to allow for increased fishing mortality for an interim period while the ADF Plan is prepared and implemented. While preparing the ADF Plan, the Councils and the Secretary will continually monitor the condition of the resource and will address resource problems as they arise.

Environmental Impact Statement
for the
Interim Plan for Atlantic Groundfish

Table of Contents

I. INTRODUCTION

The Magnuson Fishery Conservation and Management Act (MFCMA) of 1976 established a national program of fisheries management designed to achieve the optimum yield from the fishery resources of the U.S. The MFCMA authorizes eight regional fishery management councils to prepare comprehensive fishery management plans (FMP) for the resources within their geographical areas of authority. These FMPs are in turn submitted to the Secretary of Commerce for approval and implementation through the promulgation of federal regulations.

The National Environmental Policy Act requires all agencies of the Federal Government to include in every proposal for "major federal actions significantly affecting the quality of the human environment" a detailed statement on the environmental impacts of and alternatives to the proposed action. NOAA has determined that actions initially adopting and implementing natural resource management plans, program or policies, including fishery management plans, are actions which normally require an environmental impact statement (Revised NOAA Directive 02-10, July 1980.)

The "major federal action" described in this statement is a process, prescribed by the MFCMA, with three identifiable phases, i.e., adoption, approval, and implementation of the Interim Fishery Management Plan for Atlantic Groundfish (Interim Plan). The first step in the process is taken by the New England Fishery Management Council. The second and third steps are taken by the Assistant Administrator for Fisheries, NOAA, under authority delegated by the Secretary of Commerce.

The Interim Plan has been under development for two years. During this time, the Council's Groundfish Oversight Committee has met nineteen times, almost always with numerous members of its Advisory Panel. The Plan has been the subject of two sets of public hearings, one during July of 1980 and another in July of 1981. Thus, after extensive and careful consideration, extended debate and much opportunity for public input, the Interim Plan was adopted by the Council at it's regular monthly meeting in September, 1981, in Portland, Maine. This draft EIS will accompany the FMP through the MFCMA review process and serve as a vehicle for further public and agency review of the management program. Comments received on the Draft EIS will be thoroughly considered by the Council.

This draft Statement draws directly from the accompanying FMP for most of the descriptive and analytical discussion presented herein. For more detailed discussions and analysis, the reader is referred to the FMP and the "Resource Document for the Interim Plan" available during regular business hours at the Council's office.

II. PURPOSE OF AND NEED FOR ACTION

There are two principal reasons for the Interim Plan: (1) to eliminate problems with the current groundfish management system and; (2) to establish a reliable data base. Each of these will help provide a receptive management environment for the preparation and implementation of a comprehensive, long-term management program for a broad range of groundfish species.

1) The Council has recognized that there are a number of serious problems with the current Atlantic Groundfish management program. Foremost among these is that the plan is not achieving the established Optimum Yields. Cod, haddock and yellowtail flounder optimum yields under the current plan are fixed numbers and, experience has demonstrated, that there is no acceptable way to insure that any fixed number representing a specific species harvest level will be achieved with exactitude. This is because harvesting of these three species is conducted in conjunction with the harvest of other species. The entire New England mixed trawl fishery would have to stop fishing to insure a single regulated species harvest level.

The administrative process for making revisions to the plan based upon new biological information or new information concerning the fishing industry is too cumbersome for making decisions that can respond to new developments in a timely way. Two annual stock assessments have been produced (1980, 1981) which the current plan does not consider. These tend to indicate a level of stability in the resources after recovery from their unhealthy condition of the late 1960's and early 1970's. The kind of protection which could be provided by an effective and restrictive quota-based management program is no longer necessary for the rebuilding of the resources. Since 1977 the New England fishing industry has changed dramatically. There has been a large influx of new vessels, including great growth in the large vessel class. Fixed gear has grown in both the Gulf of Maine and Cape Cod areas. Current allocations among vessel classes and gear types are still based upon historic averages from the early 1970's, rather than on current distribution of effort within the fishery.

The current plan is not practically or efficiently enforceable. For example, the mesh size regulations cannot be practically enforced since a fishermen is allowed an incidental catch with a small mesh net, and can claim that fish were caught with a large mesh simply by carrying one on board. The effective average mesh in the otter-trawl fishery today is acknowledged to be significantly less than the 5 1/8" required by the existing plan.

2) Comprehensive Atlantic Groundfish management requires that all the major species comprising the groundfish complex be managed in coordination with each other. The New England Council has already adopted (August 1979) the proposed management unit and objectives for the Atlantic Demersal Finfish FMP (ADF Plan). Preparation of a multiple species demersal finfish plan requires a favorable management environment brought about by establishing management credibility with industry and resultingly, broad fishing industry cooperation.

The Interim Plan is needed to acquire reliable and essential fisheries data for the preparation of the ADF Plan. It is deliberately intended, in part, to remove regulations which have caused industry to alter normal fishing practices and misreport or not report fisheries data. Accurate data on landings, species dependency, bycatch, switching behavior and seasonal fishing patterns of vessels in the mixed trawl groundfish fisheries is important for stock assessments and a broad range of analysis to support future management program development.

Objectives

The objectives of the management program proposed and analyzed in this Statement are as follows:

1) Enhance spawning activities;

2) Reduce the risk of recruitment overfishing of cod, haddock and yellowtail flounder; and

3) Acquire reliable data, in support of the development of the ADF Plan, on normal fishing patterns of the industry and the biological attributes of stocks as determined by commercial activities.

Three points concerning the first two objectives should be noted. The first is that the term "recruitment overfishing" is intended to mean the reduction of a spawning stock by fishing to a point where reproduction holds poor potential for future recovery of the stock. The second is that the objectives of this Plan and the proposed management measures are intentionally limited. They will provide a degree of stock conservation, but not total protection; they will reduce the risk, but not necessarily prevent or eliminate recruitment overfishing; they will enhance, but not guarantee adequate spawning. The success in attaining the objectives that concern spawning and recruitment overfishing will be measured relative to what would take place if no regulations were in effect. The third is that the objectives do not directly address the overall level of stock removals in the immediate future years. There is an element of biological risk associated with this approach, which this Plan accepts. In order to concentrate on long-range management of the fishery, the possibility of a decline in stocks over the short term must be lived with. However, serious damage to the stocks would be the result of cumulative impacts over time, which would be observable. The Council will be able to respond to these problems before levels of overfishing are reached.

The Council does not, by this Interim Plan, seek to attain any objectives other than those stated above. It recognizes that, at this time, credible management depends upon setting limited but relevant and attainable objectives which are readily understood and accepted by large segments of the fishing industry, and for which compliance may be reasonably expected.

III. DESCRIPTION OF ALTERNATIVES AND PROPOSED ACTION

A. Basis For Identifying Management Strategy Alternatives

Several reasonable strategy alternatives were carefully considered by the New England Fishery Management Council in selecting a preferred management strategy and adopting the controlling measures of this management plan for Atlantic cod, haddock and yellowtail flounder. These alternatives are described below. Each strategy alternative is analyzed in relation to the management objectives and the feasibility and desirability of the individual strategies. The biological implications of these strategies are considered in relation to the objectives to enhance spawning and reduce the risk of recruitment overfishing.

B. Alternative Strategies (Including the Preferred Alternative)

The four strategies discussed herein are primarily defined in terms of the kinds of control measures that they would employ to enhance spawning activities and reduce the risk of recruitment overfishing.

The four alternative strategies are as follows:

1. Control on the catch of the regulated species (e.g., through species quotas); see §602 of FMP.
2. Control on the fishing effort directed at the regulated species (e.g., through limits on vessels or fishing time); see §603 of FMP.
3. Control fishing practicies which affect the vulnerability of the regulated species to fishing (e.g., through gear restrictions or closed area/seasons); see §604 of FMP.
4. Controls which represent some modification to the existing management program which contains elements of all of the above; see §605 of FMP.

Table I presents a judgemental evaluation of these strategies in relation to each other.

Control on Catch

This general strategy for managing the cod, haddock and yellowtail flounder fisheries was previously adopted for the existing groundfish management plan. The strategy most often employs quotas as the primary control measure. Quotas could be geared toward either 1) achieving a desirable harvest rate (associated with the enhanced long-term productivity of the resources), or 2) achieving a desired stock level at the end of a quota period. In either case, quotas would rely heavily on current stock assessment information in order to avoid unnecessarily penalizing the industry and the nation in the short run.

Although the capability presently exists to calculate short-term levels of allowable catch corresponding to either a specified harvest rate or a stock size goal, the objectives of this Interim Plan do not identify an optimal level of catch. The administrative costs of controls on catches can be very high, particularly in a fishery with a large number of participants. The administrative problems are exacerbated when large segments of the industry have little faith in the management program and look for loopholes or ways to avoid enforcement.

Additionally catch control is most efficient in a single species fishery. Where various species of fish are caught together in a mixed-trawl fishery. Species-specific catch limits may artificially constrain the harvesting of associated species, keep other species quotas from being achieved (both of which impose costs on the industry), or prove to be ineffective in controlling any removals.

Finally, in a situation where vessel entry and exit are not controlled, the existence of quotas may induce undesirable behavioral changes in the fishery. The potential for a fishery closure has in part encouraged vessels to "scramble" for a share of the management quota. Such a "scramble" phenomenon often result in operating inefficiencies, negative price effects and reduced net revenues to the industry, followed by product scarcity and elevated prices during extended fishery closure periods. In addition, concern for a pending fishery closure can lead to misreporting of catch and increased monitoring/enforcement costs.

Control on Fishing Effort

Controlling fishing effort is designed to increase long-term resource productivity by constraining the rate at which the resource is harvested. This strategy implies the use of management measures such as a limit on the number of fishing days available in a given year or a limit on the number of participating vessels. Such effort control measures are generally considered to be more efficient than quota measures at limiting exploitation of the resource. In effect they provide a more direct control on the rate of harvest without acting to deny the opportunity for the industry to take advantage of increased catches that come with natural fluctuation in resource abundance.

From a biological perspective, effort control serves the same purpose as catch control in limiting the extent to which fish are harvested before they can contribute to the spawning potential of the stock (recruitment overfishing). However, as noted for catch control, it is not possible to identify a specific "appropriate" level of effort in the current groundfish fishery. An overly restrictive specification of effort control may result in an undesirable loss of short-term benefits to the industry, even though long-term benefits to the resource may be enhanced.

In addition, successful implementation of effort control measures in the cod, haddock and yellowtail flounder fisheries suffers from several important shortcomings. First, direct vessel effort represents only one of the factors which influence biological resource exploitation; vessel/gear efficiency and age-at-first-capture must be simultaneously considered. Second, although it is often possible to relate information on previously applied effort to historic trends in catch and abundance, the development of a meaningful relationship between nominal fishing effort and exploitation is complicated by three factors: 1) changes in vessel/gear efficiency cannot be readily accounted for, 2) nominal effort in the fisheries where cod, haddock and yellowtail flounder are caught cannot be directly associated with any one species, but rather with the collection of species taken on the same trip, and 3) nominal effort data is not available for all sectors of the fishery or all vessel/gear groups.

Control on Fishing Practices

Like control on catch and effort, the general strategy of adopting control measures which affect fishing practices also attempts to increase long-term resource productivity by constraining exploitation of the stock or of certain age groups within the stock. However, this strategy relies on measures such as gear restrictions (e.g., mesh size or net configuration), or closed areas and seasons, which in effect selectively reduce the vulnerability of the stock to capture. Measures of this type have been used extensively over the past decade in management programs for cod, haddock and yellowtail flounder. Seasonal closures of haddock spawning areas were established under the International Convention for the Northwest Atlantic Fisheries (ICNAF) and continued under the management authority of the MFCMA. Similarly, cod-end mesh restrictions for the cod, haddock and yellowtail flounder fisheries in the Gulf of Maine, Georges Bank and Southern New England areas were established under ICNAF and also continued under MFCMA authority. Area closures to fishing with certain vessel/gear configurations were established under ICNAF for portions of Georges Bank, but were never incorporated into the groundfish plan.

In the context of the management objectives, control measures affecting availability are very useful because they permit intervention prior to the fishing activity. Concern for recruitment overfishing can be addressed by measures (e.g., minimum mesh or minimum fish size) which focus the fishery away from sexually immature fish and permit those age groups to remain in the population long enough to contribute to the spawning stock. Enhancement of spawning activities can be addressed through fishery closures during periods when fish are spawning and/or in areas which favor spawning activity. In addition to recruitment and spawning considerations, measures of this type which control age-at-entry into the fishery also have significant implications for the total production that can be derived from year classes recruiting to the cod, haddock and yellowtail flounder fisheries. In combination with area closures these measures may significantly enhance the long-term productivity of the fishery resources.

There are, however, two major limitations to this general strategy. First, because the overall exploitation of the cod, haddock and yellowtail flounder resources is greatly influenced by the level of applied effort, measures controlling fishing practices typically offer only loose control over resource exploitation, and consequently may require frequent tuning to ensure resource conservation. Second, gear regulation (e.g., mesh size) is designed to affect resource vulnerability by making it more difficult to catch fish. Such measures are often inefficient from an industry perspective because in the short-run they increase the per unit cost of catching fish. That is, catch (revenue) per day fished is reduced by decreasing the efficiency of a fishing day.

Modification of Existing Control Measures (No Action)

The modification of the control measures in the existing FMP, as an alternative strategy, refers to either a respecification of the values of those measures or a change in the manner in which they are implemented. In either case it is understood that the basic combination of measures (quotas, trip limits, mesh sizes, spawning closed areas) would remain unchanged. This approach has been used by the Council and the Secretary in many amendments to the existing FMP. The Council's experience (see Section §101 and §501 of FMP) has demonstrated that none of the previous attempts at plan modification has satisfactorily addressed their concerns for resource conservation, industry benefits, and accurate data reporting. The current management program has promoted inefficient use of the resources, severely strained existing enforcement capabilities, and has failed to generate data of a quality acceptable for biological assessment or industry analysis purposes. As a consequence, this alternative holds little promise for the effective management of the regional cod, haddock and yellowtail flounder resources, particularly in view of the Council's decision to move ahead with a multispecies (mixed-trawl) management program.

Selection of Preferred Management Strategy

Selection of a preferred management strategy is based upon evaluation of the relative merits of the four general strategy alternatives discussed in the previous section. The evaluation was conducted with reference to the following five criteria:

1) compatibility with Objectives 1 and 2 (biological considerations).

2) feasibility for implementation (management considerations).

3) minimization of costs and regulatory burdens to industry (economic considerations).

4) quality of data reporting (biological and administrative considerations).

5) minimization of administrative and enforcement costs (administrative considerations).

Table I presents a summary evaluation of the various strategy alternatives. The alternatives are rated qualitatively [i.e., poor (P), fair (F), and good (G)] relative to the above criteria.

An examination of the analysis contained in Table I indicates that controls on fishing practices should be the preferred management strategy. Biologically, these provide protection to the resource most consistent with the objectives of this plan, and not inconsistent with the current status of the resource. They have great advantages in minimizing costs to industry and

TABLE 1: EVALUATION OF STRATEGY ALTERNATIVES

Generalized Strategy	Criteria	Rating[1/]	Comment (see text for further elaboration as required)
1. CATCH CONTROL:			
	Compatibility w/Objectives 1 & 2	F	·Although quota control is relevent to the objectives, it is not possible to specify an appropriate level of catch that meets the objectives.
	Feasibility for Implementation	G	·Quota levels can be calculated and related to status of resource, although hindered by recent quality of reported catch data. (Objective 3)
	Min. Cost to Industry	F	·Uncertainty in stock assessment is reflected in quota and may result in some short-term loss of revenue; ·Quotas encourage "scramble" behavior, result in economically inefficient use of resource. ·Quotas are problematic in a mixed species fishery.
	Quality of Data Reporting (Objective 3)	P	·Experience has shown that quotas imposed on an open fishery encourage underreporting and misreporting.
	Min. Admin./Enf. Effort	F	·Monitoring of vessel landings imposes reasonable costs.
2. EFFORT CONTROL:			
	Compatibility w/Objectives 1 & 2	F	·Effort control is a powerful management tool and relevent to the objectives, but there is no "appropriate" level of effort that meets the objectives.
	Feasibility for Implementation	F-P	·Although standardized effort units may be calculable, effort cannot be operationally related to all vessel/gear groups or easily reconciled with a subset of species in a mixed species fishery. (Objective 3)
	Min. Cost to Industry	G	·Effort control allows vessels to take advantage of resource availability, and depending on the form, encourages efficient use of the resource.
	Quality of Data Reporting (Objective 3)	G	·Effort control should encourage accurate reporting of species landings data; accurate effort data may be problematic.
	Min. Admin./Enf. Effort	F	·Monitoring of vessel effort imposes reasonable costs.
3. CONTROL ON AVAILABILITY:			
	Compatibility w/Objectives 1 & 2	F	·Candidate measures (mesh size, minimum fish size, closed area/seasons) are particularly suited to objectives; specification of measures still requires a partially subjective judgement of appropriateness.
	Feasibility for Implementation	F-G	·Sufficient data exist to permit specification of most measures. However, the mixed-trawl nature of the fishery implies trade-offs in the degree of effectiveness for individual species.
	Min. Cost to Industry	F-G	·Candidate measures allow vessels to maximize catch per trip, but gear related measures may impose short-term costs at the points of implementation or respecification.
	Quality of Data Reporting (Objective 3)	G	·Candidate measures should encourage accurate reporting of all fishery data.
	Min. Admin./Enf. Effort	F	·Monitoring of compliance with measures imposes reasonable costs.
4. MODIFICATION OF EXISTING MEASURES (No Action):	Compatibility w/Objectives 1 & 2	F	·The justification of a quota management system is strained in relation to the objectives. ·The existence of a vessel-class trip limit scheme is not justified by the objectives.
	Feasibility for Implementation	F	·Although quota level calculations are technically valid, accuracy has been compromised by data quality. ·Trip limit program is operationally insensitive to changes in fleet structure, nor is it responsive to changes in vessel efficiency.
	Min. Cost to Industry	P	·Quota system with associated vessel class allocation and trip limit measures has been costly to the industry: excessive regulatory burden; imposed constraints on trip catch and the quota "scramble" phenomenon have resulted in lost profits and inefficient resource utilization.
	Quality of Data Reporting (Objective 3)	P	·Induced misreporting and nonreporting degraded the effectiveness of the management system, undermined ability for biological resource assessment.
	Min. Admin./Enf. Effort	P	·Incremental cost of enforcing trip limit system was high.

[1/] G = Good, F = Fair, P = Poor; These ratings are relevant only to the management of the cod, haddock and yellowtail flounder resources improving the quality of data reporting. Administratively, they are clear and easy to deal with, requiring the exercise of a little discretion or balancing between competing interests to run the management program. This Interim Plan, therefore, adopts controls on fishing practices as its strategy.

C. Proposed Management Measures and Alternatives

The proposed action is to adopt and implement an interim fishery management program for cod, haddock and yellowtail flounder which will achieve the objectives stated in Section II. The management measures specified herein are consistent with the Council's limited objectives, will allow the fishery to operate relatively freely and are justified by current resource levels. They strike the proper balance between providing protection to the resource, avoiding overregulation of the industry, and providing an atmosphere conducive to the development of the ADF Plan. The major features of the FMP proposed by the Council for implementation and a comparison to alternatives are summarized below.

Management Unit

The management unit of the Interim Plan is the Atlantic cod, the haddock and the yellowtail flounder which inhabit the area of the Northwest Atlantic subject to the jurisdiction of the United States including the territorial seas.

Optimum Yield

The optimum yield for cod, haddock and yellowtail founder is the amount of those species harvested by the United States fishermen under the conservation and management measures specified in this Interim Plan.

Harvest levels during the life of the Interim Plan may begin at a slightly higher level than currently, but will subsequently depend on overall stock abundance. Stock abundance may decline somewhat, but it is not likely that the decline will jeopardize recruitment.

Domestic Annual Harvest (DAH) and Total Allowable Level of Foreign Fishing

By definition, the domestic fisheries will harvest the entire optimum yield and there is no surplus to be allocated to foreign fishing. Domestic fleets have demonstrated for the past four years that they are capable of harvesting these three species at levels near or in excess of MSY. Current resource levels, although improved, do not support a surplus for foreign harvest.

Numerical DAH values can be predicted annually by specifically examining at any given time the current resource levels, harvest potential and market conditions.

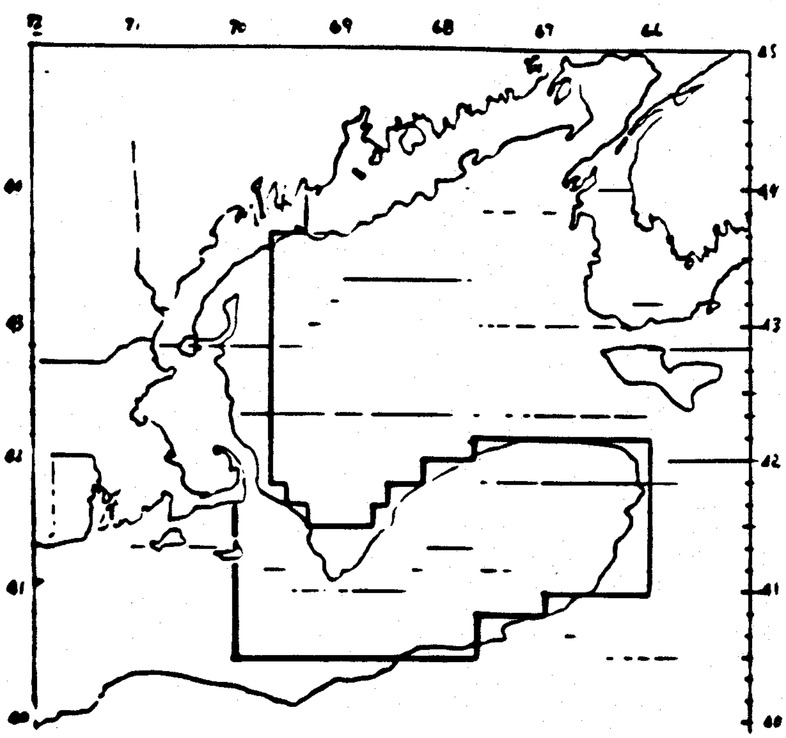
Domestic Annual Processing and Joint Venture Processing (JVP)

United States processors are capable of utilizing the entire harvest of cod, haddock and yellowtail flounder by domestic fishermen. Continuing imports of fresh as well as frozen product by United States processors indicates that they have a demand for fresh fish beyond what domestic fishermen are currently landing. It is reasonable to conclude that domestic processors will be able to utilize fully any likely increase in domestic harvest. JVP, therefore, equals 0.

Large Mesh Area

The Plan establishes an area where only large mesh fishing gear may be used throughout the year. The large mesh area is illustrated by the figure below (longitude and latitude coordinates are found in §805 of the FMP).

LARGE MESH AREA



PERCENT OF TOTAL COMMERCIAL LANDINGS ENCOMPASSED BY LARGE MESH AREA.

Cod	88.0
Haddock	81.3
Yellowtail Flounder	89.9

This area geographically encompasses a major proportion of the commercial catch of cod, haddock and yellowtail flounder. This measure is intended to insure that the fishery for these species will be predominantly prosecuted using a mesh which is consistent with the objectives of the plan. Four alternative "large mesh" area specifications (see Figure V.C.1.) were designed and examined to allow selection of the area, which in the Council's judgement maximimizes the coverage of the total annual landings of cod, haddock and yellowtail flounder while minimizing impacts on existing small mesh fisheries. Section V.C. examines in detail these four alternative specifications. The selected alternative provides significant protection for cod, haddock and yellowtail flounder while minimizing impacts on redfish fisheries. Minimizing impacts on silver hake fisheries would have unduly lessened the protection for cod, haddock and yellowtail flounder.

Minimum Mesh Size Permitted Within Large Mesh Area

The Council proposes that vessels using trawl gear in the large mesh area established by this Plan be required to use nets having cod ends with mesh of at least 5 1/8" during the first year of this Plan, and 5 1/2" thereafter. Vessels using gillnets in the large mesh area must use nets with at least 5 1/2 inch mesh. Selection of a minimum mesh size involves balancing short-term costs against long-term benefits. Alternative mesh sizes considered and examined were 4 3/4 inches, 5 1/8 inches, 5 1/2 inches and 6 inches. Analysis shows that the present value of long-term gross revenues is greatest with a mesh size far in excess of anything considered to date (see Table V.C.2. and related discussion). On the other hand, short-term costs are very high both in terms of equipment investment and foregone catches while fish currently in the population grow to the point where they will be harvested by the larger meshes. It is entirely inappropriate to consider any reduction in the current regulation mesh size since the analysis shows that this would not return any long-term benefits. Allowing the industry a year to phase in a 5 1/2" mesh provides the appropriate balancing of these interests. However, it is expected that there will be immediate benefits even during the first year of the minimum mesh size, since the new mesh regulation is more enforceable.

Minimum Fish Sizes

The Council proposes that the minimum size of any cod, haddock and yellowtail flounder which may be landed be established as follows: for commercially caught cod and haddock, 17 inches; for yellowtail flounder, 11 inches; for recreationally caught (by rod and reel or handline) cod and haddock the minimum size will be 15 inches.

This measure is intended to supplement as well as improve the effectiveness of the area/mesh scheme by imposing a disincentive on setting on known concentrations of juvenile fish since these small fish cannot be landed. The proposed minimum size(s) correspond to the length of a fish that has had an opportunity to spawn once, rather than the 50% retention level of the regulated mesh size. Technical information leading to the selection of the minimum fish sizes and on alternative sizes is found in Section V.B.

A special provision for recreational fishing is provided since recreational vessels do not catch signficant amounts of juvenile groundfish. A 15" size limit for cod and haddock corresponds to the minimum size of fish which are currently caught by commonly used hook gear on board commercial sportfishing boats. A higher size would impose significant costs without appropriate benefits. "Recreational fishing" here is intended to apply only to hand held hook and line gear.

Optional Settlement Program

As an exception to the mesh size required in the specified large mesh area, it is proposed that the Regional Director design and implement an optional settlement program to allow fishermen to prosecute legitimate small mesh fisheries within that area. Specific Council intent with regard to the Optional Settlement Program is found in Section 808 of the FMP. Alternatives to the Optional Settlement Program included various seasonal exemptions for small mesh redfish fisheries and permitted declared fisheries for silver hake (i.e. scaled-down versions of Optional Settlement).

Spawning Area Closures

Under the Interim Plan the areas shown in Figure III.C.1. shall be closed to all fishing with bottom-tending gear during the months of April, May and June. Coordinates for Area I and Area II are found in Section 703.2 of the FMP.

This measure modifies Area I by extending it slightly to the southeast. The modification responds to a shoalward shift to the Southeast reported by the industry in haddock spawning activity, i.e. the shallower water between Little Georges and Cultivator Shoals. Area II is not changed.

Three major spawning area options were considered by the Council (See Figure V.C.1.). There is insufficient information on the newly-identified and proposed spawning areas to indicate that they should be adopted.

Permits and Enforcement

Any vessel which catches cod, haddock or yellowtail flounder in the FCZ must first obtain a permit from the Regional Director, which shall be available at no cost. Vessels must comply with standard procedures to assist in enforcement of regulations implementing the Plan.

Data Collection

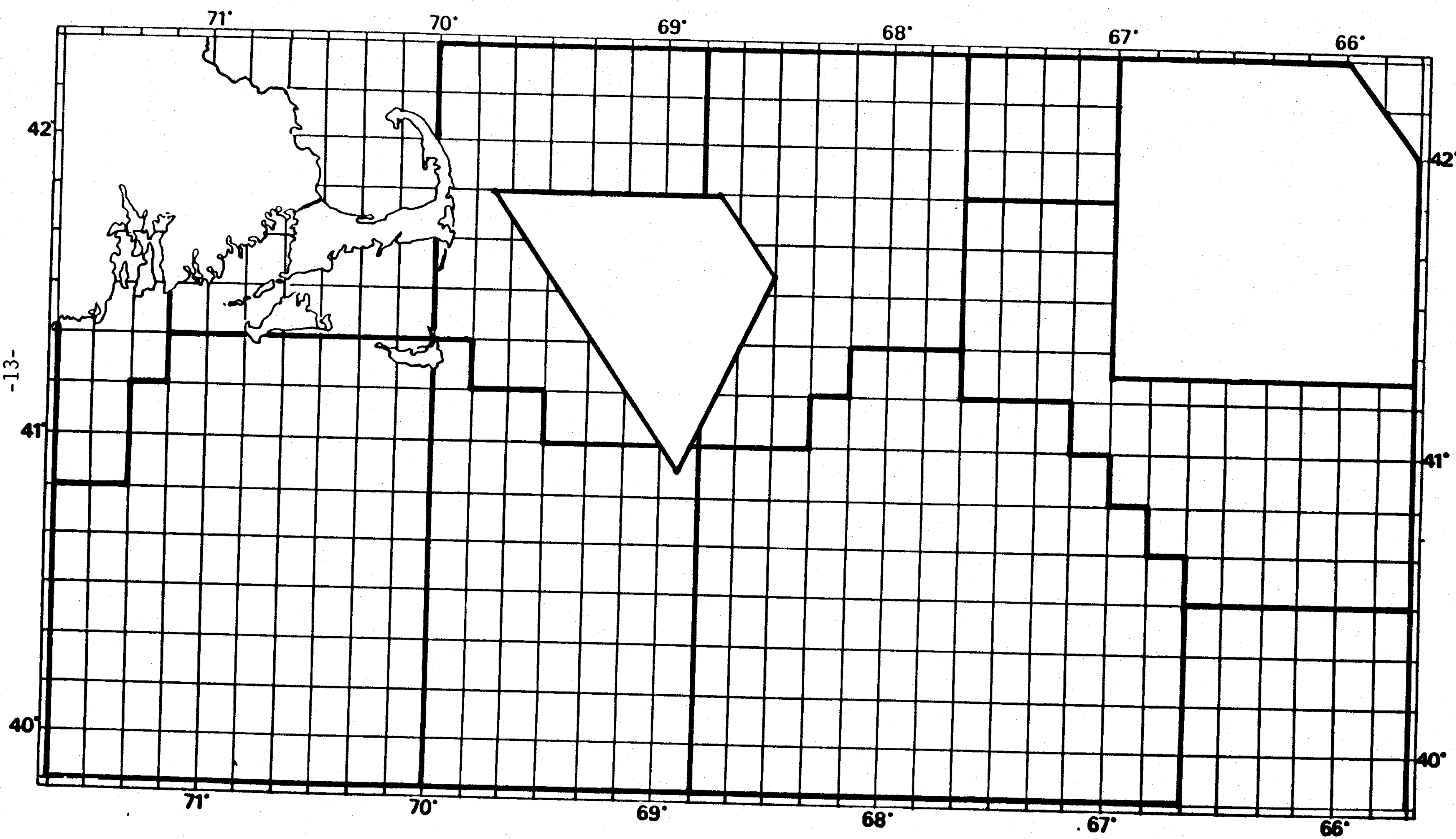
The Regional Director (NMFS) is currently preparing to implement and carry out a program of data collection in the groundfish fisheries which includes an expansion of the current weighout system, vessel logbooks and sea sampling. The Plan adopts this data collection procedure. All or parts of this program may be implemented through voluntary or mandatory measures as the Regional Director, in consultation with the Council finds necessary to insure the completeness, accuracy and integrity of the data. The information shall be maintained with vessel identifiers, appropriately masked to the extent possible, so that vessel-specific performance analysis can be performed.

D. Alternative Measures Considered But Not Adopted

Numerous alternative specifications of the conservation and management measures comprising the "proposed action" (i.e., minimum mesh size and area, minimum fish size and spawning area closures) were considered by the Council. Discussion and analysis of these alternative specifications is found in brief in Section III.C, with more complete examination throughout Section V.

In addition to alternative specifications of the selected management measures, other management measures from the range of generalized strategies

Figure III.C.1. Spawning Areas Closed Under the Interim Plan



identified in Table I were considered and rejected at this time by the Council. Three major measures considered but ultimately rejected were fishing trip limits, ad hoc nursery area closures, and a "braking" mechanism.

Trip Limits

As a possible alternative measure for inclusion in the Interim Plan, the Council sought public comment on an initial 60,000 lb. trip limit, consisting of any combination of cod, haddock and yellowtail flounder, except that yellowtail flounder would not exceed 33% of the trip limit in force. The trip limit would be increased by 5,000 lbs. every three months. All trip limits would be removed effective with the implementation of 5 1/2 inch mesh (i.e., one calendar year from implementation of the Interim Plan)."

Trip limits carry with them an implicit vessel quota; the lower the trip limits, the lower the exptected overall removals. However, in relation to recruitment overfishing, trip limits also carry heavy opportunity costs to the industry. That is, trip limits set low enough to have the desired effects on the harvest of immature fish will necessarily and proportionally reduce the harvest of older, sexually mature fish in the harvestable stock. The costs incurred are thus defined as the opportunity costs of not catching the larger fish.

In their general application, trip catch limits are specified in terms of some level of acceptable catch, and as such are desirable if the present value of the increased future production (resulting from the catch effect) outweighs the costs of foregone catch today. Under the Interim Plan it is unknown whether a one-year imposition of trip limits would improve or protect the resource at all. If fishermen are profit maximizers (or cost minimizers), then their individual allocation of inputs into the fishery will be efficient. Trip limits would likely alter such an allocation of inputs, causing inefficiencies or increased costs. As a consequence of being faced with restrictive trip catch limits, fishermen would require fewer days per trip and might well increase the total number of fishing trips. Thus, total catch might not be affected at all.

Further explanation of the Council rationale for not including trip limits is found in Section 705.3 of the FMP.

Ad Hoc Nursery Area Closures

A system for identification and closure of areas with concentrations of juvenile fish could be made on the basis of fishermen's reports for an initial period of two weeks. If, at the end of a two-week closure period verification of criteria are still met, then a subsequent two-week closure could be instituted over the same or a somewhat redefined area.

The protection of juvenile fish through the closure of nursery areas to mobile gear fishing is potentially a very effective measure to aid in avoidance of recruitment overfishing. But concentrations of juveniles are not static, rather movements of such concentrations while in search of food or to avoid predators may be very rapid. Current understanding of these movements does not permit prior identification of nursery areas for cod, haddock or yellowtail flounder except in a very gross manner. Hence, efficient identification of nursery areas must be accomplished on an ad hoc basis.

Practical considerations for implementing nursery area closures has led to the conclusion that ad hoc closure action would require a minimum of five (5) working days for completion. It is clear, however, that this time frame is impractical considering the mobility of fish concentrations. Therefore, it must be reluctantly concluded that effective nursery area closures are not biologically practicable given the current state of knowledge.

Braking Mechanism

During consideration of this Interim Plan it was suggested that, since the Plan involves some risk to the resource, it should include a mechanism to curtail fishing mortality if the stocks reached a certain minimal point. This has been variously referred to as a "braking" or "fail-safe" mechanism.

Despite considerable attention to the issue, the Council has been unable to identify either a point at which such a mechanism should be triggered; or measures which could be effective. This Interim Plan is intended to be a short-term management program, and harvests are not expected to be that much greater than if the current management program were continued. It can also be expected that before any serious harm is done to the resources, various indicators of resource problems will be observable. These include a) major downward trends in spawning stock sizes and average annual recruitment; b) increased variability in annual recruitment; c) major shifts to younger year classes in the fishery; and d) the presence of fewer year classes in the spawning stock. As part of its continuing management effort, and in developing the ADF Plan, the Council intends to follow these factors closely and will change its program to meet problems as appropriate when they arise.

Therefore, because the need for a braking mechanism is not clear and because the specifics for any such mechanism have not yet been identified, the Council believes that the Interim Plan should be implemented as soon as possible without a braking mechanism. However, the Council has established continuing consideration of this matter as its first priority in addressing long-term management of the groundfish complex and an appropriate mechanism might be implemented even before a full transition to the ADF Plan.

IV. Affected Environment

A. The Cod, Haddock and Yellowtail Flounder Resources

The Atlantic cod, Gadus morhua, the haddock, Melanogrammus aeglefinus, and the yellowtail flounder, Limanda ferruginea, are demersal species inhabiting the continental shelf off New England. Cod are heavy bodied North Atlantic fish that range widely over the continental shelf from the shoreline to the shelf edge. The maximum length for cod is about 183 cm (72 inches). Maximum age is in excess of 20 years, although commercially caught cod are generally from 2-15 years old. In New England waters cod concentrate over hard bottom and in areas where food is most plentiful at depths between 5 and 75 fathoms. They are associated with relatively cold water that has risen from deep in the ocean. The most productive fishing grounds are found on the eastern part of Georges Bank, the South Channel Region from Cultivator Shoals to Cape Cod, and on the smaller banks and ledges around the western periphery of the Gulf of Maine. Cod apparently do not migrate extensively in New England waters, although they do exhibit a seasonal pattern of movement into shoaler water in the spring and a retreat to deeper, but warmer, waters in the winter. In the southern part of their range cod migrate from summer grounds off southern New England to wintering grounds off the coast of New Jersey.

The haddock is a smaller member of the cod family and lives at moderate depths. It is a less widely distributed and more demersal than the cod but can be very abundant in some areas. Haddock attain a maximum length of 112 cm (44 inches) and maximum age of approximately 18 years. In New England waters they concentrate in localized areas with favorable depth and bottom conditions. They are most abundant on the the eastern part of Georges Bank, in 50 - 150 meters (27-87 F), but also occur in commercial quantities from the South Channel to eastern Nantucket Shoals and in southwestern Gulf of Maine. Most haddock migrations are of short duration; and are primarily seasonal adjustments of depth distribution associated with spawning, feeding and temperature conditions. The most extensive seasonal migration of haddock appears to be a movement from wintering areas in the southwestern Gulf of Maine to summer grounds along the Maine coast east of Mt. Desert.

The yellowtail flounder is a medium sized, small-mouthed flounder belonging to a family of flatfishes (Pleuronectidae) that are "right-handed", that is, the eyes and the viscera are on the right side as the fish lies on the bottom. It is a demersal species that prefers moderate depths, sandy mud bottoms and occurs abundantly in fairly distinct geographic areas. Concentrations of yellowtail flounder are found in three areas which support the heaviest yellowtail fishing: the Southern New England ground, extending from the South Channel to Long Island in waters of 14 to 30 fathoms; the southeast part of Georges Bank in depths of 25 to 41 fathoms; and along the outer edge of Cape Cod to Massachusetts Bay in 5 to 36 fathoms. Lesser concentrations are found along the western periphery of the Gulf of Maine. Yellowtail are not migratory, although some seasonal shifting of the southern New England and the Georges Bank stock does occur. The Cape Cod stock does not seem to be seasonally migratory, but there may be a northward dispersal of yellowtail along the western Gulf of Maine.

Environmental Factors. Four important environmental factors which influence the distribution of cod, haddock and yellowtail flounder are: termperature, light intensity, food availability and bottom conditions. Temperature is a primary factor that influences the distribution of groundfish species; it determines, either directly or indirectly, their range and seasonal distribution patterns. Diurnal vertical migrations are common for cod, and to a lesser degree for haddock and yellowtail. Food and bottom conditions affect the spatial distribution of groundfish. Non-random aggregations of haddock, and occasionally cod, are associated with the distribution of the macroinvertebrate fauna. Yellowtail have a strong preference for sand and sandy mud bottoms.

Predator/Prey Relationships. The food habits and interspecific relationships of cod, haddock and yellowtail are complex because they are interwoven with the other components of the ecosystem. The amount and kinds of food available to these species can influence their abundance, distribution, movement, growth, reproduction, and physiological condition. Prey availability can also dictate the degree of competition between species with similar food preferences. These interactions are not well understood because the system is complex and remote.

The adult gadiform fishes can be classified into three basic feeding types: those that feed mainly on fish, those that feed mainly on invertebrates, and those that are mixed feeders. Cod belong to the first feeding type and are primarily active, piscivorous predators, a habit they share with silver hake and pollock. Haddock belong to the second feeding type and consume primarily sedentary or slow moving benthic or epibenthic invertebrates. The yellowtail is, like haddock, characteristically a consumer of benthic and epibenthic invertebrates.

Competitive Interactions. Competition between groundfish species inhabiting the same waters may affect the productivity and availability of these species, but these relationships are difficult to discern and evaluate. The potential for interspecific competition can be determined by the degree to which their diets overlap and the extent to which their distributions coincide. The existence of competition for limited resources may depend on the abundance of a particular prey species and on the abundance of the predators. It can only rarely be perceived that one species has, in fact, interacted with another to the extent that the abundance or distribution of either species has been altered. This is not necessarily because these interactions do not occur, but because they are difficult to detect.

Present Condition

The condition of the cod, haddock and yellowtail flounder stocks are given in Serchuk and Wood (1981), Clark, Mayo and Lavik (1981) and Clark, O'Brien and Mayo (1981). These represent the most recent assessment of the groundfish stocks. The primary source of data were indices of abundance from research vessel survey catches.

Cod - Georges Bank and South. The results of six annual resource surveys show a consistent pattern of relative year class strengths. The 1975 year class, which has sustained the fishery in recent years, has been replaced as the dominant year class by the 1977, which is of average strength. The 1978 year class is above average but not as strong as the 1975, while the 1979 is poor in strength. Preliminary estimates of the 1980 year class indicate that it is of average strength. The surveys do not show a consistent pattern of abundance indices, some of the surveys show increased 1980 values while others show decreased values. The current assessment indicates that the Georges Bank and South cod stock biomass may have begun to decline from the relatively high levels observed in 1978 and 1979, but definitive conclusions will have to wait until subsequent survey data is available.

Conflicting abundance indices for Georges Bank cod stocks from the most recent research surveys leaves the future trend in stock biomass in doubt. However, relative exploitation rates of Georges Bank cod have increased since 1978 and are now within the range of the 1964-1970 period of high fishing levels. This implies that, if current catch levels continue, discernible stock size reductions could be observed on Georges Bank.

Cod - Gulf of Maine. The results of offshore and inshore resource surveys in the Gulf of Maine have shown relatively high abundance indices of cod in the Gulf of Maine since 1977. Except for the 1980 summer offshore data, all of the 1980 survey indices are consistent in reflecting a high Gulf of Maine stock size. The age distribution of Gulf of Maine cod from the 1980 survey indicates that the 1979 and 1978 year classes may be the strongest ones since the 1973 year class and that the 1977 and 1980 year classes are at least average strength. The results of the present assessment indicate that the Gulf of Maine cod stock biomass has continued to remain at the relatively high levels noted during 1977-1979.

In the Gulf of Maine, continued increases in harvestable biomass should continue in 1981 and 1982. If fishery levels (as indicated by relative exploitation rates) remain as low as they have in the past few years, stock biomass of cod should remain at relatively high levels over the next few years.

Haddock - Georges Bank and Gulf of Maine. The Georges Bank and Gulf of Maine haddock stocks have increased markedly from the historically low levels prior to 1977 as a result of the recruitment of the strong 1975 and 1978 year classes. Three sets of data from 1977-1970 survey cruises indicated that the biomass of haddock is substantially higher than it was in the late 1960's and early 1970's.

The haddock stock on Georges Bank is now primarily dependent on the 1978 year class. The 1976, 1977, and 1979 year classes appear to be very weak. Preliminary evidence suggests that the 1980 year class is of at least average size. The 1981 stock biomass is estimated to be comparable to values observed in the late 1960's, and is about midway between the long-term (1935-1960) average and the very low levels observed in the early 1970's. The future prospects appear more favorable than the late 1960's because of potential increases in biomass due to growth of fish (i.e., the dominant 1978 year class) and potential average to strong recruitment from the 1980 year class in 1982.

The haddock stock in the Gulf of Maine was supported through 1979 by the dominant 1975 year class. The 1978 year class has been relatively weak in the Gulf of Maine and the 1980 fishery has been supported largely by the 1976 year class, which was stronger than previously supposed. The 1980 autumn survey indicated that the abundance of 0 age haddock (1980 year class) was highest since 1963. Recent research vessel survey data indicate that biomass levels in the Gulf of Maine declined in 1980 and 1981 and are expected to continue to decline unless the 1980 year class produces substantial recruitment.

Yellowtail - Southern New England and Mid-Atlantic. Research survey data indicate a pronounced decline in abundance between the late 1960's and mid 1970's, with relatively constant abundance and biomass through 1980. There is some disparity between to different sets of surveys in terms of prospects for future recruitment surveys. The Northeast Fisheries Center survey indicated that abundances of age 1 and 2 fish have been substantially lower during 1977-1980 than in former years, although the 1976 and 1977 year classes appeared somewhat stronger than other recent year classes. However, Council/state/industry cooperative surveys in Southern New England indicate substantial recruitment of the 1979 year class in 1981. Both surveys indicate, nonetheless, that relatively low abundance continues and that recent mortality levels have been high. In this case the Southern New England fishery could become dependent almost completely on incoming recruitment. The situation in the Mid-Atlantic appears comparable to that observed for Southern New England.

Yellowtail - Georges Bank. In contrast to the situation in Southern New England, 1980 survey abundance indices have increased sharply over 1977-79 levels. The 1977 and 1978 year classes appear to be the strongest of recent year classes, although recent year classes have been weaker than those that recruited in the late 1960's. There is a possiblity that recent apparent increases in abundance levels may be in part due to changes in distribution that make yellowtail relatively more vulnerable to capture.

Yellowtail - Cape Cod and Gulf of Maine. Survey indices for the Cape Cod yellowtail stock indicate relatively constant levels of abundance during 1978-1970. This stock seems to be more stable than those on Georges Bank or in Southern New England. The abundance in the Gulf of Maine appears to have increased in recent years.

B. DESCRIPTION OF HABITAT

Bathymetry

The continental shelf on the U.S. east coast is narrowest off Cape Hatteras, North Carolina, where the 100 fathom contour is only about 20 miles offshore. As one travels northward, the shelf extends out considerably further with the 100 fathom contour located about 80 miles off Cape May, New Jersey, and about 100 miles off Cape Cod.

Between Cape Cod and Nova Scotia is the expansive Gulf of Maine, enclosed to the seaward by Brown's Bank and Georges Bank. The topography of the Gulf, scoured by glaciation, includes many deep basins and shallow banks and ledges. Water exchange with the Atlantic Ocean takes place primarily through the deep Northeast Channel region and the shallow Great South Channel.

Georges Bank, located between the Great South Channel and the Northeast Channel, is a large, relatively shallow bank with water depths of less than 20 feet in several areas.

Sediments

From Cape Hatteras north to Cape Cod, the bottom sediments of the shelf are mostly sand, with areas of mud and gravel. Gulf of Maine sediments vary considerably, from rocks to silt, gravel, and sand. Georges Bank is primarily sand, with pockets of gravel and sand-gravel.

Hydrography

Nearshore surface circulation from Cape Cod to Cape Hatteras is generally southwesterly throughout the year. Further offshore, the Gulf Stream flows northeasterly. Shelf waters along the coast are strongly influenced by the extensive estuaries of the region, including Chesapeake Bay, Delaware Bay, Hudson River, Narragansett Bay, and the estuaries behind the barrier beach systems.

The Georges Bank plateau is largely responsible for the circulation patterns of water in the Gulf of Maine. On the bank itself, currents result in well-mixed water. Surface circulation in the Gulf of Maine is basically counterclockwise. Slope water enters through the Northeast Channel and shelf water enters over the Scotian Shelf and Brown's Bank. Water flow continues to the Bay of Fundy. During the winter, a southerly flow exists along the western side of the Gulf, and streams out through the Great South Channel. Several eddies develop near the center of the Gulf at this time. In the spring, the Gulf of Maine eddy develops into a strong counterclockwise gyre, and then starts to break down in early summer. By late autumn the currents are weak, and water flows out over Georges Bank.

There is very slow (0.1 miles/day) movement of water, primarily shoreward, in the deeper parts of the Gulf. Pronounced upwelling of nutrient-laden bottom waters occurs, particularly in the eastern and northeastern edges of the Gulf, as a result of tidal forces and circulation patterns.

Surface water temperatures in shelf waters of the mid-Atlantic Bight vary from less than 3°C in February in the northern region to 27°C off Cape Hatteras in later summer. The annual temperature range of shelf waters may exceed 20°C. Water temperatue may vary at different depth, especially in the summer. Salinity of the region is lowered by large estuarine fresh water inflow in the spring. Intrusion of offshore saline water eventually raises salinity to maximum again in the winter. Salinities in this area average 32 parts per thousand.

Frequent verticial mixing of waters at the eastern edge of the Gulf of Maine and Georges Bank minimizes vertical salinity and temperature gradients in those regions. The western part of the Gulf is stable in summer, resulting in warm temperatures and low salinities at the surface, and little verticial mixing. Water temperatures range from 2°C to 17°C at the surface of the Gulf and Georges Bank, while the cold deeper waters of the Gulf range from 4°C to 9°C. Surface temperatures decrease easterly and northeasterly across the Gulf in summer, while deep water temperatures and salinities generally increase easterly and northeasterly at all seasons. Average salinities are 32 parts per thousand. The lower salinity values are close to shore, but salinities vary with depth depending upon the influence of slope water intrusion.

The Biotic Assemblage

Zoogeographically, the Gulf of Maine region is boreal, and the fauna is typically Acadian. South of Cape Cod to Cape Hatteras the region is warm temperate, and the fauna is Virginian. Although Cape Cod is the general dividing line, many species are found throughout the region from the Gulf of Maine to Cape Hatteras. Gulf of Maine fauna may include subtropical, tropical, temperate, and arctic immigrants at various times of the year.

The Plankton. The plankton are microscopic plants and animals that drift in the water column. The annual cycle of the plankton community is typical of the temperate zone. Nutrients are abundant in the winter but plankton abundance is low because productivity is suppressed by low levels of solar radiation and temperature. The level of solar radiation increases as spring approaches, and causes an intense phytoplankton bloom which is comprised primarily of diatoms. This level of productivity results in a decrease of inorganic nutrients, and as summer approaches, phytoplankton abundance begins declining.

Zooplankton feed predominantly on phytoplankton and fish larvae, but fish larvae commonly feed on copepods.

During summer, zooplankton reach maximum abundance, while the phytoplankton decline to near winter levels. Dinoflagellates and other forms, apparently more suited to warm, nutrient-poor waters, become abundant during summer. Bacteria in the sediment actively mineralize nutrients, but, because of vertical temperature and salinity gradients, nutrients may not be returned to the euphotic zone where they contribute to primary productivity. On Georges Bank and the eastern and northeastern edge of the Gulf of Maine, vertical mixing of the water column occurs during the summer, thereby recirculating nutrients and maintaining high plankton productivity. Water column stability may be affected by severe storms, and anomalies in temperature may disturb the timing between annual cycles of interacting species. In the autumn, decreasing water temperatures result in breaking down of the vertical temperature gradient, and nutrients are again circulated to the euphotic zone. Another phytoplankton bloom results, and lasts until low solar radiation levels inhibit photosyntheses. Phytoplankton and zooplankton levels then decline to the winter minimum, and nutrient levels increase to their winter maximum.

The Nekton. The nekton are animals that swim in the water column. They are predominantly fish, but also include other animals such as squid (a mollusc), and whales and porpoises (mammals). The ability to swim allows nektonic organisms to migrate between locations or to maintain a specific breeding location with some consistency year after year.

The feeding habits of nekton vary by species, by the size of the individual, and probably by season and food availability. Adults of many commercially important species of the region feed on either fish or invertebrates, but small fish, including the young of some large species, often feed on plankton. Adults of some large species, such as various whales, basking sharks, and ocean sunfish, are plankton-eaters throughout life.

The Benthos. The benthos are animals that live on or within the bottom substrate. They are predominantly invertebrates, although strongly bottom-oriented fishes are considered benthic. Benthic organisms are extremely diversified, and include species from several phyla. They can be classified by size (meiobenthos, macrobenthos), by their location in the substrate (epifauna, infauna), by the type of bottom in which they live (sand, mud, gravel, rock, etc.), by feeding type (deposit feeders, suspension feeders, herbivores, carnivores), and by the type of community with which they are associated

Habitats Of Concern

Groundfish are heavily dependent on the bottom for food and living space, and therefore the integrity of the benthic environment should be of prime concern in areas where there is a high density of groundfish. This is particularly true of haddock and yellowtail. Both species are fairly specific in their habitat requirements, yellowtail to particular bottom substrates and haddock to areas of high food concentration. Obviously the areas that have been previously described as harboring concentrations of groundfish should be considered prime habitats, and any alteration or contamination of these environments should be minimized. Likewise, spawning areas, particularly of cod and haddock, should be considered sensitive habitats during the time that the fish are concentrating on the spawning grounds and releasing their sex products into the water.

C. The Groundfish Industry

Recent Commercial Domestic Catch

The recent commercial catch of cod, haddock and yellowtail flounder are provided in Table IV.C.1. The 1979 through 1980 reported landings data are believed to underestimate actual commercial catch due to unreported catch and discards.

Recreational Fisheries

There is substantial recreational fishing for cod and haddock from Maine to New York principally from private boats, party and charter boats, and, to a lesser extent, by shore-based anglers. There is no significant recreational effort for yellowtail flounder though occasionally a few may be caught by anglers.

Table IV.C.1: Recent U.S. Commercial Catch (metric tons)

	Cod		Haddock		Yellowtail Flounder		
Year	Georges Bank	Gulf of Maine	Georges Bank	Gulf of Maine	Georges Bank	GOM & Cape Cod	So. New Eng. and Mid-Atl.
1976	14,906	10,172	2,904	1,865	12,100	4,000	2,100
1977	21,138	12,426	7,934	3,296	9,700	3,700	3,500
1978	26,579	12,426	12,160	4,538	5,000	4,400	3,000
1979	32,639	11,679	14,275	4,622	6,100	5,000	6,600
1980	39,045	11,997	17,448	7,270	7,100	6,200	7,000

Adapted From: NEFC Lab. Ref. Doc. #81-05, 81-06, and 81-10. Data qualifications are provided in these documents.

1/ ICNAF 5Z-SA6. 5NK (not known) reported landings have been assigned to Georges Bank.

2/ Gulf of Maine and Mid-Atlantic yellowtail flounder landings were less than 1,000 MT in each of the years reported in this table.

3/ Includes undertonnage vessels.

Table IV.C.2: Total Recreational Catch Estimates (metric tons)

Species	1960 1/	1965 1/	1970 1/	1974 2/	1979 3/
Cod	14,016	13,565	16,292	12,368	3,857
Haddock	767	9,702	1,147	NA	406 4/

1/ Salt Water Angling Surveys
2/ Northeastern Regional Survey of Recreational Fishing in Saltwater (1973-1974)
3/ 1979 Marine Recreational Fisnery Statistics Survey. Catch estimates based on pre-1979 surveys must be viewed with caution because of acknowledged problems with sample design and recall bias which were incorporated in the methodology. Although the 1979 National Survey avoided many of the previous survey methodology problems, subsequent survey data will be necessary to verify its reliability.
4/ Unpublished data from 1979 Survey found in NEFC Ref. Doc. 81-05

Data on the total recreational catch of cod and haddock in recent years are incomplete and not directly comparable due to varying estimation techniques. Available estimates are provided in Table IV.C.2.

About 507 commercial sportfishing vessels from Virginia to Maine were licensed to fish for cod and haddock in March of 1979. Ninety-two percent of these licensed vessels were located from New York to Maine. Commercial sportfishing vessels north and east of Montauk, New York, are likely to be dependent on cod and haddock during some portion or all of their operating season. The 1978 reported catch of licensed sportfishing boats was approximately 1101 metric tons of cod and 279 metric tons of haddock. The substantial decrease in the reported 1979 (cod 423 metric tons, haddock 61 metric tons) and 1980 (cod 669 metric tons, haddock 51 metric tons) catches by commercial sportfishing boats results, in part, from confusion about reporting requirements, which were changed in 1979.

Economic Characteristics

The Atlantic groundfish industry is comprised of fishermen, processors, wholesalers and retailers that harvest, process and distribute cod, haddock and yellowtail flounder as well as other groundfish species. This industry is diverse and complex with subsectors ranging from eastern Maine through the Mid-Atlantic states. New England is the center of the harvesting and processing sectors of the groundfish industry. The distribution of fresh fish is in New England and to a limited extent in nearby regions of the country, while frozen fish are distributed from New England to the entire United States. Domestic landings of cod, haddock and yellowtail flounder are largely distributed to the fresh fish markets and cannot entirely meet the needs of processors. Many New England and Mid-Atlantic processors (90 to 100) rely to some extent on imports of primarily fresh groundfish from Canada. Some large processing firms, with high capacity plants and national markets, rely on imported frozen blocks (primarily cod, pollock and haddock) from Canada and Europe.

Cod, haddock and yellowtail flounder are marketed as fresh fish, fillets and steaks (fresh and frozen), sticks and portions (breaded), and canned and cured products. The normal economic interactions of supply and demand are not easily defined in the groundfish industry largely due to uncertainty of supply and the "multi-output" nature of production. Complex economic interactions, such as substitutability of the various groundfish species, create rapidly changing groundfish industry conditions that are often unpredictable because they are not well understood.

Multi-Species Fishery

Cod, haddock and yellowtail flounder belong to a group of economicially interrelated species harvested by the New England mixed trawl fishery. The other most important species of this resource are: Pollock (*Pollachius virens*); Silver Hake (*Merluccius bilinearis*); True Hakes [principally (*Urophycis chuss*) and (*U. tenuis*)]; Redfish (*Sebastes marinus*); Summer Flounder or Fluke (*Paralichthys dentatus*); Winter Flounder (*Pseudopleuronectes americanus*); American Plaice (*Hippoglossoides platessoides*); and Witch Flounder (*Glyptocephalus cynoglossus*).

A joint harvesting relationship exists because demersal finfish gear does not selectively harvest individual species. The extent of these relationships becomes clear with examination of the distribution of species in the demersal finfish catch. In many cases, a large proportion of the total catch of a given demersal finfish species is derived from very small landings on numerous individual trips, i.e. derived from the bycatch (see Figure IV.C.1.) Further, the mix of these species on any given trip depends on the unpredictable, relative abundance of individual species.

Substitution of species by fishermen occurs when a fisherman expects net revenues from one species to increase relative to those of another. He will then shift his fishing effort, partially or entirely, to the more desirable species. A major reason behind such changes is the seasonal availability and abundance of individual species, which affects greatly the cost of catching that species, as well as its price. Seasonal switching of effort between species as a means of improving the economic returns is the rule rather than the exception for otter trawlers and fixed gear fishermen.

Substitution of species in the marketplace occurs as a result of price differences between groundfish species. Economic demand studies have shown that the price of cod is partially dependent on the price or landings of haddock.

Harvesting Vessels and Gear

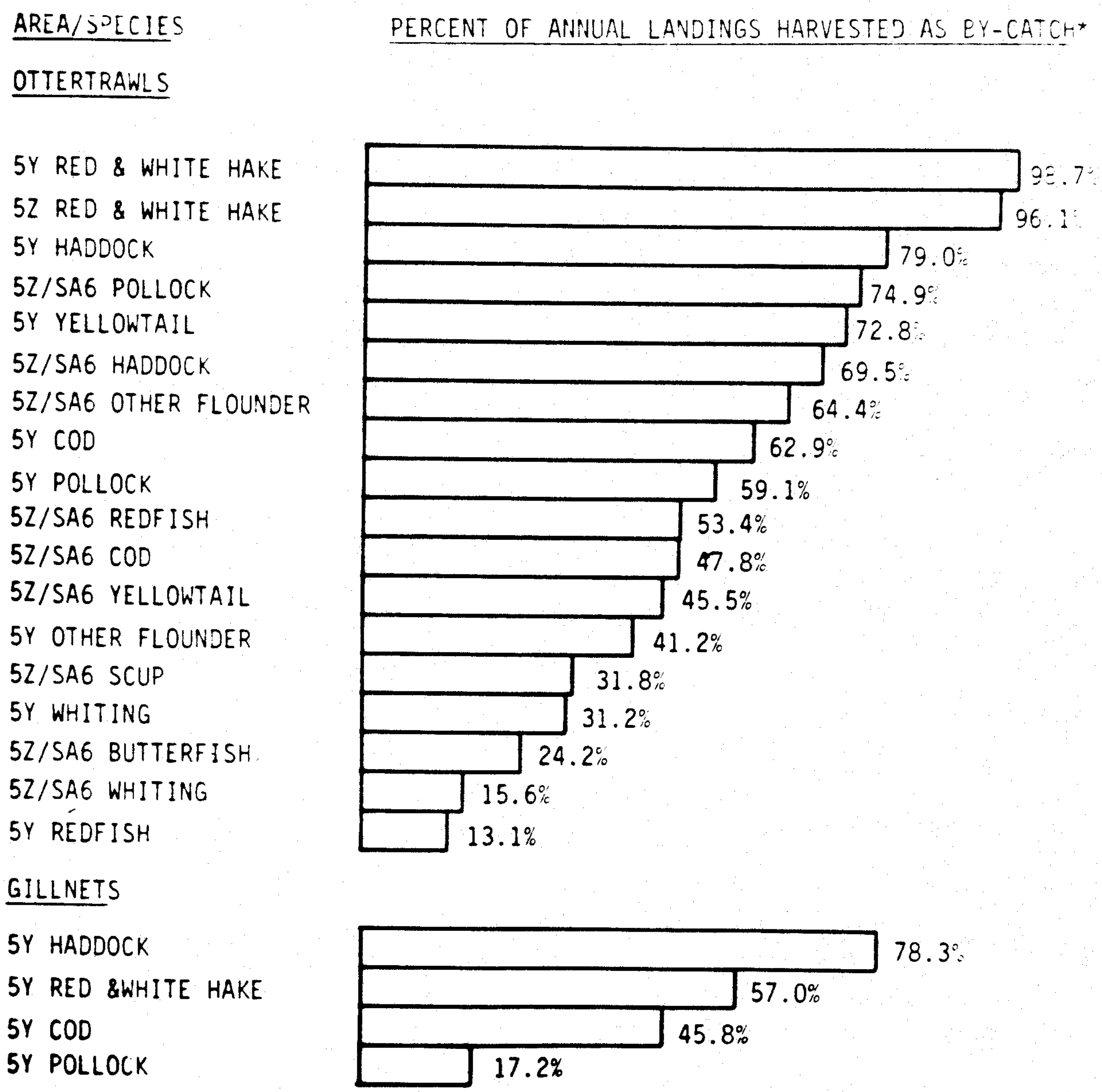
The number of vessels participating in the New England fishery for cod, haddock and yellowtail has increased substantially since 1976 (Table IV.C.3).

Table IV.C.3: Number of New England Vessels Landing Cod, Haddock and Yellowtail by GRT (1976-80)

Year	5-60 GRT	61-125 GRT	125+ GRT	Total
1976	385	175	81	641
1977	395	190	99	684
1978	459	200	114	772
1979	566	232	198	996
1980	N.A.	N.A.	N.A.	N.A.
Percent Increase	47%	75%	144%	55%

From 1976 to 1979 the total number of vessels landing cod, haddock or yellowtail flounder increased by 55%. As indicated by Table IV.C.3, the greatest relative increase within the individual vessel classes has occurred in the 125+ GRT vessel class, which has more than doubled since 1976. From

Figure IV.C.1. Proportion of Total Landings of Individual Groundfish Species Harvested as By-catch during 1978.



*Traditionally the term "by-catch" has applied to the harvesting of a species when the species accounts for 50 percent or less of an individual trip's catch. Using this criterion, for example, 69.5% of the total haddock catch from the Georges Bank area is caught as by-catch.

1970 (569 vessels) to 1975 (606 vessels), a comparable 5-year period, the total number of vessels landing the regulated species increased by only 6%.

The primary gear used to harvest the regulated species is mobile net gear (Table IV.C.4). Mobile gear, principally the otter trawl, accounted for approximately 80.0% of the catch of cod; 92.7% of the catch of haddock; and 98.4% of yellowtail in 1980 (Table IV.C.5).

Table IV.C.4: Number[1/] of New England Vessels by Size and Gear Type Landing Cod, Haddock or Yellowtail Flounder During 1980.

GRT	5Y Mobile Gear	5Y Fixed Gear	5Z-SA6 Mobile Gear	5Z-SA6 Fixed Gear
5-60	312	96	116	18
61-125	75	*	186	*
125+	52	*	232	*

1/ Number of vessels represents highest number of vessels landings in any quarter of 1980. The total number of individual vessels fishing during the year is probably greater since all vessels are not likely to participate during all four quarters.

* During the years 1970 through 1979 no more than 4 vessels greater than 60 GRT reported landings of groundfish using fixed gear. 1980 data on fixed gear vessels 61 GRT or larger is not available.

Other types of mobile gear include mid-water trawls and Scottish seining, the latter only recently introduced into New England groundfish fisheries.

The primary fixed gear currently used to harvest the regulated species is the sink gillnet. In 1978 there were approximately 66 fixed gear vessels (mostly gillnets) landing groundfish from 5Y and this number increased dramatically to 108 in 1979. During the second quarter of 1980, 96 registered fixed gear vessels landed groundfish from 5Y. Fixed gear in 1980 accounted for 5.2% of the haddock landings. Other fixed gear methods include longline (tub or automated) and the use of jigs.

In general, vessel operating and fixed costs increase along with the size of the vessel. Consequently, fixed gear vessels, most of which are less than 60 GRT, provide a less expensive means of entering a fishery in addition to the advantage of less sea time since the gear need not be attended.

Landings

Landings of cod, haddock and yellowtail flounder have generally increased since 1976. Table IV.C.6 gives the New England landings of the three species

Table IV.C.5: Percent of 1980 Total New England Landings* of Groundfish by Major Gear Types and Vessel Class (Tonnage Vessels)

	MOBILE GEAR		FIXED GEAR	
	Total Landings by Gear/GRT	Percent of Grand Total	Total Landings by Gear/GRT	Percent of Grand Total
Cod:				
5-60	7155.9	13.9	2848.1	5.6
60-125	11729.5	22.8		
125+	22324.2	43.3		
TOTAL		80.0		
Haddock:				
5-60	1803.4	7.6	1237.9	5.2
60-125	6198.5	26.1		
125+	13977.5	59.0		
TOTAL		92.7		
Yellowtail:				
5-60	5486.9	29.1	15.3	0.1
61-125	6568.5	34.8		
125+	6496.1	34.5		
TOTAL		98.4		

*For cod, undertonnage vessels landed 14.5% of the grand total; haddock, 2.1%; and yellowtail flounder, 1.5%. Of the 14.5% cod landings by undertonnage vessels 70.5% were landings by fixed gear vessels from 5Z-SA6.

by area and vessel class for 1976 to 1980. Undertonnage vessel landings (under 5 tons) are excluded. The landings of all three species were highest in 1980. Landings of haddock from 5Y (Gulf of Maine) and 5Z/SA6 (Georges Bank and South) and of cod from 5Z/SA6 increased substantially (247%, 508%, and 166% respectively) in 1980 compared to 1976. With the exception of yellowtail from 5Z/SA6, the landings showed a fairly consistent increase each year. Yellowtail landings in 5Z/SA6 decreased to a low point in 1978 and returned to close to the 1976 level in 1980.

Landings of cod, haddock and yellowtail flounder in the Mid-Atlantic have been considerably smaller than those in New England (Table IV.B.7). Most of the landings are made in New York and New Jersey ports. Cod and haddock historically have not been landed in great quantities in the Mid-Atlantic because the principal stock distribution of the species is to the north and

Table IV.C.6: New England Landings from the Gulf of Maine and Georges Bank & South (metric tons)1/

	1976	1977	1978	1979	1980
Area 5Y:					
Cod:					
5-60	3776.8	4650.0	4634.5	4433.4	4749.0
61-125	2505.8	3033.4	2321.0	2211.6	2307.3
125+	304.9	504.4	802.2	811.4	1044.2
Fixed Gear	1532.0	2033.0	2473.2	2225.1	2367.9
TOTAL	8119.5	10220.8	10230.9	9681.5	10488.4
Haddock:					
5-60	646.9	1136.6	1101.4	1012.4	1324.6
61-125	705.6	1096.4	1477.8	1379.0	1715.8
125+	169.2	277.0	934.2	950.2	1737.1
Fixed Gear	174.8	491.9	630.1	630.6	1114.7
TOTAL	1696.5	3000.9	4143.5	3972.2	5892.2
Yellowtail:					
5-60	1903.2	1886.7	1792.9	2295.4	2466.2
61-125	286.9	419.3	281.8	140.1	234.6
125+	1.5	24.2	51.6	15.9	61.5
Fixed Gear	7.2	3.1	8.7	4.0	14.9
TOTAL	2198.8	2333.3	2135.0	2455.4	2777.2
Area 5Z & SA6					
Cod:					
5-60	880.9	1904.1	2420.7	1991.6	2406.9
61-125	6132.2	9425.9	9138.9	9759.3	9422.3
125+	5502.3	7954.6	10851.2	15420.1	21280.0
Fixed Gear	104.9	41.9	98.6	184.6	460.1
TOTAL	12620.3	19326.5	22509.4	27355.6	33569.3
Haddock:					
5-60	114.6	463.4	378.5	315.7	478.8
61-125	1411.5	3903.1	4923.1	5175.1	4482.7
125+	1319.2	3476.2	6670.6	8648.9	12240.4
Fixed Gear	2.3	5.9	19.8	18.1	123.2
TOTAL	2847.6	7848.6	11992.0	14157.8	17325.1
Yellowtail:					
5-60	1478.8	1648.3	1151.1	1669.6	3020.7
61-125	9157.4	7300.7	3838.5	5707.7	6333.9
125+	3937.3	4691.6	3701.2	5269.3	6434.6
Fixed Gear	*	*	2.0	0.1	0.4
TOTAL	14573.5	13640.6	8692.8	12646.7	15789.6

1/ Tonnage vessel landings only.
*Less than .05 metric tons.

requires extended trips from Mid-Atlantic ports. Yellowtail flounder, however, have been landed in Mid-Atlantic ports in the past in substantial quantities. Landings in the early 1970's reached 14% of the total (approximately 4,000 MT tons) and resulted from abundant supplies of yellowtail in southern New England and Mid-Atlantic fishing grounds. Subsequent declines in the yellowtail stock reduced Mid-Atlantic landings by 1976 to relatively low levels (approximately 250 MT).

A detailed discussion of groundfish prices, gross revenues, processing, marketing and the role of imports within the groundfish industry is found in Section 3 of the FMP.

Table VI.C.7: Mid-Atlantic Landings1/ of Cod and Haddock and Yellowtail Flounder

	1976	1977	1978	1979	1980
Cod	412	285	231	257	233
Haddock	4	3	02/	34	64
Yellowtail Flounder	271	242	248	454	906

1/ Northeast Fishery Center (Personal Communication). Landings include New York and South.

2/ No recorded landings in 1978.

D. Other Management Institutions

Relationship to State Fisheries Programs

Cod, haddock and yellowtail flounder are distributed within most of the New England and Mid-Atlantic States' territorial waters as well as within the FCZ. The management unit is considered to include the regulated species when they occur within the States' waters as well; and the management policies, measures and recommendations contained in the Plan are appropriate for application in State waters. Therefore, the coordination of the States policies towards cod, haddock and yellowtail with this Plan is important to the implementation of an effective and sound regional groundfish management policy.

Maine

The State of Maine at present has no specific management program for cod, haddock or yellowtail flounder that is stated in a state fishery management plan. Some general fisheries laws and regulations effect the groundfish fishery within Maine's waters. Non-resident commercial fishermen are required to report to the Department of Marine Resources, upon entering into and exiting from the State's territorial waters; and when leaving to report information concerning the areas where they have fished, the type of gear used and the amount of fish, by species, taken. Resident commercial fishermen are required to be licensed with the Department of Marine Resources. Several areas of Maine's inshore waters have restrictions on otter trawling. Trawling for lobster is prohibited.

New Hampshire

Landing and possession restrictions are in effect for groundfish caught in New Hampshire territorial waters. Fishing vessels are limited to 2,500 pounds of cod, 1,500 pounds of haddock and 2,500 pounds of yellowtail flounder per vessel per day. Gear restrictions include a minimum mesh size of 5-1/2 inches for gillnets and 5-1/8 inches for otter trawls when taking or possessing cod, haddock or yellowtail. New Hampshire law also prohibits the use of a purse seine, beam trawl or otter trawl towed from the side or stern of any vessel for the taking of cod, haddock, pollock, hake, flounders, striped bass, coho salmon or crustaceans from the State's marine waters within two miles of the shore.

Massachusetts

Under Massachusetts regulations it is unlawful to possess or land more than 2,500 pounds of cod, 1,500 pounds of haddock or 2,500 pounds of yellowtail flounder taken from Massachusetts waters per vessel fishing trip. It is, however, lawful to possess or land cod, haddock or yellowtail in excess of that amount if the excess has been lawfully taken in the FCZ. State waters may be closed to the possession of cod, haddock or yellowtail in the event that there is a closure in the FCZ. The State's closure is not automatic, however, and will depend on a review of the FCZ closure, including public hearings. A permit issued by the Division of Marine Fisheries is required to fish for or possess cod, haddock or yellowtail for commercial purposes.

Rhode Island

The fisheries for cod and haddock in Rhode Island waters remain open and unlimited until area/period quotas in the FCZ have been reached. In the event of an FCZ closure, the Rhode Island Marine Fisheries Council, after emergency public meetings, selects from two options: (1) the fishery may remain open and unlimited in Rhode island waters; (2) the fishery in State waters may be limited to bycatch provisions in the categories of mobile gear fishery, fixed gear fishery, and rod and reel fishery. Other provisions provide for licening of out-of-state vessels and multiple gear harvesting.

The fishery for yellowtail flounder is under a landing or possession limit of 3,000 lbs. or the combined total of the legal limit from Massachusetts waters, plus one legal limit from one zone of the FCZ (east or west of 69° longitude, whichever is greater).

Connecticut

There are no statutes in effect which impose quota restrictions on groundfish caught within Connecticut territorial waters. The landings of groundfish from Connecticut waters, however, are historically very low. Reporting requirements are in effect for Connecticut finfish trawlers, as with a minimum size limit of 10 inches for commercially caught cod.

Mid-Atlantic States

All of the Mid-Atlantic States require a permit or license for the commercial harvest and sale of finfish. The criteria for defining "commercial" harvest and sale, however, vary among the States. It is impossible to gauge the degree to which such requirement may affect domestic harvests, since fees for such permits and the enforcement of the applicable regulations also vary among the States.

All of the States have various regulations which prohibit or restrict the use of various kinds of commercial (and sometimes recreational) fishing gear within certain portions of State waters during all or parts of the year. For example, New Jersey prohibits all trawling within two miles of shore. Maryland prohibits the use of otter and beam trawls within one mile of shore. Delaware prohibits fishing with trawls, dragnets, and dredges operated by any power vessel within three miles of shore. Virginia prohibits fishing with trawl nets or "similar devices" within the three mile limit of the Virginia Atlantic shoreline (with limited exceptions).

In addition, several States restrict and/or regulate commercial harvesting within their jurisdictions by non-residents. Such regulations may or may not inhibit the magnitude of the commercial and recreational harvests of these species. It is probable, however, that these kinds of restrictions, particularly on trawling, serve to maintain or increase the proportion of the commercial catch which is harvested from the FCZ. This should support the effectiveness of the management measures in this Plan, since it would be difficult in many States for individuals to circumvent the regulations accompanying the Plan by falsely reporting their harvests of these species as having been caught in the territorial sea. Several States also have mesh size specifications which may affect the magnitude of and/or the size of the fish in the catch.

Relationship to International Fisheries Programs

Prior to the initial enactment of the Magnuson Act, fisheries for cod, haddock and yellowtail flounder were managed, along with other fisheries, under the auspices of the International Commission for the Northwest Atlantic Fisheries (ICNAF). That organization established management policies and allocated allowable harvests among member nations, but implementation and enforcement was left to the individual member nations. The United States withdrew from ICNAF on December 31, 1976. There is no current international management program applicable to these fisheries.

Significant fisheries for cod and haddock are pursued by Canadian fishermen under regulation by that country. Much of this fishery is conducted on the same stocks being fished by United States fishermen. There is currently no bilateral fisheries agreement between the United States and Canada. In recent years Canada has established quotas for its fisheries in area 5Ze keyec to calculations made by the United States for its fisheries. During the past few years, fishery management decisions have been made by the Canadian government in response to changes in the management program in the United States. It is not known how the Canadian government will react to the management program contained in this Interim Plan.

Other Special Management Programs

OCS Leasing

During the summer of 1981 exploratory drilling for oil and gas began on Georges Bank. Other sections of Georges Bank are currently proposed to be leased under the Outer Continental Shelf Act. Oil and toxic discharges from drilling rigs could, in certain seasons, cause significant mortality of cod and haddock larvae from the Georges Bank spawning stocks. The Council is represented on the Biological Task Force established by the Department of Commerce and Interior and the Environmental Protection Agency. The Council is also represented on the Bureau of Land Management's North Atlantic Regional Technical Working Group Advisory Committee. Through participation in these groups, the Council monitors OCS activities and advises concerning ways of minimizing impacts on fishery resources.

Marine Mammals and Endangered Species Acts

Numerous species of marine mammals occur in the Northwest Atlantic, although the definitive species composition is unknown. The most numerous species in the area are the common (saddleback) dolphin (Delphinus delphis), harbor porpoise (Phocoena phocoena), and harbor seal (Phoca vitulina). Data on population abundance for various species are sketchy at best, and non-existent for some species, although current studies are gradually improving the information base. Marine mammal feeding behavior and food preferences are not well understood. These factors make it extremely difficult to assess, even qualitatively, the potential impact of any Atlantic groundfish management program on marine mammal populations.

Whenever fishing and marine mammals occur in the same area, there exists a potential for an incidental take of marine mammals. However, the number of animals killed is relatively small in comparison to the total population size. Incidental mortalities of harbor seals and harbor porpoises are known to take place in the Gulf of Maine fixed gear fisheries; preliminary estimates place this mortality at about 100 animals per year.

Of the numerous marine mammal species which frequent the Gulf of Maine, Georges Bank and southern New England waters, six have been classified as endangered. These are the finback whale (Balaenoptera physalus), the humpback whale (Megaptera novaeangliae), the right whale (Eubalaena glacialis), the blue whale (Balaenoptera musculus), the sei whale (Balaenoptera borealis), and the sperm whale (Physeter catodon). The finback, humpback and right whales sometimes frequent nearshore waters. All whales inhabit the area only on a seasonal basis and "critical habitats" have not been designated in the Northwest Atlantic. Data on population abundance and occurrence is sparse, typically gathered through "sightings."

In addition to certain marine mammals, the only other threatened or endangered species occurring in the Northwest Atlantic are shortnosed sturgeon (Acipenser brevirostrum) and several species of sea turtles. There has been no documented mortality of shortnosed sturgeon as a result of fishing operations for groundfish. Because data on occurrences of shortnose sturgeon are vital to understanding its current status, the Council urges fishermen to report any incidental catch of this species to the Sturgeon Recovery Project of the National Marine Fisheries Service.

Available data appear to indicate that several species of sea turtles are regularly found in New England waters. These turtles are the Kemp's Ridley, (Lepidochelys kempi), the leather back (Dermochelys coriacea), and the loggerhead (Caretta mydas). In addition, hawksbill turtles (Eretmochelys imbricata) occasionally stray into the area. The Kemp's Ridley turtle, while probably the most endangered reptile on earth (total population estimated at several thousand adults), is also the most frequently observed sea turtle in New England waters, especially in Cape Cod Bay.

Although Kemp's Ridley turtles have in past years been found stranded or dead along the beaches of Cape Cod Bay, there is no solid evidence to indicate that fishing operations were responsible. Based on inquiries to fishermen conducted by the National Marine Fisheries Service and the Massachusetts Division of Marine Fisheries, the general conclusion can be drawn that the occasionally numerous deaths of Kemp's Ridley turtles in Cape Cod Bay do not occur as a result of normal commercial fishing operations. Yet, because of the extremely tenuous status of the population of the Kemp's Ridley turtle, NOAA and the New England Fishery Management Council remain concerned about the mortalities in Cape Cod Bay. The Council and NMFS believe that monitoring of turtles in New England is necessary.

No habitat areas where fishing for groundfish is conducted have been identified as critical areas for any endangered species.

Implementation of this plan will have no effect upon populations of marine mammals and endangered species in the area. As additional understanding of the status and dynamics of marine mammals and sea turtle populations become available, the Council will integrate this information into its examination of potential impacts upon the environment as a result of fishery management programs.

Coastal Zone Management

Most of the States in the areas affected by this Plan have approved Coastal Zone Management programs. Since this fishery management plan does not specifically authorize any physical change in the coastal zone, it will not have any direct impacts to measure against standards set in the various State programs. Nonetheless, these programs have been reviewed, and no inconsistencies between them and the measures, policies and provisions of this Plan have been found.

V. ENVIRONMENTAL CONSEQUENCES

A. Impact of Withdrawal of Quota Constraints

Expected Catch

The analysis of the expected catch of the regulated species as a consequence of removing quota constraints on the fishery was approached in three steps. First, the expected catches of cod, haddock, and yellowtail in the absense of quotas were estimated looking at trends in catch, abundance and effort. Second, these estimates were compared with 1) the catch levels that would have been recommended under some modification of the existing quota system, and 2) a catch estimate which looks only at recent levels of fishing mortality and current prospects for recruitment. Finally, the economic impacts of elimination of the seasonal quotas/vessel class allocations are discussed in relation to the expected change in catch.

The catches of cod, haddock and yellowtail flounder in the Gulf of Maine and Georges Bank and Southern New England were projected for calendar years 1982 and 1983. The methodology for this analysis is described in NEFMC Res. Doc. 81 GF 1.1, revised. The projections are based in general upon an analysis of the relationship between seasonal landings from the two resource areas over the period 1970-1979, and trends in vessel effort and relative species abundance over the same period. "Effort" includes information on days fished by vessels in various tonnage classes and seasonal periods, taking into consideration the vessel's input costs at that time. "Species abundance" is a relative index based upon catch per tow information from the NMFS autumn bottom trawl surveys. Using this model, projected 1980 aggregate catches of cod, haddock and yellowtail flounder were 85,500 MT. This value compares favorably with the actual reported aggregate catch for 1980 of 85,800, although the annual catch of individual species varied by as much as 5,000 MT. In projecting 1982 and 1983 catch by species and resource area, the analysis uses species abundance information (catch per tow data) from the 1980 autumn bottom trawl survey.

Aggregate cod, haddock and yellowtail flounder landings of 109,700 MT are projected for 1982, and 115,600 MT for 1983. (See Table V.A.1.) Because of the difficulty in partitioning fleet effort among species, these projections should only be made in the aggregate. The catch projection for 1982 (A) is compared with the total expected catch (B) that might be considered reasonable in 1982, considering recent levels of fishing mortality and current recruitment prospects, and the level (C) that would likely have been recommended under some continuation of the existing groundfish management program.

Projected catch for 1982 is within a range of catch values that might be expected considering the current status of the resource, prevailing fishing mortality rates, and recruitment prospects. Further, the 1982 projection exceeds by only 15% the total catch quota that might have been recommended for 1982 using the more conservative fishing mortality policies in the existing FMP. (The catch projection for 1983 is based on that for 1982, and is used in the economic evaluation of alternative management measures.)

Table V.A.1: Projected Total Catch of Regulated Species Following Quota Withdrawal

A.	1982 Projected catch [1] based on trends in catch, abundance and effort.	109,700 MT
B.	1982 Expected catch [2] based on recruitment prospects and recent levels of fishing mortality	101,000 MT - 108,000 MT
	and a 20% increase in fishing mortality.	119,000 MT - 126,000 MT
C.	1982 Catch [3] based on current quota management policies (Fo.1, F_{max}) and recruitment prospects.	95,000 MT
D.	1983 Projected catch [1] based on trends in catch, abundance and effort.	115,600 MT

1/ Projection based upon catch analysis detailed in NEFMC Resource Document 81 GF 1.1 (revised).

2/ Expected catch based upon personal communication with NMFS/NEFC assessment personnel.

3/ Quota which would likely be recommended for 1982 under some modification of the current quota management program.

Impacts of Expected Catch on the Resource

Georges Bank Cod and Haddock. Considering the apparent decline in the abundance of Georges Bank cod in relation to the expected increase in the abundance of haddock from the same resource area, and in view of the joint harvesting relationship for these two species, the projected aggregate catch level carries the potential for resource exploitation in excess of F_{max} for cod and $F_{0.1}$ for haddock. (These fishing mortality indices were used as target values in setting quotas under the existing FMP). For Georges Bank cod, exploitation in excess of F_{max} may imply further stock reduction, depending on the strength of the recruiting 1979 and 1980 year classes, which currently appear poor and average, respectively, in the 1981 Georges Bank cod assessment. For Georges Bank haddock, exploitation in excess of $F_{0.1}$ will moderate any expected increase in stock abundance from growth of recent recruiting year classes.

The residual biomass of both Georges Bank stocks will be comprised of only one or two principal year classes in 1982. As noted in NMFS/NEFC Resource Document 81-09, the spawning potential of these stocks will be dependent on only a few cohorts, rather than a heterogneous mix of age groups.

Gulf of Maine Cod and Haddock. The 1981 assessment for the Gulf of Maine stocks of cod and haddock indicate that 1) recent recruiting year classes have maintained cod abundance at among the highest levels observed over the past decade in spite of heavy fishing pressure, and 2) recent, relatively weak, recruiting year classes of haddock have contributed to a decline in abundance from previous, relatively high levels. Catches of cod and haddock at the level projected for 1982 can be expected to result in maintenance of cod abundance and further reduction in haddock abundance. The absolute abundance of the Gulf of Maine haddock resource entering 1983 will depend significantly upon the strength of the recruiting 1980 year class, which currently appears to be average in strength. At current and projected 1982 levels of catch, the Gulf of Maine cod abundance is expected to remain stable going into 1983.

Yellowtail Flounder: Recent reported yellowtail flounder catch levels (approximately 20,000 MT in 1980) have generated fishing mortality levels significantly in excess of F_{max} in the major resource areas. Such levels of fishing mortality result in year classes being harvested rapidly as they enter the yellowtail fishery, and as a consequence, the fishery becomes increasingly dependent on annual recruitment, and thus subject to variability inherent in annual recruitment. Catches at the levels projected for 1982 and 1983 in the absence of quotas will likely maintain this trend in the fishery for the forseeable future.

Impacts of Expected Catch on the Industry

The 1982 and 1983 levels of projected catch exceed reported 1980 landings of the three regulated species (about 85,800 MT). The projected increase in landings in 1982 and 1983 is expected to result in increased gross benefits to the industry, (increasing revenues, decreasing prices), due to the high elasticity of ex-vessel demand for cod, haddock and yellowtail (NEFMC Res. Doc. 81 GF 1.1, revised). An analysis projecting present value of gross revenues associated with various changes in mesh and selected large mesh area options, such as is embodied in the preferred alternative, is presented in Section C of this Statement.

B. Analysis of Minimum Fish Size and Mesh Size

Resource Considerations and Relationship of Fish Size and Mesh Size

Given the knowledge sufficient to describe the relationship between the size of the mesh openings and the size of fish which such gear will capture, known as fish selection curves, an appropriate mesh size may be chosen such that the majority of fish of a given species in the catch will be larger than a specified size. The biological basis for establishing minimum fish sizes to meet the objectives of the Interim Plan is principally related to the size at sexual maturity. To the extent that only fish larger than those at sexual maturity to be caught, the spawning potential of the stock will be enhanced and the likelihood of recruitment overfishing reduced.

Reducing the risk of recruitment overfishing implies that adequate spawning stocks should be maintained, sufficient to enhance the likelihood of successful spawning activity and continued recruitment to the fishery. The available mechanisms for achieving such goals fall into two broad categories, controls on total removals and controls on fishing practices. Having selected the latter as the management strategy for this Plan, the biological basis for management is related to the size at which sexual maturity is attained. A target minimum fish size may be attained in fishing operations by choosing a corresponding mesh size on the basis of selection curves. A selection curve for a particular species of fish caught by a mobile trawl net is typically in an S-shaped form which expresses the cumulative percent of fish over a range of lengths which are retained in the net.

Although there is no well-defined stock-recruitment relationship for most species of groundfish, the evidence from the world's cod and haddock fisheries suggests that strong spawning stocks enhance the likelihood of continued, stable, strong recruitment, whereas more depleted spawning stocks exhibit much more erratic recruitment. Therefore, since an adequate spawning stock must be maintained, the choice of minimum fish and mesh sizes should at a minimum ensure that a sufficient number of juvenile fish survive to contribute to the spawning potential of the stock. This determination must be made in consideration of the level of effort in the fishery.

The majority of the groundfish landings are taken with mobile trawl gear. However, a significant catch is made with fixed gear such as longlines and gill nets. On the basis of available information from the New England groundfish fishery (Clark, 1978), it appears that gill nets select for groundfish at least as large as those retained in mobile trawls with the same sized meshes in the codend. Hence, until more information becomes available it may be appropriate to treat the two types of gear in a substantially similar manner. Very little information is available from the New England groundfish fishery relative to the selection of fish by hooks (longlines); thus, analysis of this gear type should await accumulation of sufficient data.

A criterion which may be useful as a benchmark for an effective minimum size in groundfish management is the size at 50% maturity. That is, the size at which 50% of all similarly sized fish of a given species may be expected to be sexually mature and capable of spawning. Table V.B.1 provides available data regarding the size and age at which six groundfish species become sexually mature.

Mobile trawl net selectivities are often expressed in terms of the 50% retention length, i.e., at least 50%, by number, of a given species of fish which enter the net and are that length or larger are retained in the cod-end. Table V.B.2 gives the estimated 50% retention lengths (and corresponding ages) of six groundfish species, by four alternative mesh sizes, calculated on the basis of information obtained in mesh trials conducted by NMFS (Smolowitz, 1978) using synthetic mesh cod ends.

Table V.B.1: Comparative Age (Size) at Maturity Data For Six Groundfish Species

Species	Age at First Maturity (Years)	Age at 50% Maturity (Years)	Size at 50% Maturity (Inches)
Cod	3	3-6	Male: 21.1 Female: 19.5
Haddock	2	3	Male: 16.3 Female: 16.9
Yellowtail Flounder	2	3	Male: 9.6 Female: 10.8
Pollock	*	5-6	Male: 19.7-25.6 Female: 21.7-27.6
Winter Flounder	2-3	*	*
Dabs	2	2-3	Undifferentiated: Less than 11"

*Not Known Source

Information from the two tables suggest that the size at 50% maturity for cod most closely corresponds to the 50% retention length of a 6-inch mesh, while that for both haddock and yellowtail flounder appears to fall near the 50% retention length of 5 1/8 inch mesh. Pollock and winter flounder, by the 50% maturity criteria, would be harvested with a 6-inch mesh, whereas dabs (mature by their third year) could be taken with a 4 3/4 inch mesh. Thus, the choice of a single mesh size for the mixed trawl groundfish fishery must involve a number of compromises. Noting these facts, and in recognition of established small mesh fisheries within the overall groundfish complex (such as silver hake and redfish), it seems necessary to examine mechanisms whereby small mesh fisheries may be accommodated within the overall management scheme for New England groundfish.

Resource Considerations for Minimum Fish Sizes

The preceding discussion (particularly that in relation to Table V.B.1) indicates that the size at 50% maturity for haddock and yellowtail flounder is probably about 17 inches and 11 inches, respectively. (See Table V.B.1.) These sizes also correspond to the 50% retention length for 5 1/8 inch mesh.

Table V̄.B.2: Estimated 50% retention length (inches) for six species of groundfish at four levels of cod-end mesh size. Numbers in brackets indicate approximate age in years.

Species	4 3/4	5 1/8	5 1/2	6
Cod	16.1	17.3	18.6	20.3
(Gulf of Maine)	(3.1)	(3.4)	(3.6)	(4.0)
(Georges Bank)	(2.1)	(2.3)	(2.6)	(3.0)
Haddock	15.3	16.6	17.8	19.4
	(2.0)	(2.4)	(2.7)	(3.2)
Yellowtail Flounder	10.4	11.2	12.0	13.1
(Georges Bank)	(2.0)	(2.3)	(2.5)	(3.0)
Pollock	15.7	16.9	18.2	19.8
	(2.8)	(3.1)	(3.4)	(3.8)
Winter Flounder	9.9	10.7	11.5	12.5
	(1.9)	(2.1)	(2.3)	(2.5)
Dabs	11.1	12.0	12.9	14.0
	(3.0)	(4.3)	(4.7)	(5.2)

(See Table V̄.B.2.) Although 17 inches corresponds to the 50% retention length for cod using a 5 1/8 inch mesh, the size at 50% maturity for cod is about 20-21 inches. A mesh size which would select for cod at the 50% maturity level (6 inches) would correspond to the 50% retention level for haddock at 19 inches and for yellowtail at 13 inches. Thus, if the size at 50% maturity is to be used as a criterion for minimum fish size, certain tradeoffs will be required. Because joint-harvesting relationships make a single mesh size the only practical option, it must be decided whether the relative protection to be afforded should favor cod on the one hand, or haddock and yellowtail on the other.

From a biological perspective and in consideration of the current status of the resource, a 17-inch minimum size for cod may be adequate as a measure to reduce mortality on juvenile fish. In the current overall resource context it may not be biologically justifiable to require the larger size limit for haddock and yellowtail flounder (i.e., 19 inches and 13 inches, respectively) if the intent of management is to allow a majority of (but not necessarily all) juveniles to survive and recruit to the spawning stock.

Minimum fish size relates to mesh size in two ways. First, the combination of minimum sizes should be selected for the three regulated species keeping in mind that they are all going to be caught with a single mesh size. Second, to be an effective measure in addressing the management objectives, the chosen mesh size must exhibit a retention curve such that the majority of fish retained in the net will on average be larger than the chosen minimum fish sizes. Since the minimum fish sizes are largely determined by criteria relating to size at maturity, any possible future increases in mesh size do not require simultaneous adjustments in the minimum fish sizes.

In order to achieve a minimum fish size consistent with the 50% sexual maturity size, some mesh size between 5 1/8 inches and 6 inches appears appropriate. However, for purposes of the analysis contained in this Part, 4 3/4 inches is included to demonstrate the relative impacts of a smaller mesh size.

Resource Impacts of Mesh Sizes

The Beverton-Holt yield per recruit analysis was used for assessing the relative expected biological impacts upon the cod, haddock, and yellowtail flounder fisheries. It is assumed in the analysis that for the first year following implementation of the Interim Groundfish FMP (1982) mesh size will be continued at 5 1/8 inches. Further, mesh size would be subject to change one year after implementation (1983).

The mesh size impact analysis has both short-term and long-term components. These components are distinguished primarily by assumptions regarding the strength of recruiting year classes. The short-term analysis makes use of currently available information regarding the expected strength of year classes that will compose the fishable stock in 1982. Table V.B.3 provides information on the relative strengths of recent year classes of cod and haddock.

The long term analysis projects impacts of various mesh sizes based upon the assumptions of 1) constant average recruitment and 2) constant fishing mortality. (See Table V.B.4.) These assumptions are used only for convenience and simplicity and are valid for the purposes of the analysis. The relative ordering of impacts is assumed to be independent of the actual levels of annual recruitment and fishing mortality over time. If stock recruitment relationships exist for the three regulated species, then increased mesh may actually enhance recruitment; and the relative yield benefit may increase. If, conversely, effort increases above the assumed level, relative long-term yield benefits may decrease. However, under all but the extreme case of stock collapse the relative ordering of mesh sizes vis-a-vis yield benefits should not change.

The results of the analysis appear in Table V.B.5. The values are expressed in terms of the expected percentage change in total catch resulting from implementation of various codend mesh sizes relative to a 5-1/8" mesh size, assuming that the entire catch would be affected by changes in the mesh size.

It is clear that reduction of the cod end mesh size from 5-1/8 inches to 4-3/4 inches would provide short-term increases in total catch but would also lead to long-term catch reductions and increase the potential for recruitment

Table V.B.3: Relative Strengths of Recruiting Year Classes of Cod and Haddock

Year Class	Cod	Haddock
Gulf of Maine		
1975	strong	strong
1976	poor	above average
1977	average	poor
1978	above average	poor
1979	above average	poor
1980	average	average
Georges Bank		
1975	strong	strong
1976	poor	poor
1977	average	poor
1978	above average	strong
1979	poor	poor
1980	average	average

Table V.B.4: Projected Fishing Mortality Rates, 1983 1/

	F
Cod	
Gulf of Maine	0.4
Georges Bank	0.6
Haddock	
(Both Areas)	0.3
Yellowtail Flounder	
Georges Bank	0.9

1/ These fishing mortality rates are based upon recent levels of catch and resource conditions.

Table V.B.5: Short-term[1] (first year) and Long-term[2] (equilibrium) Percentage Changes in Yield of Cod, Haddock, and Yellowtail Flounder Relative to 5-1/8" Cod End Mesh Size[3]

Species		Alternative New Large Mesh Size (Inches) 4-3/4	5-1/2	6
Cod, Gulf of Maine	short-term	+5.42	-6.59	-16.10
	long-term	-5.59	+5.42	+12.25
Georges Bank	short-term	+7.97	-9.69	-22.98
	long-term	-7.39	+7.32	+16.82
Haddock	short-term	+7.12	-9.10	-23.35
	long-term	-2.62	+1.85	+2.66
Yellowtail Flounder	short-term	+12.86	-16.92	-40.04
	long-term	-9.45	+9.75	+22.89

1 The actual first year impact will be highly dependent upon strengths of the recruiting year classes.

2 The long-term equilibrium calculation assumes that annual recruitment and fishing mortality are constant and independent of stock size. Mesh is the only variable element in the analysis.

3 Impacts have been calculated assuming that entire catches would be affected by mesh changes.

overfishing. The data in Tables V.B.1. and V.B.2. indicate that a 6 inch mesh size may be appropriate for cod in consideration of the management objectives, whereas that for haddock and yellowtail flounder is 5-1/8 to 5-1/2 inches. On the other hand, the short-term impacts upon the catch of cod (16-23%) associated with going to a 6 inch mesh (from 5-1/8 inch mesh) in a single step are substantial.

Looking at current year class strengths (see Table V.B.3.), with two above average year classes currently in the Gulf of Maine cod fishery (1978 and 1979), the projected 16% reduction in catch in the first year (1983) is probably an overestimate. Moreover, the strong 1978 year class in the Georges Bank haddock fishery, if still a significant fraction of the population in 1983, may reduce the projected 23% short-term impact associated with changing to a 6 inch mesh. Conversely with the uncertain prospects for recruitment in the Gulf of Maine haddock and Georges Bank cod fisheries, the mesh size impacts are more likely to be as stated in Table V.B.5. With regard to yellowtail flounder, it is unknown whether future recruitment effects could reduce the projected short-term impact (40%) because information regarding the strength at recruitment of recent yellowtail flounder year classes is unavailable.

With the exception of yellowtail flounder, all projected catch reductions in the first year (1983) associated with going to a 5 1/2 inch mesh are less than 10%. Moreover, as discussed above, consideration of the above average year classes present in the fishable stock suggest that short-term impacts upon the fisheries for Gulf of Maine cod and Georges Bank haddock may be substantially less than estimated, because the latter estimates were made assuming average strength year classes. Yellowtail flounder may remain as the most highly impacted species, although the exact level of relative impact upon 1983 catches will be highly dependent upon the strength of the 1980 and 1981 year classes.

Given the fact that any increase in mesh size may result in some short-term losses in total yield, it is possible that the industry response would be to increase fishing effort in order to minimize such projected losses. Computer simulations, illustrated in Figure V.B.1 using Gulf of Maine cod, examined a scenario whereby the mesh size was increased from 5-1/8 inches to 5-1/2 inches. Recruitment was held constant to isolate the effects of increases in fishing mortality rate (F) as a consequence of increased effort. In general it was observed that if F was increased in the year following the mesh change but held constant thereafter, then projected short-term losses in yield could be avoided but at the expense of slight reductions in the projected long-term yield gains. Nevertheless, significant increases in the level of long-term average yield are still possible. Under all conditions, however, the increase in mesh size would be expected to result in more young fish (by number) reaching sexual maturity and contributing to the spawning stock. It must be emphasized that the absolute shape of the curves presented in Figure V.B.1 would be highly dependent upon the actual levels of recruitment (which was held constant in this analysis), especially during the earlier years following the change in mesh size.

In summary, the following conclusions may be drawn from the mesh analysis:

1) In the short run, an increase in cod end mesh above 5 1/8 inches will be accompanied by a reduction in catch, and vice versa.

2) In the long run, an increase in cod end mesh above 5 1/8 inches will result in proportionally increased catch, and vice versa.

3) Absolute short-term impacts may be increased or lessened for a given cod end mesh, depending upon fishing effort and the strengths of year classes in and recruiting to the fishery at the time of implementation. But the relative ordering of mesh sizes vis-a-vis yield benefits is not expected to change.

4) Absolute long-term yield benefits for a given codend mesh will vary with actual effort and recruitment over time. But again, the relative ordering of mesh in relation to benefits is not expected to change.

5) Increased mesh size tends to buffer long-term yield from the fishery to moderate increases in effort over time, although stock size may decline.

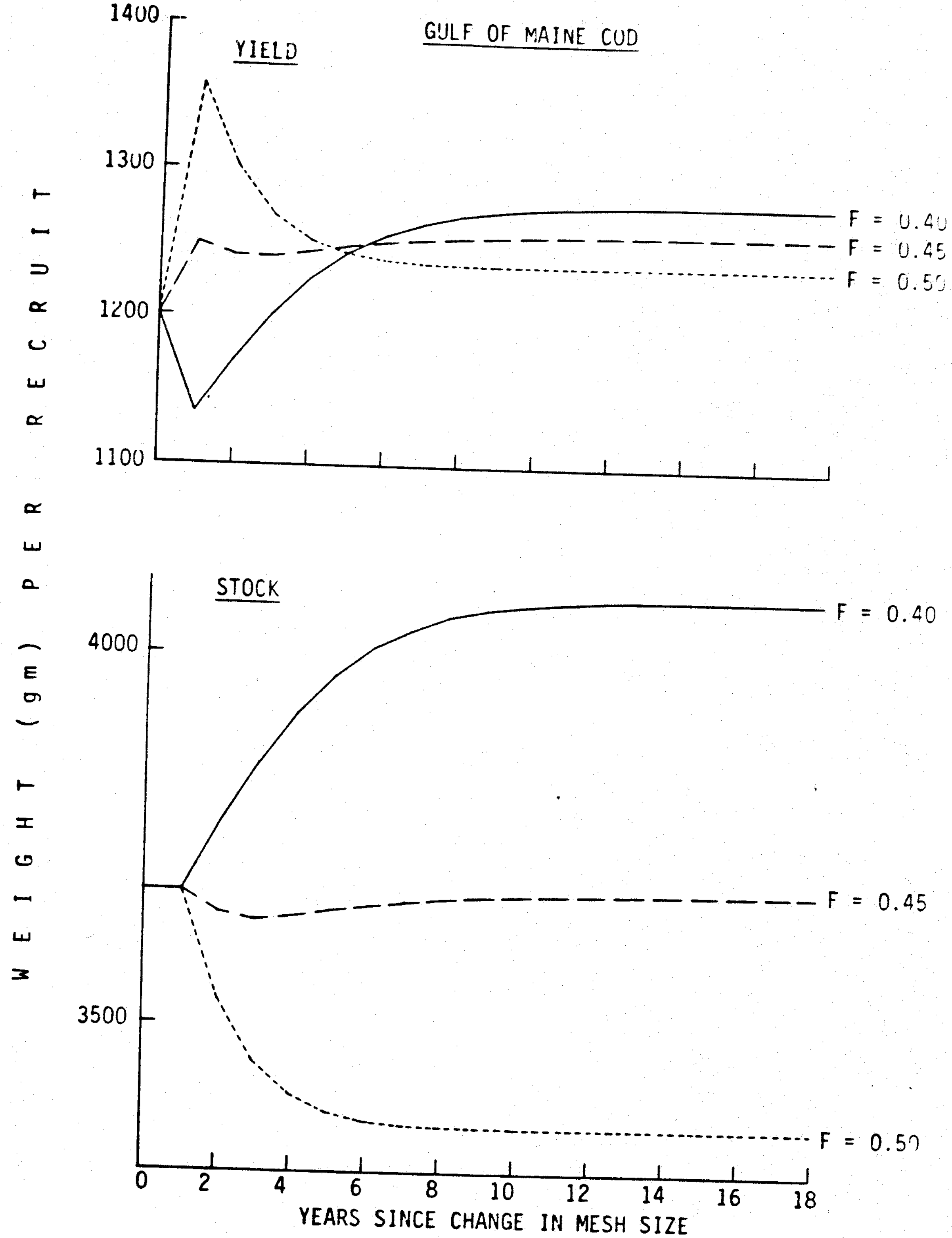


Figure V.B.1. Effects of increasing fishing mortality rate (F) following a change in mesh size from 5 1/8 in. to 5 1/2 in. for Gulf of Maine cod. Solid lines indicate yield and stock size with constant F = 0.4 in all years. Dashed (dotted) lines show effect of increasing F by 12.5% (25%) to F = 0.45 (F = 0.50) in year 1, constant thereafter. Recruitment held constant for all cases.

10/30/81

C. Large Mesh Area

Resource Impacts of Large Mesh Area

In response to general concerns that a "large mesh" fishery for cod, haddock, and yellowtail flounder should have the minimum possible impact upon traditional "small mesh" fisheries, a series of "large mesh" area options were defined on the basis of detailed historical catches by area. To achieve an appropriate balance, alternative "large mesh" area specifications were designed with the intent of maximizing the coverage of the total annual landings of cod, haddock, and yellowtail flounder, while minimizing the impact on the fisheries for which small mesh nets are necessary, most importantly redfish and silver hake.

The four major options which were examined are illustrated in Figure V.C.1. and described in Table V.C.1. All area options are concerned only with the western Gulf of Maine and Georges Bank within statistical areas 5Y and 5Ze, since these are the primary areas of cod, haddock and yellowtail catches.

Over 90% of annual historical landings of each of cod, haddock and yellowtail are encompassed by Option 1. Option 2 provides slightly lower coverage of cod, haddock, and yellowtail flounder than does Option 1, but has a significantly lower impact upon redfish. This was accomplished by subtracting a portion of the area encompassed by Option 1, located in the northern approaches to the Great South Channel, to more closely conform to the 50 fathom curve (see Figure V.C.1, Options 1 and 2). Option 3 covers the same area as Option 1 except that the more northerly portions of both Georges Bank and the western Gulf of Maine would be opened to a small mesh fishery (redfish) during January - April (see Figure V.C.1, Option 3, hatched area). Option 4 again covers the same area as Option 1 but with a small mesh fishery allowed during July - October for silver hake in a specified area of the western Gulf of Maine and on Georges Bank in the Cultivator Shoals area (see Figure V.C.1, Option 4, hatched area).

Options 1 and 2 are alternative specifications for a "large mesh" area with no specific provision for seasonal "small mesh" fisheries. Options 3 and 4 are variations on Option 1 which include specifically defined seasonal/areal provisions for the "small mesh" fisheries. Options 3 and 4, with very specific time/area provisions, may lend themselves to an effective enforcement effort, but are rigid and may be unresponsive to small mesh fish availability on a year-to-year basis.

An alternative approach to meeting the concerns of the "small mesh" fisheries is to establish a system whereby vessels could be permitted to target their fishing effort on specified small mesh species with the specific approval of the NMFS Regional Director.

Table V.C.1: SUMMARY OF AREA/MESH OPTIONS

Option	Description	Percent of Annual Catch Encompassed	Comments
1	- Annual large-mesh area - No seasonal exemption	COD 93.4 HAD 90.3 YT 90.1 RF 19.2 SH 77.5	Directed, declared single mesh, silve hake fishery possible.
2	- Annual large-mesh area - No seasonal exemption	COD 88.0 HAD 81.3 YT 89.9 RF 10.9 SH 76.4	Directed, declared single mesh, silver hake fishery possible.
3	- Annual large-mesh area - Seasonal exemption	COD 89.0 HAD 84.3 YT 90.0 RF 14.8 SH 74.0	Jan. - Apr. exemption directed at concentrations of redfish landings.
4	- Annual large-mesh area - Seasonal exemption	COD 74.3 HAD 72.9 YT 80.8 RF 14.7 SH 15.4	Jul. - Oct. exemption directed at concentrations of silve hake landings.

1/ Based upon average landings over the period 1974-1978. The percentages in Options 3 and 4 are reduced because of the seasonal exemptions.

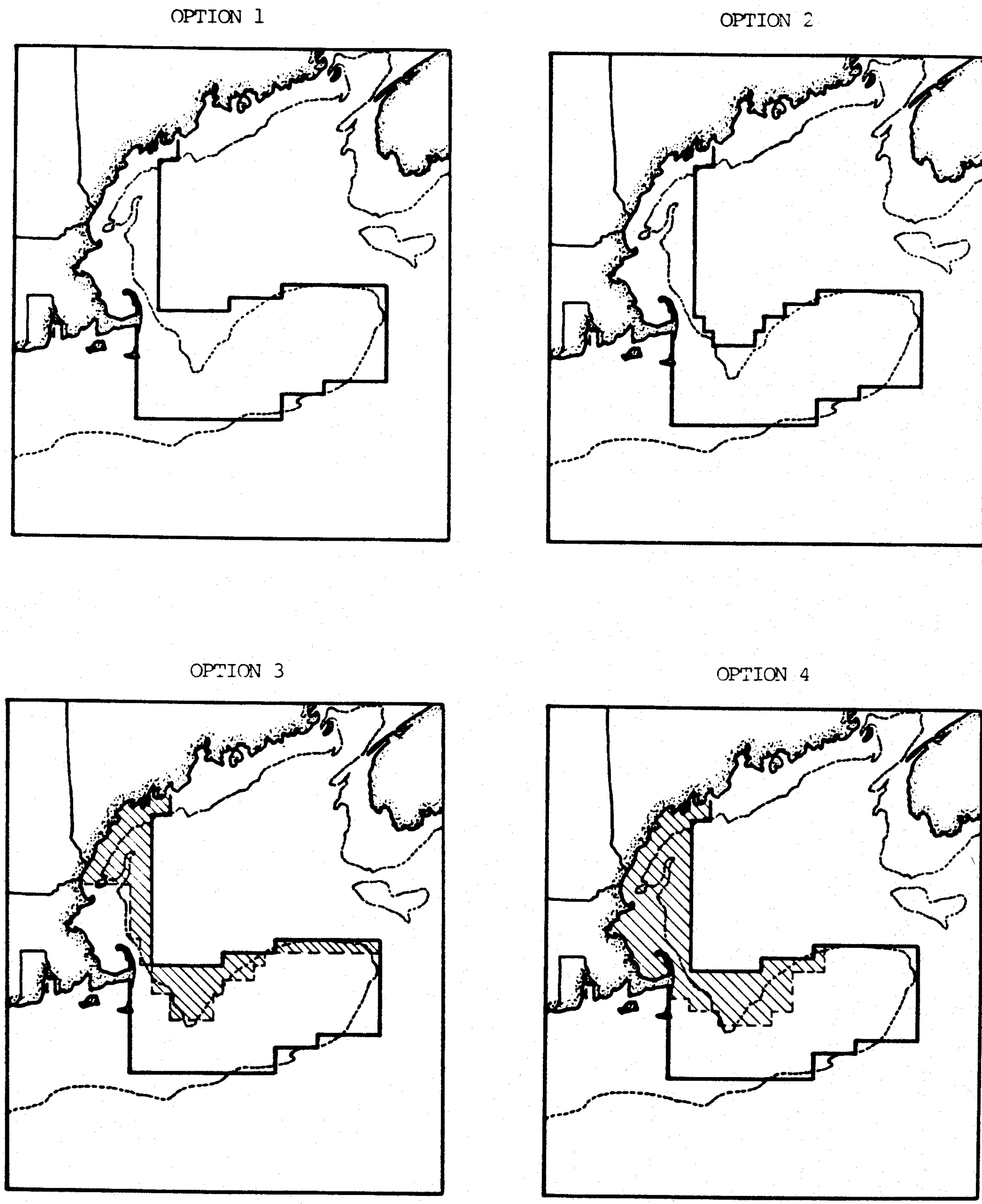


Figure V.C.1. Large mesh area options. Crosshatching indicates area exemptions for small mesh fisheries.

The identified management options are presented below in Table V.C.2.

Table V.C.2: MESH SIZE/AREA MANAGEMENT OPTIONS

Large Mesh Area Options	Optional Settlement/ Mesh Exemption	Large Mesh Size Options
1. a.	With Optional Settlement No Area/Mesh Exemption	4 3/4 in., 5 1/8 in., 5 1/2 inc., 6 in.
b.	No Optional Settlement No Area/Mesh Exemption	Same as above
2. a.	With Optional Settlement No Area/Mesh Exemption	Same as above
b.	No Optional Settlement No Area/Mesh Exemption	Same as above
3.	Redfish Area/Mesh Exemption No Optional Settlement	Same as above
4.	Silver Hake Area/Mesh Exemption No Optional Settlement	Same as above

Impacts of Large Mesh Area on Industry

The economic impacts of the various alternative specifications of the fish size, mesh size and large mesh area measures will be dealt with in the following sequence:

a) the present value analysis of changes in gross revenues to the harvesting sector due to changes in landings resulting from the various area/mesh options;

b) the qualitative impacts on the expected gross revenues [from (a) above], of increases in fishing mortality (F) in this fishery;

c) the qualitative impacts on operating costs in the cod, haddock and yellowtail harvesting sector;

d) the qualitative impacts on small-mesh fisheries;

e) the relationship of minimum fish size to the area/mesh analysis.

Initially, there are several possibilities for changes in vessel operations due to changes in mesh size in this fishery. Two extreme cases for any given year are:

Case 1. Assume that such costs remain constant in order to catch the same number of (larger) fish; that is, profits are positive because vessels operate exactly as before the imposition of a minimum mesh size (same fishing areas, same time fishing) and simply catch all larger fish (and small fish passing through the net).

Case 2. Assume that the costs of catching the same number of fish with a larger mesh size (due to more steaming and towing time) equal or exceed the extra revenues (profits are zero or negative) generated by the increased unit value and weight of catching all larger fish.

The Case 2 situation does not permit quantitative analysis since cost responses to the management measures cannot be predicted. Therefore, in the following discussion, the present value and gross revenue analyses assume constant costs. However, these are followed by a qualitative analysis of impacts on operating costs, based on Case 2.

Present Value Analysis. The present value analysis of various area/mesh options in the cod, haddock and yellowtail fisheries assumes constant costs and is presented as relative changes in gross revenue for the various area/mesh options. The analysis starts with projected landings for the fishery for 1983 (NEFMC Res. Doc. 81 GF 1.1, revised), because the 5-1/8" mesh size is expected to be maintained through 1982. The total period for the present value analysis is taken to be twenty-five years, assuming that changes in catch over time are represented by the data in Table V.B.5. Utilizing price coefficients from cod, haddock and yellowtail demand models, a 25-year stream of changes in gross revenue to the harvesting sector for each area/mesh option may be generated from changes in expected landings over time relative to continued catch at the projected 1983 level, Table V.A.1 (D).

The present value (at the current Water Resources Council discount rate of 7-3/8%) of the area/mesh options relative to 5 1/8" is presenteo in Table V.C.3.

Table V.C.3: Present Value of Gross Revenue Associated with Change in Mesh Over 25 Years

Area Options	MESH SIZES 4 3/4"	5 1/2"	6"
1	-$153,154,000	+$139,487,000	+$324,640,000
2	- 153,154,000	+ 136,077,000	+ 317,062,000
3	- 153,154,000	+ 136,764,000	+ 318,506,000
4	- 153,154,000	+ 119,199,000	+ 276,636,000

These results show that:

1) A decrease in mesh size from 5-1/8" to 4-3/4" results in a 153 million dollar decline in present value. (This present value is the same for all area options, because a reduction of the mesh size would be expected to affect the entire fishery.)

2) As mesh size increases, so does the present value of changes in gross revenues.

3) For any mesh size, the differences in present value among the four area options do not appear to be great.

The declines in relative present value associated with decreasing mesh size involve positive changes in gross revenues in the harvesting sector for the first few years, and negative changes thereafter; while the increases in relative present value (increasing mesh size) represent negative changes in gross revenue initially, and positive changes for the remainder of the period. For example, changing to 5-1/2" mesh from 5 1/8" mesh involves a first year (1983) loss of approximately 20 million dollars to the harvesting industry; whereas changing to a 6" mesh size, involved a first year loss of about a 45 million dollars for any area option. This changeover from short-term to long-term impacts is always two or three years in duration.

Given the high price elasticity of demand for cod, haddock and yellowtail at all market levels, the impacts on the upper market levels, including consumers, should be similar to the results presented here for the harvesting sector (i.e., increased productivity due to increased mesh size, resulting in lower relative prices and thus increased benefits).

Finally, increasing the discount rate to 10% and 12% reduces (increases, in the case of 4-3/4") the absolute amounts of the present values presented for each mesh towards zero change, but does not change the relative comparison among area/mesh options described above.

Gross Revenues. These results must be looked on as a best case scenario. The biological analysis presented earlier in this Section, which is the basis for this present value analysis, is conducted under the simplifying assumption that fishing mortality remains constant throughout the study period. In addition, the analysis assumes that fishing costs are unchanged for all of the area/mesh options in which case profitability in the cod, haddock and yellowtail fishery will necessarily improve (as indicated by the present values in Table V.C.3 above) with an increase in mesh size. This increased profitability may be expected to encourage increased effort (either more days fished or more vessels) in the fishery, and thus potentially dissipate any gains in gross revenues for the harvesting sector. The increased effort not only increases costs of catching the extra fish but also increases the fishing mortality rate. Thus, not only are any profits dissipated, but the increased production (and the protection of the stocks from excessive removals) and consequent gross revenues may be partially eroded.

Operating Costs. There currently are no empirical models that would permit analysis of fishing costs quantitatively relative to any changes in fishing operations due to the area/mesh options. If, for instance, increasing mesh size caused operating costs to increase, then the increased costs would have effects similar to those resulting from increased effort (i.e., diminishing the gains in gross revenues). If it is assumed that operating costs (such as towing and steaming costs) would increase at a faster rate than mesh size productivity, then options which may appear superior (e.g. 6" vs. 5-1/2" mesh size) using present value of gross revenues may not appear so using net revenues. However, such costs would have to increase by more than 100 percent in order to make the 5-1/2" preferrable to the 6" mesh size. Alternatively, assuming that operating costs (such as buying a new net) were a one-time increase and the same for any change in mesh size, then the relative comparison among area/mesh options in the present value analysis would not change. However, because most fishermen generally buy at least one new net each year, this problem would be mitigated in the Interim Plan by postponing the changeover to a different mesh size (from the current 5-1/8" average) for one year after implementation.

Small Mesh Fisheries. The purpose for establishing a specific area for large mesh is to minimize the negative impacts on small mesh fisheries while providing adequate protection to cod, haddock and yellowtail. It can be assumed that less catch in the small mesh fisheries due to increases in mesh size will mean reduced gross benefits from these fisheries. Therefore, creating a large mesh area eliminates these negative impacts on all small mesh fisheries which exist outside that area. Further, establishing exemptions or optional settlements within the large mesh area would further reduce those negative impacts. In fact, an optional settlement program may eliminate all of the negative impacts on small mesh fisheries within the large mesh area.

Minimum Fish Size. With respect to fish size, the foregoing analysis generally assumes that all fish caught by a specific mesh will be retained and landed. Where a minimum allowable fish length is also specified in a management program, that minimum allowable fish length should, as much as possible, correspond to a fish length which is only minimally retained by the mesh (say the 10% retention value) in order to reduce fish handling and discarding. Specification of a minimum allowable fish length at some higher value (say the mesh's 50% retention length) will necessarily result in increased discarding, lost harvestable production, and lost benefit to the stock, which may be substantial during years when recruiting year classes dominate the resource.

Summary. A larger mesh size gives a greater present value based on changes in gross revenues to the harvesting sector for the cod, haddock and yellowtail flounder fishery; means a larger short-run (1983) loss in these gross revenues; and may increase effort and operating costs, which could dissipate these gross revenues. Negative impacts on small-mesh fisheries may be mitigated through establishing large mesh areas, exemptions, and optional settlement programs.

The complete specification of the various options for management of cod, haddock, and yellowtail flounder is comprised of three elements. These are 1) options with respect to the areal/temporal description of the "large mesh" area; 2) options which allow accommodation of recognized "small mesh" fisheries; and 3) options with respect to an appropriate mesh size for "large mesh" nets specific for cod, haddock, and yellowtail flounder.

D. Spawning Area Closures

Three major options for defining a spawning area closure measure were identified and considered by the Council. Figure V.D.1 represents these options. Two areas on Georges Bank are defined for closure under the current Atlantic Groundfish FMP. The issue of whether these area closures should be continued, modified, or expanded addresses the issue of enhancement of spawning activities.

Option 1. Continuation of existing spawning closed areas.

Areas I and II are located on Western Georges Bank (primarily encompassing depths between 50 and 100 fathoms) and on the Northern Edge and Northeast Peak of Georges Bank, respectively. These areas have historically been characterized by concentrations of spawning haddock during the March-May period, and have been closed annually since 1969 during that three-month period. During the closure period these areas also encompass some cod and yellowtail flounder spawning activity, although the specific sites for this activity are not well defined.

Option 2. Continuation of existing spawning closed areas plus closure of additional areas.

In addition to Option I, this option is for the possibility of defining additional area/periods to enhance spawning activity for cod. Area III

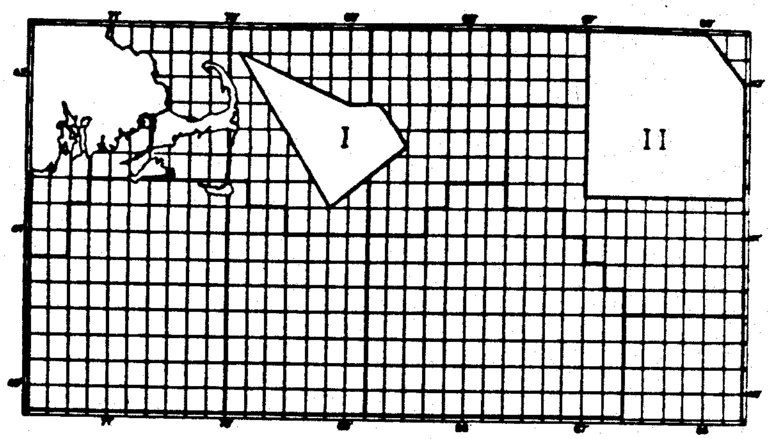
Figure V.D.1 SPAWNING AREA CLOSURE OPTIONS

Option 1.

Continuation of existing spawning closed areas:

Area I March-May

Area II March-May



Option 2.

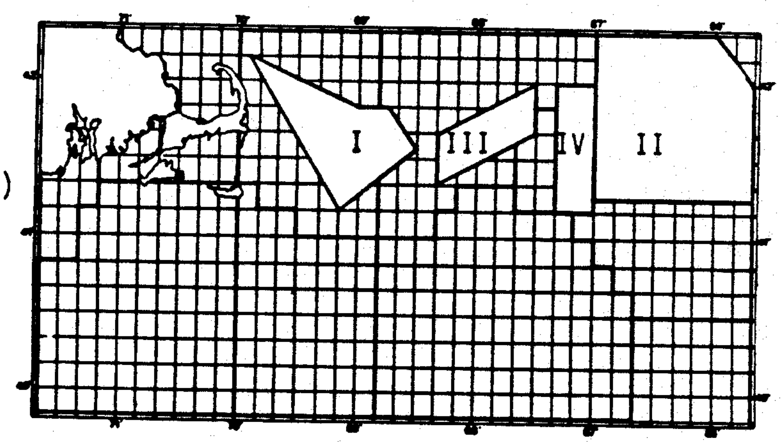
Continuation of existing spawning closed areas plus closure of additional area(s)

Area I March-May

Area II March-May

Area III Feb-Mar or Dec-Apr

Area IV Feb-Mar or Dec-Apr

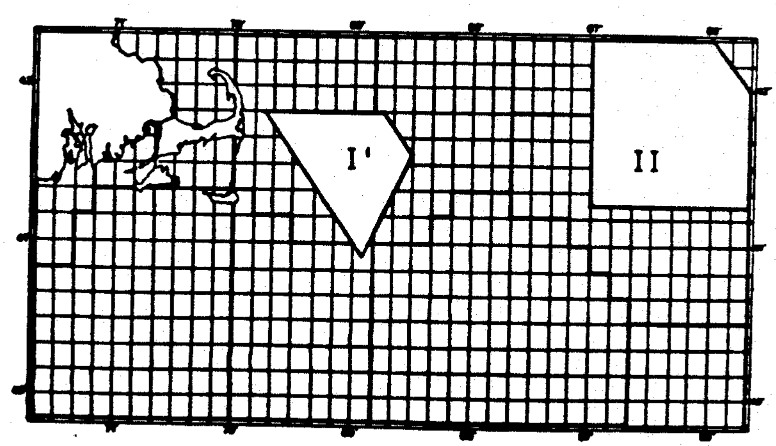


Option 3.

Modification of existing spawning closed areas

Area I' March-May

Area II March-May



encompasses the area between Cultivator and Georges Shoals. Consistent late winter spawning has been reported for that area. Analysis of commercial catch data (by 10 minute area squares) indicates that Area III coincided with concentrated commercial activity during February and March from 1964 to 1974, and this activity was assumed to corroborate the presence of concentrations of cod during the spawning season. Commercial catch data for the period 1975-1978, however, do not indicate a concentration of commercial fishing activity in Area III.

The Northeast Fisheries Center identified Area IV as being of equal size to Area III but encompassing considerably more commercial activity during the suggested closure period. The Center also suggested the possibility of closing Areas III or IV for a 5-month period, December-April, during which time there are indications that cod spawning occurs, based upon recent ichthyoplankton data.

Option 3. Modification of existing spawning closed areas.

Public input during preparation of the Interim Plan indicated that some area adjustments to Area I would be appropriate to refocus the closure on concentrations of spawning haddock and lessen the incidental impact of the existing Area I on fisheries for other species. Area I' in Figure V.D.1. addresses this comment responding to a reported shoalward shift in haddock spawning activity to the Southeast, into the shallower water between Little Georges and Cultivator Shoals. No modifications to Area II have been suggested.

Resource Considerations

The closure of spawning grounds during periods of concentrated spawning activity has long been considered an appropriate conservation and management technique. Operationally, the measure terminates the fishery at a time when fish are highly aggregated and vulnerable to capture. From a resource perspective, the closure allows the fish to spawn without disturbance, and thus may enhance the prospects for future recruitment. A spawning closure reduces exploitation directly on the spawning stock, and thus may help maintain the spawning potential of the resource.

The resource benefits of adopting a spawning closure measure cannot be quantified. However, the qualitative expectations regarding benefits that will accrue to the stocks are founded upon past experience and the widely held belief, fully shared by the affected fishermen, that a relationship does exist between a spawning stock and subsequent recruitment, particularly at low spawning stock levels.

For the above reasons, all of the spawning closure options, singularly or in combination, are biologically appropriate to the extent that they can reasonably be expected to coincide, spatially and temporally, with actual spawning activity. Based upon information derived largely from the industry, Areas I or I' and II appear to have relevance for haddock spawning. These areas also encompass some cod and yellowtail flounder spawning activity, and thus appear to support a broad range of species spawning activity.

Regarding the appropriateness of Areas III and IV, however, the NMFS/Northeast Fisheries Center has reported that there is little evidence to support the theory that a significant component of the Georges Bank cod stock spawns on well-defined spawning grounds or during a consistent time period. As a consequence, the areas of concentrated cod fishing activity on Georges Bank (supporting the definition of Areas III and IV) may not have any direct association with cod spawning. Nonetheless, altnough a closure to fishing may not coincide with spawning in that area, overall spawning activities would be enhanced if the closure (presumably in areas where fish are concentrated) reduced the total mortality applied to the spawning stock.

Impacts on Industry

Spawning area closures may be economically desirable if the present value of the increased future production from recruitment exceeds the opportunity costs of inefficiently catching the current production. If fishermen are profit maximizing (or cost minimizing), and if their most efficient mode of operation includes fishing in a spawning area, then closing that area reduces their efficiency, because either they expend the same effort and catch less fish, or they expend more effort to catch the same amount as before.

There are currently no empirical cost models available that would make possible the quantitiative estimation of the effects of removing fishing areas/periods from the cod, haddock and yellowtail fishery. More importantly, neither can the increased future production from spawning closures be quantified, because of the lack of a well-defined stock-recruitment relationship for these groundfish species. Therefore, the costs of inefficiencies imposed on the fishery are minimized to the extent that the number, size and duration of spawning area closures include only those areas and time in which spawning activity is most likely to occur.

In relation to the management measures adopted in this Interim Plan, the possible continuation of the current spawning area closures would have no measurable economic impact on the industry relative to the period from 1969 when spawning closures were instituted. An increase in the areas or periods would increase costs but possibly also increase future production benefits. A reduction in the areas or periods subject to closure would decrease costs and quite possibly decrease any potential production benefits from those areas and periods. Thus, if evidence of spawning activity in an areas is weak, costs of inefficiencies may be minimized by eliminating the area.

E. Recreational Impacts

There is substantial recreational fishing for cod and haddock from Maine to New York, principally from private boats, party and charter boats and, to a lesser extent, by shore-based anglers. There is no significant recreational effort for yellowtail flounder.

The only Interim Plan management measure which will have a direct impact on the recreational fishing industry and on anglers is the minimum fish size of 15 inches for cod and haddock. The greatest potential impact of the minimum fish size is likely to be on the private small boat and shore-based fisheries for cod during the spring and fall inshore runs. However, the extent and nature of any potential impact on these user-groups cannot be determined since there is very little detailed data on the recreational fisheries, in particular, with regard to the proportion of the cod and haddock recreational catch under any given minimum size.

The cod and haddock minimum fish size will have less impact on the near shore (3-25 miles) and offshore (greater than 25 miles) commercial party and charter boat fisheries. These vessels generally employ a hook size which only occasionally will catch cod or haddock under 15 inches. The 15-inch recreational minimum fish size, which is an exception to the 17-inch commercial minimum size, is based on the recommendation by segments of the New England charter and party boat industry.

F. Institutional Impacts

Cod, haddock and yellowtail flounder are distributed within most of the New England and some of the Mid-Atlantic States' territorial waters, as well as within the FCZ. The management unit is considered to include the regulated species when they occur within the states' waters as well; and the management policies, measures and recommendations contained in the Plan are appropriate for application in State waters. Therefore, effective implementation of the proposed management program will require action by the affected states to ensure uniform application of the minimum fish size and minimum mesh size. States are urged to adopt management policies and regulations consistent with the provisions of this Interim Plan.

VI. List of Preparers

This Environmental Impact Statement and the Interim Atlantic Groundfish Fishery Management Plan were prepared by:

Stanley Chenoweth, M.S., Maine DMR, Liaison with New England Fishery Management Council. Mr. Chenoweth currently serves as a Fisheries Biologist for the State of Maine and previously served as a consultant to the Council's staff on various Plan development activities. Mr. Chenoweth is the principal author of Section 2 of the FMP.

John H. Dunnigan, J.D., LL.M., Deputy Executive Director, New England Fishery Management Council. Mr. Dunnigan is generally responsible for the overall development and preparation of Fishery Management Plans by the Council and was principally responsible for this Plan and DEIS. He was the principal author of Sections 1, 4, 5, 8 and 9 of the Plan.

Mr. Dunnigan served as a NOAA field attorney for more than eight years and was Regional Attorney in both the Southeast and Northeast Regions. In these capacities, he provided legal and policy advice to NMFS and five Regional Fishery Management Councils concerning managing fisheries under the MFCMA and other applicable laws.

Louis Goodreau, Economist, New England Fishery Management Council, has an M.S. in Resource Economics from the University of Rhode Island. Mr. Goodreau has been with the Council since 1977 as an Economist and Statistician. Mr. Goodreau is primarily responsible for Sections 701.2, 701.4, 702.4, 702.5, 703.4, 703.5, 704.4, 704.5 and 705.

Guy Marchesseault, Ph. D., Senior Scientist, New England Fishery Management Council. Mr. Marchesseault is generally responsible for all scientific/technical analysis and information supporting the Interim Groundfish Fishery Management Plan and this DEIS. He participated in the preparation of FMP Sections 2, 3, 6, 7 and 8. Mr. Marchesseault has served on the staff of the Council for four years; his principal expertise is in fishery science and decision analysis.

Richard Ruais, M.P.A., Staff Analyst, New England Fishery Management Council. Mr. Ruais has served in numerous capacities on the Council staff for more than three years. He has assisted in the development of Council Fishery Management Plans and Environmental Impact Statements and also assisted in the implementation of a wide range of major Council policy decisions.

Mr. Ruais is the principal author of Section 3 of the Fishery Management Plan and he structured and assembled this EIS.

Howard J. Russell, Jr., M.S., Biologist, New England Fishery Management Council. Mr. Russell is principally responsible for providing quantitative biological impact analyses in cooperation with other technical staff members. His contributions to this Fishery Management Plan are elements of Part 7 and in the technical appendices.

Mr. Russell's career in fisheries management began with eight years as a Marine Fisheries Biologist for the State of Rhode Island, and he has been with the New England Fishery Management Council since April 1977.

Stanley Wang, Ph.D., former Council Senior Economist, directed the economic analysis.

The Council Staff has benefited greatly in the preparation of the Fishery Management Plan from the assistance of the Regional Office, NMFS, in Gloucester, Massachusetts.

Editorial Assistance was provided by Sharon MacDonald and Laurie Gronski.

VII. List of Agencies, Organizations and Persons to Whom Copies of the Statement are Sent for Review and Comment

A. Federal Agencies

U.S. Environmental Protection Agency (Regions I, II, III)
Department of State
U.S. Coast Guard
Department of Interior
- Bureau of Land Management
- Fish and Wildlife Service
- Bureau of Indian Affairs

Department of Commerce
- NOAA, Office of Coastal Zone Management

U.S. Army Corps of Engineers
Marine Mammal Commission
Mid-Atlantic Fishery Management Council
South Atlantic Fishery Management Council
Atlantic States Marine Fisheries Commission

B. State Agencies

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

DRAFT REGULATORY IMPACT REVIEW

Interim Fishery Management Plan for

Atlantic Groundfish

New England Fishery Management Council

October 30, 1981

INTRODUCTION

This Regulatory Impact Review has been prepared in connection with Executive Order 12291, "Federal Regulation." It concludes that implementation of the Interim Fishery Management Plan for Atlantic Groundifsh (Interim Plan) would not be a "major" rule under the Executive Order; and would be consistent with the general requirements specified in Section 2 of the Executive Order. This review has been prepared in consultation with the National Marine Fisheries Service.

STATEMENT OF THE PROBLEM

Truly effective groundfish managment should address the individual needs of a large number of interrelated stocks and a wide array of fishing practices. Thus, the major species of the overall groundfish complex, about ten species in all, must be managed over the long term in close coordination. Although the New England Council has recognized this need since it first addressed groundfish management, its original management program as a first step only addressed the three species which were particularly vulnerable to fishing pressure. This initial program has not been effective, primarily because it used single-species strategies in a multi-species context. In fact, it has worked so poorly that the management process has become preoccupied with short-term problems, rather than getting on with devising an acceptable long-term program for the management of the Atlantic groundfish complex. It is, therefore, necessary to get out from under the current unworkable and ineffective management program in order to address long-term concerns through the development of what will be called the ADF (Atlantic Demersal Finfish) Plan. This Interim Plan, therefore, is not intended to be a permanent, long-term managment program. Rather, it is intended to satisfy a short-term need for management of these highly valued resources pending development of a long-term multi-species management program.

Because of its relatively short-term nature, the Interim Plan adopts only limited biological objectives. The resources under management have recovered from their low levels of the late 1960's and early 1970's, and now permit a period of relaxed regulation. The Interim Plan has no specific economic goals. One objective, however, is to improve the quality of fisheries data to assist in preparation of the ADF Plan.

The objectives of the Interim Plan are to: 1.) enhance spawning activities; 2.) reduce the risk of recruitment overfishing of cod, haddock and yellowtail flounder; and 3.) acquire reliable data, in support of the development of the ADF Plan, on normal fishing patterns of the industry and the biological attributes of stocks as determined on the basis of commercial activities. The Council acknowledges that there is some risk associated with this approach. Spawning should be enhanced, but cannot be guaranteed. "Recruitment overfishing" will not be prevented at all cost, but the risk that it could do serious damage to the stocks will be reduced relative to a completely unregulated fishery. But perhaps most importantly, the data base which is absolutely essential to effective fishery management will be strengthened.

ALTERNATIVES AND THEIR IMPLICATIONS

Although the purpose of this Interim Plan from its beginning has been to back away somewhat from detailed management of the fishery, total deregulation has never been considered appropriate. These resources have demonstrated a particular sensitivity to fishing pressure, and are most subject to fishing pressure because of their relatively high value. Complete deregulation, therefore, has never been considered or treated as a viable option. The Council has, however, considered a number of other strategies, set forth below, and selected the one it determined to be most consistent with its objectives. To implement this strategy, a number of detailed alternative measures were analyzed, and the Council adopted the ones it determined would be most effective in achieving its objectives.

Alternative Strategies. As possible ways to achieve its objectives, the Plan considers four strategies, which are set forth in more detail in Part 6 of the Plan. Catch control, the basic strategy used by the current management program, would involve attempting to limit the total removals from the resource. This strategy can be attractive for managment purposes, since it is most directly tied to the resource being managed. However, managing single species in a multi-species fishery causes problems since species-specific catch limits may artificially constrain the harvesting of associated species. In the past, once target harvest levels have been reached, potential closures have encouraged fishermen to "scramble" for a larger share of the quota before the closure became effective. This can result in operating inefficiencies, negative price effects and reduced revenues to the industry; followed by product scarcity and elevated prices during extended fishery closure periods. The administrative costs of enforcing a closure are high, particularly in a fishery where there are large number of fishermen, spread out over a wide geographical area. Fishermen's attempts to avoid enforcement of closures in the past have been part of the cause for the deterioration of the fisheries data base.

Effort control can also be an attractive strategy for management purposes, since it directly addresses the human activity which affects fishery resources, i.e., fishing pressure. However, it involves high administrative costs in monitoring the level and distribution of effort in the fishery. It also requires better, more sophisticated data than is currently available in order to specify an overall program that is equitable. One current problem with the data base is that, because of the multi-species nature of the fishery, there is no way to apportion measurable past effort among the various groundfish species to attain a starting point for analysis.

Controls on fishing practices also directly address the human activity which effects fishery resources. Measures such as gear restrictions, closed areas and closed seasons in effect selectively reduce the vulnerability of the stock to capture. However, since they do not directly limit the overall effort which may be applied to a fishery resource, they typically offer only loose control of resource exploitation. They may, therefore, involve a greater degree of risk to resources than catch control and effort control, and may require frequent tuning to ensure resource conservation. Such measures also impose short-term inefficiencies on the industry since they increase the per unit cost of catching fish.

Looking at these strategies, and comparing them to the Interim Plan's objectives, it is apparent that the "no action" alternative is inappropriate. Its annual and per trip catch controls have had only imprecise, if any, effect on removals from the stock and distribution of benefits within the industry. It has also directly led to the serious deterioration of the data base used in managing fisheries. Therefore, some other approach is necessary.

Although any of the three strategies discussed above may well be appropriate to the long-term management of groundfish, it is the Council's judgement that only controls on fishing practices are appropriate while such a long-term program is being devised. Such controls can provide some protection to spawning (e.g., through closures of spawning areas), and reduce the risk of fishing on juvenile fish (e.g., by mesh sizes which allow escapement or minimum fish sizes which discourage fishermen from fishing on known concentrations of juvenile fish). Most significantly, they allow for improvement in the data base since they eliminate incentives for misreporting; and since, as was shown by public comment on the Interim Plan, they are widely supported by the industry. Although they do not directly address long-term management issues, they are not necessarily inconsistent with long-term conservation, which will depend on recruitment levels and the degree to which fishing effort increases. In any event, any serious resource problem will be evidenced ahead of time by observable changes in the fishery (e.g., a succession of poor year classes, increasing dependence of the fishery on juvenile fish), and the Council will be in a position to respond to the problem in the circumstances in which it arises.

Alternative Management Measures. A number of different kinds of measures controlling fishing practices were considered in the development of this Interim Plan. Alternatives were considered for mesh sizes, fish sizes, large mesh areas and spawning areas.

The most significant measures from the standpoint of economic analysis are the alternative mesh sizes. The Interim Plan considers a range of mesh sizes, including 4-3/4 inches, 5-1/8 inches, 5-1/2 inches and 6 inches. (See detailed discussion in Section 702 of the Plan.) The economic implications of establishing or raising minimum fish sizes are similar to those for minimum mesh sizes, since in each case the presumed effect is to raise the average size of fish being landed.

While increases in minimum sizes for mesh and/or fish result in increases in the present value of gross revenues over the long term (due to increases in yield-per-recruit), they may also result in increases in short-run costs represented by foregone catches. Over time, however, this short-term loss becomes a long-term gain as the fish grow and are harvested at larger sizes. The analysis contained in Section 702 of the Interim plan indicates that only two mesh size alternatives increase the present value of gross revenues relative to the current regulated 5 1/8" mesh size: 5-1/2 inches and 6 inches. Assuming average recruitment, the reductions in aggregate yield for cod, haddock and yellowtail flounder in 1983 range from 6 to 16 percent for a 5-1/2 inch mesh, and from 16 to 40 percent for a 6 inch mesh. This can be compared to a 17.8 percent decrease in landings if a quota is maintained. Thus, the 5-1/2 inch mesh size is not expected to eliminate the 1983 gains from eliminating the quota; whereas the 6 inch mesh size would eliminate these 1983 gains.

With regard to large mesh areas, four alternatives were considered. (See detailed discussion in Section 702 of the Interim Plan.) Each of these has different implications for the balancing of the need to protect cod, haddock and yellowtail flounder against the need to allow unregulated fisheries to proceed as freely as possible. (See Table 702.3.) The Plan selects a balance which specifically minimizes the incidental impact on redfish fisheries, although significant fisheries for silver hake are conducted within the large mesh area. Therefore the Plan provides for further minimization of the incidental impacts of the large mesh area by providing for an optional settlement program. (See Section 808.) The alternative large mesh areas have substantially identical impacts on relative present values of gross revenues from cod, haddock and yellowtail flounder.

Different spawning areas were examined. Generally, the larger the spawning area the greater the protection afforded the resources; but the greater the impact on the industry as well. Neither the benefits to be derived from spawning areas nor the costs of foregone production from closing these areas can be quantified. The benefits of enlarging the spawning areas are judged in the Plan to be too speculative to justify enlarging them. (See discussion in Section 703 of the Plan.) Maintaining current spawning areas will not change any costs imposed on the industry.

The permits and enforcement and data collection provisions of the Plan continue regulations that are currently in effect, and do not involve significant costs to the industry.

REGULATORY IMPACTS

Because recruitment to the fishery cannot be predicted, only short term analysis is possible with any acceptable degree of quantitative accuracy. Long term analysis could be done assuming average recruitment, but the time period would have to be so long that the analysis would not be useful. An analysis over some mid-range period cannot be performed since average recruitment cannot be reasonably assumed and actual recruitment is unknown. Therefore, this analysis looks at regulatory impacts over a short-term (two year) period.

Regulations implementing this Plan would not be major rules requiring a Regulatory Impact Analysis under Executive Order 12291. The total effect of this Plan on the national economy should be less than $100 million. Even compared to complete absence of regulation, the total effect on the national economy, i.e., the total change in gross revenue at the retail level, would reflect a decrease of approximately $50 million.

This Plan will not result in any increase in the total cost or price of goods or services to the national economy, nor to any industry or market, level of government, or geographic region. It will result in higher landings over each of the next two years, which should decrease the costs of goods and services below what they would have been if landings did not increase. It is clear from the analysis in the Plan that larger mesh sizes return greater long-term benefits, but at the expense of short-term costs. A 6 inch mesh size, for example, would have increased the total short-term cost of goods and services to the national economy, perhaps by more than $5 million. However, this is the only mesh size which increases short term costs, and was not selected.

This Plan does not impose any restriction on entry to a fishery, nor in any way directly limit the number of U.S. fishing vessels that may participate in the Atlantic groundfish fishery. It will have incidental effect on fishermen fishing for other species, but these effects are mitigated by limiting required large mesh to a specific area, and by establishing the optional settlement program.

Because landings could be expected to increase, it is not likely that employment would be reduced. On the contrary, it is more likely that employment will be increased in both the harvesting and processing sectors. Similar to the effects on total costs of goods or services, the 6 inch mesh size could reduce employment since it would result in lower total landings over the short term.

The Plan should not have an adverse impact on investment. Indeed, a relaxation of regulation of the fishery would allow investment to be determined by market forces rather than regulatory constraints. There may be some increase in investment risk if adopting a larger mesh size results in lower fishing yields over time. However, these increases are not likely to be significant with respect to investment during the short-term.

The Plan should increase rather than reduce gross revenues to the participants in the fishery over the short term. As noted above, the 6 inch mesh size would probably have resulted in short term reductions in gross revenues by more than 10%. (See discussion in the Interim Plan, Section 702, Figure 702.2.)

The Plan should not reduce the ability of domestic businesses to compete with foreign businesses. There currently are no significant exports of groundfish. If landings increase, however, there should be less demand for imports of groundfish from Canada.

CONCLUSIONS

Since none of the criteria contained in the executive order or the interim NMFS guidance are met (see discussion above), regulations implementing this Plan are not "major" under the executive order.

The need for moving away from quota-based management of these fisheries at this time is well-documented in the Interim Plan. (See Section 501.) Although there are obvious short term benefits of removing quotas (evidenced by likely increased landings), the most important benefits of this Plan relate to development of the more comprehensive long-term management program for the Atlantic groundfish complex. The Plan will achieve these benefits by creating an environment in which the Council will be able to concentrate its groundfish planning activities on the long term rather than the short term, and in which data collection activities can be improved through greater cooperation from fishermen. In the long term, a management program which addresses the needs of the entire multi-species fishery, including all types of fishing gear and practices, will provide benefits to the whole of the New England and Mid-Atlantic fishing industry.

The important costs of implementing this Plan relate to the long term viability of the resource, and cannot be quantified in monetary terms. If excessive levels of fishing pressure were allowed to continue indefinitely, it is likely that at some point fish stocks could be reduced to a point where reasonable fisheries could not be conducted for a period of time. What that point would be, and the length of time it would take to rebuild stocks thereafter, depend on future recruitment to the spawning stock, which cannot be predicted or quantified. As happened when fishing stocks collapsed in the late 1960's and early 1970's, the costs of a stock collapse are borne throughout the fishing industry.

The Plan balances these the potential benefits and costs to provide some protection to the stocks while a long term management program is being devised. None of the considered alternative approaches provides both the short term financial benefits to the industry and the long term benefits of being more able to devise a comprehensive management program, without providing greater costs to the industry (in terms of foregone catches) or unreasonable risk to the fishery resources. In striking this balance, therefore, the Plan adopts the altenative which involves the least net cost to society.