AMENDMENT #2 TO THE

FISHERY MANAGEMENT PLAN

FOR THE

ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERIES

June 1985

Mid-Atlantic Fishery Management Council

in cooperation with the

National Marine Fisheries Service

New England Fishery Management Council

and the

South Atlantic Fishery Management Council

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2. SUMMARY

The Fishery Management Plan for the Atlantic Mackerel, Squid, and Butterfish Fisheries (FMP) modified by this Amendment was implemented on 1 April 1983 for a period ending 31 March 1986. This Amendment would extend the FMP for an indefinite period of time, or until amended.

The management unit is all Atlantic mackerel, *Loligo pealei*, *Illex illecebrosus*, and butterfish under US jurisdiction, excluding the Gulf of Mexico and the Caribbean Sea.

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the US commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

Fishing Year

The fishing year for Atlantic mackerel, *Illex*, *Loligo*, and butterfish is the twelve (12) month period beginning 1 January.

Squid Bycatch TALFFs

The FMP provides minimum bycatch Total Allowable Level of Foreign Fishing (TALFF) allowances. The bycatch TALFFs are changed by the Amendment. The *Loligo* bycatch TALFF is changed to 1.0% of the allocated portion of the *Illex*, 0.04% of the allocated portion of the mackerel (if a directed fishery is allowed), and 0.5% of the allocated portions of the silver and red hake TALFFs. The *Illex* bycatch TALFF is changed to 10.0% of the allocated portion of the *Loligo* TALFF and 0.2% of the allocated portions of the silver and red hake TALFFs.

Atlantic Mackerel

The Regional Director (RD), in consultation with the Mid-Atlantic Fishery Management Council (Council), determines annual specifications relating to Initial Optimum Yield (IOY), Domestic Annual Harvest (DAH), Domestic Annual Processing (DAP), Joint Venture Processing (JVP), and TALFF. The Council and RD review yearly the best available biological data pertaining to the stock. Allowable Biological Catch (ABC) in US waters for the upcoming fishing year is that quantity of mackerel that could be caught in US and Canadian waters (T) minus the estimated catch in Canadian waters (C) and still maintain a spawning stock size (S) in the year following the year for which catch estimates and quotas are being prepared equal to or greater than 600,000 mt.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on biological and economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. Ordinarily, IOY will be specified so that the fishing mortality rate associated with T is less than or equal to $F_{0.1}$. However, if development of the US fishery requires a fishing mortality rate greater than $F_{0.1}$, but still less than or equal to ABC, IOY may be set at the higher level. This modification will be for the fishing year only, and will revert to $F_{0.1}$ unless modified again in subsequent years. Such development requirements are intended to be limited to catch by US fishermen for US processing and to such over the side joint ventures and directed foreign fishing as has a clear and significant (not token) benefit to the US fishery in terms of increases in the amount of US harvested and processed mackerel. This deviation from F0.1 is intended to allow the US fishing industry the opportunity to market additional mackerel into the world market during high demand periods such as may occur if a stock problem with the northeastern European Atlantic mackerel stocks developed. Determining these allocations involves estimating both the US and foreign harvesting potential.

The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing data concerning past domestic landings, projected amounts of mackerel necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The recreational fishery component of DAH is determined by the equation $Y = (0.01)(X) - (166)$ where Y is the predicted recreational catch and X is the mackerel spawning stock size in the upcoming fishing year, in metric tons (Section 7.2). The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD must provide for a TALFF of at least a minimum bycatch of mackerel that would be harvested incidentally in other directed fisheries. This bycatch level is 0.4% of the allocated portion of the silver and red hake, 1.0% of the allocated portion of the *Loligo*, and 0.1% of the allocated portion of the *Illex* TALFFs (Section 7.3). In addition, this specification of IOY is based on such criteria as contained in the Magnuson Act, specifically section 201(e), and the application of the following factors:

1. total world export potential by mackerel producing countries;
2. total world import demand by mackerel consuming countries;
3. US export potential based on expected US harvests, expected US consumption, relative prices, exchange rates, and foreign trade barriers;
4. increased/decreased revenues to the US from foreign fees;
5. increased/decreased revenues to US harvesters (with/without joint ventures);
6. increased/decreased revenues to US processors and exporters;
7. increases/decreases in US harvesting productivity due to decreases/increases in foreign harvest;
8. increases/decreases in US processing productivity; and
9. potential impact of increased/decreased TALFF on foreign purchases of US products and services and US caught fish, changes in trade barriers, technology transfer, and other considerations.

Proposed annual specifications of the ABC and IOY and its component amounts are published in the *Federal Register* and provide for a public comment period. At the close of the public comment period, a notice of final annual specifications with the reasons therefore are published in the *Federal Register*.

The IOY may be adjusted by the RD, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs, including when the application of the above factors warrants an adjustment in TALFF. However, TALFF may not be adjusted to a quantity less than that already allocated to and accepted by foreign nations or less than that needed for bycatch. Any adjustments to the IOY are published in the *Federal Register* and may provide for a public comment period.

Butterfish

Butterfish maximum OY is 16,000 mt. The RD in consultation with the Council, determines annual specifications relating to IOY, DAH, DAP, JVP, and TALFF. The RD reviews yearly the most recent biological data, including data on discards, pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower ABC for the fishing year. This level represents essentially the modification of the MSY to reflect changed biological circumstances. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC. The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing the data concerning past domestic landings, projected amounts of butterfish necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD provides for a bycatch TALFF equal to 3.0% of the allocated portion of the *Loligo* TALFF and 0.5% of the allocated portion of the *Illex*, 0.08% of the allocated portion of the Atlantic mackerel, and 0.1% of the allocated portion of the silver and red hake TALFFs (Section 7.3). Note that the nine factors considered in establishing IOY for the squids and mackerel do not apply for butterfish because the butterfish TALFF is established for bycatch only in accordance with the preceding percentages.

Proposed annual specifications of the ABC and IOY and its component amounts are published in the *Federal Register* and provide for a public comment period. At the close of the public comment period, a notice of final annual specifications with the reasons therefore are published in the *Federal Register*.

The IOY may be adjusted by the RD, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs. However, TALFF may not be adjusted to a quantity less than that needed for bycatch. Any adjustments to the IOY are published in the *Federal Register* and may provide for a public comment period.

US Fishing Vessel Permits

The requirement that US vessels have permits for the mackerel, squid, and butterfish fisheries is continued, but permits expire on 31 December of each year. The permits of vessel participating in the fishing vessel record program will be renewed automatically. Permits may be revoked for violations of this FMP.

Foreign Fishing Areas and Seasons

Foreign nations fishing for Atlantic mackerel, squid or butterfish shall be subject to the time and area restrictions in 50 CFR 611.50 and the fixed gear avoidance regulations in 50 CFR 611.50(e).

Alternatives to the adopted FMP are discussed in Appendix 1 of the Amendment.

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APPENDICES

4. INTRODUCTION

4.1. HISTORY OF DEVELOPMENT OF THE FMP

In March, 1977, the Council initiated development of the Mackerel and Squid FMPs. The Council adopted the Mackerel FMP for hearings in September 1977 and the Squid FMP for hearings in October 1977. Hearings on Mackerel and Squid FMPs were held in December, 1977. The Mackerel and Squid FMPs were adopted by the Council in March 1978. The Mackerel FMP was submitted for NMFS approval in May 1978. The Squid FMP was submitted for NMFS approval in June 1978. However, based on NMFS comments, the Council requested that the Mackerel and Squid FMPs be returned.

The FMPs were revised, the revisions being identified as Mackerel FMP Supplement #1 and Squid FMP Supplement #1. These two Supplements, along with the original Butterfish FMP, were adopted for public hearings by the Council in July of 1978. Hearings on all three documents were held during September and October 1978 and all three FMPs were adopted in final form by the Council in November 1978. The Butterfish FMP was submitted for NMFS approval in December 1978. Mackerel FMP Supplement #1 and Squid FMP Supplement #1 were submitted for NMFS approval in January 1979. NMFS approved Squid FMP Supplement #1 in June 1979 and Mackerel FMP Supplement #1 in July 1979. Both FMPs were for fishing year (1 April - 31 March) 1979-80.

The Butterfish FMP was disapproved by NMFS in April 1979 because of a need for additional justification of the reasons for reducing OY below MSY. The Butterfish FMP was revised, adopted by the Council, and resubmitted for NMFS approval in June 1979. It was approved by NMFS in November 1979 for fishing year 1979-80.

The Council adopted Amendments #1 to both the Mackerel and Squid FMPs for hearings in August 1979. Hearings were held during October 1979. The Amendments were adopted by the Council and submitted for NMFS approval in November 1979. Both Amendments were approved by NMFS in March 1980. This extended the Squid FMP for an indefinite time beyond the end of fishing year 1979-80 and extended the Mackerel FMP through fishing year 1980-81. Butterfish FMP Amendment #1, extending the FMP through fishing year 1980-81, was adopted by the Council for hearings in December 1979 with hearings held during January 1980. During January 1980 the Amendment was adopted in final form by the Council and submitted for NMFS approval. It was approved in March 1980.

The Council began work on an amendment to merge the Mackerel, Squid, and Butterfish FMPs in March 1980 the document being identified as Amendment #2 to the Mackerel, Squid, and Butterfish FMP. The Amendment was adopted by the Council for public hearings in August 1980. However, NMFS commented that there were significant problems with the Amendment that could not be resolved prior to the end of the fishing year (31 March 1981). The Council then prepared separate Amendments #2 to both the Mackerel and Butterfish FMPs to extend those FMPs through fishing year 1981-82. Since Amendment #1 to the Squid FMP extended that FMP indefinitely, there was no need to take this action for the Squid FMP. Those drafts were adopted for public hearing by the Council in October 1980 with hearings held in November. The Amendments were adopted in final form by the Council and submitted for NMFS approval in November 1980. Amendment #2 to the Mackerel FMP was approved by NMFS in January 1981 and Amendment #2 to the Butterfish FMP was approved by NMFS in February 1981.

In October 1980 the merger amendment, previously designated as Amendment #2, was redesignated Amendment #3. The Council adopted draft Amendment #3 to the Squid, Mackerel, and Butterfish FMP in July 1981 and hearings were held during September. The Council adopted Amendment #3 in October 1981 and submitted it for NMFS approval. NMFS review identified the need for additional explanation of certain provisions of the Amendment. The revisions were made and the revised Amendment #3 was submitted for NMFS approval in February 1982.

The Amendment was approved by NMFS in October 1982. However, problems developed with the implementation regulations, particularly with the Office of Management and Budget through that agency's review under Executive Order 12291. In an effort to have the FMP in place by the beginning of the fishing year (1 April 1983) the FMP, without the squid OY adjustment mechanism, or a revised Atlantic mackerel mortality rate, and redesignated as the Atlantic Mackerel, Squid, and Butterfish FMP, was implemented by emergency interim regulations on 1 April 1983. By agreement of the Secretary of Commerce and the Council, the effective date of those emergency regulations was extended through 27 September 1983.

The differences between the FMP and the implementing regulations resulted in a hearing before the House Subcommittee on Fisheries and Wildlife Conservation and the Environment on 10 May 1983.

Amendment #1 to the Atlantic Mackerel, Squid, and Butterfish FMP was prepared to implement the squid OY adjustment mechanism and the revised mackerel mortality rate. That Amendment was adopted by the Council on 15 September 1983, approved by NMFS on 19 December 1983, and implemented by regulations published in the Federal Register on 1 April 1984.

4.2. PROBLEMS FOR RESOLUTION

4.2.1. Introduction

Federal management of the mackerel,squid, and butterfish fisheries took a new direction with the merger of the FMPs for management of the three fisheries in 1982, and with adoption of Amendment #1 to the FMP for Atlantic Mackerel, Squid, and Butterfish in 1983. From 1978 to that time, the three fisheries were managed under separate FMPs which set DAH and other plan terms in a manner which was not conducive to growth and development of the US fisheries. The Atlantic Mackerel FMP (established a severe quota for) the US and established a bycatch TALFF for the foreign fishery to allow the depleted stock to rebuild. The squid fishery was managed through fixed annual quotas with set TALFFs and Reserves. The Butterfish FMP had a set US allocation and a set TALFF.

Through a series of amendments, including the merger of the three FMPs into one, management has continued to work toward the objectives of sound management of the resource and development of the US fishery. The extent to which those objectives are being achieved can be indicated by a review of sections 5 through 8. The current Amendment is designed not only to extend the FMP beyond its current sunset of 31 March 1986, but to attempt resolution of certain problems identified since implementation of Amendment #1. As noted below, the solution of certain problems was postponed for the next Amendment pending additional study which was not possible given the deadline on expiration of the current FMP.

After merging the management of the three fisheries and the adoption of terms that allowed more flexibility in setting of annual specifications in Amendment #1, the Council was able to undertake more controlled management of the three fisheries to maximize the opportunities for US growth and development in these fisheries. Over the past three years, domestic landings for the squids and butterfish have been higher than in the past (Tables 1 and 7). Substantial investments have been made in US vessels for operation in these fisheries (Section 8.1.1) and in some shoreside facilities. The FMP continues to provide for allocations to TALFF, but Council recommendations for TALFF are tailored to actual need in terms of bycatch amounts and to consistency with FMP goals where directed fisheries are involved. Proposals by foreign partners for joint ventures or other joint enterprises have increased and become more competitive in the past three years, and have been subject to close scrutiny by the Council (Section 9.1.2.3.2) and debated at length by industry members and the public at Council and committee meetings.

A number of the terms below are made to continue the approach adopted in Amendment #1, to revise terms not yet changed to reflect the current management strategy and to improve the operation of existing terms to achieve the FMP's objectives. Among the proposed terms falling in this category are revisions to the annual specification of terms in the mackerel and butterfish fisheries, revision of bycatch TALFF percentages, permit and data collection requirements to improve the data base on which the FMP operates, and terms directed toward making partners in US/foreign joint ventures or joint enterprises more accountable with regard to promises made to gain favorable recommendations for their permit applications. The change in the fishing year from the period 1 April to 31 March to a calendar year is intended to ease administration burdens of making and reviewing such applications. Other proposals revise terms in light of recently acquired scientific information. Changes in the mackerel regime to revise the spawning stock guideline from 400,000 mt to 600,000 mt per year and modification of the recreational catch formula fall into this group. The adoption of a butterfish minimum count term was adopted based on recent scientific and statistical information which projects a potential resource problem with continued harvests of large amounts of small butterfish. A more detailed discussion of the problems addressed follows. The terms are specified in Section 9.1 and evaluated in Section 9.2.

4.2.2. Mackerel Regine

The Council considered a number of issues related to the Atlantic mackerel regime in order to improve the management of that fishery and to update the derivation of specifications based on more recent scientific information and analysis. As described in Section XII.E. of Amendment #1 to the FMP, the specifications for OY, TALFF, and DAH were based on a complicated two case procedure depending on whether the resulting stock size would be over or under the spawning stock size reference of 400,000 mt. The recreational catch forecasting formula was expressed as $Y = (0.01)(X) + 180$ based on analysis of information available at that time.

The essential provisions of Amendment #1 are presented as Alternative 2 (Appendix 1) of this Amendment #2. Changes have been made to many of these components as described in the following sections.

4.2.2.1. Development of the US Mackerel Fishery

The mackerel regime is currently not designed to enhance the development of the US fishery as is the squid regime. Briefly, the mackerel regime includes a Reserve to allow for adjustments to DAH during the year, with the unused portion of the Reserve allocated to TALFF toward the end of the year. The effect of the current mackerel regime is that foreign nations can essentially control the magnitude of the DAH and consequently TALFF and Reserve. Since OY is set based on biological data and DAH is made up of the projected recreational catch, the US catch for domestic markets and export, and US joint venture catch, by minimizing joint ventures and export purchases, foreign nations can effectively reduce DAH, thus increasing the difference between OY and DAH, and thereby leading to a larger initial TALFF and a larger transfer from Reserve to TALFF during the year. While this problem has not yet become discernable since demand for US Atlantic mackerel has been relatively small in the recent past (Table 4), there is a possibility that declines in European mackerel stocks (Section 9.2.2.5) may increase this demand.

This problem relates directly to the attainment of Objective 2. In the original Butterfish FMP, the Council and, by approval of the FMP, the Commerce Department, established the principle of using the specification of OY as a tool to help in the development of the US commercial fishery. The principle was based on the concept that foreign nations will not purchase fish from US harvesters or processors if they are allowed to harvest them directly. It has always been recognized that lower TALFFs will not automatically develop export markets for US caught fish, however, the higher TALFFs were felt to minimize opportunities for the US industry to develop export markets. This concept was introduced into the squid regime with the current FMP, which allows for in season adjustments to OY, DAH, DAP, and TALFF in response to events that aid development of the US fishery.

In the past Reserves were used in the squid regime, but were replaced with a procedure that allows for adjustments to DAH and TALFF during the year based on developments in the fishery and evaluation of specific criteria designed to determine whether TALFF adjustments are in the best interest of the US fishery. If the mackerel fishery is to develop, it is necessary that the policy upon which the squid regime is based be applied to the mackerel fishery.

The problem is that the automatic division of the difference into TALFF and Reserve and the time related review of US fishery performance can create problems because of its inflexibility. With the current FMP, the squid OY and estimates of DAH are set annually and may be increased during the year, so those values are flexible in that they may be adjusted during the year to reflect the dynamic character of the fishery. The TALFF and Reserve provisions do not have this flexibility and thus, present an impediment to the efficient operation of development efforts. The purpose of the Magnuson Act (Section 2b(3) and (6)) and this FMP is to develop the US fishery while recognizing that a significant part of such development, particularly in the short run, involves arrangements with foreign nations to purchase US harvested and processed fish, with incentives to the foreign nations provided by preferential allocations from TALFF. To do this effectively requires the ability to adjust OY and DAH during a year in response to changing economic conditions.

It is recognized that reducing availability of mackerel to foreign nations will not automatically lead to development of the US fishery. However, if there are no incentives for the foreign nations to help develop the US fishery, the chances of development (at least of export markets) are negligible. This was recognized in the recent amendments to the Magnuson Act, which made the efforts of foreign nations to help the US industry a consideration when making TALFF allocations.

The revised mackerel regime is presented in Section 9.1.1.4 and evaluated in Sections 9.2.2.4 and 9.2.2.5.

4.2.2.2. Mackerel Recreational Catch Forecasting Equation

For purposes of determining the recreational fishery component of the annual DAH, the FMP relies on an equation that projects recreational catch based on spawning stock size. A number of recreational fishery surveys have been conducted since the equation was developed. Therefore, it was necessary to review the equation in light of the recent survey findings to determine whether the equation is adequate or needs to be respecified. The revision is discussed in Section 7.2 with the revised management term specified in Section 9.1.1.4.

4.2.2.3. Revision of Mackerel Minimum Spawning Stock Size

The FMP with Amendment #1 provides for a mackerel minimum spawning stock size of 400,000 mt below which allowable catch levels are significantly reduced. Anderson (1985) examined the stock recruitment relationship for mackerel and found the relationship between year class size at age 1 and spawning stock biomass that produced that year class (Figure 6) indicates a high probability of low spawning stock levels producing poor year classes and that there seemed to be a stock recruitment relationship sufficient to be of guidance for management purposes. This issue is discussed in Section 5.4.3. The revised management term is specified in 9.1.1.4 and evaluated in 9.2.2.5.

4.2.3. River Herring Bycatch in the Directed Foreign Mackerel Fishery

The foreign river herring fishery is managed through the Trawl Fisheries of the Northwest Atlantic PMP. The TALFF is 100 mt and is allocated for bycatch in other fisheries, primarily the mackerel fishery. The river herring TALFF is low because of the condition of the resource.

The Council has the preparation of a River Herring FMP on its long range schedule. The Atlantic States Marine Fisheries Commission (ASMFC) is preparing a river herring management plan which may serve as the basis of the Council's FMP.

The most significant (in terms of size of catch) mackerel fishery in the recent past has been the Polish fishery carried out primarily for research purposes. The average river herring bycatch in that fishery for the last three years has been 3% of the mackerel catch (Section 7.3.2). There is some indication that the river herring bycatch increases as the fishery moves closer to shore, although a complete analysis of this is currently under way.

The river herring fishery was an inshore US fishery until the late 1960s when foreign fleets entered the fishery. The US catch averaged 24,800 mt between 1963 and 1969. A downward trend began in 1969, with the 1983 catch 4,100 mt. Data from the NEFC spring and autumn bottom trawl surveys from the Gulf of Maine to northern New Jersey indicate that stock levels have been relatively stable since 1968. Data from the spring bottom trawl surveys between northern New Jersey and Cape Hatteras indicate an increase in river herring biomass since 1975 (USDC, 1984a).

While the intent is not to regulate river herring as part of this FMP, the river herring situation poses a significant problem, particularly with regard to the development of the mackerel fishery. If the mackerel fishery develops only with US vessels, the river herring catch will likely increase but it will have no regulatory significance since the PMP does not manage the US fishery. However, the most likely case is that the fishery will develop initially through joint ventures, probably with related directed foreign fisheries. If the latter situation prevails, if the river herring TALFF remains 100 mt, and if the 3% bycatch relationship continues, there is clearly a problem relative to foreign catches in the development of the US fishery. If the only river herring catch by foreign vessels is bycatch in the mackerel fishery, if the foreign catch amounts to 3 mt of river herring for every 100 mt of mackerel, and if the river herring TALFF is 100 mt, then the total allowed foreign mackerel catch cannot exceed 3,333 mt. While this might represent a worst case situation and additional analyses are needed, there is a problem that, if it cannot be solved, at least must be recognized in the development of the mackerel fishery.

The Council has determined to not resolve this problem as part of Amendment #2 because of the relationship of such solution to river herring management and the progress of the ASMFC Shad and River Herring Plan. The Council will continue to study this issue and will incorporate appropriate changes in the next Amendment.

4.2.4. Joint Venture Policy

The FMP currently provides for joint ventures but does not contain a policy framework concerning, for example, review procedures and priority criteria. The Council adopted a policy concerning the review of joint venture proposals after the FMP was implemented. The New England Council adopted a joint venture policy virtually identical to that of the Mid-Atlantic Council. In order to eliminate possible confusion between the provisions of the FMP and the joint venture policy, consideration should be given to including some or all of the Council's joint venture policy in the FMP (Sections 9.1.2.3.2 and 9.1.2.5). The schedule for setting annual ABC, OY, DAH, etc. and the review of joint venture proposals are another part of this problem.

4.2.5. Biological Sensitivity of Butterfish Regime

The FMP currently allows an annual butterfish catch (US and foreign combined) of up to 16,000 mt. There is no provision to reduce that maximum for biological reasons. The only way to reduce the maximum allowable catch for biological reasons is by amending the FMP, which, because of the time needed to prepare and secure approval of an amendment, is not an acceptable way of dealing with stock problems. The NEFC butterfish stock assessment methodology has been improved so that data are now available to make year to year adjustments in the allowable catch to reflect changing stock conditions. The mackerel and squid regimes are both biologically sensitive in that the maximum allowed catch in any year is set based on the latest available stock assessment information. A similar system should be established for butterfish to allow for adjustments to the allowable catch to reduce the chances of overfishing on an annual basis (Sections 9.1.1.5, 9.1.2.5, 9.2.2.6, and 9.2.2.7). Fortunately, the butterfish stock has been robust so the need to reduce allowable catch levels has not developed to date. However, should a problem develop, it seems more appropriate to have a measure in place to deal with it rather than being faced with an amendment to the FMP, be it emergency or otherwise (i.e., an ounce of prevention is worth a pound of cure).

This problem increases in importance as the fishery develops. In 1984 the adjusted nominal catch was 15,977 mt (Table 7), essentially equal to MSY. Given that the fishery has developed to a level equal to MSY, it is even more important to be able to reduce the allowable catch to account for stock problems.

Note that these revisions to the system do not relate to the allocation of the catch following development of the biologically acceptable maximum for the year. For example, for the squids, the Allowable Biological Catch (ABC) is set based on stock assessment information. However, the OY for the year is set equal to or less than that quantity based on policy considerations relative to the development of the US fishery. For butterfish, a system to set the allowable biological catch for any year would not change the policy that the TALFF is set at the bycatch level or that the catch by US fishermen is limited only by the allowable catch level minus the bycatch TALFF.

4.2.6. Large Catch of Small Butterfish

Another consideration for butterfish management is the length frequency of fish in the catch. During 1983 and 1984 there was a significant catch of small butterfish resulting from a very strong 1983 year class. The NEFC estimates that the 1983 year class was the strongest year class (Table 8) since 1968 when calculations of indices of butterfish relative abundance were initiated. However, the combination of large landings in the latter half of 1983 and 1984 (Table 7) and the high discard (30-80% of the catch on a per vessel basis; Anderson, pers. comm.) of these small fish has generated great concern over the future health of this year class. Whether this problem will be repeated in the future depends on future year class strengths and fishing patterns, but the full potential of the butterfish stock can be realized by US fishermen only if a harvesting strategy is followed which will permit fish to grow to an optimal size before being caught (Sections 5.3.4, 5.4.4, 9.1.1.5, 9.1.2.5, and 9.2.2.7). Information is not yet available to assess the impact of these discards on the health of the 1983 year class or on future year classes.

4.2.7. Fishing Year

The FMP currently operates on an 1 April - 31 March fishing year. It has been suggested that the fishing year should be revised to be the same as the calendar year (Sections 9.1.1.1 and 9.2.2.3).

The fishing year was originally set primarily to reflect the historical foreign fishing season, which generally extended from October through March. It must be remembered that policy at that time led to OY and DAH estimates set in the FMP, with allocations to TALFF of any part of the OY not harvested by US fishermen, either by transfers from DAH to TALFF or through the Reserve systems. Hence, it was necessary to have a schedule that allowed US fishermen to have a chance to catch the fish prior to any allocation to TALFF. That problem has been eliminated in the squid and butterfish regimes and will be addressed in this Amendment for mackerel (Section 4.2.2). Therefore, the reason for the fishing year specification probably no longer exists.

One of the perceived problems with the fishing year relates to the directed foreign *Loligo* fishery. Foreign fishing is allowed from October through March. There is reason to believe that the *Loligo* begin their inshore migration so that the end of the foreign fishery is directed on the incoming schools even though the fishery is technically on the end of the fishing year's allocation. Fishermen report that these squid are easier to catch because of the schools and are larger. A significant foreign fishery on the *Loligo* making their inshore migration is believed to decrease availability of the squid to US fishermen who fish primarily inshore in the spring. However, the solution to this problem may involve changing the allowed foreign fishing season in addition to changing the fishing year in the FMP. That is, no matter when the fishing year begins and ends, if a directed foreign fishery is allowed during the spring inshore migration, the potential availability problem exists. The Council will change only the fishing year at this time. If this action does not solve the problem, the seasons may be changed in the next amendment.

Changing the fishing year to match the calendar year would resolve administrative problems. The foreign trawl fishery in the northwest Atlantic involves Atlantic mackerel, squid, and butterfish (managed by this FMP), silver and red hake (currently managed by a PMP), and other finfish (managed by the Trawl Fisheries of the Northwest Atlantic PMP). The hakes and other finfish are managed on a calendar year basis. The system for permitting foreign fishing vessels also operates on a calendar year basis. In some cases this has resulted in joint ventures applying for two permits for the same project, effectively doubling the work of the applicants, State and Commerce Departments and Councils in review and related work.

Given current US fishing patterns, changing the fishing year to the calendar year would not impact the *Illex*, *Loligo*, or mackerel fisheries (Tables 13 and 17). However, the butterfish fishery is changing to move closer to the historical foreign season, i.e., the end of one calendar year and the beginning of the next (Table 21). If the US fisheries for the squids and mackerel are to expand to take a greater proportion of the allowed catch, it is logical that they will need to fish offshore in the winter, approximating the historical foreign season. However, given the current systems for setting OY, DAH, and TALFF, changing the fishing year to the calendar year should not affect this.

Based on its problem analysis, the Council concluded that the primary reason for adherence to the 1 April through 31 March fishing year no longer exists, that the administrative advantages of putting the fishing year on the same cycle with other associated procedures are substantial, and that the impacts would be minimal of moving the potential time for closures from the period January through March to the period October through December are minimal. In light of their conclusions the Council proposed a change in the fishing year to a calendar year, 1 January through 31 December (Section 9.1.1.1). The details of the administrative cost savings and the impacts on existing fishing patterns are discussed in Section 9.2.2.3.

4.2.8. Foreign Bycatch Percentages

The FMP sets minimum bycatch TALFF allocations based on historical performance of the directed foreign fishery. It is necessary to review recent data to determine whether the percentages are appropriate at this time. Such an examination is necessary to assure that the FMP is based on the best available data and to assure that bycatch TALFFs are not excessive based on current performance in the fishery. Bycatch performance is discussed in Section 7.3.2, the changes to the bycatch TALFFs are presented in Sections 9.1.1.2, 9.1.1.3, 9.1.1.4, and 9.1.1.5, and the changes are evaluated in 9.2.2.4.

4.2.9. Permit Requirement and Data Collection

The FMP contains a requirement that US fishermen obtain a permit from NMFS to fish for mackerel, squid, or butterfish. The permit requirement has been included in the FMP since its inception and was originally coupled with a logbook requirement. The intent was that the permit data would provide information on the characteristics of the vessels in the fishery and constitute the universe of vessels that would supply logbook data. Not all permitted vessels would fish, but those that did would submit logbooks and the logbook data could be analyzed in conjunction with the permit data to develop information on the US fishery.

However, the logbook requirement was never implemented by NMFS and was removed from the FMP when it was believed that the NEFC Three Tier System would meet the data needs of management. Since permits are free and there are no eligibility requirements (except for the Mid-Atlantic surf clam fishery), most fishermen apparently apply for permits in all fisheries, with the result that the permit file supplies no useful data on the mackerel, squid, or butterfish fisheries. In addition, permits are issued on a permanent basis, so there is no way to know if a vessel operator that at one time may have had an interest in one of the fisheries still has that interest. It is likely that the only productive use of the permit file at this time is that it provides NMFS with a partial mailing list of potentially interested fishermen.

The Council's Scientific and Statistical Committee (SSC) analyzed the data needs for effective fishery management in a report submitted to the Council in December 1983. The following quotations are from this Council endorsed report:

> "Squid: Capacity data was rated highest under the economic heading because of the recent focus on developing a US export market. Quantitiative data on US harvesting and processing capacities, and domestic and foreign demand analyses will have the greatest impact on managing the future of this fishery.

"Catch and fishery-independent survey categories were ranked highest for squid. Catch data (domestic and foreign) are necessary to monitor stock removals. F/NEC trawl survey represents the only means of monitoring abundance. Length samples from commercial catches are necessary for estimating cohort mortality rates.

"Mackerel: Management of the mackerel fishery involves domestic and foreign commercial harvests and markets, as well as a large recreational harvesting component. Given the number of allocation decisions which must be made, all economic data categories are close in importance. However, cost data and recreational value data would permit a preliminary analysis of the economic impacts of alternative allocation decisions.

"Current management of mackerel is based on catch quotas. All four biological categories were given the highest ranking. Absence of any of these elements seriously impedes the ability to adequately assess the status of mackerel. This would prevent NMFS from providing reliable projections of catch and stock size necessary for determining optimum yield.

"Butterfish: Capacity and cost data head the list of economic data because of the developing export market. Analyses using these data are useful in measuring trade- offs between foreign fishing/joint ventures and domestic production.

"Current butterfish management is based on an optimum yield for each fishing year. All biological categories were equally important for reasons similar to those stated for mackerel."

The SSC's detailed analysis of data needs, including uses, user groups, data sources, and comments on quality and availability are presented in Table 34. These recommendations are similar to those presented in "Economic and Biological Data Needs for Fisheries Management with Particular Reference to the New England and Mid-Atlantic Areas" (Table 35, USDC, 1980). Reference also should be made to 303(a)(5) of the MFCMA which specifies "the data which shall be submitted to the Secretary with respect to the fishery including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish and weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual processing capacity utilized by Unitedc States fish processors".

While the existing systems may collect some (if not all) of the data, there are significant problems with regard to retrieval. One problem relates to the fact that vessel identification information is currently removed from the records and replaced with random numbers that are generated anew each month. Hence, it is impossible to determine how many vessels are in the fishery as required by 303(a)(20 of the MFCMA, the extent to which the vessels are dependent on the fishery, any seasonality of participation, other species that are important to vessels participating in the fishery, and other issues that are critical to evaluating the impacts of proposed management measures or of monitoring the effects of implemented measures. Another retrieval problem relates to data access. The existing logbook system permits real time access whereas Council requests from the Three Tier System can take months to fill. While real time access is not always necessary, the delays experienced with the Three Tier System are unacceptable.

The revised terms are specified in Sections 9.1.2.1 and 9.1.3 and evaluated in Sections 9.2.2.1 aand 9.2.2.2.

4.2.10. Foreign Fishing Regulations

Foreign fishing under this FMP is regulated by the NMFS foreign fishing regulations for the trawl fishery of the northwest Atlantic (as opposed to the regulations that govern the foreign long line fishery). Those regulations include a reporting system, gear requirements, and fishing seasons and areas. The regulations were implemented with the implementation of the Magnuson Act in 1977 and have had minor revisions.

While the foreign fishing regulations have not changed materially, exceptions to the regulations (particularly the area restrictions) are not uncommon as part of joint venture arrangements (Section 9.1.2.2). For example, mackerel joint ventures may include a provision for a directed foreign fishery in conjunction with foreign purchases from US vessels at sea or from US processors, with the directed foreign fishery allowed outside the foreign fishing areas but no closer to shore than some specified distance.

However, the foreign fishery has changed dramatically as a result of reduced TALFFs which has resulted in significantly fewer foreign vessels fishing in the northwest Atlantic FCZ. Additionally, US observers must now be embarked on all foreign vessels when they are fishing in the FCZ. The Council has adopted a policy that the foreign fishing areas could be eliminated when full observer coverage was implemented.

The Council has two positions at this time as to revisions to the time and area restrictions: (1) they are continuing to work on a long term policy, but need more refinement, particularly in the area of mackerel joint ventures and the river herring issue; and (2) they support exemptions on a case by case basis as done in the recent past on an *ad hoc* basis and have included a measure (Section 9.1.2.2) to clarify the procedures.

4.2.11. Silver and Red Hake

Silver and red hake are currently managed together in a separate PMP. Historically the foreign trawl fishery involved the hakes along with mackerel, squid, and butterfish. In the recent past there has been no significant directed foreign fishery for the hakes. The foreign hake fishery is accounted for in this FMP through the bycatch percentages.

For 1983 the total allowable catch of silver hake from Georges Bank was 25,000 mt and the actual catch was 1,200 mt, 1,100 mt by US fishermen. The allowable catch from the southern New England/Mid-Atlantic area in 1983 was 30,000 mt, with an actual catch of 14,400 mt, 10,900 by US commercial fishermen and 3,000 by US recreational fishermen (USDC, 1984a). The long term potential catch is estimated at 80,000 mt from Georges Bank and 47,600 mt from southern New England/Mid-Atlantic (USDC, 1984a).

The Gulf of Maine silver hake fishery is not regulated by the PMP and it has an estimated catch in 1983 of 4,800 mt, all by US commercial fishermen. The estimated long term potential yield from the Gulf of Maine silver hake resource is 26,300 mt.

For red hake in 1983, the Georges Bank allowed catch was 6,000 mt and the actual catch was 100 mt, while the southern New England/Mid-Atlantic allowed catch was 16,000 mt and the actual catch was 1,800 mt (1,300 mt by US commercial fishermen and 500 mt by US recreational fishermen). The long term potential catch is estimated at 15,500 mt from Georges Bank and 26,000 mt from southern New England/Mid-Atlantic (USDC, 1984a).

The US hake fishery has a development potential similar to mackerel, squid, and butterfish. There is a potential for joint ventures (even with the current PMP). However, under PMP management joint ventures that involve the hakes and, perhaps, mackerel or squid, may be complicated because the Councils do not have a direct role in fisheries covered by PMPs. Given the historical relationship of the foreign fishery between the hakes and the species included in this FMP and the underdeveloped nature of the US hake fishery, it may be appropriate to include silver and red hake in the management unit of this FMP.

The Council has determined to not resolve this problem as part of Amendment #2 because of the need for extended review of the advantages and disadvantages of managing the hakes as part of this FMP or through a separate FMP. The Council will continue to study this issue and will incorporate appropriate changes in the next Amendment.

4.3. MANAGEMENT OBJECTIVES

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the US commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

4.4. MANAGEMENT UNIT

The management unit is all Atlantic mackerel, *Loligo pealei*, *Illex illecebrosus*, and butterfish under US jurisdiction, excluding the Gulf of Mexico and the Caribbean Sea.

5. DESCRIPTION OF STOCKS

5.1. SPECIES AND THEIR DISTRIBUTION

5.1.1. *Loligo*

Known by the common names of long-finned squid, winter squid, common squid, and bone squid, *Loligo pealei* is one of five Atlantic species of the genus *Loligo* of the squid family *Loliginidae*. *Loligo pealei* ranges over the continental shelf from as far north as New Brunswick (Summers, 1969) to the Gulf of Mexico. However, primary concentrations (Figure 1) occur from Georges Bank to Cape Hatteras (Serchuk and Rathjen, 1974). *L. pealei* probably forms one stock which migrates on and offshore as much as 200 km seasonally, generally remaining in waters where the temperature is greater than about 46 F (Lange and Sissenwine, 1980).

Seasonal differences in geographic and bathymetric distribution of *Loligo* are evident and appear to be related to bottom water temperatures. During winter, when water is coldest inshore, the bulk of the population concentrate along the outer edge of the continental shelf in 46-54 F waters (Summers, 1967; Vovk, 1969). From late spring to early autumn the species disperses from the shelf edge into shallow coastal waters with heaviest concentrations usually occurring in the Cape Hatteras, New York Bight, and Nantucket Shoals areas. During summer, however, concentrations of *Loligo* may occur anywhere on the continental shelf. This dispersion is part of a spring inshore spawning migration which begins in the southern areas and as water temperatures rise, proceeds northward along the coast. By April or May, mature squid arrive in Massachusetts waters with smaller immature individuals arriving in May and June. During late spring and summer, *Loligo* may be found in harbors and estuaries, particularly in southern New England. In the fall, concentrations appear in the southern New England and Hudson Canyon area (ICNAF 5Zw and 6A; Figure 2) in water less than 360' deep (Rathjen, 1973; Serchuk and Rathjen, 1974; Tibbetts, 1975). Vovk (1969) also found large fall concentrations of long-finned squid in the area between Block Island and southern Georges Bank. In late autumn they move offshore to overwinter along the edge of the continental shelf.

Loliginid squid show a diurnal cycle of vertical migration moving up in the water column at night. Catches of *L. pealei* (Summers, 1969; Serchuk and Rathjen, 1974; and Lux *et al.*, 1974) taken by bottom trawl show a decline at night. It is thought that the vertical migration of *L. pealei* may be associated with the pursuit of food organisms such as euphausids (Serchuk and Rathjen, 1974).

L. pealei usually spawn in shallow waters between Chesapeake Bay and southern Cape Cod. A six-month (May-October) spawning season (Lange, 1984a) which extends through the warmer half of the year is indicated by the annual cycle of sexual maturation of *Loligo*, with peaks in May and to a lesser extent in October, resulting in two distinct cohorts in most years (Lange, 1984a). Mesnil (1976) proposed a concept of two crossed life cycles for *Loligo pealei* based on various size groups found during research surveys and inferences to similar life cycles for *Loligo vulgaris* and the cuttlefish *Sepia officinalis* in the northeast Atlantic (Section 5.3.1).

5.1.2. *Illex*

The summer or short-finned squid (*Illex illecebrosus*) is one of three species of *Illex* found in the northwest Atlantic. It is also found in the eastern Atlantic where it ranges from Scandinavia southward to the Bristol Channel (southwest England) and westward to the Faroe Islands and Iceland. In the western Atlantic, north of Cape Canaveral it is possible that *I. illecebrosus* is the only *Illex* species taken in significant numbers (Voss and Brakoniechi, 1984). It is primarily distributed between Newfoundland and Cape Hatteras (Lange, 1984b). However, it is most abundant in summer in the Gulf of Maine and in the Newfoundland region (Mercer, 1965).

I. illecebrosus undergoes seasonal migrations. During the spring and summer, they migrate into coastal waters about 30-50' deep off Newfoundland and Nova Scotia and onto the continental shelf in the New England and Mid-Atlantic areas and may form large surface schools. This inshore movement may be in response to temperature and salinity preferences, and off Canada may be due to their pursuit of capelin (*Mallotus villosus*) which also move inshore at this time. In late fall (October-December) short-finned squid move offshore to the edge of and beyond the continental shelf where they spawn (Figure 3). Spawning occurs in the deep waters of the continental slope during the winter and to some extent into spring. Spawning takes place between the Florida Peninsula and central New Jersey (Froerman, 1984), which is substantiated by the larvae distribution.

Unlike *Loligo*, *Illex* is not restricted to water above 46 F (Mercer, 1973). The optimum temperature range of *Illex* is about 45-59 F, although they were taken by Canadian research surveys on the Grand Banks at depths of 180-1,200' with bottom water temperatures of 33-46 F (Squires, 1957). However, large concentrations of short- finned squid are usually found along the edge of the continental shelf where temperatures are greater than 41 F (Tibbetts, 1975). Since *Illex* are often seen at the surface at night, their vertical movements must frequently be several hundred meters (Arnold, 1979).

Stock structure has not been fully determined (Lange, 1984b), although there is strong evidence that *I. illecebrosus* located off the US and Canadian coasts of Nova Scotia and Newfoundland may represent two components of a single stock (Hatanaka *et al.*, 1984).

5.1.3. Atlantic Mackerel

Atlantic mackerel (*Scomber scombrus*) is a fast swimming, pelagic, schooling species distributed between Labrador (Parsons, 1970) and North Carolina (Anderson, 1976a). The existence of separate northern and southern spawning contingents was first proposed by Sette (1950). The southern group spawns primarily in the Mid-Atlantic Bight during April-May while the northern group spawns in the Gulf of St. Lawrence in June-July. Both groups overwinter between Sable Island (off Nova Scotia; Figure 4) and Cape Hatteras in water generally warmer than 45 F (USDC, 1984a).

Both groups make extensive northerly (spring) and southerly (autumn) migrations to and from spawning and summer feeding grounds (Figure 4). The southern contingent begins its spring migration from waters off North Carolina and Virginia in March-April, and moves steadily northward, reaching New Jersey and Long Island usually by April-May, where spawning occurs. These fish may spend the summer as far north as the Maine coast. In autumn this contingent moves southward and returns to deep offshore water near Block Island after October (Hoy and Clark, 1967).

The northern contingent arrives off southern New England in late May, and moves north to Nova Scotia and the Gulf of St. Lawrence where spawning occurs usually by July (Hoy and Clark, 1967; Bigelow and Schroeder, 1953). This contingent begins its southerly autumn migration in November and December and disappears into deep water off Cape Cod.

Even though there are two spawning groups of mackerel in the Northwest Atlantic, biochemical (Mackay, 1967) and meristic (Mackay and Garside, 1969) studies have not established that genetic differences exist between them. These two contingents intermingle off southern New England in spring and autumn (Sette, 1950). Tagging studies reported by Beckett *et al.* (1974), Parsons and Moores (1974) and Moores *et al.* (1975) indicate that some mackerel that summer at the northern extremity of the range overwinter south of Long Island. Precise estimates of the relative contributions of the two contingents cannot be made (ICNAF, 1975). Both contingents have been fished by the foreign winter fishery and no attempt was made to separate these populations for assessment purposes by the International Commission for the Northwest Atlantic Fisheries (ICNAF), although separate Total Allowable Catches (TAC) were in effect for Subareas 5 and 6 and for areas to the north from 1973-1977. Since 1975 all mackerel in the northwest Atlantic have been assessed as a unit stock (Anderson, 1982). Thus, Atlantic mackerel are considered one stock for fishery management purposes.

5.1.4. Butterfish

Butterfish (*Peprilus triacanthus*) occur along the east coast of North America from Newfoundland to Florida (Hildebrand and Schroeder, 1928) and are commercially important between Cape Hatteras and southern New England (Waring and Anderson, 1983). This species has also been observed in deeper offshore waters off Cape Hatteras and Florida, and infrequently as far north as Prince Edward Island (Nichols and Breder, 1927; Murawski *et al.*, 1978).

Butterfish north of Cape Hatteras display definite migratory patterns in response to water temperature (Murawski *et al.*, 1978). The seasonal migration of butterfish is similar to that of scup (*Stenotomus chrysops*), Atlantic mackerel (*Scomber scombrus*), weakfish (*Cynoscion regalis*), and long-finned squid (*Loligo pealei*). Horn (1970), Waring (1975), and Fritz (1965) concluded that summer movements of butterfish are both inshore and northward. Butterfish south of Cape Hatteras evidence no strong inshore-offshore migrations (Murawski *et al.*, 1978)

Butterfish travel in small schools, usually near the surface when inshore during the warm months. Bigelow and Schroeder (1953) state that butterfish "seldom descend deeper than 15 to 30 fathoms during the summer," and the northern component of this stock spends winter and early spring offshore and near the bottom. Water temperature is probably the most significant factor affecting butterfish distribution. In winter and early spring (Figure 5) in the Mid-Atlantic area, butterfish appear in water 600- 675' deep, at the edge of the continental shelf (Horn, 1970; Bigelow and Schroeder, 1953). South of New York Bight, from New Jersey to the Chesapeake Bay, butterfish overwinter along the 600' contour (Heald, 1968). In the spring butterfish begin moving inshore until by summer they are distributed throughout the entire Mid-Atlantic and New England areas. Butterfish appear off Rhode Island by the end of April, at Cape Cod by May, and arrive in the Gulf of Maine usually by June.

5.2. ABUNDANCE AND PRESENT CONDITION

5.2.1. *Loligo* pealei

The provisional international catch of *Loligo* in US waters in 1984 was 21,594 mt (Table 1). The provisional international catch in 1983 was 27,663 mt, a 30% increase from 1982 and 29% above the 1968-1982 mean (Lange, 1984a).

The provisional US *Loligo* catch in 1984 was 10,565 mt (Table 1). The 1983 catch, taken primarily between May and September, totalled 15,943 mt, which represented a 192% increase from 1982 and almost an eight-fold increased from the 1968-1982 average. The 1983 catch included about 2,300 mt taken in joint ventures with foreign nations. The 1984 US catch was about 25% less than 1983 and included only about 760 mt from joint ventures. Catches by Japan, Italy, and Spain (Table 1) totalled 11,720 mt in 1983, a 26% decrease from 1982 and a 40% decrease from the 1968-1982 mean. Foreign catch in 1984 was 11,029 mt.

The 1983 autumn survey estimates (62,363 mt and 4.5 billion individuals) were 135% and 94% above the 1982 estimates and 86% and 32% above the 1967-1983 means (Table 2). The 1983 biomass estimate (derived by areal expansion; Lange, 1984a) was the highest of the time series, while the abundance was the fourth highest, indicating that a lower proportion of small individuals was taken in the 1983 survey. In fact, the proportion of the abundance index (number per tow) comprised of pre-recruits (less than or equal to 8 cm) decreased from 83% in 1982 to 67% in 1983, compared to the mean during 1967- 1983 of 85% (Table 2). The 1983 pre-recruit index (251.1 individuals per tow) was still 7% above both the 1967-1983 mean and median.

Preliminary estimates of minimum biomass and abundance from the 1984 autumn NEFC survey (36,927 mt and 2.5 billion individuals) were 41% and 43% below the 1983 levels but 10% above and 25% below the 1967-1983 means. The 1984 pre-recruit abundance index was 42% below the 1967-1983 mean and 46% below the 1983 level (Table 2). Prerecruits in 1984 represented about 76% of the total abundance index. Based on comparisons between length frequency distributions from daytime and nighttime tows, individuals of all sizes are near the bottom during daytime, but at night there is a differential migration by size off bottom, with small individuals much less susceptible to the trawl than are large individuals (Lange, 1984a). To estimate total recruitment from the 1984 year class, therefore, the overall ratio of pre-recruits to recruits was applied to a minimum biomass estimate based only on daylight tows. The resulting minimum estimate of 1.0 billion individuals was 68% below the 1983 value and 49% below the 1968-1981 mean.

Overall, 1.0 billion pre-recruits were estimated from the 1984 autumn survey. During 1968-1981, about 55% of the pre-recruits in the autumn survey were from the spring cohort. Assuming the same proportion in 1984 and assuming 45% catchability in the autumn survey trawl (Lange, 1984a), 1.2 billion pre-recruits (1.0 X (.55/.45)) would be from the spring 1984 cohort and would enter the fishery during the late autumn or winter of 1984-1985. Recruitment of the autumn cohort during the 1968-1981 spring surveys was about 18% of that seen from the spring cohorts during the autumn surveys. Assuming the same proportion (0.18) in spring 1985, an additional 0.2 billion individuals should be recruited to the late winter or spring 1985 fishery. Total recruitment from the 1984 year class should, therefore, be about 1.4 billion individuals (Lange, 1984a).

5.2.2. *Illex illecebrosus*

The provisional international catch of *Illex* in US waters in 1984 was 11,048 mt (Table 1). The 1984 catch was the lowest since 1971 and is attributable to the reduction to only 638 mt in the foreign catch.

The provisional US *Illex* catch in 1984 was an all time high 10,410 mt (Table 1). The US *Illex* fishery occurs primarily during the summer while they are inshore feeding and, until recently, had been taken as a bycatch in other fisheries. Since about 1982 there has been a significant directed fishery, including landings for US processors and joint ventures with foreign nations in the Mid-Atlantic during the summer.

The 1983 minimum biomass and abundance estimates (1,237 mt and 10 million individuals) were 63% and 52% below the 1982 levels and were the lowest since 1969 and 1973, respectively (Table 3). Substantial decreases in both survey and commercial abundance indices were also observed in Canadian waters in 1981 through 1983 (Lange, 1984b).

The 1983 overall abundance index (stratified mean number per tow, Table 3) was the lowest since 1973, and the pre-recruit index (catch per tow of individuals less than or equal to 10 cm, or about 9 months old) was the lowest of the entire time series (since 1968). Pre-recruits represented only about 7% of the total abundance, compared with the 1968-1982 mean of 23%.

Preliminary minimum biomass and abundance estimates for 1984 were about three times higher than in 1983 (3,787 mt and 32 million individuals); 75% and 46% below the 1968- 1983 means. The 1984 pre-recruit abundance index was double the 1983 value but 76% below the 1968-1983 mean, with only about 4% of the 1984 abundance index attributed to individuals less than or equal to 10 cm (Table 3). Minimum estimated total abundance of pre-recruits (total minimum abundance times the ratio of pre-recruit to total catch-per-tow, Table 3), was estimated to be 1.4 million individuals in 1984. This is the third lowest level on record, and represents the portion of the stock which will provide the bulk of the catch in 1985 (Lange, 1984b).

5.2.3. Atlantic Mackerel

The US commercial catch of Atlantic mackerel has been steadily increasing since 1977 (Table 4). US commercial landings in 1984 (4,098 mt) were the highest since 1969 and second highest in the past 25 years. However, total landings were less than a tenth of what they were during the early 1970s.

Catch per tow from NEFC bottom trawl surveys (spring and autumn) and catch per day from the US commercial fishery continue to reflect an increasing trend in mackerel stock biomass (Anderson, 1985). Spring catch per tow rose sharply from 0.13 kg in 1983 to 0.83 kg in 1984, the highest index since 1971 (Table 5). Although the spring index has fluctuated markedly since 1980, it has exhibited a pronounced upward trend (Anderson, 1985). Autumn catch per tow increased from 1983 (0.03 kg) to 1984 (0.08 kg). This index has also fluctuated considerably in recent years, but has also displayed an increasing trend, although to a lesser extent than the spring index. Both indices exhibit year-to-year changes which reflect both the variability of the timing of the seasonal migrations relative to the timing of the survey and the inherent variability of mackerel catches in the NEFC bottom trawl survey. The increasing trend in both of these indices in recent years, however, is a reflection of increasing stock biomass.

The standardized US commercial catch-per-day index (Anderson, 1976a), derived by standardizing effort from various gear-tonnage categories to that of floating traps tended by 0-50 GRT vessels, increased from 0.86 mt in 1982 to 1.08 mt in 1983 (Table 5). Although CPUE rose sharply in 1980 and fell almost as abruptly in 1981 and 1982, the indices in 1980-1983 were all higher than any since 1971 and are reflective of an increase in stock biomass in recent years.

The 1981 year class at age 2 comprised 26% of the international catch in numbers, followed by the 1974 year class (age 9) with 19%, the 1978 year class (age 5) with 13%, and the 1980 (age 3), 1975 (age 8), and 1973 (age 10) year classes with 10%, 9%, and 8%, respectively (Table 6). The Canadian catch in SA 3 and 4 had the greatest contribution in numbers from age 9 fish (24%), followed by age 5 (15%), age 3 (13%), age 8 (12%), age 10 (10%), and age 2 (9%). Both the US and non-US commercial catches in SA 5 and 6 were dominated by the 1981 year class (age 3).

The fluctuations in mackerel year-classes are generally believed to be due to variations in larval survival (Sette, 1943; Bigelow and Schroeder, 1953; Hoy and Clark, 1967). Factors influencing mortality of larvae may include water temperature, zooplankton abundance, wind driven surface currents, epizotics, and the abundance of mackerel larvae relative to their prey (Sette, 1943; Taylor *et al.*, 1957; Sindermann, 1958; MacKay, 1967; Lett *et al.*, 1975; Winters, 1976; Anderson and McBride, 1976). Average recruitment levels may be reduced when the spawning stock drops below some critical level. There was concern that the heavy fishing coupled with poor recruitment in the 1970s would drive the spawning stock down below such a level, and catch restrictions have been imposed since 1976 to promote rebuilding of the stock (Anderson and Paciorkowski, 1980).

The sizes of the 1961-1979 year classes at age 1 ranged from 43 million (1977 year class) to 5,081 million fish (1967 year class), with a mean size of 1,093 million and a median size of 740 million (Anderson, 1985). The estimates for the strongest and weakest year classes differed by a factor of 117. The 1975-1979 year classes were all below the mean and median levels (range = 43-317 million, average = 166 million).

The 1980 (720 million), 1981 (590 million), 1982 (1,780 million), and 1984 (1,810 million) year classes at age 1 were all estimated to be much stronger than the 1975- 1979 year classes (Anderson, 1985). The 1980 and 1981 year classes, although stronger than the 1975-1979 year classes, were still less than the mean and median levels of 1961-1979. However, the 1982 and 1984 year classes appear to be the strongest since the 1969 year class. The 1983 year class was estimated to be only 40 million fish at age 1, which would make it the poorest since 1961 and comparable in size to the 1977, 1976, and 1979 year classes. The strong 1984 year class estimate was based on only the 1984 autumn age 0 catch per tow and will be subject to change when the 1985 spring age 1 catch per tow becomes available. However, the 1984 year class is insignificant in the catch and spawning stock biomass projections for 1985.

5.2.4. Butterfish

The nominal catch of butterfish in 1984 was the highest during the past 10 years (Table 7). The high 1984 catch is attributable to US landings of butterfish since foreign landings were the lowest during the past twenty years. Strong seasonal differences have existed between the US and foreign butterfish fisheries. Foreign catches occur mostly during January-March while US landings have been predominantly during September-December.

Waring and Anderson (1983), estimated (based on interviews with several Pt. Judith, RI fishermen and dealers) that discards of small butterfish by US fishermen prior to 1983 were approximately 10% of the annual mobile gear landings. In late summer 1983, however, components of the Pt. Judith fishery began reporting substantial quantities of discarded fish. Based on statistics collected by NMFS port agents, discards after mid-August 1983 averaged 50% by weight of the landed catch in the trawl fishery.

Based on the above information, discards during 1 January 1976 - 15 August 1983 from the US trawl fishery for butterfish were assumed to be 10% by weight of the landed catch (Waring and Anderson, 1983). Discards during 16 August - 31 December 1983 were considered to be 50% by weight of the trawl landings of butterfish at Pt. Judith (Table 7) and were used to derive the adjusted nominal catch. Estimated discards during 1976-1982 ranged between 107 mt (1977) and 784 mt (1982), and in 1983 increased to 1,150 mt (Waring and Anderson, 1983).

The 1984 relative abundance for all age groups decreased slightly from the 1983 all time peak but was still the second highest index in the 1968-1984 time series (Table 8). The 1984 indices for both young of the year and age 1 and older were both the second highest in the time series with the young of the year index being higher only in 1983 and the age 1 and older index slightly higher only in 1980. The index for weight in 1984 (11.6 kg/tow) also was high and exceeded 13 of the previous 16 years' estimates. Autumn bottom trawl surveys indicate that very good year classes have occurred in five of the past six years with 1982 being the only exception.

5.3. ECOLOGICAL RELATIONSHIPS AND STOCK CHARACTERISTICS

5.3.1. *Loligo*

Present data indicate that *Loligo* live for 12-24 months and grow to 7-11" dorsal mantle length, although some males survive about 36 months and reach more than 16". Individuals grow an average of 0.4-0.6" per month.

Mesnil (1976) suggested a complicated crossover life cycle for this species, related to its extended spawning season (April-September). This proposed cycle suggests that there are two overlapping reproduction cycles for *Loligo*, with maturation occurring over the winter and spawning taking place in April-May or August-September. Those squid spawned in spring would hatch in June and mature during their first winter. Most will spawn during late summer of the following year (at about 14 months, 7-9") and it is assumed that they suffer high mortality after spawning; observations on squid mating in tanks indicate significant damage to females. A few may survive to the following spring and it is presumed that these did not spawn yet. The squid spawned in late summer hatch in September and are too young to mature over their first winter and therefore spend the next spring and summer feeding and growing. Maturation for this group occurs during their second winter and they spawn early in the spring at about 20 months old or about 8" (Grosslein and Azarovitz, 1982).

Eggs are collected in gelatinous capsules as they pass through the female's oviduct during mating. Each capsule is about 3" long and 0.4" in diameter. Mating activity among captive *Loligo* was initiated when clusters of newly spawned egg capsules were placed in the tank. During spawning the male cements bundles of spermatophores into the mantle cavity of the female, and as the capsule of eggs passes out through the oviduct its jelly is penetrated by the sperm. The female then removes the egg capsule and attaches it to a preexisting cluster of newly spawned eggs. The female lays between 20 and 30 of these capsules, each containing 150 to 200 large (about 0.05"), oval eggs, for a total of 3,000 to 6,000 eggs. These clusters of demersal eggs, with as many as 175 capsules per cluster, are found in shallow waters (10-100') and may often be found washed ashore on beaches (Grosslein and Azarovitz, 1982).

Loligo eggs in captivity develop in 11 to 27 days at temperatures ranging from 73 to 54 F; in nature, they may develop over a 40 F span of seawater temperature, beginning at 46 F. Little is known about the larval stages of *Loligo*; larvae are about 0.1" at hatching. They are not often found in the spawning areas and are assumed to be washed away by currents. A few 0.8" and many 1 to 2" juveniles appear in autumn research vessel catches in shallow waters. Significant numbers of these juveniles have also been found around Hudson Shelf Valley in late winter when adults are mostly found offshore. These are presumably October spawned individuals just beginning to move offshore (Grosslein and Azarovitz, 1982).

Lange and Sissenwine (1980) estimated the length/weight (ln) equation for both sexes combined (n = 1,709) as:

$$W = 0.25662\,L^{2.15182}$$

Loligo are known to feed on small fish, such as silver hake, butterfish, mackerel, herring, and menhaden, and also on squid and crustaceans. However it is difficult to identify the species of fish eaten or to quantify the diet because squid do not swallow their prey whole (Langton and Bowman, 1977).

Bluefish, sea ravens, spiny dogfish, and the Atlantic angel shark are known to be major *Loligo* predators. The fourspot flounder, witch flounder, roughtail stingray, and white hake are also known to prey on *Loligo*. In many cases, squid remains in the stomach of fish are only identified as "squid" with no reference to the species. It is likely that some of these are *Loligo* and there are at least 42 other species of "squid"-eating fish in addition to those identified above (Langton and Bowman, 1977).

5.3.2. *Illex*

Little has been known about *Illex* reproduction (Grosslein and Azarovitz, 1982). However, Froerman (1984) recently proposed a life cycle involving five ecologically isolated stages. *Illex* spawning occurs throughout the year, with a peak in a fall- winter-spring period. Primarily the spawning takes place on the continental slope pelagial between the Florida Peninsula and 40° N, which is substantiated by the larvae distribution pattern (Froerman, 1984). After spawning, the remaining four stages of the life cycle are:

1. Planktonic development stage (embryogenesis, larva, juvenile, to 1"). This phase passes in the pelagial of the continental slope waters or in the northern Gulf Stream edge. The duration of the planktonic stage is 20-30 days. The distribution of egg masses, larvae, and juveniles during this period depends on the peculiarities of the water mass dynamics in the biotope.
2. Nektonic pelagic development stage outside the shelf. The duration is 2.5-3.5 months. During this period the juveniles of 1 to 4" mantle length feed in the pelagial of the continental slope water and perform an active migration towards the shelf on completion of the pelagic stage. The mean migration velocity is 2.5 miles per day.
3. Nektonic stage of feeding and maturation above the shelf. The duration of this stage is 7-10 months, and in the feeding ground 4-8 months. Mean length fluctuates from 4-14". Rates of growth and maturation change depending on season and feeding ground.
4. State of migration for spawning and complete maturation. The duration is 1-4 months. Length of the females is 5-7.5" and of the males 6-10". The mean migration velocity is 11.1 miles per day.

Sperm are stored in elongate, bat-shaped spermatophores. During copulation the male places spermatophores in the female's mantle cavity, attaching them to the mantle wall near the oviduct opening. It is believed that the eggs are spawned one by one, in batches, and fertilized within the mantle cavity. Fertilized eggs are assumed to float free in the water.

Not withstanding Froerman's (1984) life cycle proposal, the age and growth phase of *Illex* life history is not well understood. There is evidence, however, that its life span is only about 1.5 years (Grosslein and Azarovitz, 1982). The largest (greater than 16" mantle length) and oldest individuals live to be approximately two years old. During early life, monthly increase in weight averages about 2 oz. In older individuals the weight increment is only one-half to one-third that of the young. The growth of males and females is nearly identical at sizes less than 8" mantle length. In larger individuals the males are slightly heavier at a given length than females. In spring and summer *Illex* commonly average 6-7" mantle length and weigh 2-4 oz. By late summer and early autumn they have increased to an average of about 7-10" long and weigh 4-11 oz.

Lange and Sissenwine (1980) proposed a length/weight (ln) relationship, based on 2,605 individuals, of:

$$W = 0.04810\,L^{2.71990}$$

Food habits of squid are difficult to quantify because the squid do not swallow their prey whole. They are known to prey on fish and crustaceans such as krill (Langton and Bowman, 1977). Cannibalism is common and larger specimens in particular are known to prey heavily on others of their species (Vinogradov, 1984).

Illex are a major source of food for large carnivorous marine animals. Adults are heavily preyed on by porpoises, whales, and numerous pelagic fishes (e.g., tuna and swordfish). Other known predators of *Illex* are the fourspot flounder, goosefish, and bluefish. *Illex* is probably eaten by a substantially greater number of fish, however, partially digested animals are often difficult to identify and are simply recorded as squid remains, with no reference to the species. There are at least 47 other species of fish that are known to eat "squid" (Langton and Bowman, 1977).

5.3.3. Atlantic Mackerel

Mackerel spawning occurs during spring and summer and progresses from south to north as surface waters warm and the fish migrate. The southern contingent spawns from mid- April to June in the Mid-Atlantic Bight and the Gulf of Maine (Figure 5), and the northern contingent spawns in the southern Gulf of St. Lawrence from the end of May to mid-August (Morse, 1978). Most spawn in the shoreward half of continental shelf waters, although some spawning extends to the shelf edge and beyond. Spawning occurs in surface water temperatures of 45-57 F, with a peak around 50-54 F (Grosslein and Azarovitz, 1982).

In their third year of growth about half the mackerel reach maturity, and all are mature in their fifth year. Size at maturity averages 10.5-11" fork length (Grosslein and Azarovitz, 1982).

Fecundity estimates ranged from 285,000 to 1.98 million eggs for southern contingent mackerel between 12-17" FL. Analysis of egg diameter frequencies indicated that mackerel spawn between 5 and 7 batches of eggs per year. The eggs are 0.04-0.05" in diameter, have one 0.1" oil globule, and generally float in the surface water layer above the thermocline or in the upper 30-50'. Incubation depends primarily on temperature; it takes 7.5 days at 52 F, 5.5 days at 55 F, and 4 days at 61 F (Grosslein and Azarovitz, 1982).

Mackerel are 0.1" long at hatching, grow to about 2" in two months, and reach a length of 8" in December, near the end of their first year of growth. During their second year of growth they reach about 10" in December, and by the end of their fifth year they grow to an average length of 13" FL. Fish that are 10-13 years old reach a length of 15-16" (Grosslein and Azarovitz, 1982).

A study of growth in several year classes of mackerel in Canada suggests that growth is population density dependent, i.e., abundant year classes grow more slowly than less abundant year classes. Another study did not find this relationship for the same year classes of Newfoundland fish (Grosslein and Azarovitz, 1982).

The estimated mean weights for ages 1-14+ in the international catch during the past 20 years have been varied (Anderson, 1985). Mean weights at age increased beginning in 1977 and have since remained at levels higher than observed previously, although a noticeable decrease occurred from 1982 to 1983, particularly at the younger ages. The higher mean weights at age in the catch since 1977 are a reflection of either increased growth rates, capture later in the year, or a combination of the two factors. Some of the increase in mean weight at age in recent years could also be the result of density dependent growth. MacKay (1973) and Dery and Anderson (1983) have found an inverse relationship between growth and year class size. The recent increase in mean weight at age occurred at a time when a series of relatively weak year classes entered the fishery. The decrease in mean weight at age from 1982 to 1983 could be due in part to improved year-class sizes beginning in 1980 and to an increase in stock biomass in the last several years. Paciorkowski and Mucha (1982) expressed one of the most current length/weight (ln) relationships ($n = 741$) as:

$$W = 0.0018005\, L^{3.47764}$$

A comparison of the mean length and weight at age data from the early 1970s (Anderson and Paciorkowski, 1980) and 1982 (Paciorkowski and Mucha, 1982) shows a marked increase in both parameters with time. The greatest differences occurred in the younger age groups (2-4) and disappear by age 10.

Mackerel are opportunistic feeders and prey most heavily on crustaceans such as copepods, krill, and shrimp. They also feed on squid, and less intensively on fish and ascidians (Langton and Bowman, 1977).

Mackerel have been identified in the stomachs of a number of different fish. They are preyed upon heavily by whales, dolphins, spiny dogfish, silver hake, white hake, weakfish, goosefish, Atlantic cod, bluefish, and striped bass. They also comprise part of the diet of swordfish, red hake, Atlantic bonito, bluefin tuna, blue shark, porbeagle, sea lamprey, and shortfin, mako and thresher sharks (Langton and Bowman, 1977).

5.3.4. Butterfish

Butterfish spawning takes place chiefly during summer (June-August) in inshore waters generally less than 100' deep. The times and duration of spawning are closely associated with changes in surface water temperature. The minimum spawning temperature is approximately 60 F. Peak egg production occurs in Chesapeake Bay in June and July, off Long Island and Block Island in late June and early July, in Narragensett Bay in June and July, and in Massachusetts Bay June to August (Grosslein and Azarovitz, 1982).

Butterfish eggs, 0.027-0.031" in diameter, are pelagic, transparent, spherical, and contain a single oil globule. The egg membrane is thin and horny. Incubation at 65 F takes less than 48 hours. Newly hatched larvae are 0.08" long and like most fish larvae are longer than they are deep. At 0.2" larval body depth has increased substantially in proportion to length, and at 0.6" the fins are well differentiated and the young fish takes on the general appearance of the adult. Larvae are found at the surface or in the shelter of the tentacles of large jellyfish (Grosslein and Azarovitz, 1982).

Butterfish eggs are found throughout the New York Bight and on Georges Bank, and they occur in the Gulf of Maine, but larvae appear to be relatively scarce east and north of Nantucket Shoals. In 1973, from mid-June to early September, larvae were common in the plankton off Shoreham, NY. Post larvae and juveniles were common in plankton net samples taken in August in the vicinity of Little Egg Inlet, NJ. Juveniles 3-4" long have been taken in Rhode Island waters in late October (Grosslein and Azarovitz, 1982).

Growth is fastest during the first year and decreases each year thereafter. Young of the year butterfish collected in October trawl surveys (at about 4 months old) average 4.8" long. Fish about 16 months old are 6.6", at about 28 months old fish are 6.8", and at 40 months old they are 7.8". Maximum age is reported as six. More recent studies showed that the population was composed of four age groups ranging from young of the year to over age three (Grosslein and Azarovitz, 1982). Some butterfish are sexually mature at age one, but all are sexually mature by age two (Grosslein and Azarovitz, 1982).

Young butterfish feed primarily on jellyfish (Horn, 1970), and ctenophores and salps (Haedrich, 1967). The diet of adult butterfish includes other small fish, squid, crustaceans, polychaetes, tunicates and chaetognaths (Bigelow and Schroeder, 1953; Leim and Scott, 1966; Nichols and Breder, 1927; Maurer and Bowman, 1975).

As is typical of a small, schooling, pelagic finfish, butterfish are subject to predation by a number of larger species. Haddock, silver hake, swordfish, bluefish, weakfish, goosefish, sand tiger, porbeagle, and red hake are several species which are known to consume butterfish specifically. Butterfish are also preyed upon by squid and may be a significant part of their food since seasonal distribution patterns of L. pealei are similar to butterfish (Tibbetts, 1975).

5.4. ESTIMATES OF MAXIMUM SUSTAINABLE YIELD

5.4.1. *Loligo*

Sissenwine and Tibbetts (1977) estimated MSY at about 44,000 mt, based on the assumptions of a moderate stock-recruitment relationship and an annual recruitment of about 1.5 billion individuals. Lange *et al.* (1984) examined the results of yield per recruit (YPR) analyses for *L. pealei* in conjunction with a Beverton and Holt (1957) type stock recruitment relationship to obtain estimates of equilibrium yield, as described by Shepherd (1982). By assuming a moderate density dependent relationship between spawning biomass and recruitment, maximum equilibrium yield for an offshore/inshore (typical US/foreign catch pattern since early 1970s) fishery would be 27,900 mt and would occur at an instantaneous rate of fishing mortality (F) equals 0.70. Beyond F = 0.93, yield would not be sustainable. For an inshore (traditional US) fishery, the maximum F at which equilibrium yield could occur would also be 0.93, and the maximum equilibrium yield of 33,200 mt would occur at F = 0.80. Initial iterations of the Lange *et al.* (1984) model (Lange, 1983) simulated YPR values of 54,300-54,800 mt from an offshore/inshore fishery and 60,300-66,900 mt from an inshore fishery. It must be noted that these estimates represent long-term averages and do not take into account annual variations caused by environmental factors. Long term potential catch is currently estimated at 44,000 mt (USDC, 1985c).

There are no current valid estimates of natural mortality (M) or F0.1 (USDC, 1984a). Lange (1984a) estimated the average fishing mortality (F) during 1978-1981 as 0.41.

Yield analysis for *L. pealei* based on a simulation model described by Lange *et al.* (1984) provided estimates of YPR at various levels of fishing mortality (F) and average abundance based on different assumptions of squid catchability in the survey trawl. In that analysis, YPR was estimated for two types of fisheries with different exploitation patterns: a dominant offshore winter fishery coupled with a relatively small inshore summer fishery as has existed since the early 1970s (offshore/inshore), and a dominant inshore summer fishery similar to that traditionally conducted by US fishermen with no offshore winter fishery (inshore fishery). Yield per 1,000 recruits at the average level of fishing mortality estimated for 1978-1981 (F = 0.41) and assuming 45% catchability (Lange *et al.*, 1984) was 11.8 kg from an offshore/inshore fishery and 13.1 kg from an inshore fishery. Given the range of estimates of long- term yield predicted by the simulation model and the fact that the management regime allows for changes in ABC on an annual basis, there is no reason to change the MSY estimate at this time.

5.4.2. *Illex*

There are no reliable estimates of stock size nor certainty as to catches of *Illex* until recent years. The MSY of *Illex* was estimated by Anderson (1976b) as 40,000 mt. Although much of the biology is currently being described (Section 5.3.2), adequate estimates of natural and fishing mortality and thus YPR or equilibrium yield are not available. Based on a review of the latest stock assessment (Lange, 1984b), there is no reason to change the MSY estimate at this time. However, Lange (1984b) did address the present maximum OY (30,000 mt), which is comparable to the "long-term potential catch" estimated in USDC (1984a, 1985c).

5.4.3. Atlantic Mackerel

The current MSY estimate is 152,000-182,000 mt, based on the long-term equilibrium yield projections in Anderson (1982). The long-term equilibrium yield has been updated (Anderson 1985) to 134,000-148,000 mt. It is not considered necessary to revise the MSY estimate at this time since the long-term equilibrium yield estimates change and the management regime is not directly related to MSY.

Natural mortality (M) has been estimated at 0.20 based on analysis of catch and effort data (Anderson, 1982). Fishing mortality (F) over the past several years has been estimated as: 0.05 in 1984, 0.06 in 1983, 0.11 in 1982, and averaged 0.08 during 1978-1982. In 1976, F reached a high of 0.74.

$F_{0.1}$ (the fishing mortality rate for a given method of fishing at which the increase in YPR for a small increase in fishing mortality results in only a 10% increase in YPR for the same increase in fishing mortality from a virgin stock) has been estimated for Atlantic mackerel to be equal to 0.29, while Fmax (the fishing mortality rate which maximizes the harvest in weight taken from a single year class over its entire life span) may be about 0.62 (Anderson, 1984). Simulated long-term equilibrium yields under conditions of constant recruitment at the geometric mean level observed during 1962-1984 and same mean weights at age (1982-1983) and exploitation pattern as existed for the 1978-1983 period, yield values about 134,000 mt ($F_{0.1}$) and about 148,000 mt (Fmax). Thus, the theoretical Atlantic mackerel YPR curve (Ricker, 1975) is relatively flat-topped. In other words, a relatively large amount of fishing effort (the difference between $F_{0.1}$ and Fmax) would be required in order to increase total catches by a relatively small amount (the difference between 134,000 and 148,000 mt). This consideration is the primary reason why the practice of limiting catches to the $F_{0.1}$ level was recommended under ICNAF regulation, and why the FMP used it in the determination of OY during years of high abundance.

Anderson (1985) examined the stock recruitment relationship for mackerel and found the relationship between year class size at age 1 and spawning stock biomass that produced that year class (Figure 6) indicates a high probability of low spawning stock levels producing poor year classes. Although there is not a distinct separation between levels of spawning stock biomass which have typically produced poor year classes and those which have produced a high proportion of strong year classes, a level of about 700,000 mt appeared appropriate for Anderson. During 1962-1984, the estimated spawning stock biomass was 634,000 mt or less during 15 of those 23 years (averaging 391,000 mt per year) and only 4 of the 15 year classes produced were above median size (740 million fish at age 1). In the remaining 8 years, spawning stock biomass was 721,000 mt or higher (averaging 1,145,000 mt per year) and 7 of the 8 year classes produced were above median size. All year classes were above median size when spawning stock biomass was 763,000 mt or higher.

Anderson (1985) concluded that from the array of points plotted in Figure 6, there seemed to be a stock recruitment relationship sufficient to be of guidance for management purposes. From the standpoint of ensuring a high probability of good recruitment, the existing data base would suggest maintaining a spawning stock biomass of 700,000 mt or higher (7 of the 9 year classes produced when spawning stock biomass was above 600,000 mt were above the median year class also). However, since environmental factors also exert a strong influence on year class size, maintenance of the stock at or above such a level also helps to ensure an adequate and stable resource on which to base a fishery and which will provide a buffer in the event of the production of a poor year class.

The FMP currently contains a minimum spawning stock biomass constraint of 400,000 mt. This level was based on earlier assessment results which, at the time, indicated that 400,000 mt was appropriate. Anderson (1985) believed that, in light of the results of the current assessment, a minimum of 700,000 mt may be more appropriate than 400,000 mt. The Council has chosen a minimum of 600,000 mt since 7 of the 9 year classes produced from that size spawning stock biomass were above the median year class.

5.4.4. Butterfish

A preliminary estimate of MSY was 21,500 mt (Murawski and Waring, 1978). This estimate, however, presupposed certain mesh sizes were used in the fishery and an average level of annual recruitment to the stock. These conditions may not be completely met. Mesh sizes used by foreign and domestic vessels frequently vary from that which theoretically will produce MSY. In addition, the best scientific evidence available indicates that annual recruitment to this fishery is not constant and that the substantial variations in yearly recruitment which have been observed in the past will probably continue.

A realistic estimate of MSY, based on the present mix of gear in the fishery, may be between 15,000-19,000 mt. The best conservative estimate of MSY under current fishery conditions is approximately 16,000 mt. This is the MSY estimate used in the FMP. It is also the "long-term potential catch" projected by USDC (1984a). There is no reason to change the estimate at this time since there appear to be sufficient fish available to support a catch up to the maximum currently allowed (USDC, 1985c).

The annual instantaneous natural mortality rate (M) for butterfish has been estimated to be 0.8 (Murawski and Waring, 1979). Estimates of fishing mortality (F) on fully recruited fish (age 2 and older) dropped from 2.14 in 1976 to 0.91 in 1977 and then underwent a gradual increase to 1.04 in 1981. Mean F on ages 2 and older dropped sharply to 0.77 in 1982 and declined further to an estimated 0.67 in 1983 (USDC, 1984a). No estimates are available for 1984.

Anderson (pers. comm.) ran some computer simulations of catch and stock size assuming a constant level of recruitment and several fishing strategies. The range in fishing strategies included the average exploitation pattern (proportion of fishing mortality at age) at ages 1-4 observed during 1976-1983 with no fishing on age 0 fish and the average exploitation pattern at ages 0-4 during 1982-1983 which exhibited the highest observed proportions of fishing mortality on both age 0 and age 1. If fishing mortality were maintained at the F0.1 = 1.5 level, catch would be about 9% less under the strategy of no fishing of age 0 fish, but stock biomass would be about 23% greater. Since butterfish are short lived and have a very high natural mortality rate (M = 0.80), delaying the age of first harvest from age 0 to an older age does not lead to higher yields, which would be the case for longer lived species with lower natural mortality rates. The only possible benefit with respect to catch from delaying harvest to an older age would be that a larger size fish would probably command a higher price. There is, however, a benefit to the stock by not harvesting age 0 fish (23% increase in the above example). Assuming that a stock-recruitment relationship exists for butterfish, increasing stock size will improve the spawning potential and hopefully ensure a higher probability of producing good recruitment. In addition, a larger stock would serve as a buffer to help support the fishery in the event of a poor year class recruiting to the stock.

5.5. PROBABLE FUTURE CONDITION

5.5.1. *Loligo*

The US commercial and foreign *Loligo* catch (21,594 mt) from US waters was roughly half the MSY estimate (44,000 mt) in 1984. The current MSY estimate has not been exceeded during any of the past 20 years (Table 1).

Abundance and biomass indices (preliminary) from the 1984 survey (Table 2) are lower than the long-term means (Lange, 1984a). Recruitment from the 1984 year class was about one-half of the 1968-1981 mean and yield in 1985 will likely be less than in recent years unless fishing mortality (F) increases. At levels of F comparable to the average observed during 1978-1981, yields of slightly less than 20,000 mt may be expected. It is possible to increase fishing mortality without endangering the stock (Section 5.4.1).

5.5.2. *Illex*

Long-term potential catch estimates (30,000 mt) have not been approached since the mid-1970s and, in fact, total catch estimates in US waters in 1984 were only slightly more than one-third (11,048 mt) the potential. In the past 20 years this potential has not been exceeded (Table 1).

Pre-recruit abundance in 1984 (Table 3) was less than one-quarter the 1968-83 mean and the third lowest of the time series. If the NEFC survey estimates are a consistent measure of both relative population and the relative proportion of pre-recruits to total abundance as seen in the survey, then current abundance may not be adequate to support the present 30,000 mt OY (Lange, 1984b). The surveys cover only a portion of the range (Section 5.1.2) of this species and an unknown proportion of the stock may be outside of the survey area during a given survey. There is no evidence to indicate, however, that the stock in 1985 will not support a total harvest comparable to that seen in recent years.

5.5.3. Atlantic Mackerel

The 1984 Atlantic mackerel catch in US waters (16,524 mt) was the highest since the mid-1970s (Table 4) when the stock was overfished and subsequently collapsed. The FMP was implemented in 1977 and the stocks have subsequently rebuilt to healthy levels. The catch outside US waters in 1984 was the lowest since 1967.

Anderson (1985) projected total stock biomass at the beginning of 1985 to be 1,171,000 mt, a 23% increase from 1984. Spawning stock biomass at the beginning of 1985 was estimated to be 1,004,000 mt, a 32% increase from 1984. Projected catches in 1985 ranging from 30,000 mt to 270,000 mt (Table 9) would require mean fishing rates on ages 3-14 ranging from about 0.03 to 0.29. These catches would result in projected spawning stock biomass levels at the beginning of 1986 varying from 1,063,000 mt (6% increase from 1985) to 844,000 mt (16% decrease from 1985). Fishing at the $F_{0.1}$ level of 0.29 would result in a catch of 270,000 mt in 1985 and leave a spawning stock of 844,000 mt. If fishing mortality in 1985 remains at the 1984 level, the catch would be about 54,000 mt and the spawning stock biomass would increase 3-4% from 1985 to 1986.

5.5.4. Butterfish

The adjusted nominal catch (Table 7) of butterfish in 1984 (15,818 mt) equalled the current MSY estimate (Section 5.4.4). The adjusted nominal catch exceeded the current MSY in 1969 when 17,816 mt were landed, in 1973 with 33,236 mt, in 1974 with 17,993 mt, and 1976 with 16,249 mt being landed.

The 1984 relative abundance index for all ages was the second highest estimate in the past 17 years, but was 20% smaller than the 1983 peak (Table 8). Very high (30-80%) discard rates began in 1983 and were associated with the presence of large numbers of age 0 (1983 year class) butterfish. The increased amount of discards in 1984 included not only age 0 (1984 year class) fish, but also age 1 fish. Prior discard rates were only about 10%. Anderson (pers. comm.) believed that recent levels of catch and discard of small butterfish are detrimental to the stock. Although NEFC has "no concrete evidence of any adverse effects yet to the stock because of the high amount of discard in recent years, the decreased availability of marketable-sized fish in the first part of 1985 might be the first sign. This would constitute growth overfishing. Recruitment overfishing might be next" (Anderson, pers. comm.). Since the fishing mortality rate in 1984 is unknown the extent of either growth overfishing or recruitment overfishing is also presently unquantifiable, and while the discards generated concerns for overfishing, the latest best available evidence from NEFC (USDC, 1985c) concludes that "... sufficient fish are available to support a catch up to the maximum (16,000 mt) currently allowed by the FMP."

While growth of these small fish from the 1983 and 1984 year classes may resolve the wastage associated with discarding, this problem warrants close attention. As stated, this species is being fished at current MSY levels and although sufficient fish are available to support catches up to 16,000 mt (USDC, 1985c), the stock should not be expected to continue to support expanded growth of the fishery. The concept of setting an annual ABC allows the catch to be adjusted downward from the maximum (16,000mt) as necessary based upon the status of the stocks.

6. HABITAT

6.1. HABITAT DESCRIPTION

Climatic, physiographic, and hydrographic differences separate the ocean region from Cape Hatteras to the Gulf of Maine into two distinct areas: the Middle Atlantic- Southern New England Region and the New England Region, with the natural division occurring at Nantucket Shoals.

The Middle Atlantic - Southern New England Region is fairly uniform physically and is influenced by many large coastal rivers and the Chesapeake Bay, the largest estuary in the United States. Additional significant estuarine influences are Narragansett Bay, Long Island Sound, the Hudson River, Delaware Bay, and the nearly continuous band of estuaries behind the barrier beaches along southern Long Island, New Jersey, Delaware, Maryland, and Virginia. The southern edge of the region includes the estuarine complex of Currituck, Albemarle, and Pamlico Sounds behind the outer banks of Cape Hatteras.

At Cape Hatteras, the continental shelf (characterized by waters less than 650' deep) extends seaward approximately 20 miles, widens gradually to 70 miles off New Jersey and Rhode Island and then broadens to 120 miles off Cape Cod forming Georges Bank. The substrate of the shelf in this region is predominantly sand interspersed with large pockets of sand-gravel and sand-shell. Beyond 650', the substrate becomes a mixture of silt, silt-sand, and clay. As the continental slope turns into the Abyssal Plain (at depths greater than 6,500'), clay predominates over silt and becomes the major substrate.

Mineral resources of the area include large sand and gravel deposits, now being mined in some localities near shore. There are potentially recoverable offshore deposits of phosphate rock, titanium, monazite, zircon, and oil. Locally important concentrations of sulfur, salt, anhydrite, potash, and magnesium are known. It is also probable that manganese oxide nodules occur offshore. However, current technology is inadequate for economic recovery of most placer and hard rock deposits.

Water temperatures range from less than 35 F in the New York Bight in February to approximately 80 F off Cape Hatteras in August. The annual range of surface temperature at any location may be 25 F in slope waters to greater than 35 F near shore. During winter the vertical thermal gradient is minimized. In late April-early May, a thermocline develops although storm surges over Nantucket Shoals retard thermocline development there. The thermocline persists through the summer. Surface waters begin to cool in early autumn, weakening the thermocline so that by mid- November surface to bottom water temperature is nearly homogeneous.

The salinity cycle results from stream flow and the intrusion of slope water from offshore. The winter salinity maximum is reduced to a minimum in early summer by large volumes of runoff. Inward drifts of offshore saline water in autumn eventually counterbalance fresh water outflow and return the region's salinity distribution to the winter maximum. Water salinities near shore average 32 parts per thousand (ppt), increase to 34-35 ppt along the shelf edge, and exceed 36.5 ppt along the main lines of the Gulf Stream.

On the continental shelf, surface circulation is generally southwesterly during all seasons, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. Speeds of the drift are on the order of 5 knots per day. There may be a shoreward component to this drift during the warm half of the year and an offshore component during the cold half. This drift, fundamentally the result of temperature-salinity distribution, may be made final by the wind. A persistent bottom drift at speeds of tenths of nautical miles per day extends from beyond mid-shelf toward the coast and eventually into the estuaries. Offshore, the Gulf Stream flows northeasterly.

The New England region from Nantucket Shoals to the Gulf of Maine includes two of the worlds most productive fishing grounds: Georges Bank and Browns Bank. The Gulf of Maine, which is a deep cold water basin, is nearly sealed off from the open Atlantic by these two Banks. The outer edges of Georges and Browns Banks fall off sharply into the continental shelf. Other major features include Vineyard and Nantucket Sounds, Cape Cod Bay, and Cashes Ledge and Stellwagen Bank within the Gulf of Maine.

Water temperatures range from 35-65 F at the surface and over the banks, and 40-50 F at 650' in the inner Gulf of Maine. Mean salinity values vary from about 32 to 34 ppt depending on depth and location. However, lower salinity values generally occur close to shore. In addition, both water temperatures and salinities within the Region, but especially along the southern boundary of Georges Bank and the deep basins of the inner Gulf of Maine, are influenced by intrusions of slope water.

Surface circulation within the Gulf of Maine is usually counterclockwise. Cold Nova Scotian waters enter through the Eastern Channel and move across Browns Bank while slope waters enter through the Northeast (Fundian) Channel. Gulf of Maine waters spill out over Georges Bank and through Great South Channel onto Nantucket Shoals. The anticyclonic eddy over Georges Bank that develops in spring breaks down into a westerly and southerly drift by autumn.

Gulf Stream meanders and warm core eddies, two oceanographic phenomena which normally remain in deep offshore water, can profoundly effect environmental conditions on the fishing grounds off the northeast United States when either one moves close along the continental slope. The warm core eddies seen off the New England coast mostly form in the slope water region southeast of Georges Bank by detaching from meanders of the Gulf Stream. Rotation is in a clockwise direction at speeds varying from 0.6 to 1.8 knots.

Environmental effects and their possible influence on fishery resources resulting from meanders and eddies have been identified by Chamberlin (1977) and are:

1. Warming of the upper continental slope and outer shelf by direct contact of a meander or eddy. This may influence the timing of seasonal migrations of fish as well as the timing and location of spawning.

2. Injection of warm saline water into the colder less saline waters of the shelf by turbulent mixing at the inshore boundary of a meander or eddy. This may have influences on the fishery resource similar to that of direct warming, and also cause mortality of fish eggs and larvae on the shelf when the colder water in which they live is warmed beyond their tolerance by the mixing-in of warm slope water.

3. Entrainment of shelf water off the shelf, an effect frequently seen in satellite imagery. Mortality of Georges Bank fish larvae is known to occur, presumably because of temperature elevation when shelf water in which they occur is carried into the slope water. The most profound effects of entrainment on the fishing grounds may be changes in circulation and in water mass properties resulting from the replacement of the waters lost from the shelf.

4. Upwelling along the continental slope, which may result in nutrient enrichment near the surface and increased primary biological productivity.

The annual cycle of the plankton community of the region is typical of the temperate zone. During the winter, phytoplankton (plant plankton) and zooplankton (animal plankton) populations are low. Nutrients are available, but production is suppressed by low levels of solar radiation and low temperatures. As spring approaches and the level of solar radiation increases, an enormous diatom bloom occurs. As the bloom progresses, concentrations of inorganic nutrients decrease.

As water temperatures increase during late spring and summer, phytoplankton and zooplankton become increasingly abundant because of the more rapid development of early life stages, the spawning of fish and benthos, and the abundant food supply.

During summer, zooplankton reaches maximum abundance while phytoplankton declines to a level near the winter minimum. Dinoflagellates and other forms apparently better suited than diatoms to warm, nutrient-poor waters become more abundant during summer. Bacteria in the sediment actively regenerate nutrients, but because of vertical temperature and salinity gradients, the water column is stable and nutrients are not returned to the euphotic zone (where solar radiation and nutrients are "fixed" into organic matter). On Georges Bank, nutrients regenerated by sedimentary bacteria are immediately available to phytoplankton because of mixing (Cohen, 1975).

During autumn, as water temperatures decrease, the water column becomes unstable due to mixing and nutrients are recycled to the euphotic zone. This stimulates another phytoplankton bloom which is limited by decreasing levels of solar radiation. Phytoplankton and zooplankton levels then decline to their winter minimum while nutrient levels increase to their winter maximum.

Anomalous conditions within the generalized annual cycles are probably common. The stability of the water column which affects nutrient availability may be disrupted by severe storms. Anomalies in temperature may disturb the timing between the annual cycles of interacting species.

Although the fisheries for these species are concentrated along the Outer Continental Shelf in the winter, all are widespread over the shallower reaches of the shelf in warmer months. Atlantic mackerel, *Loligo*, and butterfish are found seasonally in shallow water along the coast and in larger estuaries, such as Long Island Sound, from Nova Scotia to Cape Hatteras. *Loligo* and butterfish use shallow coastal areas and the more saline portions of several estuaries, such as Long Island Sound and Delaware and Chesapeake Bays, as spawning and nursery habitats.

6.2. HABITAT CONDITION

Squid, mackerel, and butterfish, owing to their migratory nature, are all exposed to a range of environmental conditions and contaminants during their life history.

All of these species, with the possible exception of *Illex*, are affected to some degree by pollutant loading and habitat degradation in near shore coastal areas. *Loligo* and butterfish are most vulnerable because they use estuarine and shallow coastal areas for spawning and nursery habitats. Municipal and industrial point source discharges and urban and agricultural non-point source contaminants degrade estuarine waters, and in turn, estuarine plumes transport these pollutants into near shore shelf waters. Dredging, filling, and shoreline construction activities for water dependent and non-water dependent purposes further degrade water quality and habitat values, thereby adversely affecting the biological productivity of marine environments.

Systematic surveys of fish taken over the continental shelf of the Mid-Atlantic Bight have indicated that almost all fish and shellfish have detectable levels of PCBs in their musculature (Boehm and Hirtzer, 1982). Pelagic species that tend to feed on other fish within the water column (e.g., silver hake) seem to have higher values than demersal species such as the winter flounder.

Assessments recently conducted by the State of New Jersey (Belton *et al.*, 1982) indicate that striped bass and bluefish taken in coastal and estuarine waters have very high levels of PCBs in their edible tissues. These high levels have resulted in the issuance of warning notices by the New Jersey Office of Cancer and Toxic Substances Research indicating that these fish should not be consumed by humans or, if they are, they should be cooked in a certain manner to eliminate as much of the oily tissue as possible. In the spring of 1984, the US Food and Drug Administration lowered the PCB action level in fish flesh from 5 ppm to 2 ppm. These warnings and requirements, as well as earlier closures and warnings emanating from the State of New York regarding species such as striped bass, white perch, and eels, have compromised existing as well as potential development of recreational and commercial fisheries for several important species.

Unfortunately, comprehensive research has not yet been done on the significance of elevated body burdens to the fish themselves, or to reproductive processes and subsequent recruitment of larval, juvenile, and prerecruits to the adult fish and shellfish stocks. Although laboratory and field effects of a range of organic contaminants have been measured, there is little understanding of how contaminants such as PCBs affect the behavior, biochemistry, genetics, or physiology of these fish at either the lethal or sublethal level. Work on higher vertebrates does indicate, however, that PCBs and related materials, at levels found in the marine environments, can and do detrimentally affect experimental animals. It is also significant that where elevated levels of PCBs have been reported in the marine environment, they have generally been associated with elevated levels of toxic heavy metals, petroleum hydrocarbons, and other contaminants that have been indicated to be deleterious.

The vast majority of research on the toxicological effects of various contaminants in fish is recent. Many anomalies probably have not been described or their magnitude documented. The Councils encourage fishermen to report or provide any tumorous type growth found on any fish species to: Dr. John C. Harshberger, Director, Registry of Tumors in Lower Animals, Smithsonian Institution, Museum of Natural History, Washington, D.C. 20560 (202-357-2647) or to Dr. Robert Murchelano, NMFS, Oxford Laboratory, Railroad Ave., Oxford, MD 21654 (301-226-5193).

6.3. CAUSES OF POLLUTION AND HABITAT DEGRADATION

During the summer and early autumn of 1976, oxygen concentrations at bottom were severely depleted and widespread mortalities of benthic organisms occurred in a section of the New York Bight off New Jersey. This near-anoxic (and in places anoxic) region of oxygen levels less than 2 parts per million (ppm) was located approximately 4 miles off New Jersey and covered an area about 100 miles long and 40 miles wide during the most critical phases of the depletion (Sharp, 1976). Normal oxygen levels in this region are generally greater than 4 ppm.

Investigations indicate this depletion was probably induced by a combination of meteorological and circulatory conditions in conjunction with a large-scale algal bloom (predominantly Ceratium tripos). Lack of normal seasonal turbulence occasioned by relatively few storms, unusual wind patterns, and above-average surface water temperatures probably all contributed to depletion of the oxygen content of waters beneath the thermocline (Sharp, 1976). It is not known to what degree the routine dumping of sewage sludge and dredge spoils contributed to the depletion, but it is reasonable to assume that any effect would have been detrimental (Atkinson, 1976).

The species affected by the anoxia of most commercial importance were surf clams, red hake, lobster, and crabs. Finfish were observed to be driven to inshore areas to escape the anoxia, or were trapped in water with concomitant high levels of hydrogen sulfide (Steimle, 1976). Freeman and Turner (1977) pointed out that "...it is difficult to measure with any precision the extent of damage to highly mobile organisms, especially the fishes. Sublethal effects can also occur. Among the observed effects of the anoxic water on fishes were behavioral changes involving vertical distribution and migratory routes which in turn may affect feeding and spawning habits."

Reduction in oxygen levels in New York Bight below normal levels has been observed several times in recent history (Atkinson, 1976) although not to levels as low as those observed in summer 1976. The relative contribution of any of the above mentioned factors to the anoxia may never fully be assessed. However, it is important to note that each of these conditions, by itself, was not a unique, previously unobserved phenomenon.

Ocean disposal of sewage sludge, industrial waste products, dredged material, and radioactive wastes degrades water quality and associated habitats. There are three active dump sites for industrial chemical wastes, trace metals, suspended solids, and organic wastes in the New York Bight (Environmental Protection Agency, 1979). The Deepwater Dumpsite is 106 miles offshore. The Cellar Dirt Dump and the Derelict Vessel Dump are no longer being used. The 12-mile Sewage Sludge Dumpsite is to be delisted in 1985 (Muir, pers. comm.). Concentration of heavy metals, pesticides, insecticides, petroleum products, and other toxics all contribute significantly to degradation of waters off the northeastern states. Organic loading of estuarine and coastal waters is an emerging problem. Symptoms of elevated levels include excessive algae blooms, shifts in abundance of algal species, biological oxygen demand (BOD) increases in sediments of heavily affected sites, and anoxic events in coastal waters. Changes in biological components are a consequence of long-term ocean disposal. Harmful human pathogens and parasites can be found in biota and sediments in the vicinity of ocean dump sites.

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

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

Energy production facilities are widespread along Atlantic coastal areas. Electric power is generated by various methods, including land based nuclear power plants, fossil fuel stations, and, possibly, future offshore floating nuclear power plants. These facilities compete for space along the coastal zone; they require water for cooling and, in the case of coal fired plants, generate voluminous amounts of fly ash and sulfur dioxide, as well as electricity. The impacts on the marine and estuarine environment resulting from the various types of electric generating plants include water consumption, heated water and reverse thermal shock, entrainment and impingement of organisms, destruction and elimination of habitat, and disposal of dredged materials and fly ash.

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

6.4. HABITAT PROTECTION PROGRAMS

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

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

Other programmatic mandates of NMFS relative to habitat conservation are found in the Marine Mammal Protection Act of 1982, the Endangered Species Act of 1983, and the Anadromous Fish Conservation Act of 1965. NMFS shares responsibilities with the FWS for conservation programs under these laws.

In addition to the above mentioned NMFS programs, other laws regulate activities in marine and estuarine waters and their shorelines. Section 10 of the River and Harbor Act of 1899 authorizes the Army Corps of Engineers (COE) to regulate all dredge and fill activities in navigable waters (to mean high water shoreline). Section 404 of the Clean Water Act of 1980 authorizes EPA to regulate the discharge of fill materials into waters and adjacent wetlands. EPA has delegated authority under Section 404 to the COE to administer all dredge and fill activities under one program. Section 401 of the Clean Water Act authorizes EPA, or delegated States with approved programs, to regulate the discharge of all industrial and municipal wastes. The EPA and COE also share regulatory responsibilities under the Marine Protection, Research, and Sanctuaries Act of 1972.

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

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

A more detailed discussion of the pertinent legislation affecting their protection, conservation, enhancement, and management of living marine resources and habitat can be found in the NMFS Habitat Conservation Policy (48 FR 53142-53147). In addition, NMFS and the other federal resource agencies are involved in other programs with the States (e.g., NMFS Saltonstall-Kennedy and FWS Dingell-Johnson programs) that provide grants to conserve fish habitats and improve fisheries management. Individual states also regulate wetlands, which complements federal habitat conservation programs.

6.5. HABITAT CONSERVATION AND RESTORATION RECOMMENDATIONS

The Councils are deeply concerned about the effects of marine habitat degradation on fishery resources. They have a responsibility under the MFCMA to take into account the impact of habitat degradation on fish. The NMFS Habitat Conservation Policy established a basis for a partnership between the Councils and NMFS to assess habitat issues specific to the resources being managed. The following recommendations are made in light of that responsibility.

1. All natural habitat for squid, mackerel, and butterfish should be preserved by encouraging management of conflicting uses to assure continued access by fish to essential habitat. High water quality standards should be maintained to protect migratory routes and spawning, rearing, and feeding areas. Spawning and nursery areas are particularly important to continued productivity of these resources.

2. Coastal in-water construction and dredging projects should employ best engineering and management practices (e.g., seasonal restrictions, dredging methods, disposal options, etc.). Such projects should be permitted only for water dependent projects found to be in the public interest when no feasible alternatives are available. Project proponents should be required to address the full range of impacts on these species, their habitat, or food sources which may be associated with project implementation.

3. Coastal and open ocean waters should be protected from significant adverse effects of domestic and industrial waste disposal. The selection of methods and sites for disposal of sewage sludge, contaminated dredged material, and other domestic and industrial waste should be based on a comprehensive scientific assessment of all options (e.g., pretreatment, land based disposal, incineration, and ocean dumping). Ocean disposal should be allowed only when no practicable alternative with less impact on the total environment is available.

4. Use of best available technology to control municipal and industrial waste water discharges should be required. The EPA's Water Quality Criteria Series should be used as guidelines for determining harmful concentration levels of toxic substances in waste water discharges. Prior to the siting of any potential new discharge, project proponents should be required to address the full range of impacts on these species, their habitat, or food sources which may be associated with project implementation.

5. All available or potential natural habitat for these species should be protected from significant adverse impacts from offshore oil and gas and non-energy mineral exploitation and development activities.

Siting and regulation of these activities should be conducted such that access to essential habitat is ensured, and the quality of the habitat is maintained to protect migratory routes, and spawning, nursery, overwintering, or feeding areas.

6. Future scientific investigations should examine the possible long term, synergistic effects of combinations of environmental stresses. One focus of these investigations should be the consequences of chronic environmental loading of all types of pollutants (e.g., heavy metals, insecticides, herbicides, petroleum products, halogenated hydrocarbons, other organics, etc.) in terms of early life and adult fish survival, reproductive capacity, and genetic effects. Another focus of needed studies is the cumulative impact of all projects involving habitat modification (including dredge and fill operations, in-water construction projects, and OCS drilling and mining activity) on the total production of the fishery resources.

7. Interstate planning and coordinated management of habitat areas shared by more than one state should be encouraged. Activities among states should be expanded and become better coordinated to prevent inadequate consideration of certain areas.

8. The Mid-Atlantic Council will cooperate with NMFS and the New England and South Atlantic Councils in a review of the broad range of human activities having the potential to adversely affect squid, mackerel, and butterfish.

7. DESCRIPTION OF FISHING ACTIVITIES

7.1. US COMMERCIAL FISHERY

7.1.1. *Loligo* Landings

With a US *Loligo* catch of 10,565 mt, 1984 did not match the 1983 record of 15,943 mt (Table 1). The US catch in 1982 was 5,464 mt, up from 2,316 mt in 1981 (Table 1 and Figure 7).

The US *Loligo* catch was 3,562 mt in fishing year 1980-81, 3,049 mt in 1981-82, 5,024 mt in 1982-83, 14,583 mt in 1983-84 and 10,613 mt in 1984-85. Of those totals, JVs accounted for 323 mt in 1981-82, 1,094 mt in 1982-83, 2,332 mt in 1983-84, and 760 mt in 1984-85. There were no *Loligo* JVs in 1980-81 (Table 10).

Loligo landings (catch minus joint ventures) for Maine through Virginia show a fairly consistent increase from 168 mt in 1977 to 11,414 mt in 1983 (Table 11). The distribution of landings between state waters and the FCZ varies from year to year, but the relative importance of the FCZ appears to be increasing as the magnitude of landings increases (i.e., in 1979 the FCZ accounted for 32% of the total whereas in 1983 it accounted for 61% of the total). Note that the unclassified category represents all squid landings for 1974-1976 and may be either *Loligo* or *Illex* in 1977- 1983. Hence, some of the apparent increase over time is attributable to improved reporting quality rather than an absolute increase in *Loligo* landings, as suggested by the increase in *Loligo* landings and the decrease in Unclassified landings (Table 11).

During the 1974-1983 period *Loligo* landings were reported for Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, and Virginia. The 1983 landings ranked Rhode Island (3,933 mt), Massachusetts (2,765 mt), New York (2,679 mt), Virginia (1,510 mt), and New Jersey (486 mt), as the top five States, with the remaining States accounting for less than 100 mt (Table 11). The FCZ is most important in Rhode Island (90%), New Jersey (80%), Maryland (97%), and Virginia (80%).

North Carolina landing data are not reported by individual squid species. North Carolina squid landings peaked in 1979 and 1983 landings were second but amounted to only 139 mt (Table 12). Squid (not specified) were reportedly landed in South Carolina, Georgia, and the east coast of Florida during the past decade, but never more than 10 mt annually.

Loligo are landed year round by the commercial fishery, but the majority of the landings occur in May-July (Table 13). Squid landings in New York and the New England States generally occur from late spring through fall while landings in New Jersey - Virginia occur in the winter and spring (Table 14). The North Carolina fishery takes place generally in winter and spring (Table 12).

7.1.2. *Illex* Landings

The US *Illex* catch in 1984 was 10,410 mt (Table 1 and Figure 8), the highest ever recorded. The catch was 9,944 mt in 1983 and 5,902 mt in 1982, while only 349 mt, and 631 mt were landed in 1980 and 1981, respectively. The foreign catch has been declining, from a high of nearly 25,000 mt in 1976 to 12,350 in 1982, 1,776 mt in 1983, and only 638 mt in 1984. The US *Illex* catch was 422 mt, 593 mt, 5,772 mt, 9,760 mt and 9,585 mt for fishing year 1980-81, 1981-82, 1982-83, 1983-84, and 1984-85, respectively. JVs accounted for 2,338 mt of the total in 1982-83, 8,344 mt in 1983- 84, and 6,010 mt in 1984-85 (Table 10).

Illex landing data for Maine-Virginia for 1983 (Table 11) show a decline from the identified 3,605 mt landed in 1982. Note that the Unclassified category in Table 11 may represent *Loligo* or *Illex*.

Illex landings during the 1978-1983 period were reported for Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, and Virginia. Virginia landings were 1,042 mt and New Jersey landings were 369 mt in 1983, with the other States landing less than 100 mt (Table 11). Nearly all the *Illex* comes from the FCZ. The *Illex* season is generally May-November (Table 13).

7.1.3. Mackerel Landings

The US commercial mackerel catch generally has been increasing slightly, with a 1984 catch of 4,098 mt, the highest since 1969 (Table 4). Catch for 1983 was 3,805 mt.

The US mackerel catch was 3,260 mt, 3,297 mt, 2,084 mt, 4,859 mt and 3,062 mt for 1980-81, 1981-82, 1982-83, 1983-84, and 1984-85, respectively (Table 10). JVs accounted for 1,531 mt in 1983-84, with JV catch data suppressed because of confidentiality reasons for 1982-83 and 1984-85.

Annual mackerel landings (ME-VA) have been about 3,000 mt since 1980 (Table 15), with landings reported for all of the New England and Mid-Atlantic States, as well as for North Carolina (Table 16), during the 1974-1983 period. In 1983 landings were highest in New Jersey (977 mt), Massachusetts (744 mt), Rhode Island (692 mt), New York (251 mt), and Maine (198 mt), with all the other States landing less than 100 mt. No mackerel were reported landed in South Carolina, Georgia, or the east coast of Florida.

The bulk of the fishery in the Maine-Virginia area generally occurs March-May (Table 17). On a State by State basis (Table 18), the fishery follows the northward seasonal migration, with the Virginia fishery from January-May and the Maine fishery June- October (Table 18).

7.1.4. Butterfish Landings

The nominal (not adjusted for discards) US 1984 butterfish catch was a record 12,166 mt, up from 4,905 mt in 1983 and 9,077 mt in 1982 (Table 7 and Figure 9). The 1982 catch was the previous record high. There have been no butterfish JVs. The nominal foreign catch in 1984 was a record low (for the 1965-1984 series) 429 mt, resulting in a total catch of 12,595 mt. The catch, when adjusted for estimated discards, was 15,818 mt (Table 7), virtually equal to the MSY (Section 5.4.4).

US butterfish landings were 5,575 mt, 5,372 mt, 7,231 mt, 9,720 mt and 8,168 mt for 1980-81, 1981-82, 1982-83, 1983-84, and 1984-85, respectively (Table 10).

Landings from Maine-Virginia for 1983 totalled 4,743 mt (664 mt large, 1,095 mt medium, 1,661 mt small, and 1,323 mt unclassified; Table 19). The small category was insignificant until 1980, when landings were 169 mt. Landings in the small category were 504, 2,359, and 1,661 mt in 1981, 1982, and 1983, respectively. Virtually the entire catch is taken in the FCZ (4,366 of the 4,743 mt caught in 1983; Table 19). The size categories are 300-400 fish per 100 lb box for large, 400-450 for medium, and 450-550 for small. While all of the New England and Mid-Atlantic States account for some butterfish landings, Rhode Island is the major State with a total of 3,365 mt (71% of the total) landed in 1983 (Table 19).

North Carolina butterfish landings are relatively small, amounting to only 49 mt in 1983 and exceeding 100 mt only in 1981 (128 mt) and 1982 (120 mt) (Table 20). Less than a ton of butterfish were landed in South Carolina in 1981 and none were reported landed in Georgia or the east coast of Florida during the past decade.

Butterfish are landed in all months, but the significant months generally are September-January (Table 21), with no major differences on a State by State basis (Table 22).

7.2. US RECREATIONAL FISHERY

Although it is known that recreational marine anglers occasionally take squid and butterfish, no estimates of these catches have resulted from any of the national or regional angler surveys. Any sport catch of these species is likely to be negligible, although significant portions of the commercial catch may be used as bait in recreational fisheries for other species. The following discussion is directed at the Atlantic mackerel sport fishery.

The various NMFS angling surveys prior to 1979 produced estimates of recreational mackerel catches which ranged from 522 mt in 1977 to 16,426 mt in 1971 (Table 4). No distinctions were made in any of the above surveys as to the definition of "catch", i.e., it must be assumed that the figures cited above represent estimates of all mackerel taken, regardless of whether they were landed, released alive, or discarded dead. To overcome these and certain sampling problems, NMFS introduced a new marine angler survey methodology beginning in 1979.

In 1979, marine anglers caught approximately 7.3 million mackerel, 45% in New England and 55% in the Mid-Atlantic (Table 23). If the average weight of all fish caught was equal to the average weight of the fish landed (Table 23), the total weight caught in 1979 was 7.7 million lbs (3,479 mt). If the average weights of the released and discarded mackerel were less than the average weight of the retained fish, this estimate is too high. There is, however, no way at present to adjust for account for such possibilities.

In 1980, marine recreational anglers caught 5.4 million mackerel with 73% coming from the Mid-Atlantic region. These fish weighed approximately 5.3 million lbs (2,406 mt; Table 23). Over 11 million mackerel were caught in 1981 with an estimated weight of 19 million lbs (8,629 mt). In 1982 the estimates were 1.5 million fish weighing 2.8 million lbs (1,288 mt).

Annually, between 1979 and 1982, roughly 6.3 million mackerel were caught by marine recreational anglers (Table 24). This average annual catch ranks mackerel as the tenth (in numbers) most numerous species group caught by anglers on the east coast.

NMFS, in the Mackerel Preliminary Fishery Management FMP (PMP), and subsequently the Council, in its FMP, based their estimates of US recreational capacity for mackerel on the assumption that the sport catch is directly proportional to species abundance.

After a survey of the Mid-Atlantic fishery in 1975-76, Christensen et al. (1976) concluded: "A variety of factors affect angler harvest of mackerel including population size, availability of more desirable species, and weather conditions during the relatively brief Middle Atlantic fishing season... Therefore, it does not necessarily follow that the recreational catch is directly proportional to mackerel stock size. Nonetheless, it is believed that angler catches follow general trends set by other indicators of stock size... Indicators included in this comparison are biomass estimates, US research vessel autumn and spring bottom trawl survey indices (Anderson et al., 1976), and the international catch per standard US day fished. The trends in recreational mackerel catch exhibit a similar pattern... Length frequency data from this survey indicate that recreational fishermen primarily harvest the larger size mackerel which are part of the spawning stock. The estimated spawning stock biomass follows a similar trend..." Comparison of subsequent angler survey data and stock estimates (e.g., Anderson, 1980) supports these conclusions. Given the absence of more precise predictive relationships, the assumption that the size of the mackerel sport catch will depend on the size of the spawning stock, within limits, is reasonable given the current data on both mackerel stock abundance and recreational fishing activity for the species.

The FMP provides that the capacity for mackerel in the US recreational fishery is the amount predicted by the equation $Y = (0.01)(X) + (180)$ where Y is the predicted recreational catch and X is the mackerel spawning stock size in the upcoming fishing year, in metric tons.

The accepted hypothesis is that the US recreational fishery catch of Atlantic mackerel is dependent on mackerel spawning stock size. That hypothesis led to the development of predictive equations used in the original Background Paper #1 and its updates, the most recent equation being used in the DAH estimating process in Amendment #1 to the FMP. Revised and more extensive data are now available from the Marine Recreational Fishery Statistics Survey (MRFSS, final for 1979 through 1982). It is, therefore, appropriate to respecify the equation using these new data.

The original Background Paper #1 used NMFS recreational survey data beginning with 1960, with no adjustments to the data. The most recent revision to Background Paper #1 was done after the 1979 MRFSS had been completed and analysis suggested that data from the earlier NMFS surveys overestimated the mackerel catch to the extent that the survey estimates should be cut in half. However, only data for those years with recreational surveys were used (1965, 1970, 1974, 1976-1979).

The NEFC stock assessments have included estimates of the mackerel recreational catch for the years between survey years. Those interpolations were made by relating the commercial and recreational catch during the years with recreational surveys and using that relationship to estimate the recreational catch for the years with no surveys. The equations developed in the original Background Paper #1 and in its updates used only data for those years with recreational surveys. This update uses the latter methodology. In addition, in order to provide more data points for the equation, a regression was run using the NMFS estimates of recreational catch for those years without surveys.

Additionally, a regression was run using recreational catch as the dependent variable and commercial catch as the independent variable with data for those years with recreational surveys. The intent was to explore the relationship between recreational and commercial catch and determine whether to use the data set including the NMFS interpolated recreational catch data or the more limited data set with only survey data.

Given the poor relationship between the recreational and commercial catch it was decided to use the recreational catch-spawning stock size equation based on the data set of only the survey years rather than the set using all data for 1962-1982. Since NMFS uses the interpolated data in the analysis that produces the spawning stock size estimates, using those data in the recreational equation would compound any bias built into the spawning stock estimate because of the relationship between commercial and recreational catch.

As part of the updating process, the equation was tested with additional variables for disposable income and to account for the change in survey methodology beginning in 1979. The additional variables did not improve the equation significantly. The best equation now is:

$$Y = (0.01)(X) - (166) \quad R^2 = 0.78;\ \text{Durbin-Watson} = 2.20;\ N = 10;\ F = 28$$

This revised equation and the methodology used to develop it were reviewed and accepted by the Council's Scientific and Statistical Committee.

7.3. FOREIGN FISHERY

7.3.1. Foreign Catch

The reported foreign catch of the squids, Atlantic mackerel, and butterfish from 1965 through 1984 have varied widely (Tables 1, 4, and 7). The 1984 foreign *Loligo* catch was 11,029 mt, about the same as the 1983 catch of 11,720 mt, but well below the peak 36,508 mt caught in 1973. The foreign *Illex* catch during 1984 was 638 mt, down from 1,776 mt in 1983 and 12,350 mt in 1982, as well as from the 24,707 mt peak of 1976 (Table 1). The final squid TALFFs (on a fishing year basis) were about 37,000 mt for *Loligo* and 23,000 - 25,000 mt for *Illex* for 1980-81 through 1982-83 (Table 25). However, during that period, the total final TALFF was generally not allocated to foreign nations, with the actual catch between 60% and 70% of the allocation (Table 25). The share of the TALFF caught is considerably lower, ranging from 13% (Illex in 1984-85) to 75% (Illex in 1980-81; Table 25).

On a fishing year basis, the foreign catch (Table 25) has also continued a general decline: 19,238 mt in 1979-80 (54% of TALFF), 20,194 in 1980-81 (55% of TALFF), 13,454 mt in 1981-82 (37% of TALFF), 12,734 in 1982-83 (34% of TALFF), 12,916 mt in 1983-84 (61% of TALFF), and 7,796 mt in 1984-85, 63% of TALFF). For 1980-81 through 1982-83 the TALFF was 37,000 mt. By 1984-85 the *Loligo* TALFF had been decreased to 12,388 mt (Table 25).

As with *Loligo*, the foreign *Illex* catch on a fishing year basis (Table 25) has been declining: 15,966 mt in 1979-80, 18,641 mt in 1980-81, 14,982 mt in 1981-82, 12,940 mt in 1982-83, 408 mt in 1983-84, and 427 mt in 1984-85. The share of the TALFF caught has been decreasing: 65%, 75%, 60%, 57%, 14% and 13% for 1979-80, 1980-81, 1981-82, 1982-83, 1983-84 and 1984-85 (Table 25).

The foreign mackerel catch was declining, from 385,337 mt in 1972 to 1,597 mt in 1983. The 1984 catch increased to 9,426 mt (Table 4). The increased foreign catch is largely attributable to JVs, through which foreign nations are allocated a directed fishery in exchange for purchases from US fishermen (over the side) or from US processors.

Foreign mackerel catch by fishing year has been minimal based on recent historical performance: a high of 16,441 mt in 1984-85 and a low of 394 mt in 1979-80. The share of TALFF caught was 33% in 1979-80, 53% in 1980-81, 21% in 1981-82, 13% in 1982- 83, 9% in 1983-84, and 39% in 1984-85 (Table 25).

The foreign butterfish catch declined from 17,847 mt in 1973 to 429 mt in 1984 (Table 7). Foreign butterfish allocations have been generally set at bycatch levels in the recent past in order to encourage the development of the US fishery. The resulting TALFFs have been decreasing, primarily as a result of lower *Loligo* TALFFs. For 1981- 82 the TALFF was set through the Annual Fishing Level process of the Magnuson Act at 1,400 mt. Even with these low TALFF levels, the share of the TALFF caught has been low: 31%, 28%, 36%, 20%, 26%, and 45% for 1979-80, 1980-81, 1981-82, 1982-83, 1983- 84, and 1984-85 (Table 25).

The number of foreign fishing vessels in the Atlantic FCZ has declined drastically since 1978 (Figure 10). In 1978 there were 420 foreign vessels fishing in the Atlantic FCZ and by 1984 there were less than 120 vessels. Spain showed the most significant decline with 220 vessels in 1981 and less than 50 in 1984.

7.3.2. Bycatch TALFFs

Incidental catch relationships among the foreign fisheries for the squids, mackerel, butterfish, and the hakes are important for management of these species. These relationships were discussed in the original FMPs and have been analyzed under both ICNAF and Act management (MAFMC, 1982). The FMP currently provides for minimum bycatch TALFFs. Bycatch TALFFs must not be confused with bycatch allowances or limits. The bycatch TALFFs are designed to assure that foreign nations have adequate amounts of TALFFs established for secondary species that are caught along with targeted species in directed foreign fisheries. In other words, the bycatch TALFFs work at the TALFF calculation level, not at the allocation to nation level and not at the vessel catch level.

For *Loligo* the bycatch TALFF level is 1% of the allocated portion of the *Illex*, mackerel (if a directed fishery is allowed), silver hake, and red hake TALFFs. For *Illex* the bycatch level is 10% of the allocated portion of the *Loligo* and 1% of the allocated portion of the mackerel (if a directed fishery is allowed), silver hake, and red hake TALFFs. For mackerel the bycatch level is 2% of the allocated portion of the silver hake and 1% of the allocated portions of the *Loligo*, *Illex*, and red hake TALFFs. For butterfish there is only a bycatch TALFF, which is 6% of the allocated portion of the *Loligo* and 1% of the allocated portions of the *Illex*, mackerel, silver hake, and red hake TALFFs.

To determine whether these percentages remain valid, data from the US/Poland mackerel research program, data submitted by foreign nations to NAFO, and data submitted by foreign nations to NMFS were reviewed.

Using data from the US/Poland mackerel program for 1981-1984 (Anderson, pers. comm.), the bycatch percentages in the mackerel fishery were 0.0431% *Loligo*, 0.0018% *Illex*, 0.0912% butterfish, and 3.0521% river herring. The hakes were recorded only in 1982, when the bycatch was 0.1388% for silver hake and 0.0005% for red hake.

There has not been a directed foreign hake fishery in the recent past. The observer data used to establish the current bycatch percentages (MAFMC, 1982), therefore, remain the best available data. Those percentages for the hake fishery are 0.36% mackerel, 0.11% butterfish, 0.53% *Loligo*, and 0.22% *Illex*.

Data from January 1977 through March 1985 submitted by foreign nations to NMFS were analyzed by species, month, year, and nation to develop the most recent update. These data have been designated by NMFS as confidential so the details of the analysis cannot be published. The major problem to be solved in doing this analysis was the determination of when was the catch of a particular species the result of a directed fishery as opposed to being a bycatch in another fishery. Each record in the data set available to the Council showed the catch of *Loligo*, *Illex*, mackerel, butterfish, silver hake, red hake, river herring, and other finfish for every month for every nation from 1977 through 1984. The assumption was made that the largest species catch for each year/nation/month record was the directed fishery for that record. The data were sorted accordingly and were summed by year and nation. The summed data were then analyzed to identify any trends that might impact the bycatch TALFFs.

The foreign fishery has changed dramatically since 1977 (Tables 1, 4, and 7), through both a reduction in TALFFs and a reduction in the nations participating. Therefore, it seemed inappropriate to merely average the data over the entire time period (1977- 1985). Hence, averages for more recent time periods were calculated and compared with the data for the most recent years (1984 and 1985). The final bycatch TALFF percentages resulted from an examination of these averages, ~~and~~ most recent performance (1984 and 1985), and an interpretation of the data in light of changes in the fisheries (e.g., decreased TALFFs, decreased directed fishery allocations, and changes in the composition and number of nations actually fishing). In no event were the bycatch TALFF percentages reduced from recent average (all nations) performance.

It must be recognized that the need for bycatch TALFF will be reduced as TALFFs are reduced because with smaller allocations foreign vessels will be able to prosecute their fisheries with less bycatch.

While the foreign catch data by nation are considered confidential, the total foreign catch data (Table 25) suggests that the existing bycatch TALFF allowances are more than adequate. For example, the majority of the foreign butterfish catch takes place as bycatch in the *Loligo* fishery, which was the basis of the bycatch TALFF percentage. Given the other TALFFs in the recent past (e.g., since 1982-83), it would be expected that the percentage of the TALFF caught for *Loligo* and butterfish should be roughly similar if the foreign nations truly needed the allocation established by the bycatch TALFF. In fact, in 1982-83 (Table 25), foreign nations caught 34% of the *Loligo* TALFF and only 20% of the butterfish TALFF. Additionally, for the same year, only 28% of the butterfish TALFF was allocated vis-a-vis 55% of the *Loligo* TALFF. The same pattern was repeated in 1983-84 and 1984-85.

In the *Loligo* fishery, bycatch TALFF allowances of 1.0% for mackerel, 3.0% for butterfish, 10.0% for *Illex*, 0.5% for red hake, and 6.0% silver hake appear reasonable. While not directly the concern of this FMP, the bycatch TALFF allowance in the *Loligo* fishery is 10.0% for "other finfish" and 0.01% for river herring. For *Illex*, the bycatch TALFF allowances are 0.1% mackerel, 0.5% butterfish, 1.0% *Loligo*, 0.1% red hake, and 1.0% silver hake (also 2.0% "other finfish" and 0.0% river herring). For mackerel, the bycatch TALFF allowances (using both NMFS and the US/Poland survey data) are 0.08% butterfish, 0.0% for *Illex*, 0.04% for *Loligo*, 0.0% red hake, and 0.1% silver hake (0.7% "other finfish" and 0.4% river herring).

Using these bycatch TALFF allowances, the percentages in the FMP would be changed. The *Loligo* bycatch TALFF level would become 1.0% of the allocated portion of the Illex, 0.04% of the allocated portion of the mackerel (if a directed fishery is allowed), and 0.5% of the silver and red hake TALFFs. The *Illex* bycatch TALFF level would become 10.0% of the allocated portion of the Loligo and 0.2% of the allocated portions of the silver and red hake TALFFs. The mackerel bycatch TALFF level would become 0.4% of the allocated portions of the silver and red hake, 1% of the allocated portion of the *Loligo*, and 0.1% of the allocated portion of the Illex *TALFF*. The butterfish bycatch TALFF would be changed to 3.0% of the allocated portion of the *Loligo*, 0.5% of the allocated portions of the *Illex*, 0.08% of the allocated portion of the mackerel, and 0.1% of the allocated portions of the silver and red hake TALFFs.

The Council believes that the revised bycatch TALFF percentages are reasonable and attainable. At its September 1985 meeting the Council passed a motion that in no event should the bycatch TALFF percentages be increased to levels greater than those established in Amendment #1.

8. DESCRIPTION OF ECONOMIC CHARACTERISTICS OF THE FISHERY

8.1. DOMESTIC HARVESTING SECTOR

8.1.1. Commercial Fishery

For *Loligo* and *Illex*, separate prices were not published consistently until 1977 (Table 11). In nominal terms and when adjusted for inflation, 1983 *Loligo* prices were the lowest for the period since 1977. In spite of the lower prices, *Loligo* ex-vessel value was a record $7.8 million in nominal terms and $2.6 million when adjusted for inflation in 1983, up from about $2.8 million (nominal) in 1982 as a result of record landings. Note that the ex-vessel value and price relate to landed squid, not JVs.

Illex prices increased in 1983 over 1982, from $252 to $383/mt. However, ex-vessel value fell from $907,823 to $562,624 because of the decrease in landings (Table 11).

Total squid (*Loligo*, *Illex*, and unclassified) ex-vessel value to fishermen in the Mid- Atlantic and New England continued to increase in 1983 to $10,012,611, a record for the period since 1974 both in nominal and deflated ($3,355,432) terms (Table 11).

During the period 1974-1983, the commercial ex-vessel value Atlantic mackerel landings increased from $383,140 in 1974 to $1,344,109 in 1983 (Table 15). Using the wholesale price index to adjust for inflation, the real value of mackerel in terms of 1967 dollars increased from $259,396 in 1974 to $450,430 in 1983. It must be noted that deflation by the wholesale price index may be misleading since fishery products are a very small sector of the economy while the wholesale price index covers all sectors of the economy. Its use is just to indicate that while nominal prices have increased over the long term, some of this increase may have been due to inflationary causes occurring outside the fishery. The price, in nominal terms, increased from $357 to $460 per mt, while the deflated price fell from $241 to $154 per mt, between 1974 and 1983, respectively.

Butterfish ex-vessel value for Maine-Virginia was $970,033 in 1974 and $3,344,952 in 1983 (Table 19). Value of landings peaked in 1982 at $5,142,804. Adjusted for inflation (1967 dollars), these values are $656,746 for 1974, $1,783,819 for 1982, and $1,120,939 for 1983. During the period, prices ranged from $542/mt (1975) to $798/mt (1978), with 1983 at $705/mt.

Perhaps the most significant recent development in the fishery is the introduction of US built catching/processing or catching/freezing vessels. The potential of these vessels cannot be quantified at this time because they have not been in the fishery long enough and because of the lack of data.

The number of permitted vessels in all fisheries has been growing annually for all three classes of permit (commercial, party/charter, and incidental). Vessels with commercial permits for mackerel increased from 769 in 1981 to 1,836 in 1984. For squid the increase was from 674 to 1,496 and for butterfish from 345 to 1,133, for 1981 and 1984 (Table 26). Since there are no qualification rules for obtaining permits (except for surf clams in the Mid-Atlantic Area), most vessels get all permits, so the vessels with mackerel, squid, and butterfish permits may be the same vessels, and additionally, the vessels may rarely, if ever, actually fish for these species. This is merely a function of the system, which allows fishermen to check off as many permits as he wishes (with the one exception noted above), charges no fee for the permits, and keeps the permits in effect without a termination time. Hence, the permit data probably provide a picture of the growth in fishing vessels in the northeast more than an indication of interest in the squid, mackerel, or butterfish fisheries.

Information supplied by Huntress, Inc., Seafreeze Ltd., and Bender Shipbuilding and Repair Co., Inc. during the 1985-86 quota setting process demonstrate at least eight freezer trawler vessels designed for harvesting mackerel, squid, whiting, and other underutilized species may be available by September 1986. The four freezer trawlers proposed by Huntress, Inc. and Seafreeze Ltd. are to have a production capacity of 48,000 mt per year and they estimated that more than half that capacity will be made up of *Loligo* and *Illex*. Five of the six vessels which are under construction or scheduled for construction by Bender Shipbuilding and Repair Co., Inc. are all over 150 feet in length. Although the capacity of these new freezer trawlers is several times greater than the maximum OYs for *Loligo* and *Illex*, and therefore it is not possible for them to target only on species included in this FMP, it is obvious that the cost of conversion or construction and operation of these vessels will require tremendous quantities of fish. Dramatic changes in these fisheries are anticipated with the increase in fishing power attributable to these freezer trawlers. These changes and their associated industry impacts need to be documented and evaluated fully as the vessels enter the fishery.

8.1.2. Recreational Fishery

The marine recreational fishing industry is important in the New England and Mid- Atlantic areas (Centaur Management Consultants, Inc., 1977), with 1975 sales estimated at a minimum of $634 million.

The cost-revenue data available for recreational mackerel catch in recent years is meager. However, some data exist from previous years which is applicable in a general sense.

Data exist for recreational catch by area and mode for 1979-1982 (Table 27). Average cost data for different types of fishing were collected only during 1979 and 1980. These data have been transformed into 1984 dollars to be most easily compared.Average mackerel catch per trip in the Mid-Atlantic region in 1978 ranged from 155 to 1,693 fish for party/charter boats, and from 34 to 104 for private boats. Estimates of 4,558 party/charter boat trips and 73,106 private boat trips were postulated (Christensen, et al, 1979). Using the costs available for 1979 and 1980 along with the 1978 catch rates results in direct expenditures of $1,620,893 and $1,751,763, respectively. It is not possible to determine the economic value of mackerel fishing in New England since accurate estimates of neither the number of trips catching mackerel nor the mackerel catch per trip exist.

The costs shown above demonstrate that the expenditures on recreational fishing rose in real terms between 1979 and 1980. It is possible that this is an ongoing process with the cost of recreational fishing outstripping inflation, or that the effect is a residual of the 1979 fuel price shocks.

The percentage of recreational mackerel caught by mode of fishing has varied tremendously from year to year (Table 28). With the exception of 1982, the party/charter and private/rental modes totalled over 90% of the catch. Since the catch per trip is so large relative to other species the marginal cost per fish is lower than perhaps all other species (assuming the charter/rental costs do not increase greatly for mackerel fishing).

The recreational season is very abbreviated due to the nature and timing of the spring northward mackerel migration. In the Mid-Atlantic region the 1979 season began about 4 April in Delaware and ended 8 June in Long Island. Each area had 20 to 25 days of active fishing (Christensen et al., 1979). The season was later in New England. Such short seasons amplify the revenues associated with mackerel fishing and add substantially to local income during their occurrence.

While the Atlantic mackerel catch ranked tenth on the east coast from 1979 thru 1982 (Table 24), it was not a highly sought after species. The percentage of anglers seeking mackerel in the New England region hovered from 3.86% in 1980 to 3.52% in 1982. However, in 1979, 7% sought mackerel. The Mid-Atlantic region showed less than 1% interest throughout the period (USDC, 1984b and 1985b).

No data exist on the economics of recreational fishing for squid or butterfish. As previously mentioned, they are used for bait in other recreational fisheries, therefore, some become a direct expense of other recreational fisheries. It is presumed that they are largely an incidental catch in the recreational fishery and not a targeted species.

8.2. DOMESTIC PROCESSING SECTOR

Since mackerel, squid, and butterfish have small markets in comparison with groundfish and other major fisheries of the Atlantic coast, processing sector and export information is very limited.

In 1983 there were 5 plants that processed mackerel on the east coast (Fitzgibbon, pers. comm.), although mackerel constitutes only a small percentage of the total volume processed. Processing for domestic consumption primarily involves filleting, curing, and smoking. A substantial portion of the catch is also sold for bait. In 1963, 1965, 1975, and 1983, the value of processed mackerel from New England was $5,000, $21,000, $75,000, and $84,000, respectively.

A total of seven processing firms reportedly participate in the squid fishery. Of the total, five are located in Massachusetts and one each in Maine and New Jersey. All of these firms handle other fish products in addition to their seasonal squid supply (Fitzgibbon, pers. comm.). Six plants in Pennsylvania and New York processed butterfish. No plants in the South Atlantic handled processed butterfish, mackerel, or squid.

New England produced the majority of frozen squid on the Atlantic coast (Table 29). Canned squid has reportedly been produced by New York and New Jersey firms. While east coast production has increased in recent years, it is still a minor commodity when compared to Pacific coast production. At present, canned and frozen squid are the only US commercially prepared east coast squid products.

Most butterfish reported landed is sold fresh or frozen for human consumption. Demand in the US for butterfish as food is concentrated mainly on the largest and best quality fish. The vast majority of landed butterfish is exported to foreign nations, mainly Japan.

A small fraction (approximately 0.6-2.0% of all landings) of the catches of the largest butterfish is smoked and sold in specialty markets. This processing is carried out almost exclusively in New York City, and most of these fish come from Suffolk County, New York, landings in the autumn, when large butterfish are most available in that area. In 1983, about $40,000 worth of smoked butterfish was processed in the US.

About 20% on average of the annual reported butterfish catch was used industrially from 1965-1975. This percentage has probably declined greatly because of the recent increase in landings used for exports. Most of this industrial fraction of the catch is used for bait. Large quantities of butterfish have been periodically taken by industrial (scrap fish) fisheries which do not report landings by species. The composition of such "trash" fish landings may fluctuate markedly from year to year.

The US physical capacity to catch, freeze, and export squid, mackerel, and butterfish undoubtedly is equal to or exceeds the OYs recommended in this Amendment, but much of this capacity is now used for other species which are currently more profitable for US industries. Processor reporting requirements (instituted pursuant to the original FMPs) have not been in effect long enough to derive more precise estimates of shore- based and freezer trawler processing capacities.

In order to provide background information on the DAP portion of DAH, the Council has conducted an annual survey of processors beginning in 1981. Responses to earlier surveys of mackerel, squid, or butterfish processors were 6 in 1981 and 10 in 1982 (Table 30). In 1983, in order to improve the scope of the survey, the Council, in cooperation with the New England Council, NMFS, and the National Fisheries Institute, identified 190 firms that potentially process squid, mackerel, or butterfish. The list was intended to cover all potential processors regardless of size or volume handled. Firms were requested to respond only if they made direct purchases from vessels, as opposed to from distributors or other processors, to minimize double counting. That list was the basis of the surveys in 1983 and 1984. Responses were received from 19 firms in 1983 and 8 firms in 1984. The questionnaire requested estimates of how much of each species the firm planned to process during the current and the upcoming fishing years. Responses for 1985-86 indicate an intent to process 18,652 mt of *Loligo*, 6,613 mt of *Illex*, 6,591 mt of mackerel, and 2,836 mt of butterfish (Table 30). The responses for the squids and mackerel seem reasonable in light of development of those fisheries. However, the butterfish response suggests a lack of response by butterfish processors given the trend in landings in that fishery.

The total number of processors of each species is unknown. The true number probably lies above those stated by NMFS and below the total surveyed by the Council. Therefore, the proposed processing volume presented above is only an approximation at best. A procedure for better data collection is presented in section 9.1.3.2 of this FMP. With the total number of processors known, subsequent statistics can be meaningfully evaluated.

Squid, butterfish, and mackerel landings are only a small percentage of the potential capacities of harvesters and processors. These species have very small US markets for they are primarily consumed by ethnic communities in the Mid-Atlantic and New England. Given this limited demand, ex-vessel prices are very sensitive to landings. Harvesters are unwilling to land these species if their prices are not high enough relative to alternative species and if increased landings will cause ex-vessel prices to decline rapidly. Processors have shown a willingness to expand their production of these species in recent years because of increased demand for US caught squid and butterfish by foreign countries. This demand has stabilized ex-vessel prices with respect to landings and harvesters have responded accordingly.

A number of joint ventures have also been implemented. The first for 1,000 mt with Japan, involved ***Loligo*** squid in 1981. During 1982, eight joint ventures were applied for involving ***Loligo*** and ***Illex*** squid, Atlantic mackerel and Atlantic herring. Seven were approved, and efforts to harvest for over the side sales were undertaken for allocations totaling 24,900 mt, of which 14,900 mt were squids. Results of the 1982 joint ventures were mixed, with only limited success realized for those attempted. While the full potential of the joint ventures was not reached, and several were totally unsuccessful, the experience was encouraging. In fact, 14 joint ventures were applied for in 1983. Eleven were approved, primarily for the squids. In 1984 there were nine joint venture applications, eight of which were approved. Two of the 1984 joint ventures were for mackerel, the balance involving the squids (Table 31).

The character of the JVs has been changing from strictly over the side purchases from US fishermen to a combination of over the side sales, shoreside purchases, and direct foreign fishing to shoreside purchases in exchange for direct foreign fishing. The extent of this shift varies by species. Both Spain and Italy have indicated a desire to purchase US processed ***Loligo***, a situation further evidenced by only two JV proposals for ***Loligo*** for 1985 (Table 31). There is also foreign interest in US processed mackerel, with both 1985 mackerel JVs consisting of over the side purchases, shoreside purchases, and direct foreign fishing. The proposals for 1985-86 received to date (Table 31) are:

1. Scan Ocean/Netherlands for 5,000 mt of mackerel JV, 3,000 mt of mackerel purchased from US processors, and a directed fishery for 30,000 mt. This project is for calendar 1985, with the JV, US processed, and up to 15,000 mt of the directed fishery during 1985-86 through 31 December 1985.
2. Joint Trawlers/German Democratic Republic for 5,000 mt of mackerel as well as a directed mackerel fishery, the project to run through the end of April 1985.
3. Stonavar/Spain for the purchase of 2,500 mt of US processed ***Loligo***, 2,500 mt of ***Illex*** and 2,000 mt of silver hake JV, and a directed fishery for ***Loligo*** and ***Illex***.
4. Eastern Long Island Trawlers/Japan for 1,000 mt of ***Loligo*** and 1,500 mt of ***Illex*** JV.
5. ISTC/Italy for 1,000 mt each of ***Loligo*** and ***Illex*** JV.
6. Joint Trawlers/Portugal for 1,000 mt of ***Illex*** JV.
7. Scan Ocean/Portugal for 500 mt of ***Loligo*** and 1,000 mt of ***Illex*** JV.
8. Lund's/Portugal for 200 mt ***Loligo*** and 1,000 mt ***Illex*** JV.
9. RNS/USSR for 5,000 mt of mackerel JV.

8.3. INTERNATIONAL TRADE

In 1984, 19,894 mt live weight equivalent of mackerel worth about $6.8 million was imported into the US, the largest quantity since 1979 when 21,162 mt was imported (Table 32). Exports in 1984 amounted to 77 mt live weight equivalent, worth $101,632, up from 17 mt in 1983 and down from 149 mt in 1982. Note that these data are for "mackerel". There is no way to fully identify what portion may be Atlantic mackerel.

Squid import data are not available in a comprehensive series. Exports of US canned squid (east and west coast combined) have been falling from a peak 4,268 mt live weight equivalent worth $1.6 million in 1980 to 228 mt worth $93,747 in 1984 (Table 33). Frozen squid exports were not recorded until 1981 when 864 mt live weight equivalent worth about $1.4 million were exported. Exports peaked at 3,719 mt and $7.1 million in 1983 and declined to 1,771 mt worth #3.4 million in 1984.

Butterfish export data east of the Mississippi River are available from 1981 through 1984. In 1981, 1,987 mt worth $3,058,532 ($.70/lb) were exported. Exports in 1982 increased to 6,305 mt worth $10,289,714 ($.74/lb), decreased again in 1983 to 2,172 mt worth $3,917,845 ($.82/lb), and increased again in 1984 to 7,532 mt worth $11,415,922 ($.69/lb) (NMFS NERO).

9. FISHERY MANAGEMENT PROGRAM

This section is divided into four subsections. Section 9.1 described the management measures as they will exist following implementation of Amendment #2. Section 9.2 is an evaluation of those measures changed by this Amendment. Section 9.3 is a discussion of the Amendment relative to other applicable laws and policies and Section 9.4 is a discussion on Council monitoring of the FMP and fishery. The reader may find it useful to review the discussion of the problems to be addressed by Amendment #2 in Section 4.2. The essential management measures currently in effect are presented as Alternative 2 in Appendix 1. In summary form the proposed changes are:

1. The fishing year is changed to the twelve month period beginning 1 January (Sections 4.2.7, 9.1.1.1, and 9.2.2.3).
2. The *Loligo* bycatch TALFF is changed to 1.0% of the allocated portion of the *Illex*, 0.04% of the allocated portion of the mackerel (if a directed fishery is allowed), and 0.5% of the allocated portions of the silver and red hake TALFFs (Sections 4.2.8, 7.3.2, 9.1.1.2, and 9.2.2.4).
3. The *Illex* bycatch TALFF is changed to 10.0% of the allocated portion of the *Loligo* TALFF and 0.2% of the allocated portions of the silver and red hake TALFFs (Sections 4.2.8, 7.3.2, 9.1.1.3, and 9.2.2.4).
4. The Atlantic Mackerel regime is revised by replacing the TALFF/reserve provisions with an ABC/IOY procedure similar to the squids, by revising the recreational catch forecasting equation, by increasing the minimum spawning stock sized from 400,000 mt to 600,000 mt, and by allowing the maximum catch to exceed $F_{0.1}$ under certain conditions. The bycatch TALFF percentages are also revised. The problems relating to the mackerel regime change are presented in Sections 4.2.2, 4.2.8, 5.4.3, and 7.3.2. The revised regime is presented in Section 9.1.1.4 and evaluated in Sections 9.2.2.4 and 9.2.2.5).
5. The butterfish regime is revised by allowing the maximum annual catch quota to be reduced for biological reasons, and by changing the bycatch TALFF percentages (Sections 4.2.5, 4.2.6, 4.2.8, 5.3.4, 5.4.4, 9.1.1.5, 9.1.2.5, 9.2.2.4, 9.2.2.6, and 9.2.2.7).
6. The vessel permits are revised from perpetual to annual (Sections 4.2.9, 9.1.2.1, and 9.2.2.2).

9.1. MEASURES RECOMMENDED TO ATTAIN MANAGEMENT OBJECTIVES

9.1.1. Specification of ABC, OY, DAH, DAP, JVP, and TALFF

9.1.1.1. General

The fishing year is 1 January - 31 December. OY, ABC, IOY, DAH, DAP, JVP, and TALFF will be specified annually through an administrative process which requires that the Regional Director (RD), in consultation with the Council, prepare the required estimates as described below for *Loligo*, *Illex*, Atlantic mackerel, and butterfish, and also provide for public comment on those estimates. The estimates will be prepared annually, however, as discussed below, and for certain species may be changed during the year. The ABC is set within the OY range based on biological information and becomes the upper limit for OY for the particular year and may not be changed during a year. The initial DAH for any of the species may be adjusted during any fishing year by increases within the OY range if actual catches by US vessels exceed the initial DAH estimates.

It is possible that a US/Canadian bilateral fisheries agreement may be developed and implemented during the life of the FMP. In order for the FMP to remain valid following such an agreement, and to the extent that the species included in this FMP are jointly managed pursuant to such an agreement, all of the allowable catch levels are conditioned so that the allowable catch levels would be developed as provided in the FMP or would be the US share of the total catch of the species allowed by joint management procedures, whichever is less.

If the US share of the catch was less than the allowable catch level calculated pursuant to the FMP in any year, the allowable catch level would be reduced by reducing the TALFF by the appropriate amount, unless the TALFF was only for bycatch that year.

9.1.1.2. ***Loligo***

The maximum OY for *Loligo* is 44,000 mt. The RD in consultation with the Council, determines annual specifications relating to Initial Optimum Yield (IOY), Domestic Annual Harvest (DAH), Domestic Annual Processing (DAP), Joint Venture Processing (JVP), and Total Allowable Level of Foreign Fishing (TALFF). The RD reviews yearly the most recent biological data pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower Allowable Biological Catch (ABC) for the fishing year. This level represents essentially the modification of the maximum sustainable yield (MSY) to reflect changed biological circumstances. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing the data concerning past domestic landings, projected amounts of *Loligo* necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The Joint Venture Processing (JVP) component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD provides for a TALFF of at least a minimum bycatch of *Loligo* squid that would be harvested incidentally in other directed fisheries. This bycatch level is 1.0% of the allocated portion of the *Illex*, 0.04% of the allocated portion of the mackerel (if a directed fishery is allowed), and 0.5% of the allocated portions of the silver and red hake TALFFs (Section 7.3). In addition, this specification of IOY is based on the application of the following factors:

1. total world export potential by squid producing countries;
2. total world import demand by squid consuming countries;
3. US export potential based on expected US harvests, expected US consumption, relative prices, exchange rates, and foreign trade barriers;
4. increased/decreased revenues to the US from foreign fees;
5. increased/decreased revenues to US harvesters (with/without joint ventures);
6. increased/decreased revenues to US processors and exporters;
7. increases/decreases in US harvesting productivity due to decreases/increases in foreign harvest;
8. increases/decreases in US processing productivity; and
9. potential impact of increased/decreased TALFF on foreign purchases of US products and services and US caught fish, changes in trade barriers, technology transfer, and other considerations.

Proposed annual specifications of the ABC and IOY and its component amounts are published in the *Federal Register* and provide for a public comment period. At the close of the public comment period, a notice of final annual specifications with the reasons therefore are published in the *Federal Register.*

The IOY may be adjusted by the RD, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs, including when the the application of the above factors warrants an adjustment in TALFF. However, TALFF may not be adjusted to a quantity less than that already allocated to and accepted by foreign nations or less than that needed for bycatch. Any adjustments to the IOY are published in the *Federal Register* and may provide for a public comment period.

9.1.1.3. ***Illex***

The maximum OY for *Illex* is 30,000 mt. The RD, in consultation with the Council, determines annual specifications relating to IOY, DAH, DAP, JVP, and TALFF. The RD reviews yearly the most recent biological data pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower ABC for the fishing year. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. The IOY is composed of an initial DAH and initial TALFF. The RD determines the IOY and any adjustments by the same procedures and factors set out above for *Loligo*, except that it provides for a minimum bycatch of *Illex* squid that would be harvested incidentally in other directed fisheries. This bycatch level is 10.0% of the allocated portion of the *Loligo* TALFF and 0.2% of the allocated portions of the silver and red hake TALFFs (Section 7.3). In addition, this specification of IOY is based on the application of the factors listed above under *Loligo.*

9.1.1.4. Atlantic Mackerel

The RD, in consultation with the Council, determines annual specifications relating to IOY, DAH, DAP, JVP, and TALFF. The Council and RD review yearly the best available biological data pertaining to the stock. ABC in US waters for the upcoming fishing year is that quantity of mackerel that could be caught in US and Canadian waters (T) minus the estimated catch in Canadian waters (C) and maintain a spawning stock size (S) in the year following the year for which catch estimates and quotas are being prepared equal to or greater than 600,000 mt.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on biological and economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. Ordinarily, IOY will be specified so that the fishing mortality rate associated with T is less than or equal to $F_{0.1}$. However, if development of the US fishery requires a fishing mortality rate greater than $F_{0.1}$, but still less than or equal to ABC, IOY may be set at the higher level. This modification will be for that fishing year only and will revert to $F_{0.1}$ unless modified again in subsequent years. Such development requirements are intended to be limited to catch by US fishermen for US processing and to such over the side joint ventures and directed foreign fishing as has a clear and significant (not token) benefit to the US fishery in terms of increases in the amount of US harvested and processed mackerel. The deviation from $F_{0.1}$ is intended to allow the US fishing industry the opportunity to market additional mackerel into the world market during high demand periods such as may occur if a stock problem with the northeastern European Atlantic mackerel stocks developed. Determining these allocations involves estimating both the US and foreign harvesting potential.

The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing data concerning past domestic landings, projected amounts of mackerel necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The recreational fishery component of DAH is determined by the equation $Y = (0.01)(X) - (166)$ where Y is the predicted recreational catch and X is the mackerel spawning stock size in the upcoming fishing year, in metric tons (Section 7.2). The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD must provide for a TALFF of at least a minimum bycatch of mackerel that would be harvested incidentally in other directed fisheries. This bycatch level is 0.4% of the allocated portion of the silver and red hake, 1.0% of the allocated portion of the *Loligo*, and 0.1% of the allocated portion of the *Illex* TALFFs (Section 7.3). In addition, this specification of IOY is based on such criteria as contained in the Magnuson Act, specifically section 201(e), and the application of the following factors:

1. total world export potential by mackerel producing countries;
2. total world import demand by mackerel consuming countries;
3. US export potential based on expected US harvests, expected US consumption, relative prices, exchange rates, and foreign trade barriers;
4. increased/decreased revenues to the US from foreign fees;
5. increased/decreased revenues to US harvesters (with/without joint ventures);
6. increased/decreased revenues to US processors and exporters;
7. increases/decreases in US harvesting productivity due to decreases/increases in foreign harvest;
8. increases/decreases in US processing productivity; and
9. potential impact of increased/decreased TALFF on foreign purchases of US products and services and US caught fish, changes in trade barriers, technology transfer, and other considerations.

Proposed annual specifications of the ABC and IOY and its component amounts are published in the *Federal Register* and provide for a public comment period. At the close of the public comment period, a notice of final annual specifications with the reasons therefore are published in the *Federal Register*.

The IOY may be adjusted by the RD, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs, including when the application of the above factors warrants an adjustment in TALFF. However, TALFF may not be adjusted to a quantity less than that already allocated to and accepted by foreign nations or less than that needed for bycatch. Any adjustments to the IOY are published in the *Federal Register* and may provide for a public comment period.

The specification of mackerel OY, DAH, DAP, and TALFF is:

ABC = allowable biological catch in US waters for the upcoming fishing year.

T = total catch in all waters (US and Canadian) for the upcoming fishing year.

C = estimated mackerel catch in Canadian waters for the upcoming fishing year.

S = mackerel spawning stock biomass in the year after the upcoming fishing year.

Bycatch = 0.4% of the allocated portion of the silver and red hake, 1.0% of the allocated portion of the *Loligo*, and 0.1% of the allocated portion of the *Illex* TALFFs.

ABC = T - C such that S greater than or = 600,000 mt.

OY less than or = ABC and additionally, ordinarily, the fishing mortality associated with OY less than or = $F_{0.1}$.

DAH less than or = OY - Bycatch.

DAP less than or = OY - Bycatch.

TALFF greater than or = Bycatch.

9.1.1.5. Butterfish

Butterfish maximum OY is 16,000 mt. The RD in consultation with the Council, determines annual specifications relating to IOY, DAH, DAP, JVP, and TALFF. The RD reviews yearly the most recent biological data, including data on discards, pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower ABC for the fishing year. This level represents essentially the modification of the MSY to reflect changed biological circumstances. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC. The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing the data concerning past domestic landings, projected amounts of butterfish necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD provides for a bycatch TALFF equal to 3.0% of the allocated portion of the *Loligo* TALFF and 0.5% of the allocated portion of the *Illex*, 0.08% of the allocated portion of the Atlantic mackerel, and 0.1% of the allocated portion of the silver and red hake TALFFs (Section 7.3). Note that the nine factors considered in establishing IOY for the squids and mackerel do not apply for butterfish because the butterfish TALFF is established for bycatch only in accordance with the preceding percentages.

Proposed annual specifications of the ABC and IOY and its component amounts are published in the *Federal Register* and provide for a public comment period. At the close of the public comment period, a notice of final annual specifications with the reasons therefore are published in the *Federal Register*.

The IOY may be adjusted by the RD, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs. However, TALFF may not be adjusted to a quantity less than that needed for bycatch. Any adjustments to the IOY are published in the *Federal Register* and may provide for a public comment period.

The precise specification of OY is:

ABC less than or = 16,000 mt.

OY less than or = ABC.

DAH less than or = OY - bycatch.

DAP less than or = OY - bycatch.

TALFF = bycatch = 3.0% of the allocated portion of the *Loligo* TALFF and 0.5% of the allocated portion of the *Illex*, 0.08% of the allocated portion of the Atlantic mackerel, and 0.1% of the allocated portion of the silver and red hake TALFFs.

9.1.2. Specification of management measures

9.1.2.1. Permits and fees

Any owner or operator of a vessel desiring to take any Atlantic mackerel, squid, or butterfish within the FCZ, or transport or deliver for sale, any Atlantic mackerel, squid, or butterfish taken within the FCZ must obtain an annual permit for that purpose. Each foreign vessel engaged in or wishing to engage in harvesting the TALFF must obtain a permit from the Secretary of Commerce as specified in the Act. This section does not apply to recreational fishermen taking Atlantic mackerel, squid, or butterfish for their personal use, but it does apply to the owners of party and charter boats (vessels for hire).

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

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

9.1.2.2. Time and area restrictions

Foreign nations fishing for Atlantic mackerel, squid or butterfish shall be subject to the time and area restrictions in 50 *CFR* 611.50 and the fixed gear avoidance regulations in 50 *CFR* 611.50(e).

9.1.2.3. Catch limitations

9.1.2.3.1. General

The fishing year for Atlantic mackerel, *Illex*, *Loligo*, and butterfish is the twelve (12) month period beginning 1 January.

The specification of OYs and other values for the squids, Atlantic mackerel, and butterfish are described in Section 9.1.1 and need not be repeated here. On an annual basis, the RD, in consultation with the Council, and after giving opportunity for public notice and comment, sets initial annual values for the terms specified in Section 9.1.1.

On or before 15 October of each year, the Council will prepare and submit recommendations to the RD of the initial annual amounts for the fishing year beginning 1 January, based on information gathered from sources including: (1) results of a survey of domestic processors and joint venture operators of estimated processing capacity and intent to use that capacity; (2) results of a survey of fishermen's trade associations of estimated fish harvesting capacity and intent to use that capacity; (3) landings and catch statistics; (4) stock assessments; and (5) any other relevant scientific information.

By 1 November each year, the Secretary will publish a notice in the *Federal Register* that specifies preliminary initial amounts of OY, DAH, DAP, JVP, and TALFF for each species. The amounts will be based on information submitted by the Council and from relevant sources including those sources specified above. In the absence of a Council report, the amounts will be based on information from the sources specified and other information considered appropriate by the RD. The *Federal Register* notice will provide for a comment period. The Council's recommendation and all relevant data will be available in aggregate form for inspection at the office of the RD during the public comment period.

On or before 15 December of each year, the Secretary will make a final determination of the initial amounts for each species, considering all relevant data and any public comments and will publish a notice of the final determination and response to public comments in the *Federal Register*.

Additional adjustments may be made to annual values for OY, DAH, and TALFF for the *Loligo*, *Illex*, mackerel, and butterfish fisheries during the year. The RD, in consultation with the Council, may modify these values up to ABC, applying the factors described in Section 9.1.1, for the benefit of the nation. The Secretary will publish a notice in the *Federal Register* and provide for comment before such revisions may take effect.

NMFS shall close the US fishery for *Loligo*, *Illex*, mackerel, or butterfish when US fishermen have harvested 80% of the allowable domestic harvest if such closure is necessary to prevent the allowable domestic harvest from being exceeded. The closure will be in effect for the remainder of the fishing year. If such a closure is necessary, NMFS will provide adequate notice to US fishermen and to the Executive Directors of the New England, Mid-Atlantic, and South Atlantic Fishery Management Councils. During a period of closure, the trip limit for the species for which the fishery is closed is 10% of the weight of the total amount of fish on board.

9.1.2.3.2. Joint ventures

The Amendment continues the procedure of permitting joint ventures on a case-by-case basis, so long as joint ventures do not result in a negative impact on US processors. The Council believes that this is a reasonable approach. In other words, joint ventures are considered on a case-by-case basis for Atlantic mackerel, *Illex*, *Loligo*, and butterfish and are permitted if such joint ventures would not have a negative impact on the development of the US harvesting and processing sectors.

9.1.2.4. Types of vessels, gear, and enforcement devices

Foreign nations fishing for Atlantic mackerel, squid, or butterfish are subject to the gear restrictions set forth in 50 *CFR* 611.1.50(c).

9.1.2.5. Other measures

Each US fishing vessel shall display its official number on the deckhouse or hull and on an appropriate weather deck. Foreign fishing vessels shall display their International Radio Call Signs (IRCS) on the deckhouse or hull and on an appropriate weather deck. The identifying markings shall be affixed and shall be of the size and style established by NMFS. Fishing vessel means any boat, ship or other craft which is used for, equipped to be used for, or of a type which is normally used for, fishing, except a scientific research vessel. Fishing vessel includes vessels carrying fishing parties on a per capita basis or by charter which catch Atlantic mackerel, squid, or butterfish for any use.

Vessels conducting fishing operations pursuant to this FMP are subject to the sanctions provided for in the Act.

Pursuant to Section 204(b)(12) of the MFCMA, if any foreign fishing vessel for which a permit has been issued has been used in the commission of any act prohibited by section 307 of the MFCMA the Secretary may, or if any civil penalty imposed under section 309 of the MFCMA has not been paid and is overdue the Secretary shall: (a) revoke such permit, with or without prejudice to the right of the foreign nation involved to obtain a permit for such vessel in any subsequent year; (b) suspend such permit for the period of time deemed appropriate; or (c) impose additional conditions and restrictions on the approved application of the foreign nation involved and on any permit issued under such application, provided, however, that any permit which is suspended pursuant to this paragraph for nonpayment of a civil penalty shall be reinstated by the Secretary upon payment of such civil penalty together with interest thereon at the prevailing US rate. Foreign nations fishing for Atlantic mackerel, squid, or butterfish are subject to the incidental catch regulations set forth in 50 *CFR* 611.13, 611.14, and 611.50.

No foreign fishing vessel operator, including those catching Atlantic mackerel, squid, or butterfish for use as bait in other directed fisheries, shall conduct a fishery for mackerel, squid, or butterfish outside the areas designated for such fishing operations in this FMP.

9.1.3. Specification and sources of pertinent fishery data

The butterfish fishery is approaching or possibly exceeding a safe harvest rate due to fishing practices and annual variations in stock distribution. The squids are being taken to a greater extent by US fishermen each year and TALFFs are rapidly diminishing such that it is expected that there may be no directed foreign fishing within the next two years. The markets are certainly available in the US and abroad for US utilization of total quotas. The Council now needs more timely data than in the past to allow a more accurate accounting of changing fishing practices and to allow the setting of annual allocations that will prevent recruitment overfishing as well as allowing for in season adjustments.

The Magnuson Act (303(a)(5)) requires that FMPs "specify the pertinent data which shall be submitted to the Secretary with respect to the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls ... ". NMFS data systems (e.g., the NEFC Three-Tier System) collect much information on the squid, mackerel, and butterfish fisheries and the reporting procedures in this FMP are based on those systems continuing in operation and being revised so that vessel identification information is retained in the data files in a manner that facilitates necessary analyses.

Foreign fishermen are subject to the reporting and recordkeeping requirements set forth in 50 CFR 611.9.

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

9.2.1. The FMP Relative to the National Standards

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

The best scientific information available indicates that squid, mackerel, and butterfish are not currently overfished. Harvests at the OY levels described in the FMP should not endanger future harvests at comparable levels.

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

The FMP is based on the best and most recent scientific information.

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

The FMP meets the requirements of this standard by simultaneously managing Atlantic mackerel, *Loligo*, *Illex*, and butterfish in a complementary manner. The FMP also takes into account the catch of mackerel outside US waters. The Council continues to review data on the squid and butterfish fisheries in the Gulf of Mexico to determine whether the management unit should be amended in the future to include this area.

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

The OY and DAH estimates described in the FMP will accommodate all US demand for squid, Atlantic mackerel, and butterfish in the commercial and recreational fisheries without prejudice to residents of any State. The seasonal movements and distributions of these species make it extremely unlikely that fishermen of any State could harvest the DAH before the species become available to other US fishermen.

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

The FMP permits growth of the US fishery up to maximum biological levels. The only restrictions placed on US fishermen are the overall quotas, and the permitting requirement. No measures would change the economic structure of the industry or the economic conditions under which the industry operates.

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

The FMP anticipates fluctuations in species abundance and expected trends in demand for mackerel, the squids, and butterfish.

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

The FMP is consistent with and complements, but does not duplicate, management measures contained in other FMPs and PMPs.

9.2.2. Cost/Benefit Analysis.

9.2.2.2. Annual Permit System (related information presented in Sections 4.2.9 and 9.1.2.1)

9.2.2.2.1. Introduction

The Council proposed the revisions to the permit system described in Section 9.1.2.1 to make the permit system a more effective support for the management of the four fisheries. The principal objective is to have the system operate in a manner which enables the Council and NMFS to know on an accurate and timely basis how many participants there are in the fishery during a given year.

This is a critical need of a program which depends on an accurate calculation of annual specifications for various users of the four fisheries managed under the FMP. To this end, the Council has proposed an annual permit system so that the participants can be identified on an annual basis. In addition to usual permit data, information on the prior year's landings of squid, mackerel, and butterfish must be included in the annual permit application. The permit may be revoked for violations of the FMP, including failure to adhere to the mandatory reporting requirements. The Council will work with NMFS staff to develop an appropriate schedule of penalties to correspond to FMP violations of this section so that the Council's view of the seriousness of permit and reporting violations will be reflected in enforcement actions pursued under the FMP.

9.2.2.2.2. Costs

Prior to this Amendment, all permits for the squid, mackerel, and butterfish fisheries were issued on a perpetual basis (having no expiration date). It is the intent of the Council that this system be modified to the extent that each permit be renewed annually by the applicant, and an estimation of the applicant's previous year's landings of squid, mackerel, and butterfish be included on the application form. The costs of using annually renewed permits must be considered in two parts: the first would be the initial "start-up costs" involved with putting a renewal system in place, and second would be the annual (recurring) costs of maintaining and executing it.

Start-up Costs. The start-up costs of instituting an annual permit system consist basically of the time and effort (labor costs) required to design it. At this stage, it would be premature to estimate how long NMFS will require to modify their operating procedures. However, it is important to note that NMFS is now receiving requests from both the Mid-Atlantic Council (regarding squid, mackerel, and butterfish) and the New England Council (regarding groundfish) for annually renewed permits. The best operational system for NMFS to use in dealing with these requests is clearly a matter best resolved within the Service itself. However, there is also little doubt that it would be most efficient for NMFS to change their system only once to accommodate all fisheries which will go to annual permits at the same time. Both Councils are currently discussing the logistical details of such a system with the NMFS Permit Office. It is anticipated that a system could be in place by 1 January 1987.

Annual Maintenance Costs. Once an annual permit system is in place, the process of maintaining it should be straightforward. A renewal application would be sent to each permit holder which contains all the standard information concerning his vessel. The owner or operator would simply update the form by writing corrections directly on it (e.g. change in gear, owner's address, etc.) and noting the vessels' catch of squid, mackerel, and butterfish for the past year. NMFS would process the application upon its return and issue a renewed permit. The following cost estimates for new and renewed permits were obtained from the NMFS Analytical Services Branch (Terrill, pers. comm.):

1) Costs to Issue Each NEW Permit:

Computer costs	2.88
Labor costs	1.60
Permit form & mailer	0.15
Postage	0.22
TOTAL	4.85 X 3,100 permits = $15,035 (maximum)

2) Costs to <u>RENEW</u> Each Permit:

Computer costs (half)	1.44
Labor costs	0.96
Permit form & mailer	0.15
Postage	0.22
TOTAL	2.77 X 3,100 permits = $8,587 (maximum)

Notes:

- The cost of mailing out permit application forms adds an additional $185.
- Labor costs equal 16 cents per minute. This is the wage rate for a government employee at Level GS-5 Step 1 ($14,390) plus overhead of 27.5% (benefits and taxes).

9.2.2.2.3. Benefits

The benefits of instituting an annual permit system are several. The first and most direct benefit is the value to managers of knowing how many participants are actively engaged in a given fishery, as well as basic information on how it is being executed (gear types, vessel sizes, etc.). Those who are familiar with the current (perpetual) permit system are aware that fishermen can obtain a permit for any fishery (except Surf Clams) simply by checking off boxes on the application form. The most common tendency is to check off <u>all</u> the boxes, regardless of whether a real interest exists for participating in any given fishery. This may be simply for the purpose of leaving all options open, or in some cases fishermen fear the prospect of a limited entry program being instituted at some point in the future, and wish to establish a record of having participated.

There is no current provision for discovering if a given vessel did indeed exercise its right to fish for any particular species. Nor is there any capability for updating this information across time. A vessel may actually have participated in a fishery, but then left it a short time later. Its name will still appear in the permit files on an equal basis with the rest.

In essence, the fishery manager is currently denied the most fundamental information on entry to and exit from the fishery. It should also be remembered that substantial costs were incurred in setting up the present system, and continue to accrue from maintaining it. Whereas the value of the information generated by the system is minimal. The modifications proposed by this Amendment not only greatly improve upon the system, but they will justify the investment that has already been made in it.

A second benefit from the new system is a vastly improved ability to conduct the Regulatory Impact Reviews of management plans which are required of the Councils by E.O. 12291. In order to assess the impacts of management measures on fishermen, it is clearly necessary to be able to identify who these fishermen are.

A third benefit is that the three-tier information collecting system used by NMFS is based on samples. The Permit File, theoretically, is the one data bank available which covers 100% of the population in question. Clearly it would be beneficial to fishery managers to be able to utilize its full potential.

Finally, it should be recognized that the Permit Files have the potential for being an invaluable data base on the East Coast fishing fleet as a whole, not simply from the perspective of individual fisheries. If annual permits were required across *all* fisheries, a comprehensive and continually updated data base would be the resultant product.

9.2.2.2.4. OMB Approval

The Office of Management and Budget has already approved the use of annual permits as requested on Standard Form 83. The current system allows for a total of 9,400 responses per year across all fisheries in the Northeast. With a mean response rate of 30 minutes per application, a total of 4,700 Public Burden Hours have been approved.

Since the greater part of permit renewal will be simply verifying and correcting information already printed on the renewal form, response time should require less than the approved 30 minutes. With the total number of permits issued in the squid, mackerel, and butterfish fisheries currently numbering 3,100, the limit of 9,400 responses per year presents no problem.

The only modification of the permit system proposed by this Amendment which may require OMB approval is in providing space on the renewal form itself for the past year's landings of squid, mackerel, and butterfish. The Council believes that adding these questions will not increase public response time beyond the approved 30 minutes.

9.2.2.3. Changing the fishing year (related information presented in Sections 4.2.7 and 9.1.1.1)

Changing the fishing year to the calendar year should reduce costs for both industry and government. Foreign fishing permits are issued on a calendar year basis and all of the species in the Atlantic foreign fishery other than squid, mackerel, and butterfish are managed on a calendar year. The April-March fishing year has resulted in foreign nations processing two joint venture applications (particularly for mackerel) in order to rationalize the differences between the fishing year, calendar year, and mackerel fishing season, resulting in doubling the work of the foreign nation and US joint venture partner, the State and Commerce Departments, and the Councils. Putting all of the management systems on the same time basis will simplify procedures, as well as leading to a substantial administrative cost saving. There will also be a reduction in costs since there will no longer be a need to maintain data on both a fishing year and calendar year basis.

In order to obtain a rough estimate of the administrative cost savings from changing to a calendar year, separate calculations have to be made for the agencies in Washington, DC and the two Councils. The Permits and Regulations Office in Washington has calculated the average cost of processing a permit as being $167 (Freese and Bilik, pers. comm.). The Department of State would be expected to spend only a fraction of the time spent by the Councils or NMFS in processing permits, and a reasonable figure would be in the vicinity of one-third, or $56 per permit. At an annual average of 10 joint venture applications (or 20 permits given the current system) for the Northeast Region over the last 4 years (Table 29), the total administrative cost savings would come to $2,230 each year in Washington, D.C.

The Councils, however, require a more extensive analysis. Joint venture discussions are an important agenda item for at least 3 Council meetings occurring in the period December through March. Committee meetings occur prior to each Council meeting in order to formulate recommendations. To calculate the value of the man-hours invested in this process, the following estimates are provided:

At a COUNCIL MEETING:

- 20 Council members at an average $33.00 per hour ($263 per day compensation)
- 5 Council Staff at an average $15.00 per hour ($30,000 annual salary)
- 5 NMFS personnel at an average $20.00 per hour ($40,000 annual salary)

At a COMMITTEE MEETING:

- 5 Council members at an average $33 00 per hour ($263 per day compensation)
- 6 NMFS personnel and Council Staff at an average $20.00 per hour ($40,000 annual salary)

It is assumed that for Council meetings, each individual will have spent one hour preparing for joint venture discussions, and three hours in the actual discussions at the meeting. For Committee meetings, it is assumed that each individual will have spent three hours in preparation and three in discussions.

Making the required calculations, one arrives at a cost of $5,050 associated with Council and Committee deliberations on joint ventures for each meeting. Multiplying by 3 for each of the 3 meetings yields $15,150 per year per Council. Finally, adding the two Councils together brings the total annual cost to $30,300.

Clearly, however, this entire amount will not be saved by changing the fishing year and removing the need to issue permits twice. The Mid-Atlantic Council estimates that a time savings of approximately 50% will accrue from the change, yielding a value of $15,150 as the total administrative cost savings for the Councils. When the $2,230 from the agencies in Washington, D.C. is added, the total overall savings comes to $17,380. It should be noted, however, that this figure is a very conservative estimate. When a controversial application is under consideration, these costs (and corresponding savings) increase significantly.

Theoretically, changing the fishing year could affect US fishermen who fish in the October-March period. January-March constitute the end of the current fishing year and fishermen active in those months face a potential closure since any closure would come at the end of the year whereas with the revised fishing year these fishermen would be active in the first quarter, thus virtually eliminating the chances of a closure during their season. Fishermen active during the October-December period have faced relatively little chance of closure in the past, whereas with the changed fishing year their activity will be placed closer to the end, and have a greater chance of being affected if there is a closure. Reviewing seasonal catch data (Tables 14, 18, and 21) suggest that the chances of real negative impacts from changing the fishing year are minimal.

Additionally, the change in the fishing year will change the period during which earned TALFFs are allocated. During the last four months of fishing years 1983-84 and 1984-85, over 67% of the *Loligo* and 30% of the *Illex*

TALFFs were allocated (Table 36). When the fishing year coincides with the calendar year this earned TALFF will be allocated during the fall season. The winter earned TALFF allocations result in foreign fishing on squid while they are concentrated just prior to their inshore migration. US fishermen report that just prior to and during this inshore migration the squid are easier to catch because they are schooled and larger. Should the US harvesting sector increase its capability to harvest these schools, a direct conflict will exist. Recent developments in the fishing industry suggest this may occur.

The fishing year change will allow for the existing pattern of limited TALFF allocations as part of joint ventures (or no TALFFs except bycatch when the appropriate conditions develop) to be made early in the year. To the extent that foreign nations meet or exceed their commitments in a way that determinations are made that they have earned additional TALFF allocations, these allocations could be made and fished during the fall.

9.2.2.4. Revised bycatch TALFF percentages (related information presented in Sections 4.2.8, 7.3.2, 9.1.1.2, 9.1.1.3, 9.1.1.4, and 9.1.1.5)

The methodology for developing the revised bycatch TALFF percentages is set forth in section 7.3.2. The revisions reflect the average recent performance of the nations that have been in the foreign fishery and therefore should not have a negative impact on the foreign fishery. They should have a positive impact by making more fish available for directed fisheries by both US and foreign fishermen while maintaining the principle of assured bycatch TALFFs.

9.2.2.5. Revised mackerel regime (related information presented in Sections 4.2.2, 4.2.8, 5.4.2, 7.3.2, and 9.1.1.4)

The changes to the mackerel OY setting processes should have no administrative cost impacts.

Revising the recreational catch forecasting equation should have no impacts. This change was made to incorporate the most recent recreational catch data so that the FMP is consistent with National Standard 2.

The increase in the minimum spawning stock size (Section 5.4.3) was made to incorporate the most recent available data which indicates that 7 of the 9 year classes produced when the spawning stock biomass exceeded 600,000 mt were above the median year class (Figure 6). Benefits should, therefore, be positive by increasing the probability of good year classes to provide the basis of a stable fishery over the buffer provided by the previous 400,000 mt minimum.

Revising the mackerel regime to replace the TALFF-Reserve system with the ABC-IOY system should assist in development of the US fishery. The rate or magnitude of such development cannot be quantified. However, it is clear, based on the butterfish and squid experiences, that so long as foreign nations can get unconditioned, direct fishing allocations for their fleets they will not purchase US harvested or processed fish. So long as a species can be caught in waters other than the US FCZ, or so long as there are substitutable species, there is no assurance that any foreign nation will purchase US caught or processed fish. Without some stimulus in terms of foreign purchases of US caught or processed fish, it is highly unlikely there will be significant fishery development.

The amended mackerel regime allows for increased flexibility in dealing with US and world market conditions at no additional cost. The revision consists of the elimination of reserves, basing TALFFs on a fish and chips policy, and the latitude to increase OY from the $F_{0.1}$ level on a yearly basis should US economic conditions warrant it. These changes will make the FMP compatible with the most recent amendments to the MFCMA and the NMFS Fish and Chips Policy (USDC, 1985a).

The market under consideration is that for raw (as yet unprocessed) mackerel harvested off the US east coast. Total demand in this market may be considered as having five components: US commercial, US recreational, joint ventures, foreign bycatch TALFFs, and requests for directed foreign fishing (TALFFs). Supply equals ABC, which may be specified in two ways pursuant to Amendment #2. The first specification of ABC/supply is an allowable catch bounded at the top by $F_{0.1}$ and at the bottom by a spawning stock biomass of 600,000 mt, which is essentially the same as the current FMP. The second specification of ABC/supply is an allowable catch bounded only by the 600,000 mt spawning stock biomass.

A sensitivity analysis was conducted examining three scenarios under the present and proposed regimes. The first is when total demand is less than or equal to ABC/supply at any level; the second is when US demand (commercial, recreational, and joint venture) and bycatch TALFFs combine to be equal to or greater than ABC/supply; and third, when total demand is greater than ABC/supply.

The first scenario of adequate or excess supply would completely satisfy both US and foreign demand under both the current and proposed regimes. However, under the new regime, the TALFF would not be automatically specified as half the difference between IOY and DAH. Instead, TALFF would be a negotiable amount based on criteria set forth in the MFCMA and the FMP.

In the second scenario, US demand and bycatch TALFF are equal to or greater than ABC/supply. If these are equal to the ABC/supply under the current FMP then there is no directed TALFF and if domestic demand is greater than ABC, only that amount in excess of bycatch TALFF is allowed for DAH. Under the revised regime US demand would still be considered first; the RD would have the option, however, based on economic considerations, to adjust OY up to the limit of ABC/supply calculated using only the 600,000 mt spawning stock biomass rule. This decision would have to be based on the specific demand criteria, their economic implications, and any current biological considerations.

The third scenario consists of total demand being greater than ABC/supply. By definition, the excess demand is caused by directed TALFF requests (all other possibilities are included in the second scenario). Under the current FMP there is a bargaining potential for the reserves and for the initial TALFF. However, under the revised regime all TALFF becomes negotiable. Since demand is high in this scenario this places the US in a stronger position to bargain for increased technology transfer, purchases of US harvested fish, research, etc.

The costs of revising the mackerel regime are primarily administrative. Most of these costs are already expended by the time the FMP is submitted and reviewed. Therefore, they must be considered sunk costs. They are costs that will be expended whether the measure is approved or not. There will be a marginal increase in permit review costs since TALFF will be negotiable. However, the system has informally operated in this mode for the past year, so costs are not expected to increase over the current level. Some foreign directed and joint venture mackerel fishing may not occur that otherwise would based on negotiable TALFF, but, again, this is probably only marginal since the proposed FMP merely institutionalizes an existing policy.

The benefits of the revised regime are demonstrated in Table 37. The option value of the change is neutral or positive throughout.

The scenario of supply being greater than total demand is the most probable case. In this scenario the situation under this FMP would mirror present policy and practices. There would be no change in US costs or allocations. However, this FMP formalizes Council policy and Council, NMFS, and State Department practice and therefore reduces confusion and discrepancies concerning joint venture and directed TALFF allocations.

The greatest possible gain to the US could come from scenario two if US demand were greater than ABC/supply while ABC/supply was at a high level. The second highest gain to the US is the third scenario at any ABC/supply level (under this circumstance foreign bidding for TALFFs and joint ventures would increase US gains).

The Council believes that setting ABC/supply greater than $F_{0.1}$ will occur most likely only if the northeast (European) Atlantic mackerel fishery collapses or is so reduced as to be unable to supply its markets. Should this occur it is expected that foreign dealers and processor will apply to the US for combinations of direct purchases of US harvested mackerel, joint ventures, and directed TALFF. If the requests are of such a magnitude as to exceed the ABC/supply that would follow from the $F_{0.1}$ provision, the revised regime allows for exceptions on a one year at a time basis The TALFFs will be judged on an individual basis on the criteria set forth in this FMP and the MFCMA. The economic gains from each can then be evaluated and compared. The optimal situation would be to maximize each country's willingness to pay as exemplified in Crutchfield (1983) and Chen (1982). Under a situation of demand exceeding supply the maximum payment could be extracted from each country in fees, purchases of US harvested fish, technology transfer, etc. By allowing a greater supply to become available there could be a greater gain possible. This could only be determined at the time of the excess demand. The decision would have to depend on, among other items, the exact reasons fostering excess demand, the specific economic gains offered to the US, the projected duration of elevated demand, and the development potential of domestic industries.

After the economic considerations have been evaluated a decision would be arrived at to determine the actual harvest level allowed. If the spawning stock was lowered to 600,000 mt " cost" would be the number of years required for stock rebuilding to an acceptable level. This recovery period, of course, depends upon the fishing rate in the subsequent periods. With a spawning stock biomass of roughly 600,000 mt, if subsequent annual harvest reverted to levels of $F_{0.1}$ then there would be a slight (3% on average) stock rebuilding per year (Anderson, 1983). Of course, at levels below $F_{0.1}$, the rebuilding rate would be correspondingly increased as has been the case since the Atlantic Mackerel Supplement #1 was implemented in 1979. These costs and benefits could be evaluated at the margin to determine the optimal harvest level based on the specific criteria involved.

Recent review of data on the European segment of the species (Anonymous, 1985) indicate two well-separated overwintering areas and two major spawning grounds with both activities occurring in the Celtic Sea and the northern North Sea. The ICES hypothesis is that of separate European spawning stocks and thus they perform separate assessments. No reference identifying intermixing between European and American segments of Atlantic mackerel is known.

World landings of Atlantic mackerel have varied significantly from the mid-1970s to the mid-1980s (FAO, 1985). In 1975 there were nearly 1.1 million metric tons of Atlantic mackerel landed from both sides of the North Atlantic whereas in 1983 (the last year for which data are available) the landings were only slightly more than 600,000 mt. A slow but steady decline appears evident in landings for the total North Atlantic since 1979 when 671,400 mt of mackerel was landed (1980: 656,200 mt, 1981: 634,500 mt, and 1982: 624,800 mt). Since total North Atlantic landings of mackerel in US waters during 1979 to 1983 reached 15,000 mt (Table 4) the US controlled portion of the total Atlantic landings never exceeded 3%, and the decline in landings is attributable solely to activities in the Northeast Atlantic ocean. This apparent slow decreasing trend in total Atlantic mackerel landings is likely to continue for awhile since the ICES Mackerel Working Group (Anonymous, 1985) is interpreting recruitment indices to indicate very weak 1982 and 1983 year classes in European waters.

World demand for Atlantic mackerel primarily is supplied from northeast Atlantic catches. These catches by the European Community (EC) have varied from 829,100 to 572,100 mt over the past 10 years (FAO, 1985). In recent years the threat of overfishing this stock has been identified by scientists and commissions (Fishing News, 1984, 1985a). There seems to be a reluctance on the part of the EC to reduce quotas. In fact, some member countries are notorious for grossly overfishing their mackerel quotas (Eurofish, 1985 a and b). This would suggest that demand factors currently exist at sufficient level to induce overfishing.

The largest markets for Atlantic mackerel seem to be the USSR (at-sea deliveries of European Community catches) and West African countries (canned and frozen products) (Dunbar, 1981). In addition, demand is being cultivated in Europe where canned mackerel is replacing canned herring (Infopesca, 1981). Less developed countries, particularly along the African west coast and especially Nigeria, are viewed as having strong market potential depending on their specific economic (oil related) conditions (Dunbar, 1981).

Foreign nations which are direct purchasers of mackerel often use floating processors and transshipping fleets to transport the mackerel to market. The economics of operation dictate that the most efficient use of these fleets is for continuous operation. Due to the EEZs of most countries, these second parties purchase their catch directly from fishermen (Dunbar, 1981). Such mobile fleets represent "roving" demand which is able to respond to shifts in availability. Shore based processors are less able to respond to a shift in availability unless their catch can be or already is delivered in a frozen state.

Canned mackerel is used by many countries for food aid to less developed countries and to countries devastated by natural disasters (Dunbar, 1981). This is made possible by mackerel's high nutritional value and low harvesting cost.

Initially the EC subsidized mackerel exports to foreign countries. In late 1983 these subsidies were halted since it was determined that the foreign markets were strong enough to allow profitable unsubsidized exports (Fishing News, 1983). However, by 1985 UK mackerel prices were not as strong as expected even in the face of future supply decreases. One reason for lower prices was that the Eastern bloc countries "... have ruled by division to push the price down" (Fishing News, 1985b). This demonstrates the buying power of the Eastern bloc countries and their combined effect on the Atlantic mackerel market.

9.2.2.6. Revised butterfish regime (related information presented in Sections 4.2.5, 4.2.6, 4.2.8, 5.3.4, 5.4.4, 9.1.1.5, 9.1.2.5, and 9.2.2.7)

The changes to the butterfish OY setting processes should have no administrative cost impacts. This is because the procedure to establish annual OY under Amendment #1 is the same as utilized by this Amendment #2.

The revision to the butterfish ABC-OY process will reduce the chances of the stock being overfished because of the lack of flexibility of the current FMP.

The current and projected economic conditions in the butterfish fishery are such that the total ABC is harvestable by US vessels and the bycatch TALFF However, with increased fishing effort it becomes necessary to allow modification for biological considerations in a timely manner. In order to evaluate the impacts of a reduced ABC due to biological reasons it is desirable to analyze the costs and revenues that would accrue to harvesters and processors under various scenarios. These figures could then be added across the number of participants to determine overall and marginal costs and revenues for butterfish. These data would give some indication of the change in producer surplus associated with a butterfish OY reduction.

At the present time the NEFC does not retain vessel identifiers across months (Peterson, pers. comm.). Therefore, it is impossible to acquire individual vessel cost, revenue, or effort data across time. Also, it is possible to determine the actual number of vessels involved in either the directed or incidental butterfish fishery. Likewise, the processor surveys conducted by NMFS are voluntary. Therefore, they tend to underestimate the actual number of processors and dealers involved in butterfish. NMFS's best estimate of the number of processor is described in Section 8.2. The cost, revenue, and volume data for the processors is not required by law. Therefore, accurate overall and marginal cost and revenue data are unavailable for this sector of the fishery also.

The best estimate of the number of vessels actually participating in the butterfish fishery is 719 (Frailey, pers. comm.). These vessels are distributed along the eastern seaboard from Maine to North Carolina. Most butterfish landings have been in Rhode Island. Therefore, it is expected that many of the vessels were based for all or part of the year in southern New England. Likewise, it is expected that the largest volume of processed butterfish occurred in southern New England. Therefore, the processing plants there probably were the main handlers of butterfish. The fishery is expanding into the Mid-Atlantic.

A closure of the butterfish fishery due to a reduced ABC/OY would affect the fishery in two major ways. A reduced OY would only occur if the stock were reduced from present levels. Assuming a constant effort level, that would infer lower harvest throughout the year due to decreased abundance. The second major affect would be a possible closure sometime during the year. This may or may not occur depending on what reduction, if any, occurs in the catch.

Due to butterfish biology (Sections 5.3.4 and 5.4.4), an increased population could occur relatively rapidly following one strong year class. If the harvest level is not adjusted downward then growth overfishing would probably occur and the stock would remain at lower levels.

The worst case foreseen is a reduction of ABC to zero (or more technically correct, to bycatch TALFF only levels). This would be caused by a severe reduction in both commercial landings per unit of effort (if measurable) and year class abundance. Such a severe reduction would certainly be proceeded by reduced landings per unit of effort. Likewise, total landings would no doubt have been reduced for some previous period. These reductions would be due to stock rather than market factors. A total elimination of US landings would therefore have to be compared to what the market had been at the time of restriction. If it is assumed that the total landings the year prior to the reduction were 8,000 mt or half of current landings, the revenues lost would be $4,384,000 (at the average 1984 ex-vessel price of $.27/lb; USDC, 1985a). The effort directed toward butterfish would be redirected to some extent. Therefore, new revenues would be obtained from other fish stocks by the same boats and crew. It is assumed that the net revenues obtained from this redirected effort would be less than that obtained from butterfish fishing. This is because the most lucrative fishery would probably be the first choice. The change in ex-vessel revenue, both gross and net, is not expected to be substantial. The actual change would depend on the number of boats still fishing for butterfish before the closure, their operating costs, catch, and profits, and the fisheries to which they redirect, including new costs, etc.

The dealers and processors still involved in butterfish marketing would be impacted also. They would either redirect to other species or close during their butterfish season. Since no operator is known to rely solely on butterfish and since any total closure would presumably be proceeded by a period of poor harvests, it is assumed that no dealer or processor would be forced out of business.

Overall producer and consumer surpluses would be reduced by the lack of butterfish. Producer surplus can only be determined if costs and revenues are known (which they are not). The largest impact may in fact be consumer surplus. Most of the butterfish are for the export market, specifically Japan, so the vast majority of consumer surplus is foreign. Foreign consumer surplus is unknown. The primary substitutes for Atlantic butterfish in the Japanese market is Pacific butterfish, sea bream, and jack mackerel (USDS, 1979). Based on world catch statistics (FAO, 1985), catches of these substitutes are at much higher levels than Atlantic butterfish. A total closure of Atlantic butterfish would reduce Japanese consumer surplus. The magnitude of this reduction in consumer surplus is unknown In order to evaluate the reduction, domestic marketing studies (including demand variables, income levels, market prices, substitutes, etc.) of Atlantic butterfish consuming countries are necessary. US consumer surplus would be almost totally eliminated barring availability of substitutes. This surplus is unknown, but in total presumed to be not substantial. Domestic consumption is discussed in Section 8.2. Based on their reproductive capacity, butterfish could be expected to recover to a level sufficient to provide some harvest within, at most, two years, providing environmental conditions are not restrictive. Upon resumption of harvest it is likely that the ABC would be approximately equal to that assumed to exist before the closure. Within two or three additional years the population could be expected to have returned to its present level and the ABC would be the present 16,000 mt.

It is unknown whether the butterfish population could rebound to its present level from a severely depressed level without a reduced quota or closure. The directed effort at any point in time would be important. As stated previously, the current effort levels are unknown as are estimates of projected levels during any population decrease. If the population would not rebound on its own, the effect would be continued growth overfishing, reduced harvests, reduced profits, higher consumer prices, reduced consumer surplus, and reduced exports. This would continue until such time as the population did rebound. If the stock rebounded on its own without a regulated reduction in fishing effort, then these problems would be eliminated. The chance of a natural rebound in the face of growth overfishing is determined by the Council to be possible but not very likely.

9.2.2.8. Prices to consumers (related information presented in Sections 9.2.2.1, 9.2.2.6, and 9.2.2.7)

The Amendment should have no effect on consumer prices.

9.2.2.9. Enforcement

Cost of enforcement of the foreign fishing regulations does not change.

9.3. RELATION OF RECOMMENDED MEASURES TO APPLICABLE LAWS AND POLICIES

9.3.1. FMPs

This Amendment is related to other plans to the extent that all fisheries of the northwest Atlantic are part of the same general geophysical, biological, social, and economic setting. US and foreign fishing fleets, fishermen, and gear often are active in more than a single fishery. Thus regulations implemented to govern harvesting of one species or a group of related species may impact upon other fisheries by causing transfers of fishing effort. Many fisheries of the northwest Atlantic result in significant non-target species fishing mortality on other stocks and as a result of other fisheries. In addition, Atlantic mackerel, squid, and butterfish are food items for many commercially and recreationally important fish species and Atlantic mackerel, squid, and butterfish utilize many finfish and invertebrate species as food items. Furthermore, research programs often provide data on stock size, levels of recruitment, distribution, age, and growth for many species regulated by preliminary fishery management plans, FMPs, and proposed FMPs.

9.3.2. Treaties or international agreements

No treaties or international agreements, other than GIFAs entered into pursuant to the Act, relate to these fisheries. It is possible that a fisheries agreement with Canada will be developed in the future.

9.3.3. Federal law and policies

The US Department of Commerce, acting through the Council, pursuant to the Act, has authority to manage the stocks under US jurisdiction. Foreign fishing for mackerel, squid, and butterfish is regulated by the Act pursuant to which Governing International Fishery Agreements (GIFA) are negotiated with foreign nations for fishing within the FCZ.

While Outer Continental Shelf (OCS) development plans may involve areas overlapping those contemplated for offshore fishery management, no major conflicts have been identified to date. The Council, through involvement in the Intergovernmental Planning Program of the MMS monitors OCS activities and has opportunity to comment and to advise MMS of the Council's activities. Certainly, the potential for conflict exists if communication between interests is not maintained or appreciation of each other's efforts is lacking. Potential conflicts include, from a fishery management position: (1) exclusion areas, (2) adverse impacts to sensitive biologically important areas, (3) oil contamination, (4) substrate hazards to conventional fishing gear, and (5) competition for crews and harbor space. We are not aware of pending deep water port plans which would directly impact offshore fishery management goals in the areas under consideration, nor are we aware of potential effects of offshore fishery management plans upon future development of deep water port facilities

9.3.3.1. Marine Mammals and Endangered Species

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

Four hundred and seventy-one large whale sightings, 1,547 small whale sightings, and 1,172 sea turtles were encountered in the surveys (Table 38). Also presented in Table 38 are the study team's "estimated minimum population number" for the area, if calculated, and those species currently included under the Endangered Species Act.

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

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

The only other endangered species occurring in the northwest Atlantic is the shortnose sturgeon (*Acipenser brevirostrum*). The Council urges fishermen to report any incidental catches of this species to the Regional Director, NMFS, Federal Building, 14 Elm St., Gloucester, MA 01930, who can forward the information to the active sturgeon data base.

The ranges of the subject species of this FMP and the above marine mammals and endangered species overlap to a large degree, and there always exists a potential for an incidental kill. Except in unique situations (e.g., tuna-porpoise in the central Pacific), such accidental catches should have a negligible impact on marine mammal/endangered species abundances, and the Council does not believe that implementation of this Amendment will have any adverse impact upon these populations. As additional information on this subject becomes available, it will be integrated into future Amendments to this FMP.

9.3.3.2. Marine Sanctuaries

The USS *Monitor* Marine Sanctuary was officially established on January 30, 1975, under the Marine Protection, Research, and Sanctuaries Act of 1972. Rules and regulations have been issued for the Sanctuary (15 *CFR* 924). They prohibit deploying any equipment in the Sanctuary, fishing activities which involve "anchoring in any manner, stopping, remaining, or drifting without power at any time" (924.3 (a)), and "trawling" (924.3(h)). Although the Sanctuary's position off the coast of North Carolina at 35°00'23"N, 75°24'32"W is located in the FMP's designated management area, it does not occur within, or in the vicinity of, any foreign fishing area. Therefore, there is no threat to the Sanctuary by allowing foreign fishing operations under this FMP. Also, the *Monitor* Marine Sanctuary is clearly designated on all National Ocean Survey charts by the caption "protected area". This minimizes the potential for damage to the Sanctuary by US fishing operations.

9.3.3.3. Indian treaty fishing rights

No Indian treaty rights are known to exist relative to mackerel, squid, or butterfish.

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

9.3.4.1. Management activities of adjacent States and their effects on the FMP's objectives and management measures

Several States have minimum size limits for the commercial sale or possession of mackerel: Massachusetts, 6"; Connecticut, 7"; New York, 7"; and New Jersey, 7".

All of the east coast States mandate 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 2 miles of shore. Maryland 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 jurisdiction 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 FMP, since it would be difficult in many States for individuals to circumvent the regulations accompanying the FMP by transferring their harvests of these species to the territorial sea.

Several States also have mesh size specifications which may affect the magnitude of and/or the sizes of the fish in the catch.

No other State or local laws that control the fisheries that are the subject of this FMP are known to exist.

9.3.4.2. Coastal Zone Management (CZM) Program consistency

The CZM Act of 1972, as amended, is primarily protective in nature, and provides measures for ensuring stability of productive fishery habitat within the coastal zone. It is recognized that responsible management of both coastal zones and fish stocks must involve mutually supportive goals. States with approved CZM programs are Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, and Maryland. Copies of this Amendment were mailed to states with CZM programs with a determination that the programs were either not affected by the Amendment or were consistent with it. New Hampshire, Connecticut, New York, New Jersey, Pennsylvania, Massachusetts and Delaware have concurred with the Council's evaluation. Maine, Rhode Island, and Maryland made no response.

9.4. COUNCIL REVIEW AND MONITORING OF THE FMP

The Council will review the FMP annually The review will include the most recent stock assessment data and data on the US harvesting and processing industries. This will permit a review of MSY, OY, DAH, DAP, JVP, and TALFF and the development of required annual estimates of OY, DAH, DAP, and TALFFs, and any modifications to the FMP. These reviews will be carried out so that any amendments to the FMP can be reviewed by the Council and public and then be implemented by the Secretary of Commerce by 1 January of each year. This schedule may be modified as the US fishery evolves.

In order to make the required annual estimates of OY, DAH, DAP, JVP, and TALFF in addition to the reports required by this FMP, information must be developed by NMFS on the status of the stocks involved and on the capacity of the processing sector.

It is recognized that additional research must be carried out to refine the bycatch estimates. NMFS is requested to carry out such studies. Refinements of these estimates will be included, as appropriate, in future amendments to this FMP.

Additional data are also needed on recreational fishing to refine the relationships. NMFS is requested to continue the annual Marine Recreational Fishery Statistics Surveys, or other similar appropriate and comparable studies, and to supply the Council with the necessary data for future amendments.

The problems identified (Section 4 2) but not addressed in this Amendment must be studied as soon as possible for possible inclusion in additional amendments. Specifically included in this category are the addition of silver and red hake to the management unit and revising the regulation of foreign fishing. These issues are discussed as Alternatives 3 and 4 in Appendix 1.

On 12 August 1985 the Council formally requested that the NEFC conduct fishing mortality mesh studies on butterfish. In addition the Council requested a survey of butterfish fishing areas relative to butterfish sizes, a survey of processors to determine the sizes of butterfish landed, and a survey on the use of mechanical sorters. These latter three studies are to be completed by 31 March 1986 in order to be based on pre-Amendment #2 data.

10. REFERENCES

Anderson, E.D. pers. comm. NMFS, Woods Hole.

________________. 1985. Status of the northwest Atlantic mackerel stock - 1984. NMFS, NEFC, Woods Hole Lab. Ref. No. 85-03. 46 p.

________________. 1982. Status of the northwest Atlantic mackerel stock - 1982. NMFS, NEFC, Woods Hole Lab Ref. No. 82-44. 45 p.

________________. 1980. Status of the northwest Atlantic mackerel stock - 1980. NMFS, NEFC, Woods Hole Lab. Ref. No. 80-29. 43 p.

________________. 1976a. Measures of abundance of Atlantic mackerel off the northeastern coast of the United States. ICNAF Res. Bull 12: 5-21.

________________. 1976b. Estimate of maximum sustainable yield of fish stocks in ICNAF Subarea 5a and Statistical Area 6. NEFC, NMFS, Woods Hole Lab. Ref. No. 76-05.

Anderson, E.D. and M M. McBride. 1976. Relationship between environmental factors and mackerel recruitment. ICNAF Res. Doc. 76/139.

Anderson, E.D. and A.L. Paciorkowski. 1980. A review of the northwest Atlantic mackerel fishery. Rapp. P. -v. Reun. Cons. int. Explor. Mer; 177: 175-211.

Anonymous. 1985. Report of the mackerel working group. ICES. CM. 1985/Assess: 7. 98 p.

Arnold, G.P. 1979. Squid a review of their biology and fisheries. Lab. Leafl. MAFF Direct. Fish. Res. Lowestaft (48). 37 p.

Atkinson, L.P. 1976. Chemical oceanography. In: Sharp, J.H. (ed.). Anoxia on the middle Atlantic shelf during the summer of 1976. Report on a workshop held in Washington, D.C., 15-16 October 1976. NSF Contract No. OCE 7700465. Univ. Del.: 81-84.

Beckett, J.S., W.T. Stobo, and C.A. Dickson. 1974. Southwesterly migration of Atlantic mackerel, *Scomber scombrus* tagged off Nova Scotia. ICNAF Res. Doc. 94.

Belton, T.J., B E. Ruppel, and K. Lockwood. 1982. PCBs (Aroclor 1254) in fish tissues throughout the state of New Jersey: a comprehensive survey. Office of Cancer and Toxic Substances Research. NJ Dept. Env. Protection.

Beverton, R.J.H. and S.J. Holt. 1957. On the dynamics of exploited fish populations. U.K. Min. Agric. Fish., Fish. Invest. (Ser. 2)19. 533 p.

Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. US Fish Wildl. Serv., Fish. Bull. 53(74). 577 p.

Boehm, P.D. and P. Hirtzer. 1982. Gulf and Atlantic survey for selected organic pollutants in finfish. NOAA Tech. Mem. NMFS-F/NEC-13. 111 p.

Centaur Management Consultants, Inc. 1977. Economic activity associated with marine recreational fishing. Final report prepared for NMFS, Contract No. 6-35195. 206 p.

Chamberlin, J.L. 1977. Monitoring effects of Gulf Stream meanders and warm core eddies on the continental shelf and slope. ICNAF Sel. Pap. 2: 145-153.

Chen, T.N. and D.L. Hueth. 1982. Welfare consuiderations in the development of a joint venture policy. unpub MS 18 p.

Christensen, D.J., W.J. Clifford, P.G. Scarlett, R.W. Smith, and D.Zacchea. 1979. A survey of the 1978 spring recreational fishery for Atlantic mackerel, *Scomber Scombrus*, in the Middle Atlantic region. NMFS, Sandy Hook Lab., Report No. 78-43. 22 p.

Christensen, D.J., B.L. Freeman, and S.C. Turner. 1976. The United States recreational fishery for Atlantic mackerel. ICNAF Res. Doc. 76/XII/142. 9 p.

Cohen, E.G. 1975. An overview of the plankton community of the Gulf of Maine. ICNAF Res. Doc. 75/106.

Dery, L.M. and E.D. Anderson. 1983. Recent problems with the aging of northwest Atlantic mackerel, especially concerning the 1977 and 1978 year classes. NMFS, NEFC, Woods Hole Lab. Ref. No. 83-02. 30 p.

Dunbar, B. 1981. Mackerel. Annex to the worldwide fisheries marketing study: prospects to 1985. Dept. of Fish. and Oceans Canada. 659 p.

Environmental Protection Agency. 1979. Draft environmental impact statement (eis) for 106-mile ocean waste disposal site designation. EPA, Office of Water Program Operations Marine Protection Branch.

Eurofish. 1985a. 28 February 1985.

________. 1985b. 20 June 1985.

Fishing News. 1985a. Mackerel stock shock. 31 May 1985. UK.

___________. 1985b. 4 October 1985.

___________. 1984. Mackerel TACs must be controlled. 9 November 1984. UK.

___________. 1983. 4 November 1983.

Fitzgibbon, D. pers. comm. NMFS, Washington.

Frailey, M. pers. comm., NOAA, Washington, D.C.

Freeman, B.L., and S.C. Turner. 1977. The effects of anoxic water on the bluefish (*Pomatomus saltatrix*), an actively swimming fish. *In* Oxygen depletion and associated environmental disturbances in the Middle Atlantic bight in 1976. NMFS, NEFC Tech. Ser. Rept. No. 3: 431-450.

Freese, S. and A. Bilik. pers. comm., NMFS, Washington, D.C.

Fritz, R.L. 1965. Autumn distribution of groundfish species in the Gulf of Maine and adjacent waters, 1955-1961. Am. Geol. Soc., Ser. Atlas Mar. Environ., Folio 10. 48 p.

Froerman, Y.M. 1984. Life cycle and mechanism of abundance fluctuations in *Illex illecebrosus*. NAFO SCR 84/IX/116. 7 p.

Gilbertson, D. pers. comm. International Multifoods, MA.

Grosslein, M.D. and T.R. Azarovitz. 1982. Fish distribution. MESA New York Bight Atlas Monograph 15. 182 p

Haedrich, R.L. 1967. The stromateoid fishes: systematics and a classification. Bull. Mus. Comp. Zool. 135(2): 31-139.

Hatanaka, H., A.M.T. Lange, and T. Amaratunga. 1984. Geographical and vertical distribution of larval stage short-finned squid (*Illex illecebrosus*) in the northwest Atlantic. NAFO SCR 84/IX/123. 20 p.

Heald, E.J. 1968. Atlas of the principal fishery resources on the continental shelf from New York to Florida. Inst. Mar. Sci., Univ. Miami. 236 p.

Hildebrand, S.F., and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Bull. US Bur. Fish. 43. Part 1, 388 p.

Horn, M.H. 1970. Systematics and biology of the stromateoid fishes of the genus Peprilus. Bull. Mus. Comp. Zool. 140(5): 165-261

Hoy, D.W. and G.M. Clark. 1967. Atlantic mackerel fishery, 1804-1965. US Fish Wildl. Serv., Fish. Leaflet 603. 9 p.

Infopseca 1981. Price report. 16 March 1981.

International Commission for the Northwest Atlantic Fisheries (ICNAF). 1979 (and earlier editions). Statistical bulletins for the years 1951- 1977 (Vols. 1 - 27). NAFO. Dartmouth, Canada.

International Commission for the Northwest Atlantic Fisheries (ICNAF). 1975. Report of Standing Committee on Research and Statistics, May-June, 1975. App. I. Report of Assessments Subcommittee. ICNAF, Redbook 1975: 23-63.

Kurkul, P. pers. comm., NMFS, Gloucester.

Lange, A.M.T., M. P. Sissenwine, and E.D. Anderson. 1984. Yield analysis of the long-finned squid, *Loligo pealei* (LeSeuer). NAFO SCR 84/IX/97. 40 p.

Lange, A.M.T., and M.P. Sissenwine. 1980. Biological considerations relevant to the management of squid (*Loligo pealei* and *Illex illecebrosus*) of the northwest Atlantic. Mar. Fish. Rev. 42 (7-8): 23-38.

Lange, A.M.T. 1984a. An assessment of the long-finned squid resource off the northeastern United States Autumn 1984 NMFS, NEFC, Woods Hole Lab. Ref. No. 84-37. 23 p.

________________. 1984b. Status of the short-finned squid (*Illex illecebrosus*) off the northeastern USA November 1984. NMFS, NEFC, Woods Hole Lab. Ref. No. 84-38. 18 p.

________________. 1983. Status of the long finned squid, *Loligo pealei*, stocks off the northeastern USA November 1983. NMFS, NEFC, Woods Hole Lab. Ref. No. 83-38. 18 p.

________________. 1981. Stock status and estimates of potential yields of squid (Loligo pealei and *Illex illecebrosus*) populations off the northeastern USA. NMFS, NEFC, Woods Hole Lab. Ref. No. 81-29. 21 p.

Langton, R.W., and R.E. Bowman. 1977. An abridged account of predator - prey interactions from some northwest Atlantic species of fish and squid. NMFS, NEFC, Woods Hole Lab. Ref. No. 77-17.

Leim, A.H., and W.B. Scott. 1966. Fishes of the Atlantic coast of Canada. Bull. Fish. Res. Bd. Canada 155. 485 p.

Lett, P.F., A.C. Kohler, and D.N. Fitzgerald. 1975. The influence of temperature on the interaction of the recruitment mechanisms of Atlantic herring and mackerel in the Gulf of St. Lawrence. ICNAF Res. Doc. 75/33.

Lux, F.E., W.D. Handwork, and W.F. Rathjen. 1974. The potential for an offshore squid fishery in New England. Mar Fish. Rev. 36(12): 24-27.

MacKay, K.T. 1973. Aspects of the biology of Atlantic mackerel in ICNAF Subarea 4. ICNAF Res. Doc. 73/70. 11 p.

________________. 1967. An ecological study of mackerel, *Scomber scombrus*, in the coastal waters of Canada. Fish. Res. Bd. Canada. Tech. Rep. 31.

Mackay, K.T., and E.T. Garside. 1969. Meristic analysis of Atlantic mackerel, *Scomber scombrus*, from the North American coastal populations. J. Fish. Res. Bd. Canada 26(9): 2537-2540.

Maurer, R.O., and R.E. Bowman. 1975. Food habits of marine fishes of the northwest Atlantic. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 75-3. 90 p.

McCauley, J. pers. comm. Pt. Judith Coopertive, RI.

Mercer, M.C. 1965. Contribution to the biology of the short-finned squid, *Illex illecebrosus* (LeSeuer), in the Newfoundland area. Fish. Res. Bd. Canada, MS Rept. Ser. (Biol.) No. 834.

________________. 1973. Length-weight relationship of the ommastrephid squid, *Illex illecebrosus* (LeSeuer). ICNAF Res. Doc. 73/72.

Mesnil, B. 1976. Growth and life cycle of squid, *Loligo pealei* and *Illex illecebrosus*, from the northwest Atlantic. ICNAF Selected Papers 2: 55-69.

Mid-Atlantic Fishery Management Council (MAFMC). 1983. Amendment #1 to the fishery management plan for the Atlantic mackerel, squid, and butterfish fisheries.

________________. 1982. Incidental catch relationships among the foreign fisheries for the squids, Atlantic mackerel, butterfish, and the hakes. Revised.

Moores, J.A., G.H. Winters, and L.S. Parsons. 1975. Migrations and biological characteristics of Atlantic mackerel (*Scomber scombrus*) occurring in Newfoundland waters. J. Fish. Res. Bd. Canada 32: 1347-1357.

Morse, W. 1978. Fecundity and spawning of Atlantic mackerel (*Scomber scombrus* L.) in the northwest Atlantic. Int. Counc. Explor. Sea. C.M. 1978/H:64. Pelagic Fish Comm.

Muir, W. pers. comm. US EPA, Philadelphia.

Murawski, S.A., D.G. Frank, and S. Chang. 1978. Biological and fisheries data on butterfish, *Peprilus triacanthus* (Peck). NMFS, NEFC, Sandy Hook Lab., Tech. Ser. Rept. No. 6. 39 p.

Murawski, S.A., and G.T. Waring. 1979. Biological and fisheries data on butterfish, Peprilus triacanthus, in the northwestern Atlantic Ocean. Trans. Am. Fish. Soc. 108(5): 427-439.

________________. 1978. Status of the northwestern Atlantic butterfish stock: July 1978. NMFS, NEFC, Woods Hole Lab. Ref. No. 78-47. 15 p.

Northwest Atlantic Fisheries Organization (NAFO). 1985 (and earlier editions). Provisional catch statistics for December 1984. NAFO Circular Letter 85/16. 6 p.

________________. 1984. Provisional report of scientific council, 6-21 June 1984. NAFO SCS 84/VI/23. 56-63.

Nichols, J.T., and C.M. Breder, Jr. 1927. The marine fishes of New York and southern New England. Zoologica 9(1). 192p.

Paciorkowski, A. and M Mucha. 1982. Report on biological observations and exploratory fishing data collected during the joint Polish-US Atlantic mackerel survey on M/T Kanaryzka in 1982. Sea Fisheries Institute. Poland. 11 p.

Parsons, L.S. 1970. Northern range extension of the Atlantic mackerel, *Scomber scombrus*, to Black Island, Labrador. J. Fish. Res. Bd. Canada 27: 610-613.

Parsons, L.S., and J.A. Moores. 1974. Long distance migrations of an Atlantic mackerel (*Scomber scombrus*). J. Fish. Res. Bd. Canada 31: 1521-1522.

Peterson, A.E. pers. comm. NMFS, Woods Hole.

Rathjen, W.F. 1973. Northwest Atlantic squids. Mar. Fish. Ref. 35(12): 20-26.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Bd. Canada 191. 382 p.

Serchuk, F.M., and W.F. Rathjen. 1974. Aspects of the distribution and abundance of the long-finned squid, *Loligo pealei*, between Cape Hatteras and Georges Bank. Mar. Fish. Rev. 36(1): 10-17.

Sette, O.E. 1943 Biology of Atlantic mackerel (*Scomber scombrus*) of North America. Part 1. Early life history, including growth, drift, and mortality of the egg and larval populations. US Fish Bull. 50(38): 149-237.

________________. 1950. Biology of Atlantic mackerel (*Scomber scombrus*) of North America. Part 2. migrations and habitats. US Fish Bull. 51(49): 251-358.

Sharp, J.H. (ed). 1976. Anoxia on the middle Atlantic shelf during the summer of 1976. Report on a workshop held in Washington, D.C., 15-16 October 1976. NSF Contract No. OCE 7700465. Univ. Del. 122 p.

Sindermann, C.J. 1958. An epizootic in Gulf of St. Lawrence fishes. Trans. 23rd North American Wildl. Conf.: 349-60.

Sissenwine, M.P., and A.M. Tibbetts. 1977. Simulating the effect of fishing on squid (*Loligo* and *Illex*) populations off the northeastern United States. ICNAF Sel. Pap. 2: 71-84.

Squires, H.J. 1957. Squid, *Illex illecebrosus* (LeSeuer), in the Newfoundland fishing area. J. Fish. Res. Bd. Can. 14: 693-728.

Squires, H.J. 1967. Growth and hypothetical age of Newfoundland bait squid, *Illex illecebrosus*. J. Fish. Res. Bd. Canada 24(6): 1209-1217.

Steimle, F. 1976. A summary of the fish kill-anoxia phenomenon off New Jersey and its impact on resource species. In Sharp, J.H. (ed.), Anoxia on the middle Atlantic shelf during the summer of 1976. Report on a workshop held in Washington, D.C., 15-16 October 1976. NSF Contract No. OCE 7700465. Univ. Del.: 5-11.

Shepard, J.G. 1982. A versatile new stock-recruitment relationship for fisheries, and the construction of sustainable yield curves. J. Cons. Int. Explor. Mer., 40(1): 67-75.

Summers, W.C. 1969. Winter population of *Loligo pealei* in the mid-Atlantic bight. Biol. Bull. 137: 202-216.

______________________________. 1967. Winter distribution of *Loligo pealei* determined by exploratory trawling. Biol. Bull. 133. 489 p.

Taylor, C.C., H.B. Bigelow, and H.W. Graham. 1957. Climactic trends and the distribution of marine animals in New England. Fish. Bull. 57(115): 149-237.

Terrill, J. pers. comm. NMFS, Gloucester.

Tibbetts, A.M. 1975. Squid fisheries (*Loligo pealei* and *Illex illecebrosus*) off the northeast United States, ICNAF Subarea 5 and Statistical Area 6. ICNAF Res. Doc. 75/60 (revised).

University of Rhode Island. 1982. A characterization of marine mammals and turtles in the Mid-and North-Atlantic areas of the US outer continental shelf. Final report. Prepared for USDI, under contract #AA551-CT8-48.

US Dept. of Comm. (USDC). 1985a. Fisheries of the US. NOAA, NMFS, Curr. Fish. Stat. No. 8360. 121 p. (and earlier editions).

________. 1985b. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1981-1982. NOAA, NMFS, Curr. Fish. Stat. No. 8324. 215 p.

________. 1985c. Status of the fishery resources off the northeastern United States for 1985. Draft. NOAA, NMFS-F/NEC.

________. 1985d. Average hourly earnings per worker, wholesale trade. Survey of current business, 65(8)S-12.

________. 1984a. Status of the fishery resources off the northeastern United States for 1983. NOAA, NMFS-F/NEC-29. 132 p.

________. 1984b. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1979 (revised) - 1980. NOAA, NMFS, Curr. Fish. Stat. No. 8322. 239 p.

________. 1980. Economic and biological data needs for fisheries management, with particular reference to the New England and Mid-Atlantic areas. NOAA Tech. Memorandum, NMFS-F/NEC-6. 14 p.

US Dept. of State (USDS). 1979. Butterfish market in Japan. Teletype to USDC. 24 September 1979.

US Dept. of Trans. (USDOT). 1985. Joint National Marine Fisheries Service United States Coast Guard fisheries enforcment study. 80 p.

Vinogradov, V.I. 1984. On feeding of two squid species in the northwest Atlantic. NAFO SCR 84/IX/117. 12 p.

Voss, G.L. and T.F. Brakoniechi. 1984. A review of the squid resources of the southeast fisheries region of the United States. NAFO SCR 84/IX/121. 16 p.

Vovk, G. 1969. Prospects for a squid (*Loligo pealei* LeSeuer) fishery. Rybin. Khoz. 45(10): 7-9.

Waring, G. 1975. A preliminary analysis of the status of butterfish in ICNAF Subarea 5 and Statistical Area 6. ICNAF Res. Doc. 75/74. 32 p.

Waring, G.T. and E.D. Anderson. 1983. Status of the northwest Atlantic butterfish stock - 1983. NMFS, NEFC, Woods Hole Lab. Ref. No. 83-41. 39 p.

Winters, G.H. 1976. Recruitment mechanisms of southern Gulf of St. Lawrence Atlantic herring (*Clupea harengus harengus*). J. Fish. Res. Bd. Canada 33: 1751-1763.

11. TABLES AND FIGURES

Table 1. US Commercial and Foreign Squid Catch (mt), 1965-1984

	From US Waters (NAFO/ICNAF Subarea 5 and Statistical Area 6)						Squid outside US waters+
	Loligo			*Illex*			
Year	US	Foreign	Total	US	Foreign	Total	
1965	709	99	808	444	78	522	8,000
1966	722	226	948	452	118	570	5,000
1967	547	1,130	1,677	707	285	992	7,000
1968	1,084	2,327	3,411	678	2,593	3,271	98
1969	899	8,643	9,542	562	975	1,537	-
1970	653	16,732	17,385	408	2,418	2,826	1,385
1971	727	17,442	18,169	455	159	614	8,905
1972	725	29,009	29,734	472	17,169	17,641	1,868
1973	1,105	36,508	37,613	530	18,625	19,155	9,877
1974	2,274	32,576	34,850	148	20,480	20,628	437
1975	1,621	32,180	33,801	107	17,819	17,926	17,743
1976	3,602	21,682	25,284	229	24,707	24,936	41,765
1977	1,088	15,586	16,674	1,024	23,771	24,795	83,476
1978	1,291	9,355	10,646	385	17,310	17,695	92,679
1979	4,252	13,068	17,320	1,780	15,742	17,522	162,082
1980	3,996	19,750	23,746	349	17,529	17,878	69,523
1981	2,316	20,212	22,528	631	14,723	15,354	29,664
1982	5,464	15,805	21,269	5,902	12,350	18,252	12,908
1983	15,943	11,720	27,663	9,944	1,776	11,720	422
1984	10,565	11,029	21,594	10,410	638	11,048	668

- = zero.

\+ Foreign catch (almost all Illex) from NAFO/ICNAF Subareas 1-4 (includes Canada).

Sources: 1965-1983: Lange, 1984a and b; 1984: unpub. prelim. NMFS data and NAFO, 1985.

Table 2. *Loligo* Total and Pre-Recruit Stratified Mean Numbers per Tow from NEFC Autumn Bottom Trawl Surveys, Minimum Biomass, and Abundance Estimates, 1967-1984 (1)

	All Sizes	Pre-Recruit		Biomass	Abundance
	Numbers	Numbers	%	(mt) (3)	(millions)
1967	134.5	126.9	94	NA	NA
1968	176.5	159.9	91	29,114	1,212
1969	237.3	217.4	92	48,055	2,393
1970	85.6	79.3	93	19,640	1,946
1971	163.3	161.5	99	14,050	1,106
1972	271.4	258.5	95	21,039	1,533
1973	372.0	353.9	95	44,252	3,092
1974	251.7	233.3	93	46,442	4,757
1975	614.4	593.3	97	48,636	7,789
1976	410.9	302.5	74	51,436	4,372
1977	388.5	297.7	77	27,421	3,157
1978	144.2	93.4	65	18,800	1,251
1979	193.7	156.5	81	19,333	2,114
1980	364.1	279.8	77	34,275	9,314
1981	226.2	161.8	72	24,345	3,411
1982	310.4	256.6	83	26,527	2,303
1983	373.4	251.1	67	62,363	4,460
1984 (2)	179.0	136.8	76	36,927	2,546
67-82 mean	277.5	234.3	85	33,483	3,388

NA = not available.
(1) Stratified mean number/tow of all sizes and of individuals less than or equal to 8 cm mantle length.
(2) Preliminary.
(3) From areal expansion of stratified mean weights (kg) and numbers per tow assuming 100% catchability during daytime. Nighttime catch data were expanded to account for diel differences in catch (Sissenwine and Bowman, 1978).

Source: Lange, 1984a.

Table 3. *Illex* Total and Pre-Recruit Stratified Mean Numbers per Tow from NEFC Autumn Bottom Trawl Surveys, Minimum Biomass, and Abundance Estimates, 1968-1984 (1)

	All Sizes	Pre-Recruit		Biomass	Abundance (millions)	
	Numbers	Numbers	%	(mt) (3)	Total	Pre-recruit
1968	2.3	0.6	26	1,845	10	2.6
1969	0.8	0.3	38	419	4	1.5
1970	3.4	0.2	6	1,524	15	0.9
1971	1.9	0.6	32	2,024	10	3.2
1972	3.5	1.8	51	1,716	15	7.7
1973	1.3	0.3	23	1,862	8	1.8
1974	3.0	2.1	70	2,500	18	12.6
1975	12.4	9.6	77	8,306	60	46.5
1976	28.7	0.6	2	42,929	134	2.8
1977	15.8	1.1	7	21,747	73	5.1
1978	28.4	5.1	18	26,435	121	21.7
1979	32.1	2.6	8	41,455	144	11.7
1980	17.0	0.7	4	18,729	80	3.3
1981	54.8	0.5	1	68,611	219	2.0
1982	4.3	1.0	23	3,319	21	4.9
1983	2.8	0.2	7	1,237	10	0.7
1984 (2)	8.9	0.4	4	3,787	32	1.4
68-83 mean	13.3	1.7	23	15,291	59	8.1

(1) Stratified mean number of tow of all size individuals (total) and of pre-recruits (less than or equal to 10 cm), Mid-Atlantic to Georges Bank.
(2) Preliminary.
(3) From areal expansion of stratified mean numbers and weights (kg) per tow, summed over strata sets.
Source: Lange, 1984b.

Table 4. US and Foreign Atlantic Mackerel Catch (mt), 1965-1984

	In US Waters (NAFO/ICNAF Subarea 5 and Statistical Area 6)					
	US					Outside US
Year	Commercial	Recreational	Total	Foreign	Total	waters +
1965	1,998	4,292	6,290	2,540	8,830	11,589
1966	2,724	4,535	7,259	6,707	13,966	12,820
1967	3,891	4,498	8,389	18,984	27,373	11,242
1968	3,929	7,781	11,710	56,040	67,750	20,837
1969	4,364	13,050	17,414	108,805	126,219	18,635
1970	4,049	16,039	20,088	205,557	225,645	21,005
1971	2,406	16,426	18,832	346,319	365,151	24,494
1972	2,006	15,588	17,594	385,337	402,931	22,359
1973	1,336	10,723	12,059	379,808	391,867	38,548
1974	1,042	7,640	8,682	293,867	302,549	44,653
1975	1,974	5,190	7,164	248,991	256,155	36,256
1976	2,712	4,202	6,914	205,945	212,859	33,063
1977	1,377	522	1,899	53,661	55,560	22,764
1978	1,605	6,571	8,176	371	8,547	25,797
1979	1,990	3,723	5,713	63	5,776	30,610
1980	2,683	2,381	5,064	399	5,463	20,499
1981	2,941	5,052	7,993	5,282	13,275	19,318
1982	3,330	1,131	4,461	9,548	14,009	16,382
1983	3,805	3,000	6,805	1,597	8,402	19,805
1984	4,098	3,000	7,098	9,426	16,524	13,585

\+ Foreign catch from NAFO/ICNAF Subareas 3 and 4 (includes Canada).
Sources: 1965-1983: Anderson, 1985; 1984: unpub. prelim. NMFS data and NAFO, 1985.

Table 5. Stratified Mean Catch (kg) per Tow of Mackerel from NMFS, NEFC Bottom Trawl Surveys in the Spring and Autumn and Catch per Standardized US Day Fished in NAFO SA 5-6, 1963-1984

Year	Spring	Autumn	Catch per Day (mt)
1963	NA	.02	NA
1964	NA	*	.43
1965	NA	.04	.49
1966	NA	.04	.84
1967	NA	.17	1.75
1968	1.62	.11	2.80
1969	.03	.21	1.92
1970	.85	.05	2.07
1971	.86	.04	1.29
1972	.59	.11	.84
1973	.37	.05	.53
1974	.37	.02	.17
1975	.16	.01	.53
1976	.16	.04	.59
1977	.06	.04	.52
1978	.17	.11	.48
1979	.09	.07	.69
1980	.13	.06	1.42
1981	.64	.03	1.19
1982	.33	.15	.86
1983	.13	.03	1.08
1984	.83	.08	NA

NA = not available. * = less than 0.01. Source: Anderson, 1985.

Table 6. Age Composition (thousands of fish) of the 1983 Mackerel Catch from NAFO SA 3-6

	Year	SA 3-4	SA 5-6				SA 3-6 Total	
Age	Class	Total#	US (comm)	US (rec)##	Non-US	Total	Numbers	%
1	1982	268.2	801.2	202.5	924.7	1,928.4	2,196.6	4
2	1981	2,920.0	7,002.3	1,432.6	4,186.6	12,621.5	15,541.5	26
3	1980	4,222.8	585.2	576.4	868.8	2,030.5	6,253.2	10
4	1979	1,473.5	88.7	181.5	225.4	495.6	1,969.2	3
5	1978	4,870.6	511.8	710.1	1,611.0	2,832.9	7,703.5	13
6	1977	517.3	36.0	65.3	89.5	190.8	708.1	1
7	1976	1,512.7	80.7	169.2	72.5	322.3	1,835.0	3
8	1975	3,892.3	406.4	509.7	720.9	1,637.1	5,529.4	9
9	1974	7,631.9	789.2	1,072.1	2,137.2	3,998.5	11,630.5	19
10	1973	3,275.6	331.2	456.6	890.4	1,678.2	4,953.8	8
11	1972	560.5	95.7	89.6	226.7	412.0	972.5	2
12	1971	178.8	77.5	38.5	123.1	239.1	417.9	1
13	1970	2.0	63.3	21.2	143.9	228.4	230.4	*
14+	1969-	205.9	215.2	74.6	313.3	603.1	809.0	1
Total		31,532.1	11,084.4	5,600.0	12,534.0	29,218.4	60,750.5	
Weight (mt)		19,805	3,805	3,000	5,935	12,740	32,545	

* = less than 0.5%.
# = based on Canadian data and raised to include 20 mt from other countries.
= Percentage age composition assumed same as SA 3-6 commercial total.
Source: Anderson, 1985.

Table 7. Atlantic Coast US Commercial and Foreign Butterfish Catch (mt), 1965-1984*

Year	US	Foreign	Nominal Catch	Adjusted Nominal Catch#
1965	3,340	749	4,089	4,089
1966	2,615	3,865	6,480	6,480
1967	2,452	2,316	4,768	4,768
1968	1,804	5,437	7,241	7,241
1969	2,438	15,073	17,511	17,816
1970	1,869	9,028	10,897	14,319
1971	1,570	6,283	7,853	10,483
1972	819	5,671	6,490	13,040
1973	1,557	17,847	19,454	33,236
1974	2,528	10,337	12,865	17,993
1975	2,088	9,077	11,165	14,852
1976	1,528	10,353	11,881	16,249
1977	1,448	3,205	4,653	4,760
1978	3,676	1,326	5,002	5,375
1979	2,831	840	3,671	3,938
1980	5,356	879	6,235	6,748
1981	4,855	936	5,791	6,255
1982	9,077	794	9,871	10,483
1983	4,905	630	5,535	6,816
1984	12,166	429	12,575	15,818

* NAFO/ICNAF Subarea 5 and Statistical Area 6.
# Adjusted to account for non-reported discards of countries not reporting butterfish from directed *Loligo* fishing operations (Murawski and Waring, 1979). The 1976-1984 adjusted landings incorporate estimated discards in US fishery.
Source: communication NMFS, 6 Sept. 1985, Schaefer to Martin.

Table 8. Indices of Relative Abundance (stratified mean catch per tow) for Butterfish by Age Group Derived from NEFC Autumn Bottom Trawl Survey Data, 1968-1984*

	Age 0	Age 1 and older	Total	Weight (kg)
1968	41.3	52.3	93.6	7.7
1969	39.5	21.1	61.6	3.9
1970	26.4	12.2	39.3	2.3
1971	208.9	9.6	218.6	4.3
1972	73.2	8.7	81.9	2.7
1973	119.1	29.3	148.4	6.1
1974	8.2	18.0	100.2	3.8
1975	26.3	19.4	45.7	2.3
1976	110.6	29.0	139.6	5.8
1977	47.7	39.3	87.0	5.2
1978	135.0	19.1	154.1	4.6
1979	231.5	78.1	309.6	12.2
1980	233.2	99.7	332.9	15.1
1981	234.6	60.3	294.9	7.0
1982	80.3	30.7	111.0	4.6
1983	358.8	92.4	451.2	12.8
1984	268.6	93.4	362.0	11.6

* Strata 1-12, 61-76, 13, 14, 16, 19, 20, 23, 25 (offshore); 1-46 (inshore).

Source: Anderson, pers. comm.

Table 9. Various Levels of Projected Catch of Mackerel in NAFO SA 2-6 in 1985 and Associated Mean Fishing Mortality (F) at Ages 3 and Older with Resulting Spawning Stock Biomass in 1986 and the Percentage Change from 1985 Projections assume a 1984 catch of 38,500 mt (F = 0.064) (catch and stock biomass in thousands of metric tons)

Spawning Stock in 1985	Catch in 1985	F in 1985	Spawning Stock in 1986	% Change in Stock from 1985
1004.0	30.0	.028	1062.6	+5.8
1004.0	40.0	.037	1053.5	+4.9
1004.0	50.0	.047	1044.3	+4.0
1004.0	60.0	.056	1035.2	+3.1
1004.0	70.0	.066	1026.1	+2.2
1004.0	80.0	.076	1017.0	+1.3
1004.0	90.0	.086	1007.9	+0.4
1004.0	100.0	.096	998.8	-0.5
1004.0	140.0	.138	962.3	-4.2
1004.0	180.0	.182	926.0	-7.8
1004.0	220.0	.228	890.0	-11.4
1004.0	270.3	.290#	844.0	-15.9

= F0.1 applicable to average 1978-83 exploitation pattern.
Source: Anderson, 1985.

Table 10. US Atlantic Coast Mackerel, *Loligo*, *Illex*, and Butterfish Landings (mt), Joint Venture (JV) Catch, and Total Catch by Fishing Year

	Loligo			*Illex*			Mackerel			Butterfish
	Landed	JV	Total	Landed	JV	Total	Landed	JV	Total	Total*
80-81	3,562	-	3,562	422	-	422	3,260	-	3,260	5,575
81-82	2,726	323	3,049	593	-	593	3,297	-	3,297	5,372
82-83	3,930	1,094	5,024	3,434	2,338	5,772	2,084	**	2,084	7,231
83-84	12,251	2,332	14,583	1,416	8,344	9,760	3,328	1,531	4,859	9,720
84-85	9,853	760	10,613	3,575	6,010	9,585	3,062	**	3,062	8,168

- = zero.
* = There have been no butterfish JVs, so landings and total catch are equal.
** = Data confidential because of the small number of countries involved in JVs.
Source: Unpub. prelim. NMFS data.

Table 11. US Commercial Squid Landings, Ex-Vessel Value, and Price, ME-VA, 1974-1983

	Landings (mt)			Ex-Vessel Value ($) SW		Ex-Vessel Value ($) FCZ		Ex-Vessel Value ($) Total		Price ($/mt) SW		Price ($/mt) FCZ		Price ($/mt) Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
							ME-VA								
LOLIGO															
1977	-	168	168	-	-	118400	65234	118400	65234	-	-	705	389	705	389
1978	277	246	523	283139	144901	264685	135456	547824	280357	1024	524	1076	551	1048	536
1979	2321	1074	3395	1938268	891564	956746	440084	2895014	1331648	835	384	891	410	853	392
1980	2909	913	3822	2186937	886114	757020	306732	2943957	1192846	752	305	829	336	770	312
1981	1218	831	2048	1169106	429815	963019	354049	2132125	783864	960	353	1159	426	1041	383
1982	1562	1869	3431	1304486	452472	1487375	515909	2791861	968381	835	290	796	276	814	282
1983	4506	6908	11414	3103917	1040184	4734954	1586778	7838871	2626962	689	231	685	230	687	230
ILLEX															
1977	9	-	9	16003	8817	-	-	16003	8817	1764	972	-	-	1764	972
1978	196	163	359	35367	18099	43968	22501	79335	40600	180	92	270	138	221	113
1979	703	1245	1948	563513	259204	265963	122336	829476	381540	801	369	214	98	426	196
1980	37	284	321	7528	3050	59705	24189	67233	27239	204	83	210	85	209	85
1981	44	571	616	17522	6441	149283	54883	166805	61324	396	146	261	96	271	100
1982	106	3500	3605	25737	8926	882086	305959	907823	314885	244	85	252	87	252	87
1983	17	1451	1468	10702	3585	551922	184958	562624	188543	640	214	380	127	383	128
UNCLASSIFIED															
1974	977	1438	2415	402168	272283	585042	396098	987210	668381	412	279	407	275	409	277
1975	817	1129	1946	327664	203262	465272	288626	792936	491888	401	249	412	256	408	253
1976	1574	2227	3801	691420	405521	885295	519232	1576715	924753	439	258	398	233	415	243
1977	818	1617	2435	644818	355269	759638	418528	1404456	773797	789	434	470	259	577	318
1978	389	353	742	403103	206292	369319	189003	772422	395295	1037	531	1047	536	1042	533
1979	38	352	390	33650	15476	284855	131025	318505	146501	886	407	809	372	817	376
1980	28	188	215	17552	7109	91614	37118	109166	44227	638	258	489	198	508	206
1981	1	202	203	765	280	121711	44743	122476	45023	531	194	603	222	603	221
1982	136	206	341	119489	41444	196789	68256	316278	109700	882	306	956	332	927	321
1983	1636	586	2222	1151788	385985	459328	153929	1611116	539914	704	236	784	263	725	243
TOTAL															
1974	977	1438	2415	402168	272283	585042	396098	987210	668381	412	279	407	275	409	277
1975	817	1129	1946	327664	203262	465272	288626	792936	491888	401	249	412	256	408	253
1976	1574	2227	3801	691420	405521	885295	519232	1576715	924753	439	258	398	233	415	243
1977	827	1785	2612	660821	364086	878038	483762	1538859	847848	799	440	492	271	589	325
1978	862	761	1623	721609	369292	677972	346960	1399581	716252	838	429	890	456	862	441
1979	3062	2671	5733	2535431	1166244	1507564	693445	4042995	1859689	828	381	564	260	705	324
1980	2973	1385	4359	2212017	896273	908339	368039	3120356	1264312	744	301	656	266	716	290
1981	1263	1604	2867	1187393	436536	1234013	453675	2421406	890211	940	346	769	283	844	310
1982	1803	5575	7377	1449712	502842	2566250	890124	4015962	1392966	804	279	460	160	544	189
1983	6159	8944	15103	4266407	1429754	5746204	1925665	10012611	3355419	693	232	642	215	663	222

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
MAINE															
LOLIGO															
1978	-	*	*	-	-	46	23	46	23	-	-	354	177	354	177
1979	2	6	8	1191	547	1693	778	2884	1325	658	302	271	124	358	164
1980	1	*	1	330	133	15	6	345	139	317	128	375	150	319	129
1981	1	2	3	486	178	1983	729	2469	907	540	198	826	304	748	275
1982	-	*	*	-	-	291	100	291	100	-	-	939	323	939	323
ILLEX															
1978	*	1	1	182	93	202	103	384	196	371	190	281	143	317	162
1979	-	1	1	-	-	340	156	340	156	-	-	420	193	420	193
1980	-	2	2	-	-	486	196	486	196	-	-	249	101	249	101
1981	-	1	1	-	-	550	202	550	202	-	-	369	136	369	136
1982	*	1	1	11	3	341	118	352	121	275	75	421	146	414	142
1983	15	*	15	9748	3266	16	5	9764	3271	649	218	400	125	649	217
UNCLASSIFIED															
1974	9	*	9	2406	1628	94	63	2500	1691	262	177	348	233	264	179
1975	3	2	5	1007	624	783	485	1790	1109	304	189	376	233	332	206
1976	1	19	19	296	173	6046	3546	6342	3719	365	214	327	192	328	193
1977	4	8	13	1819	1002	1971	1085	3790	2087	427	235	237	131	302	166
1978	*	*	1	97	49	246	125	343	174	441	223	502	255	483	245
1979	7	1	8	4964	2283	356	163	5320	2446	726	334	246	112	642	295
1980	-	1	1	-	-	270	109	270	109	-	-	314	127	314	127
1981	-	*	*	-	-	8	2	8	2	-	-	200	50	200	50
1982	-	*	*	-	-	97	33	97	33	-	-	269	92	269	92
TOTAL															
1974	9	*	9	2406	1628	94	63	2500	1691	262	177	348	233	264	179
1975	3	2	5	1007	624	783	485	1790	1109	304	189	376	233	332	206
1976	1	19	19	296	173	6046	3546	6342	3719	365	214	327	192	328	193
1977	4	8	13	1819	1002	1971	1085	3790	2087	427	235	237	131	302	166
1978	1	1	2	279	142	494	251	773	393	393	200	369	187	377	192
1979	9	9	17	6155	2830	2389	1097	8544	3927	712	327	281	129	498	229
1980	1	3	4	330	133	771	311	1101	444	317	128	271	109	283	114
1981	1	4	5	486	178	2541	933	3027	1111	540	198	647	237	627	230
1982	*	1	2	11	3	729	251	740	254	275	75	493	170	487	167
1983	15	*	15	9748	3266	16	5	9764	3271	649	218	400	125	649	217
NEW HAMPSHIRE															
LOLIGO															
1981	-	*	*	-	-	99	36	99	36	-	-	550	200	550	200
UNCLASSIFIED															
1981	-	*	*	-	-	82	30	82	30	-	-	456	167	456	167
TOTAL															
1981	-	*	*	-	-	181	66	181	66	-	-	503	183	503	183

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
MASSACHUSETTS															
LOLIGO															
1977	-	168	168	-	-	118400	65234	118400	65234	-	-	705	389	705	389
1978	126	27	153	112371	57508	25691	13147	138062	70655	894	458	950	486	904	463
1979	684	533	1217	645329	296839	413280	190101	1058609	486940	944	434	775	356	870	400
1980	1200	105	1306	809601	328039	70796	28685	880397	356724	674	273	673	272	674	273
1981	295	105	400	213447	78473	128132	47107	341579	125580	724	266	1219	448	854	314
1982	180	131	311	163964	56872	111564	38697	275528	95569	908	315	852	296	885	307
1983	1630	1135	2765	1255251	420660	714272	239367	1969523	660027	770	258	629	211	712	239
ILLEX															
1977	9	-	9	16003	8817	-	-	16003	8817	1764	972	-	-	1764	972
1978	196	162	357	35185	18006	43680	22354	78865	40360	180	92	270	138	221	113
1979	664	1241	1905	556384	255926	265132	121955	821516	377881	838	385	214	98	431	198
1980	18	278	297	4265	1728	58420	23670	62685	25398	231	94	210	85	211	86
1981	44	569	613	17522	6441	147998	54411	165520	60852	396	146	260	96	270	99
1982	105	61	167	25726	8923	16546	5739	42272	14662	244	85	271	94	254	88
1983	1	2	3	380	127	1412	473	1792	600	442	148	710	238	629	211
UNCLASSIFIED															
1974	349	300	649	151689	102700	89529	60615	241218	163315	435	295	298	202	372	252
1975	334	43	377	111627	69247	10418	6462	122045	75709	334	207	240	149	324	201
1976	668	963	1632	263765	154700	238475	139868	502240	294568	395	231	248	145	308	181
1977	341	1053	1394	206768	113921	242221	133455	448989	247376	606	334	230	127	322	177
1978	27	25	52	14440	7389	8535	4367	22975	11756	533	273	343	175	442	226
1979	22	58	80	23414	10770	57437	26419	80851	37189	1071	493	992	456	1013	466
1980	26	3	29	16299	6604	835	338	17134	6942	634	257	276	112	596	242
1981	1	25	26	644	236	19493	7166	20137	7402	492	180	774	285	760	280
1982	4	11	15	2302	798	63337	21969	65639	22767	552	191	5843	2027	4373	1517
1983	43	34	78	30084	10081	35134	11774	65218	21855	692	232	1021	342	838	281
TOTAL															
1974	349	300	649	151689	102700	89529	60615	241218	163315	435	295	298	202	372	252
1975	334	43	377	111627	69247	10418	6462	122045	75709	334	207	240	149	324	201
1976	668	963	1632	263765	154700	238475	139868	502240	294568	395	231	248	145	308	181
1977	350	1220	1571	222771	122738	360621	198689	583392	321427	636	350	295	163	371	205
1978	348	213	562	161996	82903	77906	39868	239902	122771	465	238	365	187	427	219
1979	1370	1833	3202	1225127	563535	735849	338475	1960976	902010	894	411	402	185	612	282
1980	1245	387	1631	830165	336371	130051	52693	960216	389064	667	270	336	136	589	239
1981	340	700	1040	231613	85150	295623	108684	527236	193834	681	250	423	155	507	186
1982	290	203	493	191992	66593	191447	66405	383439	132998	662	230	944	327	778	270
1983	1674	1171	2846	1285715	430868	750818	251614	2036533	682482	768	257	641	215	716	240

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
RHODE ISLAND															
LOLIGO															
1978	149	204	353	168866	86420	224884	115089	393750	201509	1134	580	1103	565	1116	571
1979	909	277	1186	652346	300067	293999	135234	946345	435301	717	330	1063	489	798	367
1980	606	462	1068	500691	202873	388325	157344	889016	360217	826	335	840	340	832	337
1981	208	425	634	195697	71947	486101	178713	681798	250660	939	345	1143	420	1076	396
1982	531	949	1480	394858	136960	707298	245334	1102156	382294	744	258	745	259	745	258
1983	382	3551	3933	232542	77929	2375530	796089	2608072	874018	609	204	669	224	663	222
ILLEX															
1978	-	*	*	-	-	86	44	86	44	-	-	215	110	215	110
1979	1	-	1	495	227	-	-	495	227	332	152	-	-	332	152
UNCLASSIFIED															
1974	147	477	624	57451	38897	228090	154427	285541	193324	392	265	478	324	458	310
1975	229	576	806	85561	53077	248167	153949	333728	207026	373	231	431	267	414	257
1976	430	736	1166	215534	126412	396813	232734	612347	359146	502	294	539	316	525	308
1977	275	168	442	248953	137164	166584	91781	415537	228945	906	499	994	548	939	517
1978	*	18	19	522	267	21834	11174	22356	11441	1160	593	1204	616	1203	615
1979	9	2	10	4750	2184	1885	867	6635	3051	552	254	1096	504	642	295
1980	1	8	9	452	183	5237	2121	5689	2304	665	269	668	271	668	270
1981	-	1	1	-	-	1376	505	1376	505	-	-	1012	371	1012	371
1982	131	82	213	116916	40553	56219	19500	173135	60053	892	309	687	238	813	282
1983	1538	344	1882	1082234	362678	292158	97908	1374392	460586	704	236	850	285	730	245
TOTAL															
1974	147	477	624	57451	38897	228090	154427	285541	193324	392	265	478	324	458	310
1975	229	576	806	85561	53077	248167	153949	333728	207026	373	231	431	267	414	257
1976	430	736	1166	215534	126412	396813	232734	612347	359146	502	294	539	316	525	308
1977	275	168	442	248953	137164	166584	91781	415537	228945	906	499	994	548	939	517
1978	149	222	372	169388	86687	246804	126307	416192	212994	1134	580	1110	568	1120	573
1979	920	278	1198	657591	302478	295884	136101	953475	438579	715	329	1063	489	796	366
1980	607	470	1077	501143	203056	393562	159465	894705	362521	826	335	837	339	831	337
1981	208	427	635	195697	71947	487477	179218	683174	251165	939	345	1142	420	1076	395
1982	662	1031	1693	511774	177513	763517	264834	1275291	442347	773	268	741	257	753	261
1983	1920	3895	5815	1314776	440607	2667688	893997	3982464	1334604	685	230	685	230	685	230

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
						CONNECTICUT									
LOLIGO															
1978	2	15	17	1902	973	13817	7071	15719	8044	932	477	937	480	937	479
1979	4	7	10	2064	949	3844	1768	5908	2717	570	262	569	262	570	262
1980	5	1	6	3013	1220	798	323	3811	1543	640	259	654	265	643	260
1981	6	5	11	6502	2390	4940	1816	11442	4206	1087	400	1079	397	1084	398
1982	2	5	6	1415	490	4000	1387	5415	1877	919	318	883	306	892	309
1983	5	-	5	3630	1216	-	-	3630	1216	662	222	-	-	662	222
ILLEX															
1981	-	1	1	-	-	735	270	735	270	-	-	1081	397	1081	397
1983	-	39	39	-	-	28050	9400	28050	9400	-	-	728	244	728	244
UNCLASSIFIED															
1974	*	5	6	300	203	2119	1434	2419	1637	612	414	403	273	421	285
1975	8	-	8	2886	1790	-	-	2886	1790	377	234	-	-	377	234
1976	-	16	16	-	-	9865	5785	9865	5785	-	-	623	365	623	365
1977	*	16	16	180	99	15078	8307	15258	8406	1000	550	961	529	961	530
1983	54	-	54	39109	13106	-	-	39109	13106	721	242	-	-	721	242
TOTAL															
1974	*	5	6	300	203	2119	1434	2419	1637	612	414	403	273	421	285
1975	8	-	8	2886	1790	-	-	2886	1790	377	234	-	-	377	234
1976	-	16	16	-	-	9865	5785	9865	5785	-	-	623	365	623	365
1977	*	16	16	180	99	15078	8307	15258	8406	1000	550	961	529	961	530
1978	2	15	17	1902	973	13817	7071	15719	8044	932	477	937	480	937	479
1979	4	7	10	2064	949	3844	1768	5908	2717	570	262	569	262	570	262
1980	5	1	6	3013	1220	798	323	3811	1543	640	259	654	265	643	260
1981	6	5	11	6502	2390	5675	2086	12177	4476	1087	400	1079	397	1083	398
1982	2	5	6	1415	490	4000	1387	5415	1877	919	318	883	306	892	309
1983	60	39	98	42739	14322	28050	9400	70789	23722	716	240	728	244	720	241

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
NEW YORK															
LOLIGO															
1979	717	57	774	633897	291580	79508	36572	713405	328152	885	407	1390	639	922	424
1980	1094	90	1184	871583	353153	104997	42543	976580	395696	796	323	1171	474	825	334
1981	705	78	782	749947	275715	111426	40965	861373	316680	1064	391	1430	526	1101	405
1982	737	237	974	703776	244112	268696	93200	972472	337312	955	331	1136	394	999	346
1983	2094	585	2679	1353365	453540	537556	180146	1890921	633686	646	217	919	308	706	237
ILLEX															
1979	38	3	40	6634	3051	491	225	7125	3276	177	81	172	79	176	81
1980	18	4	22	3263	1322	655	265	3918	1587	177	72	177	71	177	72
1983	-	1	1	-	-	142	47	142	47	-	-	225	75	225	75
UNCLASSIFIED															
1974	436	1	437	177567	120221	783	530	178350	120751	407	276	642	434	408	276
1975	235	23	258	123257	76462	10813	6707	134070	83169	524	325	478	296	520	322
1976	423	80	502	187185	109785	37630	22070	224815	131855	443	260	472	277	447	262
1977	175	45	220	171641	94568	51585	28421	223226	122989	982	541	1152	635	1016	560
1978	350	61	411	378892	193905	89278	45689	468170	239594	1083	554	1456	745	1138	583
TOTAL															
1974	436	1	437	177567	120221	783	530	178350	120751	407	276	642	434	408	276
1975	235	23	258	123257	76462	10813	6707	134070	83169	524	325	478	296	520	322
1976	423	80	502	187185	109785	37630	22070	224815	131855	443	260	472	277	447	262
1977	175	45	220	171641	94568	51585	28421	223226	122989	982	541	1152	635	1016	560
1978	350	61	411	378892	193905	89278	45689	468170	239594	1083	554	1456	745	1138	583
1979	754	60	814	640531	294631	79999	36797	720530	331428	849	391	1332	613	885	407
1980	1113	93	1206	874846	354475	105652	42808	980498	397283	786	319	1131	458	813	329
1981	705	78	782	749947	275715	111426	40965	861373	316680	1064	391	1430	526	1101	405
1982	737	237	974	703776	244112	268696	93200	972472	337312	955	331	1136	394	999	346
1983	2094	586	2680	1353365	453540	537698	180193	1891063	633733	646	217	918	308	706	236

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
NEW JERSEY															
LOLIGO															
1978	-	*	*	-	-	247	126	247	126	-	-	797	406	797	406
1979	6	194	199	3441	1582	164422	75631	167863	77213	618	284	849	390	842	387
1980	2	255	257	1719	696	192089	77831	193808	78527	690	280	754	305	753	305
1981	3	215	218	3027	1112	230338	84683	233365	85795	970	356	1071	394	1069	393
1982	3	387	391	4576	1587	287879	99853	292455	101440	1421	493	743	258	749	260
1983	96	390	486	35340	11843	282670	94728	318010	106571	369	124	725	243	655	219
ILLEX															
1982	-	2172	2172	-	-	556488	193023	556488	193023	-	-	256	89	256	89
1983	-	369	369	-	-	127681	42788	127681	42788	-	-	346	116	346	116
UNCLASSIFIED															
1974	35	549	584	12612	8538	224417	151941	237029	160479	365	247	409	277	406	275
1975	7	420	427	3288	2039	171193	106199	174481	108238	448	278	408	253	408	253
1976	53	344	397	24488	14362	172548	101201	197036	115563	465	273	501	294	496	291
1977	21	289	311	14976	8251	260082	143295	275058	151546	700	386	899	495	885	488
1978	11	184	195	9113	4663	205335	105084	214448	109747	824	422	1114	570	1098	562
1979	-	56	56	-	-	51205	23553	51205	23553	-	-	917	422	917	422
1980	*	2	2	46	18	1366	553	1412	571	1150	450	569	230	579	234
1981	-	*	*	-	-	88	32	88	32	-	-	978	356	978	356
1982	-	2	2	-	-	1469	509	1469	509	-	-	812	281	812	281
1983	*	8	8	40	13	4743	1589	4783	1602	308	100	575	193	571	191
TOTAL															
1974	35	549	584	12612	8538	224417	151941	237029	160479	365	247	409	277	406	275
1975	7	420	427	3288	2039	171193	106199	174481	108238	448	278	408	253	408	253
1976	53	344	397	24488	14362	172548	101201	197036	115563	465	273	501	294	496	291
1977	21	289	311	14976	8251	260082	143295	275058	151546	700	386	899	495	885	488
1978	11	185	196	9113	4663	205582	105210	214695	109873	824	422	1114	570	1097	562
1979	6	250	255	3441	1582	215627	99184	219068	100766	618	284	864	397	859	395
1980	3	257	260	1765	714	193455	78384	195220	79098	698	282	752	305	751	304
1981	3	215	218	3027	1112	230426	84715	233453	85827	970	356	1071	394	1069	393
1982	3	2562	2565	4576	1587	845836	293385	850412	294972	1421	493	330	115	332	115
1983	96	767	863	35380	11856	415094	139105	450474	150961	369	124	541	181	522	175

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
MARYLAND															
LOLIGO															
1982	-	*	*	-	-	101	35	101	35	-	-	1122	389	1122	389
1983	*	35	36	245	82	28306	9485	28551	9567	790	265	802	269	802	269
ILLEX															
1983	-	*	*	-	-	39	13	39	13	-	-	975	325	975	325
UNCLASSIFIED															
1974	-	29	29	-	-	15221	10305	15221	10305	-	-	526	356	526	356
1975	-	19	19	-	-	12571	7798	12571	7798	-	-	673	417	673	417
1976	-	18	18	-	-	11364	6665	11364	6665	-	-	638	374	638	374
1977	1	12	12	474	261	9472	5218	9946	5479	817	450	819	451	819	451
1978	*	4	4	39	19	3555	1819	3594	1838	433	211	844	432	836	427
1979	1	34	35	501	230	29228	13444	29729	13674	795	365	849	391	848	390
1980	1	46	47	686	277	30873	12509	31559	12786	722	292	674	273	675	273
1981	-	18	18	-	-	13058	4800	13058	4800	-	-	720	265	720	265
1982	*	11	11	271	93	10549	3659	10820	3752	1004	344	986	342	986	342
1983	-	34	34	-	-	15694	5259	15694	5259	-	-	458	153	458	153
TOTAL															
1974	-	29	29	-	-	15221	10305	15221	10305	-	-	526	356	526	356
1975	-	19	19	-	-	12571	7798	12571	7798	-	-	673	417	673	417
1976	-	18	18	-	-	11364	6665	11364	6665	-	-	638	374	638	374
1977	1	12	12	474	261	9472	5218	9946	5479	817	450	819	451	819	451
1978	*	4	4	39	19	3555	1819	3594	1838	433	211	844	432	836	427
1979	1	34	35	501	230	29228	13444	29729	13674	795	365	849	391	848	390
1980	1	46	47	686	277	30873	12509	31559	12786	722	292	674	273	675	273
1981	-	18	18	-	-	13058	4800	13058	4800	-	-	720	265	720	265
1982	*	11	11	271	93	10650	3694	10921	3787	1004	344	987	342	987	342
1983	*	70	70	245	82	44039	14757	44284	14839	790	265	633	212	633	212

Table 11. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
VIRGINIA															
LOLIGO															
1982	108	160	269	35897	12451	107546	37303	143443	49754	332	115	671	233	534	185
1983	299	1211	1510	223544	74914	796620	266963	1020164	341877	748	251	658	220	676	226
ILLEX															
1980	-	*	*	-	-	144	58	144	58	-	-	533	215	533	215
1982	-	1265	1265	-	-	308711	107079	308711	107079	-	-	244	85	244	85
1983	1	1041	1042	574	192	394582	132232	395156	132424	667	223	379	127	379	127
UNCLASSIFIED															
1974	1	76	77	143	96	24789	16783	24932	16879	122	82	328	222	325	220
1975	*	46	46	38	23	11327	7026	11365	7049	950	575	248	154	249	154
1976	*	51	51	152	89	12554	7363	12706	7452	691	405	247	145	249	146
1977	*	27	28	7	3	12645	6966	12652	6969	23	10	465	256	460	253
1978	-	59	59	-	-	40536	20745	40536	20745	-	-	683	350	683	350
1979	*	201	201	21	9	144744	66579	144765	66588	525	225	721	332	721	332
1980	*	128	128	69	27	53033	21488	53102	21515	531	208	416	168	416	168
1981	*	157	157	121	44	87606	32208	87727	32252	931	338	559	205	559	205
1982	-	100	100	-	-	65118	22586	65118	22586	-	-	649	225	649	225
1983	*	165	165	321	107	111599	37399	111920	37506	655	218	677	227	677	227
TOTAL															
1974	1	76	77	143	96	24789	16783	24932	16879	122	82	328	222	325	220
1975	*	46	46	38	23	11327	7026	11365	7049	950	575	248	154	249	154
1976	*	51	51	152	89	12554	7363	12706	7452	691	405	247	145	249	146
1977	*	27	28	7	3	12645	6966	12652	6969	23	10	465	256	460	253
1978	-	59	59	-	-	40536	20745	40536	20745	-	-	683	350	683	350
1979	*	201	201	21	9	144744	66579	144765	66588	525	225	721	332	721	332
1980	*	128	128	69	27	53177	21546	53246	21573	531	208	416	169	416	169
1981	*	157	157	121	44	87606	32208	87727	32252	931	338	559	205	559	205
1982	108	1526	1634	35897	12451	481375	166968	517272	179419	332	115	315	109	317	110
1983	300	2417	2717	224439	75213	1302801	436594	1527240	511807	748	251	539	181	562	188

- = zero.
* = less than 0.5 mt.
SW = State waters (internal + Territorial Sea).
Nom = nominal or current dollars.
Def = deflated (1967 = 100; Series 320, Consumer Prices All Items).
Source: unpub. prelim. NMFS data.

Table 12. North Carolina Squid Landings, Ex-Vessel Value, and Price, 1974-1983

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
							Landings (mt)						
1974	15	2	1	1	*	*	*	-	*	1	6	7	34
1975	10	9	3	2	*	-	-	-	-	-	-	2	27
1976	2	1	-	1	*	-	-	-	-	-	5	7	16
1977	4	1	1	2	-	-	-	-	-	-	*	1	10
1978	3	8	23	8	1	2	*	*	*	*	1	13	60
1979	39	61	72	18	2	1	3	1	27	20	2	10	256
1980	29	32	13	10	12	2	*	*	*	1	5	33	137
1981	64	21	15	11	1	*	1	1	*	*	2	12	126
1982	12	19	8	3	1	2	*	*	*	1	3	11	62
1983	11	19	19	10	*	*	*	*	*	27	16	36	139
							Ex-Vessel Value ($)						
1974	6334	951	304	336	150	46	21	-	175	259	1383	1976	11935
1975	2153	2508	966	548	32	-	-	-	-	-	-	546	6753
1976	616	450	-	243	93	-	-	-	-	-	1551	1869	4822
1977	1413	408	362	477	-	-	-	-	-	-	190	387	3237
1978	2882	8495	16339	5592	462	1424	84	290	126	124	514	12293	48625
1979	39617	39146	49536	13384	848	529	2214	237	21166	15314	1339	6777	190107
1980	11418	16594	5691	8904	8763	734	338	403	250	662	3135	18168	75060
1981	47387	9670	11596	10491	495	104	464	839	216	284	1084	9019	91649
1982	7648	13080	5996	2892	996	2228	594	351	27	734	2405	6933	43884
1983	6079	16811	19722	6687	5	149	473	294	143	17010	8088	21881	97342
							Price ($/mt)						
1974	413	421	419	431	441	221	326	-	386	492	220	278	350
1975	221	270	295	240	333	-	-	-	-	-	-	220	249
1976	250	331	-	331	331	-	-	-	-	-	339	277	298
1977	331	332	330	255	-	-	-	-	-	-	882	473	341
1978	859	1039	707	693	557	783	882	924	731	882	816	921	810
1979	1005	640	685	745	556	622	658	469	772	767	856	700	743
1980	390	521	451	913	754	441	1102	1322	1123	526	619	548	547
1981	739	470	780	999	686	840	871	1005	1105	1072	614	767	726
1982	664	692	738	965	784	995	1225	1296	875	816	688	606	712
1983	572	870	1023	657	648	650	1077	1249	1213	636	514	613	702

- = zero.
* = less than 0.5 mt.
Source: unpub. prelim. NMFS data.

Table 13. Squid Catch Distribution (%) by Month, ME-VA

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Illex	1978	-	-	-	-	-	54	13	3	25	3	3	-
	1979	-	-	-	1	21	2	11	19	31	14	1	-
	1980	-	-	-	-	2	1	5	9	17	54	13	-
	1981	-	-	-	-	-	-	1	3	35	50	10	-
	1982	-	-	-	-	11	20	21	14	30	3	1	-
	1983	-	-	-	-	1	8	32	36	23	-	-	-
Loligo	1978	-	-	-	5	32	16	4	1	4	14	18	5
	1979	1	1	2	3	55	20	9	1	1	2	3	3
	1980	3	1	2	4	48	13	14	2	2	5	4	2
	1981	4	2	3	5	26	12	17	9	3	6	5	8
	1982	2	3	3	2	20	9	12	11	9	9	10	10
	1983	2	1	2	3	37	26	5	3	2	8	6	4
Unc.	1972	1	1	3	6	35	27	3	6	4	7	6	1
	1973	3	5	4	6	22	20	6	6	7	10	6	6
	1974	6	3	3	14	25	13	7	5	6	7	6	5
	1975	5	7	8	6	19	9	5	4	3	7	14	12
	1976	3	4	3	7	42	10	6	5	6	7	4	2
	1977	3	1	1	2	20	9	8	12	16	16	7	4
	1978	8	5	7	9	15	19	11	7	3	4	8	5
	1979	25	19	23	6	1	17	1	1	1	2	1	2
	1980	23	19	12	9	20	1	-	-	-	1	2	10
	1981	27	19	10	6	1	-	-	-	1	7	8	21
	1982	8	11	10	4	27	8	3	1	6	8	6	8
	1983	1	-	1	8	65	20	4	-	-	-	1	1
Total	1972	1	1	3	6	35	27	3	6	4	7	6	1
	1973	3	5	4	6	22	20	6	6	7	10	6	6
	1974	6	3	3	14	25	13	7	5	6	7	6	5
	1975	5	7	8	6	19	9	5	4	3	7	14	12
	1976	3	4	3	7	42	10	6	5	6	7	4	2
	1977	3	1	1	2	20	9	8	12	16	16	7	4
	1978	4	2	3	6	17	26	9	4	8	7	10	4
	1979	2	2	2	2	40	13	9	7	11	6	2	2
	1980	4	2	2	4	43	12	13	3	3	9	4	3
	1981	5	3	3	4	19	9	12	7	10	15	7	7
	1982	1	2	2	1	16	15	16	12	19	6	6	5
	1983	1	1	1	4	38	23	8	5	4	6	5	3

\- = zero.
Source: unpub. prelim. NMFS data.

Table 14. Squid Catch Distribution (%) by Month by State

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ME	1972	-	-	-	-	-	-	-	39	12	46	3	-
	1973	-	-	-	-	-	-	-	36	46	14	4	-
	1974	-	-	-	-	-	77	-	20	-	-	-	2
	1975	-	-	-	-	-	61	-	-	25	8	4	1
	1976	-	-	-	-	-	3	4	20	36	34	3	1
	1977	-	2	-	-	-	19	35	8	18	10	9	-
	1978	-	-	-	-	-	1	24	31	26	11	7	-
	1979	-	-	-	-	-	47	8	12	27	4	1	1
	1980	4	-	1	-	-	-	29	-	8	41	17	1
	1981	-	-	-	-	-	-	-	28	17	38	14	4
	1982	10	-	-	-	-	15	19	13	36	7	-	-
	1983	-	-	-	-	-	90	8	-	1	-	-	-
NH	1981	-	-	-	-	-	-	-	-	67	33	-	-
	1982	-	-	-	-	-	-	-	-	-	100	-	-
MA	1972	-	-	-	-	34	47	3	6	3	3	3	-
	1973	-	-	-	-	36	43	3	3	5	7	3	-
	1974	6	6	-	-	53	14	5	2	5	6	4	-
	1975	-	-	-	-	8	14	14	26	8	14	15	1
	1976	-	-	-	1	50	9	6	8	11	10	4	1
	1977	-	-	-	-	18	6	2	18	26	23	5	1
	1978	-	-	-	1	18	43	9	3	19	3	4	-
	1979	-	-	-	1	43	9	6	12	19	9	1	-
	1980	-	-	-	3	75	2	1	2	3	11	3	-
	1981	-	1	-	1	32	4	1	2	21	31	7	-
	1982	-	-	-	-	62	16	6	1	2	4	7	2
	1983	-	-	-	4	75	19	2	-	-	1	-	-
RI	1972	3	1	6	11	36	8	3	6	4	11	10	1
	1973	1	7	4	10	25	7	2	5	11	15	7	5
	1974	5	2	3	10	13	6	8	10	13	16	8	6
	1975	3	5	12	6	20	7	5	3	5	8	13	11
	1976	4	4	5	9	46	17	2	2	2	5	2	2
	1977	5	1	-	3	32	18	14	2	2	7	11	6
	1978	3	1	1	7	18	12	5	2	6	17	22	7
	1979	3	1	1	4	57	18	2	1	1	4	4	4
	1980	5	2	1	4	45	9	1	2	4	14	9	4
	1981	4	3	3	5	22	5	2	3	8	15	10	19
	1982	1	2	3	2	24	10	2	4	14	13	10	14
	1983	2	1	1	4	50	25	2	1	2	4	5	4
NY	1973	-	-	1	-	15	16	30	18	5	8	3	2
	1973	-	-	1	-	16	17	32	19	-	8	3	2
	1974	-	-	1	2	25	30	13	6	4	6	8	3
	1975	4	5	3	4	16	22	10	9	3	7	9	9
	1976	3	3	2	7	31	10	25	9	2	5	2	1
	1977	4	2	3	3	9	11	29	12	6	6	9	6
	1978	2	1	1	2	22	24	18	10	3	5	9	4
	1979	1	-	1	1	26	25	35	3	1	1	2	3
	1980	1	-	1	1	12	30	42	5	1	2	2	1
	1981	1	1	2	1	5	22	42	21	2	1	2	1
	1982	1	1	1	1	8	11	36	18	8	7	4	2
	1983	1	1	1	2	18	38	19	8	4	4	4	1

Table 14. (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NJ	1973	11	6	5	4	2	26	2	3	6	5	10	20
	1974	7	2	5	43	12	6	2	1	1	3	6	11
	1975	9	9	4	6	22	5	-	-	-	5	22	16
	1976	15	16	9	24	16	1	1	1	-	1	7	10
	1977	14	6	5	6	23	10	12	1	-	6	5	12
	1978	14	9	10	17	6	19	2	1	-	2	10	9
	1979	22	11	12	8	10	14	2	-	-	1	7	12
	1980	16	11	14	14	6	8	5	-	-	4	6	16
	1981	19	11	15	19	9	2	-	1	1	2	10	12
	1982	1	2	1	1	2	17	29	14	26	1	3	3
	1983	5	5	8	3	3	20	21	3	10	-	12	9
MD	1980	25	15	12	4	23	2	-	-	-	1	2	16
	1981	56	28	9	1	-	1	-	-	-	-	1	3
	1982	23	56	2	5	1	3	-	1	-	-	-	9
	1983	6	14	6	4	57	2	-	-	2	-	1	7
VA	1973	14	24	40	11	-	-	-	-	1	1	1	6
	1974	33	10	17	20	3	4	3	-	1	1	4	5
	1975	7	30	19	28	7	1	-	-	-	-	1	7
	1976	8	15	14	59	1	-	-	-	-	-	-	1
	1977	8	31	23	22	5	1	-	-	-	1	5	4
	1978	13	16	34	27	3	4	-	-	-	1	1	1
	1979	14	32	38	10	1	-	-	-	-	-	1	3
	1980	29	27	16	12	1	-	-	-	-	1	1	12
	1981	29	13	12	7	1	-	-	-	-	2	10	26
	1982	1	2	2	1	20	18	1	16	26	7	6	1
	1983	1	2	3	6	4	11	11	18	11	21	7	5

- = zero.
Source: unpub. prelim. NMFS data.

Table 15. Mackerel Landings, Ex-Vessel Value, and Price, ME-VA, 1974-1983

	Landings (mt)			SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
ME-VA															
1974	575	499	1074	210852	142753	172288	116643	383140	259396	367	248	345	234	357	241
1975	508	1330	1838	163084	101166	308964	191662	472048	292828	321	199	232	144	257	159
1976	914	1345	2259	354746	208059	260246	152632	614992	360691	388	228	193	113	272	160
1977	874	386	1260	402090	221534	119066	65598	521156	287132	460	254	308	170	414	228
1978	900	617	1518	528016	270218	185794	95079	713810	365297	586	300	301	154	470	241
1979	861	891	1751	597706	274930	304785	140190	902491	415120	695	319	342	157	515	237
1980	1637	1064	2701	519376	210441	308221	124882	827597	335323	317	129	290	117	306	124
1981	637	2285	2922	323250	118839	673929	247763	997179	366602	508	187	295	108	341	125
1982	825	2475	3299	368566	127837	661800	229550	1030366	357387	447	155	267	93	312	108
1983	1486	1433	2919	829587	278007	514522	172423	1344109	450430	558	187	359	120	460	154
ME															
1974	121	7	129	31878	21582	1990	1347	33868	22929	263	178	269	182	263	178
1975	45	21	66	16080	9975	5491	3406	21571	13381	360	223	262	163	328	204
1976	153	31	184	68671	40276	12431	7290	81102	47566	449	263	405	238	442	259
1977	124	26	150	59255	32647	18708	10307	77963	42954	479	264	714	393	520	287
1978	201	18	219	86689	44364	10383	5313	97072	49677	431	221	571	292	443	226
1979	126	25	151	69004	31740	15335	7053	84339	38793	547	251	608	280	557	256
1980	219	28	246	65689	26616	13040	5283	78729	31899	300	122	472	191	320	130
1981	158	22	179	60586	22274	10622	3905	71208	26179	385	141	488	179	397	146
1982	107	80	187	48208	16721	33876	11750	82084	28471	452	157	422	146	439	152
1983	171	26	198	57207	19171	8921	2989	66128	22160	334	112	338	113	335	112
NH															
1975	-	*	*	-	-	25	15	25	15	-	-	192	115	192	115
1976	-	*	*	-	-	83	48	83	48	-	-	461	267	461	267
1977	-	2	2	-	-	728	401	728	401	-	-	350	193	350	193
1978	-	9	9	-	-	4030	2062	4030	2062	-	-	442	226	442	226
1979	-	5	5	-	-	2449	1126	2449	1126	-	-	496	228	496	228
1980	-	6	6	-	-	2616	1059	2616	1059	-	-	427	173	427	173
1981	1	13	14	487	179	12675	4659	13162	4838	492	181	998	367	961	353
1982	1	18	19	500	173	11319	3926	11819	4099	442	153	618	214	608	211
1983	2	5	7	814	272	2432	815	3246	1087	463	155	447	150	451	151
MA															
1974	217	57	274	99367	67276	29623	20056	128990	87332	458	310	519	351	471	319
1975	172	278	450	51438	31909	38360	23796	89798	55705	299	186	138	86	200	124
1976	485	218	703	164146	96273	27006	15839	191152	112112	338	198	124	73	272	159
1977	393	24	417	188283	103737	12615	6950	200898	110687	479	264	533	294	482	265
1978	424	106	529	275163	140820	57080	29211	332243	170031	650	332	541	277	628	321
1979	281	49	330	132617	61001	21082	9697	153699	70698	472	217	431	198	466	214
1980	1104	68	1172	271508	110011	35295	14301	306803	124312	246	100	517	209	262	106
1981	224	310	533	129168	47488	102896	37829	232064	85317	578	212	332	122	435	160
1982	332	189	521	110786	38427	62856	21802	173642	60229	334	116	333	115	334	116
1983	584	159	744	232693	77980	100549	33696	333242	111676	398	133	631	212	448	150

Table 15. (continued)

	Landings (mt)			SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
RI															
1974	59	48	107	24962	16900	20412	13819	45374	30719	426	289	422	286	424	287
1975	70	92	162	11483	7123	28950	17959	40433	25082	163	101	316	196	250	155
1976	117	69	186	63668	37341	23273	13649	86941	50990	545	320	336	197	467	274
1977	90	34	124	48373	26651	14159	7801	62532	34452	538	297	415	229	504	278
1978	42	65	107	35564	18200	12053	6168	47617	24368	850	435	184	94	444	227
1979	198	160	359	179749	82681	49586	22808	229335	105489	906	417	310	142	640	294
1980	91	102	193	73429	29752	29346	11890	102775	41642	803	325	288	117	532	215
1981	123	139	262	60283	22162	38880	14294	99163	36456	490	180	279	103	378	139
1982	83	184	267	62273	21600	60880	21116	123153	42716	748	260	331	115	461	160
1983	510	182	692	442840	148404	56346	18882	499186	167286	868	291	310	104	721	242
CT															
1974	12	-	12	4906	3321	-	-	4906	3321	424	287	-	-	424	287
1976	6	*	6	4696	2754	37	21	4733	2775	779	457	925	525	780	457
1977	15	*	15	12985	7154	17	9	13002	7163	884	487	94	50	874	482
1978	7	*	7	6789	3474	30	15	6819	3489	978	501	231	115	964	493
1979	5	*	6	3164	1455	93	42	3257	1497	597	275	423	191	590	271
1980	18	*	18	10843	4393	20	8	10863	4401	615	249	500	200	614	249
1981	16	23	39	6160	2264	8500	3125	14660	5389	375	138	375	138	375	138
1982	23	23	46	10839	3759	10500	3642	21339	7401	464	161	463	161	464	161
1983	7	2	9	4851	1625	1782	597	6633	2222	728	244	730	245	729	244
NY															
1974	146	-	146	39181	26527	-	-	39181	26527	268	182	-	-	268	182
1975	162	-	162	63076	39129	-	-	63076	39129	390	242	-	-	390	242
1976	113	-	113	39517	23177	-	-	39517	23177	350	205	-	-	350	205
1977	251	3	254	92818	51139	1899	1046	94717	52185	369	203	688	379	373	205
1978	225	7	232	123311	63106	3726	1906	127037	65012	549	281	520	266	548	281
1979	249	67	316	212258	97634	37186	17104	249444	114738	854	393	555	255	790	364
1980	204	122	326	97131	39356	66102	26783	163233	66139	477	193	540	219	500	203
1981	115	253	368	66428	24422	161217	59270	227645	83692	578	212	638	235	619	228
1982	265	295	560	131807	45718	145489	50464	277296	96182	497	172	493	171	495	172
1983	194	57	251	84080	28176	45989	15411	130069	43587	433	145	808	271	518	174
NJ															
1974	*	351	351	65	44	108936	73754	109001	73798	144	98	311	210	310	210
1975	*	679	679	69	42	142556	88434	142625	88476	256	156	210	130	210	130
1976	1	839	840	189	110	150410	88217	150599	88327	233	136	179	105	179	105
1977	*	248	248	80	44	48744	26856	48824	26900	296	163	197	108	197	108
1978	2	383	385	329	168	87893	44981	88222	45149	191	98	229	117	229	117
1979	*	550	550	223	102	160482	73818	160705	73920	619	283	292	134	292	134
1980	1	727	728	223	90	157276	63726	157499	63816	384	155	216	88	216	88
1981	*	1458	1458	34	12	319964	117633	319998	117645	378	133	219	81	220	81
1982	*	1645	1646	428	148	326613	113289	327041	113437	1070	370	199	69	199	69
1983	10	967	977	3465	1161	285568	95699	289033	96860	340	114	295	99	296	99
DE															
1974	-	1	1	-	-	246	166	246	166	-	-	342	231	342	231
1975	-	*	*	-	-	10	6	10	6	-	-	250	150	250	150
1976	*	-	*	24	14	-	-	24	14	185	108	-	-	185	108
1977	*	-	*	77	42	-	-	77	42	350	191	-	-	350	191
1978	*	-	*	27	13	-	-	27	13	208	100	-	-	208	100
1980	-	*	*	-	-	41	16	41	16	-	-	456	178	456	178
1981	-	*	*	-	-	72	26	72	26	-	-	400	144	400	144

Table 15. (continued)

	Landings (mt)			SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
MD															
1974	*	31	31	25	16	9581	6486	9606	6502	625	400	312	211	312	212
1975	-	93	93	-	-	33291	20651	33291	20651	-	-	359	223	359	223
1976	-	101	101	-	-	20741	12164	20741	12164	-	-	205	120	205	120
1977	-	45	45	-	-	19799	10908	19799	10908	-	-	444	244	444	244
1978	*	4	4	56	28	1881	962	1937	990	622	311	432	221	436	223
1979	*	26	26	95	43	13352	6141	13447	6184	352	159	514	236	512	235
1980	*	6	6	77	31	1198	485	1275	516	428	172	210	85	216	88
1981	-	9	9	-	-	1728	635	1728	635	-	-	203	75	203	75
1982	8	*	8	1409	488	15	5	1424	493	177	61	375	125	178	61
1983	3	13	16	1461	489	3671	1230	5132	1719	425	142	292	98	321	107
VA															
1974	20	4	24	10468	7087	1500	1015	11968	8102	521	353	352	238	491	333
1975	59	167	226	20938	12988	60281	37395	81219	50383	355	220	361	224	359	223
1976	39	86	125	13835	8114	26265	15404	40100	23518	353	207	305	179	320	188
1977	*	5	5	219	120	2397	1320	2616	1440	706	387	504	277	516	284
1978	*	24	25	88	45	8718	4461	8806	4506	284	145	357	183	356	182
1979	1	8	9	596	274	5220	2401	5816	2675	736	338	633	291	642	295
1980	1	5	5	476	192	3287	1331	3763	1523	553	223	711	288	687	278
1981	*	60	60	104	38	17375	6387	17479	6425	800	292	291	107	292	107
1982	5	41	46	2316	803	10252	3556	12568	4359	460	160	253	88	276	96
1983	3	21	24	2176	729	9264	3104	11440	3833	667	224	440	148	471	158

See Table 11 for notes.
Source: unpub. prelim. NMFS data.

Table 16. North Carolina Mackerel Landings, Ex-Vessel Value, and Price

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
						Landings (mt)							
1975	-	15	32	-	-	-	-	-	-	-	-	-	48
1976	68	96	36	-	-	-	-	-	-	-	-	-	200
1977	-	117	-	3	-	-	-	-	-	-	-	-	121
1978	-	1	6	4	*	-	-	-	-	-	-	-	10
1979	-	6	1	5	*	-	-	-	-	-	-	-	13
1980	-	*	*	1	-	-	-	-	-	-	-	-	1
1981	*	3	30	33	-	-	-	-	-	-	-	-	66
1982	*	2	13	4	12	-	-	-	-	-	-	-	32
1983	-	-	-	-	*	-	-	-	-	-	-	-	*
						Ex-Vessel Value ($)							
1975	-	3700	8139	-	-	-	-	-	-	-	-	-	11839
1976	14950	17537	7830	-	-	-	-	-	-	-	-	-	40317
1977	-	25883	-	368	-	-	-	-	-	-	-	-	26251
1978	-	120	3655	2355	20	-	-	-	-	-	-	-	6150
1979	-	4094	900	2301	33	-	-	-	-	-	-	-	7328
1980	-	20	16	167	-	-	-	-	-	-	-	-	203
1981	282	1684	11233	9895	-	-	-	-	-	-	-	-	23094
1982	96	993	1424	1818	4088	-	-	-	-	-	-	-	8419
1983	-	-	-	-	8	-	-	-	-	-	-	-	8
						Price ($/mt)							
1975	-	243	252	-	-	-	-	-	-	-	-	-	249
1976	220	182	220	-	-	-	-	-	-	-	-	-	202
1977	-	220	-	110	-	-	-	-	-	-	-	-	217
1978	-	220	653	590	130	-	-	-	-	-	-	-	598
1979	-	709	629	441	441	-	-	-	-	-	-	-	586
1980	-	337	324	225	-	-	-	-	-	-	-	-	239
1981	638	661	374	300	-	-	-	-	-	-	-	-	350
1982	441	399	111	439	331	-	-	-	-	-	-	-	263
1983	-	-	-	-	353	-	-	-	-	-	-	-	353

\- = zero. * = less than 0.5 mt.
Source: unpub. prelim. NMFS data.

Table 17. Mackerel Catch Distribution (%) by Month, ME-VA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1972	-	-	1	-	26	13	19	31	4	2	3	1
1973	1	5	4	27	32	9	10	3	2	5	1	1
1974	4	1	6	33	22	11	6	5	1	4	4	2
1975	1	13	7	18	35	5	1	1	-	1	13	5
1976	2	3	7	36	13	2	5	2	2	6	6	14
1977	3	1	10	23	18	7	8	7	4	12	4	5
1978	-	-	8	23	16	21	6	11	3	2	4	5
1979	-	1	4	20	43	5	6	2	2	4	6	8
1980	2	2	17	18	10	4	6	5	3	24	4	5
1981	2	2	31	30	14	5	3	3	2	1	5	3
1982	2	12	28	27	13	1	2	4	4	1	2	3
1983	2	5	11	24	29	5	9	2	4	1	2	5

\- = zero.
Source: unpub. prelim. NMFS data.

Table 18. Mackerel Catch Distribution (%) by Month by State

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ME	1972	-	-	-	-	-	-	69	30	-	-	-	-
	1973	-	-	-	-	-	16	59	2	10	13	-	-
	1974	-	-	-	-	-	36	24	30	10	-	-	-
	1975	-	-	-	-	-	61	16	17	6	-	-	-
	1976	-	-	-	-	-	17	32	25	13	6	7	-
	1977	-	-	-	-	-	32	33	11	11	12	1	-
	1978	-	-	-	-	-	4	23	49	17	2	4	2
	1979	-	-	-	-	-	11	28	19	18	10	9	4
	1980	-	-	-	-	1	12	28	46	11	1	-	1
	1981	-	-	-	-	-	4	17	47	25	2	4	-
	1982	-	-	-	-	-	3	10	23	58	2	3	1
	1983	-	-	-	-	-	11	10	15	54	10	-	-
NH	1981	-	-	-	-	-	-	3	32	-	7	50	8
	1982	2	-	-	-	-	3	-	-	6	62	20	8
	1983	2	-	-	-	1	6	-	-	1	42	32	16
MA	1972	-	-	-	-	11	12	23	42	6	2	4	1
	1973	-	-	-	-	29	28	17	13	3	2	4	3
	1974	-	-	-	-	41	17	6	-	1	17	17	1
	1975	-	-	-	-	11	5	-	1	-	5	62	16
	1976	-	-	-	-	15	-	8	-	4	16	15	41
	1977	2	-	-	-	4	5	10	19	1	34	11	14
	1978	-	-	-	-	-	56	7	10	1	5	11	10
	1979	-	4	-	-	36	8	3	-	2	8	10	28
	1980	2	-	-	1	11	5	4	-	4	54	8	10
	1981	-	-	-	-	42	16	3	1	1	4	19	13
	1982	3	-	-	8	44	1	-	13	-	6	9	15
	1983	5	-	-	1	43	14	10	2	-	-	7	18
RI	1972	-	-	4	1	74	19	-	-	-	-	1	-
	1973	4	14	6	3	58	2	1	-	1	10	-	-
	1974	8	1	5	21	41	3	13	6	-	-	-	1
	1975	1	19	30	2	40	2	-	-	-	-	-	4
	1976	2	12	5	22	44	1	-	-	-	2	10	2
	1977	9	-	1	12	52	3	1	-	13	7	1	1
	1978	-	-	-	18	73	3	5	-	-	-	-	-
	1979	-	-	-	8	60	3	6	1	1	5	11	4
	1980	2	-	2	30	31	7	14	1	5	2	3	3
	1981	-	-	4	24	46	-	6	2	-	-	16	1
	1982	-	7	9	16	32	1	10	12	5	1	2	4
	1983	2	1	1	11	53	2	25	2	1	-	2	1
NY	1973	-	-	1	13	57	15	7	1	-	-	1	4
	1974	-	-	-	47	39	11	2	-	-	-	-	-
	1975	-	1	1	17	65	12	2	1	1	-	-	-
	1976	-	-	1	41	50	3	-	1	1	-	-	2
	1977	1	-	-	43	44	5	3	-	1	1	2	-
	1978	-	-	1	42	44	4	2	-	-	-	-	6
	1979	-	-	1	35	33	8	9	2	-	-	3	7
	1980	6	3	8	51	18	5	4	1	1	-	2	2
	1981	1	2	40	28	11	12	4	1	-	-	-	-
	1982	4	6	18	47	18	4	-	-	1	-	1	1

Table 18. (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NJ	1973	-	-	6	84	8	-	-	-	-	-	-	1
	1974	9	2	13	69	1	-	-	-	-	-	-	6
	1975	3	-	3	38	53	-	-	-	-	-	-	3
	1976	-	2	10	82	5	-	-	-	-	-	-	-
	1977	3	4	43	45	-	-	-	-	-	1	1	2
	1978	-	-	29	55	15	-	-	-	-	-	-	-
	1979	-	1	10	34	54	-	-	-	-	-	-	1
	1980	1	7	57	34	1	-	-	-	-	-	-	-
	1981	3	2	48	44	1	-	-	-	-	-	-	1
	1982	1	21	47	31	1	-	-	-	-	-	-	-
	1983	-	14	31	50	3	-	-	-	-	-	-	1
MD	1980	-	-	84	14	2	-	-	-	-	-	-	-
	1981	-	-	53	47	-	-	-	-	-	-	-	-
	1982	-	-	1	50	-	-	49	-	-	-	-	-
	1983	-	-	-	100	-	-	-	-	-	-	-	-
VA	1973	40	-	5	54	1	-	-	-	-	-	-	-
	1974	4	22	34	2	37	-	-	-	-	-	-	-
	1975	-	76	20	3	-	-	-	-	-	-	-	-
	1976	26	23	51	-	-	-	-	-	-	-	-	-
	1977	-	9	15	55		-	-	-	-	-	-	22
	1978	-	1	31	59	9	-	-	-	-	-	-	-
	1979	15	-	36	49	-	-	-	-	-	-	-	-
	1980	40	18	1	40	-	-	-	-	-	-	-	2
	1981	-	6	20	69	-	-	-	-	-	-	-	4
	1982	11	13	23	47	-	-	-	-	-	-	3	2
	1983	1	5	3	80	8	1	-	-	2	-	-	1

- = zero.
Source: unpub. prelim. NMFS data.

Table 19. Butterfish Landings, Ex-Vessel Value, and Price, ME-VA, 1974-1983

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
Maine-Virginia															
Large															
1974	26	578	604	16343	11064	323055	218723	339398	229787	623	421	559	378	562	380
1975	21	566	587	16857	10456	343714	213222	360571	223678	814	505	607	377	615	381
1976	30	289	320	23063	13526	223240	130931	246303	144457	765	449	771	452	771	452
1977	19	316	335	15892	8755	231443	127515	247335	136270	849	468	732	404	739	407
1978	48	2434	2483	39527	20228	2106745	1078169	2146272	1098397	819	419	865	443	865	442
1979	40	1512	1552	34331	15791	1119390	514896	1153721	530687	866	398	740	341	744	342
1980	67	2390	2457	65855	26682	1937604	785089	2003459	811771	986	399	811	328	815	330
1981	35	1500	1535	31646	11633	1292730	475265	1324376	486898	909	334	862	317	863	317
1982	92	947	1038	107292	37215	909331	315407	1016623	352622	1169	406	961	333	979	340
1983	40	624	664	43945	14726	624892	209411	668837	224137	1089	365	1002	336	1007	337
Medium															
1974	4	177	181	1890	1279	77163	52242	79053	53521	509	345	436	295	438	296
1975	9	208	217	4699	2914	102539	63609	107238	66523	514	318	494	306	494	307
1976	113	146	260	64941	38087	74797	43868	139738	81955	573	336	511	300	538	315
1977	20	269	288	13145	7242	109881	60540	123026	67782	673	371	409	225	427	235
1978	21	358	380	11099	5678	181894	93086	192993	98764	523	268	508	260	508	260
1979	22	241	263	19414	8928	174225	80138	193639	89066	878	404	722	332	735	338
1980	24	1554	1579	20191	8180	783089	317295	803280	325475	826	335	504	204	509	206
1981	9	1876	1885	6542	2404	970585	356832	977127	359236	697	256	517	190	518	191
1982	18	3890	3908	15486	5369	1952728	677323	1968214	682692	846	293	502	174	504	175
1983	44	1051	1095	28939	9695	728247	244047	757186	253742	664	222	693	232	692	232
Small															
1974	2	14	16	678	458	3744	2534	4422	2992	278	188	275	186	276	187
1975	1	14	15	182	112	4799	2976	4981	3088	289	178	342	212	339	210
1976	3	15	18	1483	868	5757	3376	7240	4244	511	299	388	228	409	240
1977	1	15	15	278	152	3604	1985	3882	2137	441	241	243	134	251	138
1978	1	52	53	553	283	21273	10886	21826	11169	489	250	411	210	413	211
1979	2	13	16	647	296	3614	1660	4261	1956	265	121	271	125	270	124
1980	*	168	169	164	66	53308	21598	53472	21664	410	165	317	128	317	128
1981	1	503	504	442	161	183771	67560	184213	67721	409	149	365	134	365	134
1982	3	2356	2359	1340	463	955403	331391	956743	331854	465	161	405	141	406	141
1983	8	1653	1661	3670	1229	753407	252480	757077	253709	472	158	456	153	456	153
Unclassified															
1974	782	195	977	461704	312592	85456	57854	547160	370446	590	400	439	297	560	379
1975	743	411	1154	411677	255379	184662	114551	596339	369930	554	344	449	279	517	320
1976	546	233	779	333206	195426	138187	81045	471393	276471	611	358	592	347	605	355
1977	334	323	657	240149	132308	194825	107340	434974	239648	719	396	603	332	662	365
1978	256	444	700	187364	95884	337623	172783	524987	268667	731	374	761	389	750	384
1979	326	488	815	299952	137967	419410	192917	719362	330884	919	423	859	395	883	406
1980	323	644	968	340377	137912	603762	244633	944139	382545	1053	427	937	380	976	395
1981	248	809	1058	271447	99794	606912	223126	878359	322920	1093	402	750	276	830	305
1982	187	1344	1530	199760	69286	1001464	347365	1201224	416651	1069	371	745	259	785	272
1983	285	1038	1323	291588	97712	870264	291639	1161852	389351	1024	343	838	281	878	294
Total															
1974	815	963	1778	480615	325393	489418	331353	970033	656746	590	399	508	344	546	369
1975	774	1199	1973	433415	268861	635714	394358	1069129	663219	560	348	530	329	542	336
1976	692	684	1376	422693	247907	441981	259220	864674	507127	611	358	646	379	628	368
1977	373	922	1296	269464	148457	539753	297380	809217	445837	722	398	585	322	625	344
1978	327	3288	3615	238543	122073	2647535	1354924	2886078	1476997	730	373	805	412	798	409
1979	391	2255	2645	354344	162982	1716639	789611	2070983	952593	907	417	761	350	783	360
1980	415	4757	5172	426587	172840	3377763	1368615	3804350	1541455	1028	417	710	288	736	298
1981	294	4689	4982	310077	113992	3053998	1122783	3364075	1236775	1056	388	651	239	675	248
1982	300	8537	8837	323878	112333	4818926	1671486	5142804	1783819	1080	375	564	196	582	202
1983	376	4366	4743	368142	123362	2976810	997577	3344952	1120939	978	328	682	228	705	236

Table 19. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
Maine															
Large															
1976	-	4	4	-	-	5136	3012	5136	3012	-	-	1317	772	1317	772
1977	-	-	-	17	9	-	-	17	9	-	-	-	-		
1979	-	*	*	-	-	6	2	6	2	-	-	150	50	150	50
1980	1	*	1	1057	428	20	8	1077	436	866	351	500	200	855	346
1982	-	*	*	-	-	25	8	25	8	-	-	625	200	625	200
1983	-	*	*	-	-	364	121	364	121	-	-	1011	336	1011	336
Medium															
1976	*	-	*	161	94	-	-	161	94	732	427	-	-	732	427
1978	*	-	*	26	13	5	2	31	15	650	325	-	-	775	375
1979	*	-	*	296	136	16	7	312	143	740	340	-	-	780	358
1982	-	*	*	-	-	9	3	9	3	-	-	225	75	225	75
1983	*	*	1	74	24	500	167	574	191	822	267	1111	371	1063	354
Small															
1977	-	*	*	-	-	139	76	139	76	-	-	348	190	348	190
1981	-	22	22	-	-	6390	2349	6390	2349	-	-	292	107	292	107
1983	-	*	*	-	-	201	67	201	67	-	-	558	186	558	186
Unclassified															
1979	*	-	*	25	11	6	2	31	13	625	275	-	-	775	325
1982	-	*	*	-	-	92	31	92	31	-	-	418	141	418	141
1983	2	*	2	764	256	185	61	949	317	384	129	411	136	389	130
Total															
1976	*	4	4	161	94	5136	3012	5297	3106	732	427	1317	772	1286	754
1977	-	*	*	17	9	139	76	156	85	-	-	348	190	390	213
1978	*	-	*	26	13	5	2	31	15	650	325	-	-	775	375
1979	*	*	*	321	147	28	11	349	158	730	334	700	275	727	329
1980	1	*	1	1057	428	20	8	1077	436	866	351	500	200	855	346
1981	-	22	22	-	-	6390	2349	6390	2349	-	-	292	107	292	107
1982	-	*	*	-	-	126	42	126	42	-	-	420	140	420	140
1983	2	2	4	838	280	1250	416	2088	696	403	135	772	257	564	188
New Hampshire															
Large															
1981	-	*	*	-	-	233	85	233	85	-	-	752	274	752	274
1982	-	*	*	-	-	82	28	82	28	-	-	2050	700	2050	700
1983	-	*	*	-	-	19	6	19	6	-	-	475	150	475	150
Medium															
1982	-	1	1	-	-	402	139	402	139	-	-	423	146	423	146
1983	*	*	*	46	15	22	7	68	22	1150	375	550	175	850	275
Total															
1981	-	*	*	-	-	233	85	233	85	-	-	752	274	752	274
1982	-	1	1	-	-	484	167	484	167	-	-	489	169	489	169
1983	*	*	*	46	15	41	13	87	28	1150	375	513	163	725	233

Table 19. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
Massachusetts															
Large															
1974	1	6	7	333	225	3581	2424	3914	2649	617	417	577	390	580	392
1975	1	1	2	976	605	1101	683	2077	1288	938	582	810	502	865	537
1976	7	4	11	6359	3729	3715	2178	10074	5907	911	534	975	572	934	547
1977	2	2	4	2026	1116	1579	869	3605	1985	896	494	741	408	821	452
1978	2	4	6	2152	1101	3144	1609	5296	2710	952	487	806	413	860	440
1979	2	4	6	1518	698	2895	1331	4413	2029	839	386	770	354	792	364
1980	7	24	31	7101	2877	22899	9278	30000	12155	1004	407	938	380	953	386
1981	2	109	111	2322	853	89681	32970	92003	33823	1167	429	826	304	832	306
1982	5	7	12	4590	1592	6932	2404	11522	3996	983	341	1013	351	1001	347
1983	5	19	24	5240	1756	20223	6777	25463	8533	1122	376	1062	356	1073	360
Medium															
1974	1	43	44	358	242	20544	13909	20902	14151	398	269	478	323	476	322
1975	2	4	6	1035	642	1658	1028	2693	1670	588	365	425	264	476	295
1976	106	10	115	61294	35949	6610	3876	67904	39825	580	340	691	405	589	345
1977	13	1	15	9934	5473	1227	676	11161	6149	761	419	823	454	767	423
1978	9	7	16	5031	2574	4757	2434	9788	5008	544	278	700	358	610	312
1979	19	26	45	18098	8324	15120	6954	33218	15278	976	449	575	264	741	341
1980	18	104	122	17417	7057	70506	28568	87923	35625	955	387	679	275	721	292
1981	6	155	160	4467	1642	102610	37724	107077	39366	808	297	664	244	669	246
1982	9	102	110	7429	2576	62011	21509	69440	24085	867	301	611	212	631	219
1983	31	36	67	20346	6818	26736	8959	47082	15777	665	223	740	248	705	236
Small															
1974	1	2	3	449	303	605	409	1054	712	310	209	371	251	342	231
1975	*	1	1	72	44	396	245	468	289	400	244	350	217	357	221
1976	1	4	5	907	531	2086	1223	2993	1754	626	366	555	325	574	337
1977	*	1	1	70	38	363	200	433	238	389	211	448	247	437	240
1978	-	5	5	-	-	1759	900	1759	900	-	-	381	195	381	195
1979	-	*	*	20	9	106	48	126	57	-	-	589	267	700	317
1980	-	28	28	-	-	15444	6257	15444	6257	-	-	545	221	545	221
1981	*	46	46	115	42	16551	6084	16666	6126	426	156	361	133	361	133
1982	1	42	43	415	143	21886	7591	22301	7734	512	177	516	179	516	179
1983	2	29	31	434	145	17460	5851	17894	5996	247	82	593	199	574	192
Unclassified															
1974	20	*	20	12165	8236	62	41	12227	8277	603	408	689	456	603	408
1975	73	-	73	35430	21978	-	-	35430	21978	486	301	-	-	486	301
1977	5	-	5	4218	2323	-	-	4218	2323	775	427	-	-	775	427
1979	-	1	1	-	-	290	133	290	133	-	-	426	196	426	196
1980	-	2	2	-	-	1530	619	1530	619	-	-	662	268	662	268
1982	*	11	11	48	16	8812	3056	8860	3072	533	178	787	273	785	272
1983	*	60	61	65	21	30276	10146	30341	10167	500	162	501	168	501	168
Total															
1974	23	51	74	13305	9006	24792	16783	38097	25789	577	390	487	330	515	349
1975	76	6	82	37513	23269	3155	1956	40668	25225	494	307	494	306	494	307
1976	114	17	131	68560	40209	12411	7277	80971	47486	600	352	724	425	616	362
1977	21	4	25	16248	8950	3169	1745	19417	10695	776	427	715	394	765	422
1978	12	15	27	7183	3675	9660	4943	16843	8618	624	319	631	323	628	321
1979	20	31	51	19636	9031	18411	8466	38047	17497	964	444	595	274	742	341
1980	25	159	184	24518	9934	110379	44722	134897	54656	969	393	695	282	733	297
1981	8	309	317	6904	2537	208842	76778	215746	79315	886	326	676	248	681	250
1982	14	162	176	12482	4327	99641	34560	112123	38887	883	306	615	213	636	221
1983	37	145	182	26085	8740	94695	31733	120780	40473	702	235	653	219	663	222

Table 19. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
Rhode Island															
Large															
1974	26	572	598	16010	10839	319474	216299	335484	227138	623	422	559	378	561	380
1975	20	565	584	15881	9851	342613	212539	358494	222390	807	501	607	376	614	381
1976	23	282	305	16704	9797	214389	125741	231093	135538	721	423	761	446	758	445
1977	16	314	330	13849	7630	229864	126646	243713	134276	841	464	732	404	738	407
1978	46	2428	2474	37375	19127	2102200	1075844	2139575	1094971	813	416	866	443	865	443
1979	38	1507	1545	32813	15093	1115825	513258	1148638	528351	868	399	740	341	743	342
1980	58	2336	2394	57626	23349	1879178	761417	1936804	784766	986	400	805	326	809	328
1981	33	1384	1417	29324	10780	1196095	439740	1225419	450520	893	328	864	318	865	318
1982	87	938	1025	102702	35623	900770	312441	1003472	348064	1179	409	961	333	979	340
1983	36	601	637	38676	12961	600917	201379	639593	214340	1085	364	999	335	1004	336
Medium															
1974	3	134	137	1532	1037	56619	38333	58151	39370	545	369	423	286	426	288
1975	7	204	211	3664	2272	100881	62581	104545	64853	496	307	495	307	495	307
1976	7	137	144	3486	2044	68187	39992	71673	42036	472	277	498	292	497	291
1977	6	267	274	3211	1769	108654	59864	111865	61633	496	273	406	224	409	225
1978	12	267	278	5849	2993	123778	63345	129627	66338	504	258	464	238	466	238
1979	*	115	116	221	101	75406	34685	75627	34786	713	326	653	301	654	301
1980	6	1380	1386	2712	1098	671908	272247	674620	273345	443	179	487	197	487	197
1981	4	1627	1631	2039	749	797918	293352	799957	294101	542	199	490	180	491	180
1982	9	3703	3712	7899	2739	1835996	636835	1843895	639574	842	292	496	172	497	172
1983	12	864	876	7605	2548	595510	199567	603115	202115	658	220	689	231	689	231
Small															
1974	1	12	13	229	155	3139	2125	3368	2280	231	157	262	178	260	176
1975	*	13	13	110	68	4403	2731	4513	2799	244	151	341	211	338	209
1976	1	11	13	576	337	3671	2153	4247	2490	397	232	332	195	339	199
1977	*	14	14	208	114	3102	1709	3310	1823	462	253	227	125	235	129
1978	1	44	45	553	283	17657	9036	18210	9319	489	250	401	205	403	206
1979	*	11	11	110	50	2508	1153	2618	1203	355	161	232	107	236	108
1980	*	129	130	164	66	36081	14619	36245	14685	410	165	279	113	280	113
1981	1	415	416	279	102	154068	56642	154347	56744	388	142	371	137	371	137
1982	2	2257	2259	673	233	914024	317039	914697	317272	426	147	405	140	405	140
1983	5	1509	1515	2832	949	672172	225258	675004	226207	517	173	445	149	446	149
Unclassified															
1974	56	-	56	55539	37602	-	-	55539	37602	994	673	-	-	994	673
1975	53	-	53	39930	24770	16	9	39946	24779	758	470	-	-	758	470
1976	97	19	116	73818	43295	688	403	74506	43698	764	448	36	21	643	377
1977	70	6	75	62616	34499	3645	2008	66261	36507	900	496	659	363	882	486
1978	55	4	58	51222	26213	1669	854	52891	27067	936	479	444	227	905	463
1979	45	12	58	56515	25995	5240	2410	61755	28405	1251	575	422	194	1072	493
1980	64	276	340	71617	29018	194076	78636	265693	107654	1114	452	703	285	781	316
1981	69	304	373	83663	30758	153037	56263	236700	87021	1216	447	503	185	635	233
1982	46	732	778	51537	17876	477950	165782	529487	183658	1118	388	653	226	680	236
1983	103	235	337	96174	32229	107721	36099	203895	68328	937	314	459	154	605	203
Total															
1974	85	718	803	73310	49633	379232	256757	452542	306390	859	581	528	358	563	381
1975	80	781	862	59585	36961	447913	277860	507498	314821	743	461	573	356	589	365
1976	129	449	578	94584	55473	286935	168289	381519	223762	735	431	639	375	661	387
1977	93	600	693	79884	44012	345265	190227	425149	234239	859	473	575	317	613	338
1978	113	2743	2856	94999	48616	2245304	1149079	2340303	1197695	838	429	819	419	819	419
1979	84	1646	1729	89659	41239	1198979	551506	1288638	592745	1072	493	728	335	745	343
1980	129	4121	4250	132119	53531	2781243	1126919	2913362	1180450	1023	414	675	273	686	278
1981	106	3730	3836	115305	42389	2301118	845997	2416423	888386	1086	399	617	227	630	232
1982	144	7630	7774	162811	56471	4128740	1432097	4291551	1488568	1130	392	541	188	552	191
1983	155	3210	3365	145287	48687	1976320	662303	2121607	710990	935	313	616	206	631	211

Table 19. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
Connecticut															
Total (all Unclassified)															
1974	3	2	5	1095	741	1032	698	2127	1439	410	278	430	291	420	284
1975	4	-	4	1967	1220	-	-	1967	1220	549	341	-	-	549	341
1976	*	9	9	200	117	4271	2504	4471	2621	909	532	466	273	477	279
1977	*	13	13	30	16	7455	4107	7485	4123	750	400	585	322	586	323
1978	4	26	30	2433	1245	16055	8216	18488	9461	624	319	617	316	618	316
1979	5	7	12	2714	1248	3575	1644	6289	2892	587	270	502	231	536	246
1980	1	2	3	2169	878	3227	1307	5396	2185	1549	627	1551	628	1551	628
1981	5	227	232	3235	1189	155093	57019	158328	58208	674	248	683	251	683	251
1982	3	226	229	2351	815	159458	55309	161809	56124	721	250	706	245	706	245
1983	27	150	177	29950	10036	165300	55395	195250	65431	1102	369	1102	369	1102	369
New York															
Total (all Unclassified)															
1974	335	27	362	280355	189813	19930	13493	300285	203306	837	566	751	509	830	562
1975	482	80	562	272677	169154	54105	33563	326782	202717	566	351	674	418	582	361
1976	322	113	435	199587	117059	74367	43617	273954	160676	620	364	657	385	630	369
1977	202	92	295	141942	78204	72974	40206	214916	118410	701	386	791	436	729	402
1978	160	260	420	113311	57989	240318	122987	353629	180976	706	362	925	474	842	431
1979	149	313	463	158405	72863	293112	134826	451517	207689	1061	488	936	430	976	449
1980	201	313	514	225465	91355	371713	150613	597178	241968	1120	454	1188	481	1162	471
1981	135	174	310	158329	58209	215655	79284	373984	137493	1172	431	1236	454	1208	444
1982	107	280	388	117993	40927	301713	104652	419706	145579	1098	381	1076	373	1082	375
1983	110	537	647	127681	42788	524927	175913	652608	218701	1164	390	977	327	1009	338
New Jersey															
Large															
1978	-	2	2	-	-	1401	716	1401	716	-	-	658	336	658	336
1979	-	1	1	-	-	664	305	664	305	-	-	671	308	671	308
1980	*	30	30	71	28	35507	14386	35578	14414	789	311	1186	481	1185	480
1981	-	7	7	-	-	6721	2470	6721	2470	-	-	1015	373	1015	373
1982	-	2	2	-	-	1427	494	1427	494	-	-	686	238	686	238
1983	-	1	1	-	-	1578	528	1578	528	-	-	1349	451	1349	451
Medium															
1978	*	85	85	193	98	53354	27305	53547	27403	623	316	628	321	628	321
1979	3	100	102	799	367	83683	38492	84482	38859	280	129	841	387	825	379
1980	*	71	71	62	25	40675	16480	40737	16505	689	278	573	232	573	232
1981	-	91	91	-	-	67826	24936	67826	24936	-	-	748	275	748	275
1982	-	73	73	-	-	44480	15428	44480	15428	-	-	609	211	609	211
1983	*	115	115	53	17	80344	26924	80397	26941	589	189	700	235	700	234
Small															
1978	-	3	3	-	-	1857	950	1857	950	-	-	603	308	603	308
1979	2	2	4	517	237	1000	459	1517	696	243	111	426	195	339	155
1980	-	11	11	-	-	1783	722	1783	722	-	-	164	67	164	67
1981	-	15	15	-	-	3873	1423	3873	1423	-	-	264	97	264	97
1982	-	15	15	-	-	1944	674	1944	674	-	-	127	44	127	44
1983	-	2	2	-	-	1618	542	1618	542	-	-	830	278	830	278

Table 19. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
New Jersey (continued)															
Unclassified															
1974	298	147	444	80356	54404	54782	37090	135138	91494	270	183	374	253	304	206
1975	88	301	388	39432	24461	117474	72874	156906	97335	450	279	391	242	404	251
1976	76	76	152	32565	19099	50061	29361	82626	48460	428	251	656	385	542	318
1977	17	180	198	10837	5970	94212	51907	105049	57877	624	344	523	288	532	293
1978	17	111	128	9809	5019	56458	28893	66267	33912	569	291	509	261	517	265
1979	26	126	152	11411	5248	97910	45036	109321	50284	435	200	776	357	717	330
1980	10	29	39	7827	3171	19658	7965	27485	11136	785	318	667	270	697	282
1981	16	68	85	11623	4273	53981	19845	65604	24118	726	267	788	290	776	285
1982	10	76	86	8193	2841	51768	17956	59961	20797	845	293	679	236	698	242
1983	15	47	63	13492	4521	36490	12228	49982	16749	878	294	774	259	799	268
Total															
1974	298	147	444	80356	54404	54782	37090	135138	91494	270	183	374	253	304	206
1975	88	301	388	39432	24461	117474	72874	156906	97335	450	279	391	242	404	251
1976	76	76	152	32565	19099	50061	29361	82626	48460	428	251	656	385	542	318
1977	17	180	198	10837	5970	94212	51907	105049	57877	624	344	523	288	532	293
1978	18	201	219	10002	5117	113070	57864	123072	62981	570	292	562	288	563	288
1979	31	229	260	12727	5852	183257	84292	195984	90144	407	187	800	368	753	346
1980	10	141	151	7960	3224	97623	39553	105583	42777	784	318	691	280	697	282
1981	16	180	196	11623	4273	132401	48674	144024	52947	726	267	734	270	733	270
1982	10	167	176	8193	2841	99619	34552	107812	37393	845	293	598	207	611	212
1983	15	165	181	13545	4538	120030	40222	133575	44760	876	294	727	244	740	248
Delaware															
Total (all Unclassified)															
1974	-	*	*	-	-	51	34	51	34	-	-	567	378	567	378
1975	-	*	*	-	-	67	41	67	41	-	-	744	456	744	456
1977	*	-	*	24	13	-	-	24	13	600	325	-	-	600	325
1979	*	-	*	56	25	-	-	56	25	1400	625	-	-	1400	625
1980	2	*	2	1554	629	47	19	1601	648	931	377	1175	475	936	379
1981	-	1	1	-	-	400	147	400	147	-	-	444	163	444	163
1982	1	-	1	1500	520	-	-	1500	520	1327	460	-	-	1327	460
1983	*	-	*	660	221	-	-	660	221	1347	451	-	-	1347	451
Maryland															
Total (all Unclassified)															
1974	*	6	6	9	6	3115	2109	3124	2115	225	150	554	375	552	374
1975	2	8	10	1090	676	3790	2351	4880	3027	589	365	454	282	479	297
1976	*	9	9	61	35	5488	3218	5549	3253	678	389	593	348	594	348
1977	4	8	12	1940	1068	4674	2575	6614	3643	536	295	583	321	568	313
1978	4	7	10	1642	840	3870	1980	5512	2820	454	232	593	303	543	278
1979	1	5	6	1050	482	3440	1582	4490	2064	861	395	759	349	781	359
1980	1	5	5	629	254	3058	1239	3687	1493	699	282	668	271	673	272
1981	1	5	5	435	159	4078	1499	4513	1658	806	294	850	312	845	310
1982	1	2	2	609	211	1327	460	1936	671	896	310	733	254	778	269
1983	1	5	6	983	329	5185	1737	6168	2066	945	316	962	322	959	321

Table 19. (continued)

	Landings (mt)			Ex-Vessel Value ($)						Price ($/mt)					
				SW		FCZ		Total		SW		FCZ		Total	
	SW	FCZ	Total	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def	Nom	Def
Virginia															
Large															
1982	-	*	*	-	-	95	32	95	32	-	-	731	246	731	246
1983	*	2	2	29	9	1791	600	1820	609	725	225	943	316	938	314
Medium															
1981	*	4	4	36	13	2231	820	2267	833	400	144	601	221	597	219
1982	*	12	12	158	54	9830	3409	9988	3463	439	150	825	286	813	282
1983	1	35	36	815	273	25135	8423	25950	8696	668	224	715	240	714	239
Small															
1981	*	6	6	48	17	2889	1062	2937	1079	533	189	476	175	477	175
1982	*	41	42	252	87	17549	6087	17801	6174	514	178	424	147	425	148
1983	1	112	113	404	135	61956	20762	62360	20897	748	250	551	185	552	185
Unclassified															
1974	71	13	84	32185	21790	6484	4389	38669	26179	453	307	485	328	458	310
1975	43	22	65	21151	13120	9210	5713	30361	18833	493	306	420	260	468	290
1976	51	6	57	26975	15821	3312	1942	30287	17763	533	313	533	313	533	313
1977	36	24	60	18542	10215	11865	6537	30407	16752	520	286	494	272	509	280
1978	16	37	53	8947	4578	19253	9853	28200	14431	545	279	522	267	529	271
1979	100	24	124	69776	32095	15837	7284	85613	39379	700	322	659	303	692	318
1980	44	17	61	31116	12607	10453	4235	41569	16842	712	289	610	247	683	277
1981	23	30	53	14162	5206	24668	9069	38830	14275	611	225	827	304	733	269
1982	18	16	34	17529	6080	344	119	17873	6199	952	330	22	8	526	182
1983	26	3	29	21819	7311	180	60	21999	7371	835	280	66	22	763	256
Total															
1974	71	13	84	32185	21790	6484	4389	38669	26179	453	307	485	328	458	310
1975	43	22	65	21151	13120	9210	5713	30361	18833	493	306	420	260	468	290
1976	51	6	57	26975	15821	3312	1942	30287	17763	533	313	533	313	533	313
1977	36	24	60	18542	10215	11865	6537	30407	16752	520	286	494	272	509	280
1978	16	37	53	8947	4578	19253	9853	28200	14431	545	279	522	267	529	271
1979	100	24	124	69776	32095	15837	7284	85613	39379	700	322	659	303	692	318
1980	44	17	61	31116	12607	10453	4235	41569	16842	712	289	610	247	683	277
1981	23	40	63	14246	5236	29788	10951	44034	16187	610	224	752	276	699	257
1982	19	69	88	17939	6221	27818	9647	45757	15868	931	323	403	140	518	180
1983	28	152	180	23067	7728	89062	29845	112129	37573	826	277	585	196	622	209

- = zero.
* = less than 0.5 mt.
SW = State waters (internal + Territorial Sea).
Nom = nominal or current dollars.
Def = deflated (1967 = 100; Series 320, Consumer Prices All Items).
Large = 300-400 fish/100 lb, Medium = 400-450 fish/100 lb, Small = 450-550 fish/100 lb.
Source: unpub. prelim. NMFS data.

Table 20. North Carolina Butterfish Landings, Ex-Vessel Value, and Price

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
						Landings (mt)							
1974	1	*	2	1	*	1	*	*	1	9	14	5	34
1975	2	2	1	1	12	-	-	*	1	14	20	3	58
1976	2	13	1	1	-	-	*	*	1	3	3	2	24
1977	5	3	-	1	-	-	*	*	2	2	4	5	22
1978	*	3	8	6	1	*	4	2	10	4	8	3	50
1979	3	6	9	2	3	1	6	6	5	14	17	12	82
1980	9	17	3	2	*	1	3	7	6	9	4	5	67
1981	21	6	7	12	3	16	12	1	21	7	16	6	128
1982	6	5	7	2	3	2	6	6	12	17	13	42	120
1983	7	15	7	6	1	1	3	3	*	*	1	3	49
						Ex-Vessel Value ($)							
1974	412	199	397	260	12	167	40	152	361	2501	2660	1850	9011
1975	397	576	229	638	2758	-	-	76	361	1888	2320	544	9787
1976	292	2469	161	330	-	-	80	92	205	1077	1189	341	6236
1977	1659	985	-	258	-	-	12	5	245	641	976	3066	7847
1978	177	1521	4636	3810	422	148	923	1163	5144	2045	4200	1766	25955
1979	1664	3769	5722	1117	1595	361	3179	3291	1828	7580	9468	6001	45575
1980	4829	10128	1532	1290	83	851	2446	4283	4744	5674	2954	3157	41971
1981	13053	5343	6712	12207	2311	17499	13795	1322	17996	4481	9735	3707	108161
1982	4453	3943	5117	1337	2949	2596	7080	6618	5919	8243	6904	14810	69969
1983	4427	7809	4550	3736	1183	1166	2816	2365	415	86	1040	2230	31823
						Price ($/mt)							
1974	336	415	259	215	344	318	259	451	304	282	196	345	261
1975	212	263	220	441	223	-	-	409	263	133	118	161	170
1976	182	197	175	292	-	-	252	411	274	420	417	220	255
1977	357	331	-	331	-	-	113	105	127	305	277	568	365
1978	389	481	553	607	444	368	258	618	531	459	533	565	517
1979	608	686	642	675	462	500	569	592	359	553	555	504	557
1980	561	580	493	679	443	587	755	603	739	642	724	631	623
1981	625	875	897	1053	821	1072	1198	986	865	672	620	585	848
1982	740	812	725	578	1061	1111	1212	1118	506	493	551	357	585
1983	598	508	633	637	909	805	993	882	850	882	882	769	652

\- = zero.
* = less than 0.5 mt.
Source: unpub. prelim.NMFS data.

Table 21. Butterfish Catch Distribution (%) by Month, ME-VA

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Large	1972	2	2	1	1	4	10	3	11	5	12	46	4
	1973	2	1	1	1	2	4	5	11	18	27	18	10
	1974	27	7	5	3	-	-	1	4	12	21	9	9
	1975	36	24	10	1	1	2	1	3	5	7	6	3
	1976	8	4	2	3	3	3	1	2	14	13	22	26
	1977	16	1	1	4	2	4	2	6	16	20	20	8
	1978	1	3	2	1	5	2	3	10	12	29	20	12
	1979	26	-	1	3	4	3	11	13	13	15	6	5
	1980	2	2	5	2	1	2	2	5	30	14	10	26
	1981	3	4	-	3	6	5	9	5	8	18	13	25
	1982	3	7	1	5	7	7	3	6	7	30	13	11
	1983	6	4	3	4	5	7	16	6	17	10	15	7
Medium	1972	-	-	-	-	1	-	5	20	15	4	12	43
	1973	14	22	6	2	9	7	8	7	9	14	2	-
	1974	28	3	1	1	1	1	3	5	27	17	1	13
	1975	26	15	3	1	-	1	4	12	17	7	7	7
	1976	8	1	1	-	15	8	7	10	17	14	7	11
	1977	19	-	-	-	-	3	3	8	20	2	6	38
	1978	23	20	7	6	11	9	1	2	6	2	12	1
	1979	34	4	5	6	17	1	4	2	9	14	3	2
	1980	2	3	4	2	2	1	2	3	23	25	7	25
	1981	12	6	2	1	2	4	1	2	4	13	19	35
	1982	2	12	2	-	-	-	1	3	43	7	22	8
	1983	18	4	12	11	4	2	8	5	13	14	6	1
Small	1973	-	-	-	-	-	14	1	5	71	8	1	-
	1974	5	-	-	-	-	5	12	35	27	7	10	-
	1975	-	-	-	-	-	2	12	28	35	1	5	17
	1976	14	2	-	-	2	5	-	6	33	23	13	2
	1977	43	3	-	5	1	1	8	14	16	3	5	2
	1978	11	26	12	1	31	3	-	2	-	-	6	7
	1979	2	-	1	1	3	7	30	5	9	36	3	1
	1980	-	3	-	-	-	-	9	24	13	11	-	39
	1981	3	-	-	-	-	1	-	-	2	13	8	71
	1982	5	7	8	-	-	-	-	1	11	13	35	19
	1983	5	-	2	-	-	-	1	1	24	50	15	2
Unc	1972	-	-	-	-	16	14	2	4	17	44	2	-
	1973	1	1	5	6	11	11	9	13	24	12	7	1
	1974	1	1	2	4	10	9	12	14	22	12	12	1
	1975	2	7	5	7	14	17	10	12	11	7	5	3
	1976	4	9	2	7	10	14	6	9	15	16	8	1
	1977	7	5	3	3	10	16	5	7	10	13	10	12
	1978	2	1	1	7	8	16	14	2	2	12	24	9
	1979	5	1	2	4	17	12	8	7	13	13	12	5
	1980	2	1	2	2	7	10	10	9	25	22	9	2
	1981	17	3	1	2	10	13	6	3	7	11	17	10
	1982	1	1	2	2	11	9	4	5	15	24	21	6
	1983	1	1	1	2	10	8	2	4	14	36	18	3
Total	1972	1	1	-	-	10	11	3	8	13	29	19	5
	1973	3	4	4	4	8	9	8	12	20	16	9	3
	1974	13	4	3	4	6	5	7	10	19	15	10	5
	1975	15	13	6	5	8	10	7	9	10	7	6	3
	1976	5	6	2	4	9	10	5	8	16	15	11	9
	1977	12	3	2	3	5	10	4	7	14	12	12	17
	1978	4	5	2	2	7	6	5	8	9	23	19	10
	1979	20	1	1	3	9	6	9	10	12	14	7	5
	1980	2	2	4	2	2	3	4	6	27	19	9	22
	1981	9	4	1	2	5	5	4	3	6	14	15	32
	1982	3	9	4	1	2	2	1	3	27	13	24	12
	1983	7	2	4	4	4	3	5	3	18	32	13	3

Source: unpub. prelim. NMFS data.

Table 22. Butterfish Catch Distribution (%) by Month by State

State	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ME	1972	-	-	-	-	-	-	-	-	95	-	-	5
	1973	-	-	-	-	-	-	-	9	90	1	-	-
	1976	-	-	-	-	-	6	-	-	-	-	94	-
	1977	-	96	-	-	-	4	-	-	-	-	-	-
	1978	-	-	-	-	-	-	-	84	-	16	-	-
	1979	-	-	-	-	-	-	75	7	6	2	10	-
	1980	-	-	-	-	-	-	97	1	-	2	-	-
	1981	-	-	-	-	-	-	-	-	-	100	-	-
	1982	-	-	-	-	-	-	-	7	5	12	55	21
	1983	-	-	-	-	-	-	3	12	11	51	20	3
NH	1981	-	-	-	-	-	6	-	-	-	94	-	-
	1982	-	-	-	-	-	-	-	-	-	23	69	8
	1983	5	-	-	-	-	-	18	-	-	73	3	-
MA	1972	-	-	-	-	14	16	-	8	29	29	4	-
	1973	-	-	-	1	23	25	7	1	2	37	4	-
	1974	3	6	-	-	11	1	3	11	40	23	3	-
	1975	-	-	-	-	6	3	33	5	2	25	22	4
	1976	-	-	-	-	31	15	14	19	10	7	3	-
	1977	-	-	-	-	8	27	9	25	11	3	8	8
	1978	-	-	2	-	21	34	9	7	7	16	3	1
	1979	-	-	-	-	28	6	1	2	21	33	4	5
	1980	-	-	-	-	4	1	2	4	8	31	14	35
	1981	-	-	-	-	1	-	-	-	-	31	19	47
	1982	-	9	-	-	2	1	4	10	5	12	45	12
	1983	8	1	-	-	8	7	3	2	13	40	17	2
RI	1972	1	1	-	1	8	9	4	9	5	28	26	8
	1973	6	8	2	1	7	6	9	10	15	19	12	7
	1974	27	6	4	3	1	3	1	5	13	20	8	10
	1975	31	20	8	1	3	4	2	6	8	7	6	4
	1976	8	2	1	3	4	8	1	3	19	16	14	20
	1977	17	1	1	2	4	9	2	6	16	11	13	20
	1978	5	5	2	1	6	3	4	9	10	25	17	10
	1979	28	-	1	3	4	4	11	12	12	15	5	5
	1980	2	2	4	2	1	2	3	5	28	18	8	24
	1981	10	4	1	2	3	5	4	3	5	13	16	35
	1982	3	9	4	1	1	1	1	3	29	12	25	12
	1983	9	1	5	4	3	3	7	3	20	31	12	3
NY	1973	-	-	2	2	17	17	10	22	6	15	8	1
	1974	-	2	2	7	17	10	4	17	11	12	14	3
	1975	3	11	4	6	18	26	11	3	4	8	5	3
	1976	5	14	1	7	12	13	6	8	7	17	9	1
	1977	1	2	2	2	10	16	8	9	9	14	10	16
	1978	3	1	-	2	4	15	12	2	1	17	30	13
	1979	7	-	1	5	9	10	8	7	12	16	18	8
	1980	3	1	2	3	10	6	14	11	17	20	12	3
	1981	6	3	1	4	8	19	12	6	10	14	15	3
	1982	1	1	3	2	5	6	3	4	18	39	14	4
	1983	1	1	2	1	6	2	2	4	15	43	20	3
NJ	1973	2	1	8	10	3	1	4	10	41	11	7	1
	1974	3	2	1	3	3	6	22	11	35	7	6	1
	1975	3	3	6	10	7	3	11	26	23	3	3	2
	1976	4	5	3	9	5	7	9	8	25	14	8	3
	1977	19	12	4	4	5	2	2	1	11	16	14	12
	1978	1	2	4	13	17	15	1	3	11	2	29	3
	1979	6	6	5	9	42	6	4	1	8	6	4	3
	1980	3	3	7	5	5	4	-	11	40	13	5	4
	1981	6	12	3	9	35	4	-	3	12	9	6	3
	1982	5	4	12	5	18	2	-	-	6	16	16	17
	1983	12	11	14	10	16	3	1	2	10	12	5	2
MD	1980	4	16	20	9	7	6	-	1	13	15	10	-
	1981	28	13	22	2	1	1	-	-	12	11	8	2
	1982	9	2	-	5	4	3	2	-	13	30	34	-
	1983	-	8	2	6	40	16	7	2	2	5	6	6

Table 22. (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VA	1973	-	3	3	4	5	27	13	10	10	16	7	2
	1974	-	1	1	2	5	5	3	15	9	24	34	1
	1975	1	-	12	8	4	4	-	4	11	28	24	3
	1976	-	1	5	2	2	8	8	21	32	16	4	-
	1977	-	5	12	4	1	5	3	25	24	17	2	-
	1978	-	8	14	22	7	9	3	3	9	11	14	1
	1979	-	3	8	1	3	11	7	22	27	10	7	1
	1980	-	7	8	4	2	15	5	12	34	7	5	1
	1981	9	22	11	6	1	6	1	3	17	12	6	6
	1982	23	8	8	-	23	1	4	9	6	12	2	2
	1983	-	4	4	6	8	4	1	6	5	33	26	3

- = zero.
Source: unpub. prelim. NMFS data.

Table 23. Estimated Recreational Mackerel Catch (thousands), 1979-1983

	ME - CT	NY - VA	NC - East Coast FL	Total
1979				
Number landed (A)	1,477	3,593	*	5,070
Number harvested (B1)	1,692	402	*	2,094
Number released (B2)	138	-	*	140
Total Number Caught (A + B1 + B2)	3,307	3,998	*	7,304
Weight (lbs., 000), landed fish (A)	2,084	3,184	*	5,268
Avg. weight/landed fish (lb.)	1.41	0.89	-	1.03
1980				
Number landed (A)	819	3,745	*	4,564
Number harvested (B1)	578	221	*	799
Number released (B2)	74	*	*	74
Total Number Caught (A + B1 + B2)	1,471	3,966	*	5,437
Weight (lbs., 000), landed fish (A)	728	3,724	*	4,452
Avg weight/landed fish (lb.)	0.89	0.99	-	0.97
1981				
Number landed (A)	761	6,794	*	7,554
Number harvested (B1)	1,320	2,027	*	3,348
Number released (B2)	35	132	*	167
Total Number Caught (A + B1 + B2)	2,116	8,953	*	11,069
Weight (lbs., 000), landed fish (A)	461	12,522	*	12,983
Avg. weight/landed fish (lb.)	0 61	1.84	-	1.72
1982				
Number landed (A)	205	731	*	936
Number harvested (B1)	449	126	*	575
Number released (B2)	-	*	*	*
Total Number Caught (A + B1 + B2)	664	856	*	1,520
Weight (lbs., 000), landed fish (A)	216	1,532	*	1,749
Avg. weight/landed fish (lb.)	1.05	2.10	-	1.86

A = fish retained and sampled by interviewers. B1 = fish retained and not sampled by interviewers. B2 = fish released by anglers. Source: USDC, 1984b, 1985b.

Table 24. East Coast Recreational Catch Number of Fish (No., in thousands), Weight (Lbs., in thousands), and Average Weight of Type A Fish (Mean Lbs.), 1979, 1980, 1981, and 1982

	1979			1980			1981			1982			4 Year
	No.	Lbs.	Mean Lbs.	No.	Lbs.	Mean Lbs.	No.	Lbs.	Mean Lbs.	No.	Lbs.	Mean Lbs.	Mean No.
Bluefish	35746	136907	3.83	41514	148620	3.58	32000	123200	3.85	32666	104204	3.19	35482
Spot	25644	10257	0.40	28691	13197	0.46	28078	12635	0.45	19646	5893	0.30	25515
Winter flounder	32834	26267	0.80	19064	16776	0.88	19430	19430	1.00	19926	19128	0.96	22814
Summer flounder	24164	25130	1.04	28491	67238	2.36	13709	16725	1.22	23647	27903	1.18	22503
Other fish	18876	21680	1.15	21346	22183	1.04	11320	33507	2.96	10871	23417	2.15	15603
Sea basses/groupers	8147	10428	1.28	9971	12663	1.27	10208	9493	0.93	22298	26980	1.21	12656
Scup	11574	9490	0.82	14467	9548	0.66	7440	5729	0.77	7714	7405	0.96	10299
Weakfish	5255	12979	2.47	15030	45841	3.05	9511	15788	1.66	2300	12420	5.40	8024
Catfishes	12513	14264	1.14	4704	6726	1.43	3822	5504	1.44	4407	3745	0.85	6362
Atlantic mackerel	7304	7523	1.03	5437	5273	0.97	11069	19039	1.72	1520	2827	1.86	6333
Atlantic croaker	10111	6774	0.67	5921	3019	0.51	4100	2255	0.55	3681	1730	0.47	5953
Searobins	4939	2568	0.52	7863	4953	0.63	2488	1468	0.59	4930	3155	0.64	5055
Hakes	1342	1194	0.89	16117	7574	0.47	393	303	0.77	1170	678	0.58	4756
Grunts/tomtate	6005	3422	0.57	4668	2240	0.48	3090	1823	0.59	4618	5172	1.12	4595
Snappers	3902	4916	1.26	3512	4425	1.26	2742	3263	1.19	6204	5831	0.94	4090
Mullets	4855	2087	0.43	4275	7395	1.73	2101	2038	0.97	3719	3161	0.85	3738
Porgies	4435	3548	0.80	3047	2407	0.79	1677	1744	1.04	4737	11558	2.44	3474
White perch	7322	3514	0.48	3568	2105	0.59	1746	751	0.43	1242	707	0.57	3470
Cunner	3741	1047	0.28	4382	1270	0.29	2281	753	0.33	3298	1055	0.32	3426
Atlantic cod	3091	8685	2.81	2439	13804	5.66	4922	19590	3.98	3249	13125	4.04	3425
Pollock	3648	2261	0.62	4446	4668	1.05	2724	2724	1.00	1685	5560	3.30	3126
Tautog	3310	6454	1.95	3285	8212	2.50	2008	5602	2.79	3571	10784	3.02	3044
Kingfishes	2094	1465	0.70	3214	1799	0.56	3181	2290	0.72	2521	1537	0.61	2753
Jacks	3554	4193	1.18	2678	4606	1.72	2525	9317	3.69	2070	3560	1.72	2707
Pinfish	4981	1295	0.26	2116	613	0.29	1840	846	0.46	1715	463	0.27	2663
Flounders	1991	1752	0.88	3131	3131	1.00	908	7718	8.50	4011	3730	0.93	2510
Sharks	2515	143982	57.25	2311	39287	17.00	2574	62471	24.27	2220	43532	19.61	2405
Spotted seatrout	3803	6579	1.73	1978	2156	1.09	1304	1995	1.53	1776	1864	1.05	2215
Sheepshead	2000	4340	2.17	1147	2018	1.76	2592	4018	1.55	1061	2419	2.28	1700
Drums	2974	5888	1.98	995	3402	3.42	600	1182	1.97	1087	2097	1.93	1414
Dolphins	2095	11857	5.66	1298	6619	5.10	872	4770	5.47	702	4408	6.28	1242
King mackerel	391	3827	9.79	1385	11897	8.59	1977	15045	7.61	1079	7919	7.34	1208
Spanish mackerel	847	1787	2.11	885	1699	1.92	1303	1941	1.49	1529	2079	1.36	1141
Striped bass	2017	8894	4.41	584	2207	3.78	892	1481	1.49	911	12872	14.13	1101
Bonito & little tunny	724	4691	6.48	1052	10151	9.65	567	3583	6.32	862	3672	4.26	801
Puffers	334	150	0.45	793	578	0.73	280	109	0.39	429	321	0.75	459
Mackerels & tunas	361	8775	24.31	501	4609	9.20	593	4714	7.95	217	6039	27.83	418
Trigger & filefishes	470	925	1.97	528	1425	2.70	123	285	2.32	354	1214	3.43	369
Silver perch	390	156	0.40	575	92	0.16	157	33	0.21	344	72	0.21	367
Barracudas	404	2424	6.00	332	3814	11.49	206	1285	6.24	292	1909	6.54	309
TOTAL	270703	534375		277741	510240		199353	426447		210279	396145		239525

No. = Sum of types A and B.
Lbs. = Ave. weight of type A fish X number of types A + B fish.
Source: USDC, 1984b and 1985b.

Table 25. *Loligo*, *Illex*, Mackerel, & Butterfish OY, DAH, Reserve, TALFF, Allocation, and Catch (mt) by Fishing Year

Species	OY	Initial DAH	Initial Reserve	Final TALFF	Final Allocation	Catch	TALFF Allocated	TALFF Caught	Allocation Caught
1979-80									
Loligo	44,000	14,000	-	35,500	32,130	19,238	86%	54%	63%
Illex	30,000	10,000	-	24,730	23,285	15,966	94	65	69
Mackerel	15,500	14,000	-	1,200	1,089	394	92	33	36
Butterfish	11,000	7,000	-	4,000	1,680	1,247	83	31	37
1980-81									
Loligo	44,000	7,000	19,000	37,000	35,075	20,194	95	55	58
Illex	30,000	5,000	13,000	25,000	25,000	18,641	100	75	75
Mackerel	30,000	20,000	6,000	10,000	9,950	5,312	100	53	53
Butterfish	11,000	7,000	-	3,685	3,685	1,115	92	28	30
1981-82									
Loligo	44,000	7,000	19,000	37,000	35,789	13,454	98	37	38
Illex	30,000	5,000	13,000	25,000	24,426	14,982	98	60	61
Mackerel	30,000	20,000	6,000	10,000	7,688	2,104	77	21	27
Butterfish	11,000	7,000	-	1,400	1,200	516	85	36	43
1982-83									
Loligo	44,000	7,000	19,000	37,000	20,350	12,734	55	34	63
Illex	30,000	5,000	13,000	23,000	21,100	12,940	93	57	61
Mackerel	30,000	20,000	6,000	9,000	8,700	1,192	97	13	14
Butterfish	11,000	7,000	-	4,000	1,133	803	28	20	71
1983-84									
Loligo	44,000	22,000	11,000	21,166	16,150	12,916	76	61	80
Illex	30,000	27,100	1,450	2,900	2,886	408	100	14	14
Mackerel	101,700	30,000	35,850	71,700	17,898	6,315	2	9	35
Butterfish	16,000	13,800	-	2,200	1,435	578	65	26	40
1984-85									
Loligo	30,263	17,875	-	12,388	12,326	7,796	99	63	63
Illex	16,788	13,500	-	3,288	3,226	427	98	13	13
Mackerel	83,590	26,500	13,941	42,441	23,400	16,441	55	39	70
Butterfish	16,000	11,000	-	1,249	840	564	67	45	67
1985-86 (as of 5/9/85)									
Loligo	28,200	22,500	-	5,725					
Illex	16,700	16,000	-	3,700					
Mackerel	225,300	123,200	51,050	51,050					
Butterfish	16,000	11,000	-	1,025					

- = zero.
* = less than 1%.

Note: The initial butterfish TALFF for 1981-82 was 4,000 mt. The Council certified an annual fishing level of 759 mt. Late in the year NMFS transferred to TALFF 659 mt, bringing the final TALFF to 1,400 mt. This resulted in 2,582 mt available for foreign allocation in 1982-83, in addition to the 4,000 mt TALFF. However, that carry-over was never counted as TALFF and never allocated during 1982-83.

Sources: OY, Initial DAH, Final TALFF, and Final Allocations from USDC, 1985a. Initial Reserve from Federal Register notices.

Table 26. Permitted Mackerel, Squid, and Butterfish Vessels, 1981 - 1984

Fishery	Permit	1981	1982	1983	1984
			No. of Vessels		
Mackerel	commercial	769	1,068	1,433	1,836
	party/charter	196	247	273	310
	incidental	177	274	335	407
Squid	commercial	674	892	1,170	1,496
	party/charter	37	46	47	57
	incidental	125	185	220	234
Butterfish	commercial	345	553	829	1,133
	party/charter	10	17	21	32
	incidental	75	158	193	230

Source: unpub. prelim. NMFS data.

Table 27. Recreational Catch and Average Trip Cost of Mackerel by Mode, 1979-1982

Year	Region	Mode	Number Caught	Average Cost/Trip Nominal $	Average Cost/Trip 1984$*
1979	New England	Man made	267,000	$3.70	$5.29
		Beach/bank	37,000	8.50	12.16
		Party/charter	455,000	27.10	38.78
		Private/rental	2,548,000	12.50	17.89
	Mid-Atlantic	Man made	60,000	6.60	9.44
		Party/charter	28,000	35.20	50.37
		Private/rental	3,910,000	13.30	19.03
1980	New England	Man made	32,000	5.50	6.93
		Beach/bank	243,000	6.00	7.56
		Party/charter	132,000	32.00	40.34
		Private/rental	1,064,000	12.80	16.13
	Mid-Atlantic	Party/charter	3,713,000	35.40	44.62
		Private/rental	252,000	16.80	21.18
1981	New England	Man made	97,000	N/A	N/A
		Party/charter	878,000	N/A	N/A
		Private/rental	1,141,000	N/A	N/A
	Mid-Atlantic	Man made	632,000	N/A	N/A
		Party/charter	7,908,000	N/A	N/A
		Private/rental	414,000	N/A	N/A
1982	New England	Man made	146,000	N/A	N/A
		Beach/bank	191,000	N/A	N/A
		Party/charter	64,000	N/A	N/A
		Private/rental	264,000	N/A	N/A
	Mid-Atlantic	Party/charter	439,000	N/A	N/A
		Private/rental	418,000	N/A	N/A

* Based on consumer price index, all items, urban consumers, Survey of Current Business, USDC.

Source: USDC, 1984b and 1985b.

Table 28. Distribution of Recreational Mackerel Catch by Mode, 1979-1982

1979	Man made	4%
	Beach/bank	1%
	Party/charter	7%
	Private/rental	88%
1980	Man made	1%
	Beach/bank	4%
	Party/charter	71%
	Private/rental	24%
1981	Man made	7%
	Beach/bank	0%
	Party/charter	79%
	Private/rental	14
1982	Man made	10%
	Beach/bank	13%
	Party/charter	33%
	Private/rental	45%

Note: Percentages may total more than 100% due to rounding.
Source: USDC, 1984b and 1985b.

Table 29. Production of Frozen Squid (mt) by Region, 1973-1983*

Year	New England	Mid-Atlantic	South Atlantic	Total#
1973	213	43	2	258
1974	389	54	65	508
1975	196	68	41	305
1976	1,358	96	81	1,535
1977	740	2	2	819
1978	188	33	2	225
1979	1,631	143	-	1,774
1980	496	66	-	562
1981	150	11	-	161
1982	234	70	-	304
1983	1,548	-	-	1,548

* Production by firms voluntarily reporting to NMFS. Excludes freezings by firms not reporting to NMFS on a monthly basis, by firms operating plate freezers at the end of fillet lines, and production of fishery products frozen on US vessels.

\# % of total freezings used for human consumption, bait, and for other purposes is unknown.

Source: unpub. prelim. NMFS data.

Table 30. Summary of MAFMC Processor Surveys (mt)

	Fishing Year	*Loligo*	*Illex*	Mackerel	Butterfish
1981 Survey	1981-1982	1,600	-	2,800	3,500
	1982-1983	5,200	-	5,100	5,600
1982 Survey	1982-1983	3,311	1,724	641	3,829
	1983-1984	6,714	3,674	1,638	6,831
1983 Survey	1983-1984	6,028	2,152	5,300	6,621
	1984-1985	11,723	8,078	7,295	10,631
1984 Survey	1984-1985	5,958	2,313	1,609	3,897
	1985-1986	18,652	6,613	6,591	2,836

Note: 6 squid, mackerel, or butterfish firms responded to the survey in 1981, 10 in 1982, 19 in 1983, and 8 in 1984

Table 31. Summary of Joint Venture Activities in the Northwest Atlantic Ocean

Year	Flag State	US Partner	Species	Tonnage	Permit Status
1981	Japan	Lund's Fisheries	*Loligo*	1,000	issued
1982	Bulgaria	Joint Trawlers	Mackerel	6,000	issued
			Loligo	2,000	issued
			Illex	1,000	issued
	Italy	Fass Brothers	*Loligo*	800	issued
			Illex	800	issued
	Japan	Lund's Fisheries	*Loligo*	1,000	issued
	Poland	Oceanside Fisheries	Herring	4,000	issued
	Portugal	Lund's Fisheries	*Illex*	400	issued
		Lund's Fisheries & Joint Trawlers	*Illex*	1,400	issued
	USSR	Mid-Atlantic Fishery Export Corporation	Mackerel	6,500	withdrawn
			Silver hake	13,000	withdrawn
			Red hake	4,000	withdrawn
	GDR	Joint Trawlers	*Loligo*	2,500	issued
			Mackerel	5,000	issued
1983	GDR	Joint Trawlers	*Loligo*	2,500	issued
			Mackerel	5,000	issued
	Italy	Sea Harvest, Inc. (Intn'l Seafoods)	*Illex*	5,950	issued
			Loligo	6,000	issued
	Japan	Charles Stinson	*Loligo*	300	denied
			Mackerel	300	denied
			Butterfish	1,000	denied
		Lund's Fisheries (1)	*Illex*	850	issued
			Loligo	1,000	issued
		Lunds's Fisheries (2)	Butterfish	1,000	denied
			Mackerel	300	denied
			Loligo	300	denied
	Portugal	Lund's Fisheries	*Illex*	8,500	issued
		Joint Trawlers	*Illex*	2,550	issued
		Scan Ocean, Inc.	*Illex*	4,250	issued
			Loligo	3,000	issued
		Robert Metafora	*Loligo*	1,500	issued
	Spain	Sea Harvest, Inc. (1)	*Illex*	2,800	denied
			Loligo	1,300	issued
		Sea Harvest, Inc (2)	*Illex*	1,400	denied
			Loligo	1,400	issued

Table 31. (continued)

Year	Flag State	US Partner	Species	Tonnage	Permit Status
1983	Spain	Stonavar	*Loligo*	2,000	issued
		Shoreside Co.	*Loligo*	2,500	issued
	USSR	Scan Ocean, Inc.	*Illex*	12,000	denied
			Loligo	200	denied
			Mackerel	500	denied
1984	GDR	Joint Trawlers	Mackerel	3,400	approved
	NL	Scan Ocean, Inc	Mackerel	10,000	approved
	Spain	Stonavar	*Loligo*	2,500	approved
			Illex	1,000	approved
			S. hake	2,000	pending
	Japan	Lund Fisheries	*Illex*	1,700	approved
		Eastern LI Trawlers	*Loligo*	1,000	approved
	Italy	ISTC	*Loligo*	2,500	approved
			Illex	3,000	approved
	Portugal	Scan Ocean	*Loligo*	2,500	approved
			Illex	4,000	approved
		Lund Fisheries	*Illex*	4,000	pending
		Joint Trawlers	*Illex*	3,000	approved
1985	NL	Scan Ocean	Mackerel	5,000	approved
	Spain	Stonavar	S. hake	2,000	pending
			Illex	2,500	approved
	Japan	Eastern LI Trawlers	*Loligo*	1,000	approved
			Illex	1,500	approved
	Italy	ISTC	*Loligo*	1,000	approved
			Illex	1,000	approved
	GDR	Joint Trawlers	Mackerel	5,000	approved
	Portugal	Joint Trawlers	*Illex*	3,000	approved
		Scan Ocean	*Loligo*	500	approved
			Illex	1,000	approved
		Lund Fisheries	*Loligo*	200	approved
			Illex	1,000	approved
	USSR	RNS	Mackerel	5,000	pending

NL = Netherlands.
GDR = German Democratic Republic.
Source: NMFS Northeast Region, pers. comm. and JV applications.

Table 32. Mackerel Imports and Exports

Year	Imports: Live Weight Equivalent (mt)	Imports: Dollars	Exports from East Coast Ports: Live Weight Equivalent (mt)	Exports from East Coast Ports: Dollars
1972	4,468	797,159	NA	NA
1973	6,172	1,134,590	NA	NA
1974	6,851	1,297,871	NA	NA
1975	6,974	1,598,791	NA	NA
1976	6,265	1,664,397	NA	NA
1977	6,830	1,723,573	NA	NA
1978	18,270	5,304,475	NA	NA
1979	21,162	6,359,631	NA	NA
1980	17,936	6,007,962	NA	NA
1981	12,479	4,815,812	137	111,621
1982	12,017	5,419,014	149	173,559
1983	13,950	5,944,546	17	30,445
1984	19,894	6,811,922	77	101,632
1985	3,589	1,616,321	23	25,890

* = 1985 data Jan-Mar only.
NA = data not available.
Source: unpub. prelim. NMFS data.

Table 33. Squid Exports from East Coast Ports

Year	Canned: Live Weight Equivalent (mt)	Canned: Dollars	Frozen: Live Weight Equivalent (mt)	Frozen: Dollars
1975	132	36,669	NA	NA
1976	1,175	466,507	NA	NA
1977	346	150,073	NA	NA
1978	2,516	1,257,849	NA	NA
1979	1,866	644,270	NA	NA
1980	4,268	1,475,379	NA	NA
1981	1,172	657,787	864	1,437,970
1982	330	190,625	2,840	4,512,693
1983	375	326,250	3,719	7,127,769
1984	228	93,747	1,771	3,383,944
1985*	-	-	176	251,412

* = 1985 data Jan-Mar only.
- = zero.
NA = data not available.
Source: unpub. prelim. NMFS data.

Table 34. Squid, Mackerel and Butterfish Data Needs

Data Element	Analyses/Uses	User Groups	Data Source	Commentary Quality/Availability
A. Commercial catch				
1. By-weekly landings	Monitor catch in the event short notice is required to release reserves, close fisheries if catch exceed quotas, etc.	F/NER	F/NEC weighouts	Quality & availability currently satisfactory
2. Monthly/annual landings by area, gear, vessel class	Monitor catch; evaluate performance of fishery; input for stock assessments; economic analysis	F/NEC, F/NER, Council, Council staff	F/NEC weighouts; annual totals will include additional data from States & NMFS canvass	Quality & availability currently satisfactory
3. Fishing effort (days fished by trip, area, month, gear, etc)	Input for stock assessment; economic analysis; monitor trends in fishing effort	F/NEC, Council staff	F/NEC interviews, logbooks	Greater coverage of fishing trips desired
4. Biological data (length/age samples by area, gear, month)	Input for stock assessment	F/NEC	F/NEC port sampling; states in some cases in cooperation/ contract with F/NEC	Quality of samples has improved in recent years; some improvement still desired
5. Discarded catch (area, month, etc.)	Input for stock assessment	F/NEC	F/NEC interviews, sea sampling, logbooks	Most critical problem for butterfish; data currently inadequate, must be improved
6. Value of landings (ex-vessel price)	Economic analysis; monitor value of landings	F/NEC, F/NER, Council staff	F/NEC weighouts	Data will improve as more landings are accounted for in weighouts in some states
7. Vessel costs	Economic analysis	F/NEC, F/NER,	Vessel owners & operators	Data currently not available
B. US recreational catch (Mackerel only)				
1. Bi-monthly/annual catch by area & mode of capture	Monitor catch; input for stock assessment; analysis	F/NEC, F/NER, Council, Council staff	NMFS Rec. Fish Survey	Data collected annually since 1979; availability of results currently not satisfactory but improve in the future; accurac catch estimates uncertain
2. Biological data (length/age samples by area, bimonthly period, & mode of capture	Input for stock assessments	F/NEC	NMFS Rec. Fish Survey	Data collected since 1979 but not currently available for analysis; quality uncertain
3. Fishing effort (party/charter)	Possible input for stock assessment; monitor effort trends in this segment of fishery; economic analysis	F/NEC, Council staff	Logbooks	Would require time-series of at least 5 years to evaluate usefulness; data currently not available

Table 34 (continued)

Data Element	Analyses/Uses	User Groups	Data Source	Commentary Quality/Availability
4. Value of catch/ total expenditures	Monitor value of catch; economic analysis; develop/monitor allocations between recreational & commercial user groups	F/NEC, F/NER, Council staff	Possibly NMFS Rec. Fish Survey or other sources	Data currently not available
C. Foreign catch				
1. Weekly catch by country in US FCZ	Monitor quotas	F/NER	Foreign reports to F/NER	No apparent problem with present system
2. Monthly/annual catch by country, area in US FCZ	Monitor fishery; input for stock assessment	F/NEC, F/NER, Council, Council staff	Foreign reports to NMFS; NAFO statistics	Current data satisfactory
3. Biological data (length/age samples by country, month, & area)	Input for stock assessment	F/NEC	F/NER Foreign Fishery Observer Program	Data generally satisfactory
4. Monthly/annual catch by country, in Canadian waters (mackerel only)	Monitor fishery; input for stock assessment	F/NEC, F/NER, Council staff	Canada; NAFO	Data currently satisfactory although not always timely
5. Age composition of mackerel catch by Canada in their waters	Input for stock assessment	F/NEC	Canadian assessment scientists	Data currently satisfactory
D. Joint Venture catch				
1. Weekly/bimonthly catch by US & foreign vessels	Monitor performance of joint venture for quota purposes; enforcement	F/NER	Foreign reports to F/NER; observer reports; US partner of joint venture	Data currently satisfactory
2. Monthly/annual catch by area, joint venture, country	Monitor performance of joint venture; input for stock assessment,	F/NER, F/NEC, Council, Council staff	Foreign reports to F/NER; observer reports; US partner of joint venture	Data presently available to F/NER & F/NEC but must als available to Council staff (& to Council), particularly to ev joint venture performance in year when considering applica for next year
3. Biological data (length/age samples by country, month, area)	Input for stock assessment	F/NEC	F/NER Foreign Fisheries Observer Program	Data currently satisfactory
4. Fishing effort by US vessels in joint venture (days fished by area, month, gear, etc.)	Input for stock assessment; economic analysis	F/NEC, Council staff	F/NER Foreign Fisheries Observer Program	Data quality & quantity uncertain as program is new

Table 34 (continued)

Data Element	Analyses/Uses	User Groups	Data Source	Commentary Quality/Availability
E. Research vessel abundance index				
1. Total stock, pre-recruits	Input for stock assessment	F/NEC	F/NEC spring & autumn bottom trawl survey	F/NEC survey data currently available & being used; high year-to-year variability; excellent for monitoring long term-trends; substantial reduction in variability would be very expensive
2. Eggs, larvae	Input for stock assessment (back-calculate spawning stock size)	F/NEC	F/NEC MARMAP surveys	Of limited use now only for mackerel; not presently part of assessment data base; possible future potential
F. Estimated catch of mackerel in Canadian waters for year OY is being established	Setting mackerel OY for US waters	F/NER, Council staff	Canadian government sources; F/NER; Council staff	Difficult to estimate given uncertainities in Canadian mackeral fishery; estimate is required in formula specified in current FMP Amendment
G. Allocated portions of TALFF for red & silver hake, squid & mackerel	Determination of TALFF for butterfish & mackerel (under certain conditions of stock biomass)	F/NER, Council staff	US State Dept.	Necessary information for specifying TALFF for butterfish & mackerel based on procedures currently adopted
H. Domestic harvesting capacity (number of vessels, capacity, etc)	Economic analysis; determine DAH; monitor potential fishing effort; evaluate joint venture applications	F/NER, Council staff	F/NEC weighouts; vessel owners & operators	Quality & availability of present estimates require improvement
I. Domestic processing capacity (number of processors capacity, percentage used now percentage forecast for following year, product flow, employment, etc.)	Determine DAP; economic analysis; evaluate joint venture applications	F/NER, Council staff	Survey of processors	Quality & avilability of data currently inadequate for present needs
J. World market data (imports, exports, foreign production, foreign markets, etc.)	Determine OY, TALFF; evaluate joint venture applications	F/NER, Council staff	F/NER Market News Branch; Bureau of Census; FAO; other sources required	Some data in this category available, some not; more detailed information by species required

Source: MAFMC Scientific and Statistical Commitee, December, 1983.

Table 35. Data Priorities for Mid-Atlantic Region

Data Topic Area	Mackerel	Butterfish	Squid
1.1 Number of vessels & gear	1-1*	1	1
1.2 Detailed vessel inventory	1-5*	1	1
1.3 Costs & earnings	1-6*	1	1
1.4 Employment2	2	2	
1.5 Income level & distribution	2	2	2
1.6 Age, education, & experience	3	3	3
1.7 Cultural characteristics	3	3	3
1.8 Capacity considerations	1-2*	1	1
1.9 Landings & effort	1-3*	1	1
2.1 Production & prices	2	2	2
2.2 Number processors etc.	2	2	2
2.3 Processing and mkting. costs	2	2	2
2.4 Product flows	2	2	2
2.5 Processing employment	2	2	2
2.6 Processing employee char.	2	2	2
2.7 Processing capacity	2	1	1
3.1 Fleet size & composition	1-4*	NA	NA
3.2 Costs & earnings	2	NA	NA
3.3 Expenditures in support ind.	3	NA	NA
3.4 Detailed economics of supp. ind.	3	NA	NA
3.5 Employment2	NA	NA	
3.6 Employee characteristics	3	NA	NA
3.7 Sales of rec. caught fish	2	NA	NA
4.1 Home comsumption	3	3	3
4.2 Rest./inst. consumption	3	3	3
4.3 Industrial usage	2	2	2
5.1 Imports	2	2	2
5.2 Exports	2	2	2
5.3 Transfers to foreign ships	2	2	2
5.4 Foreign production	2	1	1
5.5 Foreign market data	1-7*	1	1
6.1 Local economic data	2	2	2
6.2 Cultural values	3	3	3

* Under mackerel, relative ranking within priority category 1 is indicated bu number after hyphen (i.e., item ranked 1-1 is most important, 1-2 second most important, etc.).

NA = Not Applicable.

Source: USDC, 1980.

Table 36. TALFF Allocations (mt) by Month, April 1983 through March 1985

	Month	Quantity (mt)	% of Yearly Total	Quantity (mt)	% of Yearly Total
1983-84	April	50	0.2	50	1.7
	May	-	-	507	17.6
	June	-	-	-	-
	July	5,500	32.4	-	-
	August	-	-	-	-
	September	-	-	-	-
	October	-	-	790	27.4
	November	-	-	-	-
	December	5,200	30.7	1,289	44.7
	January	2,600	15.3	250	8.7
	February	2,800	16.5	-	-
	March	800	4.7	-	-
	Total	16,950	100.0	2,886	100.1
1983-84	April	50	0.4	50	1.5
	May	1,600	12.9	1,100	33.4
	June	1,600	12.9	1,100	33.4
	July	-	-	-	-
	August	-	-	-	-
	September	-	-	-	-
	October	-	-	-	-
	November	750	6.1	-	-
	December	8,250	66.6	-	-
	January	139	1.1	1,039	31.6
	February	-	-	-	-
	March	-	-	-	-
	Total	12,389	100.0	3,289	99.9

Note: Percentage totals may not equal 100 due to rounding.
Source: Unpub. prelim. NMFS data.

Table 37. Benefits and Costs of Revised Mackerel Regime

Measure	Supply Greater Than or Equal to Total Demand	Domestic Demand and Bycatch TALFF Greater Than or Equal to Supply	Total Demand Greater Than Suppply
Elimination of Reserves and Dedicated TALFF	Neutral or +	Neutral	+
Fish & Chips TALFF Allocations	Neutral or +	Neutral	+
Adjustable OY	Neutral	+	+
Costs	Marginal	Marginal	Minimal
Benefits	Not Substantial	Probably not Substantial	Potentially very Substantial
Net Benefits	Neutral or +	+ but Small	Potentially Large

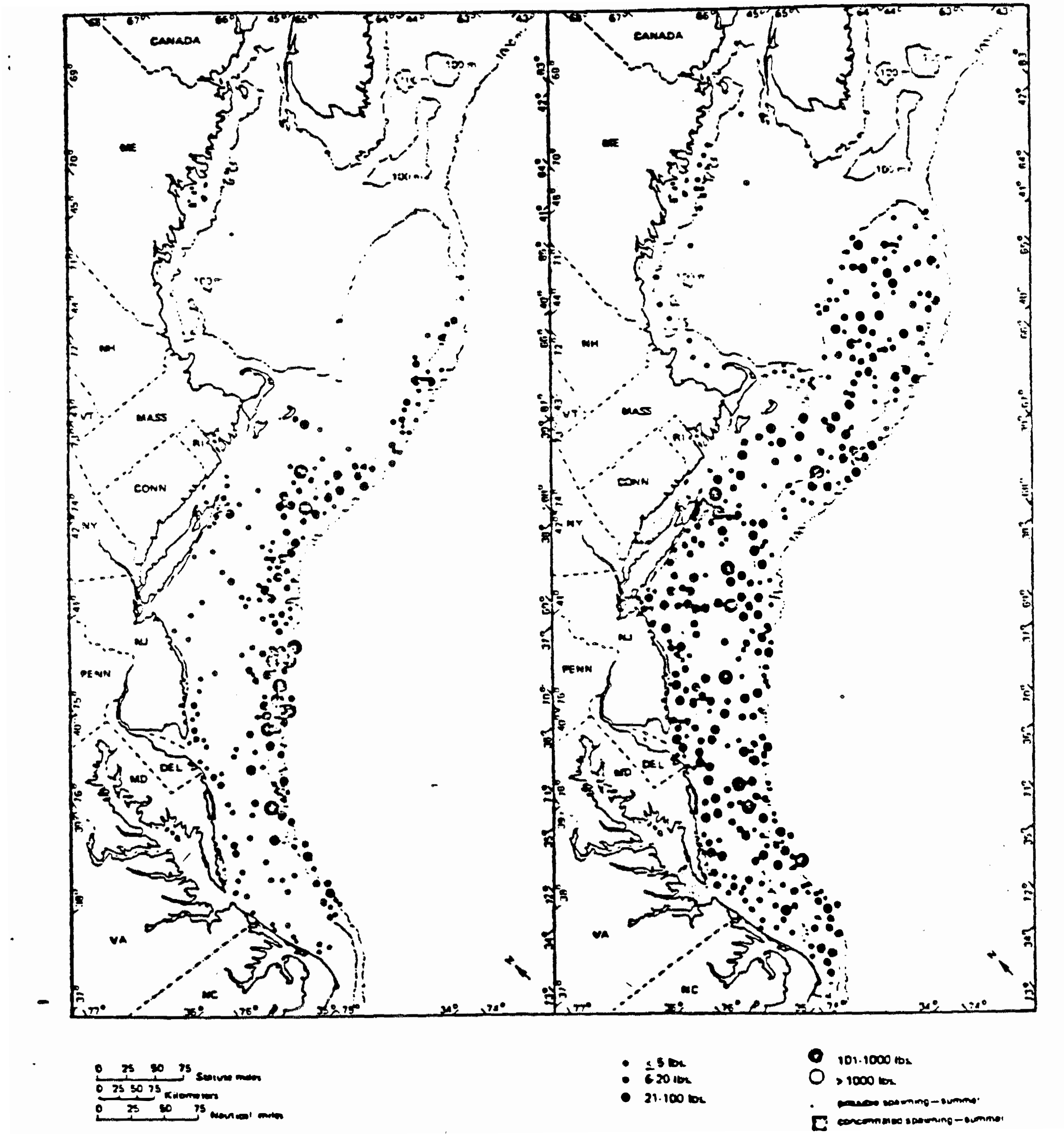
+ = positive; - = negative.

Table 38. Cetaceans and Turtles Found in Survey Area

Scientific name	Common name	Est. Minimum Number in Study Area	Endangered	Threatened
LARGE WHALES				
Balaenoptera physalus	fin whale	5,423	X	
Megaptera novaeangliae	humpback whale	658	X	
Balaenoptera acutorostrata	minke whale	320		
Physeter catodon	sperm whale	222	X	
Eubalaena glacialis	right whale	380	X	
Balaenoptera borealis	sei whale	280	X	
Orcinus orca	killer whale	unk		
Balaenoptera musculus	blue whale	11	X	
SMALL WHALES				
Tursiops truncatus	bottlenose dolphin	8,603		
Globicephala spp.	pilot whales	12,391		
Lagenorhynchus acutus	Atl. white-sided dolphin	36,281		
Phocoena phocoena	harbor porpoise	3,541		
Grampus griseus	grampus (Risso's) dolphin	11,678		
Delphinus delphis	saddleback dolphin	31,124		
Stenella spp.	spotted dolphin	190		
Stenella coeruleoalba	striped dolphin	4,319		
Lagenorhynchus albirostris	white-beaked dolphin	573		
Ziphius cavirostris	Cuvier's beaked dolphin	25		
Stenella longirostris	spinner dolphin	unk		
Steno bredanensis	rough-toothed dolphin	unk		
Delphinapteras leucas	beluga	unk		
Mesoplodon spp.	beaked whales	121		
Pseudorca crassidens	false killer whale	unk		
Feresa attenuata	pygmy killer whale	92		
Kogia spp.	pygmy sperm whale	41		
TURTLES				
Caretta caretta	logggerhead turtle	7,702		X
Dermochelys coriacea	leatherback turtle	361	X	
Lepidochelys kempi	Kemp's ridley turtle	unk	X	
Chelonia mydas	green turtle	unk		X

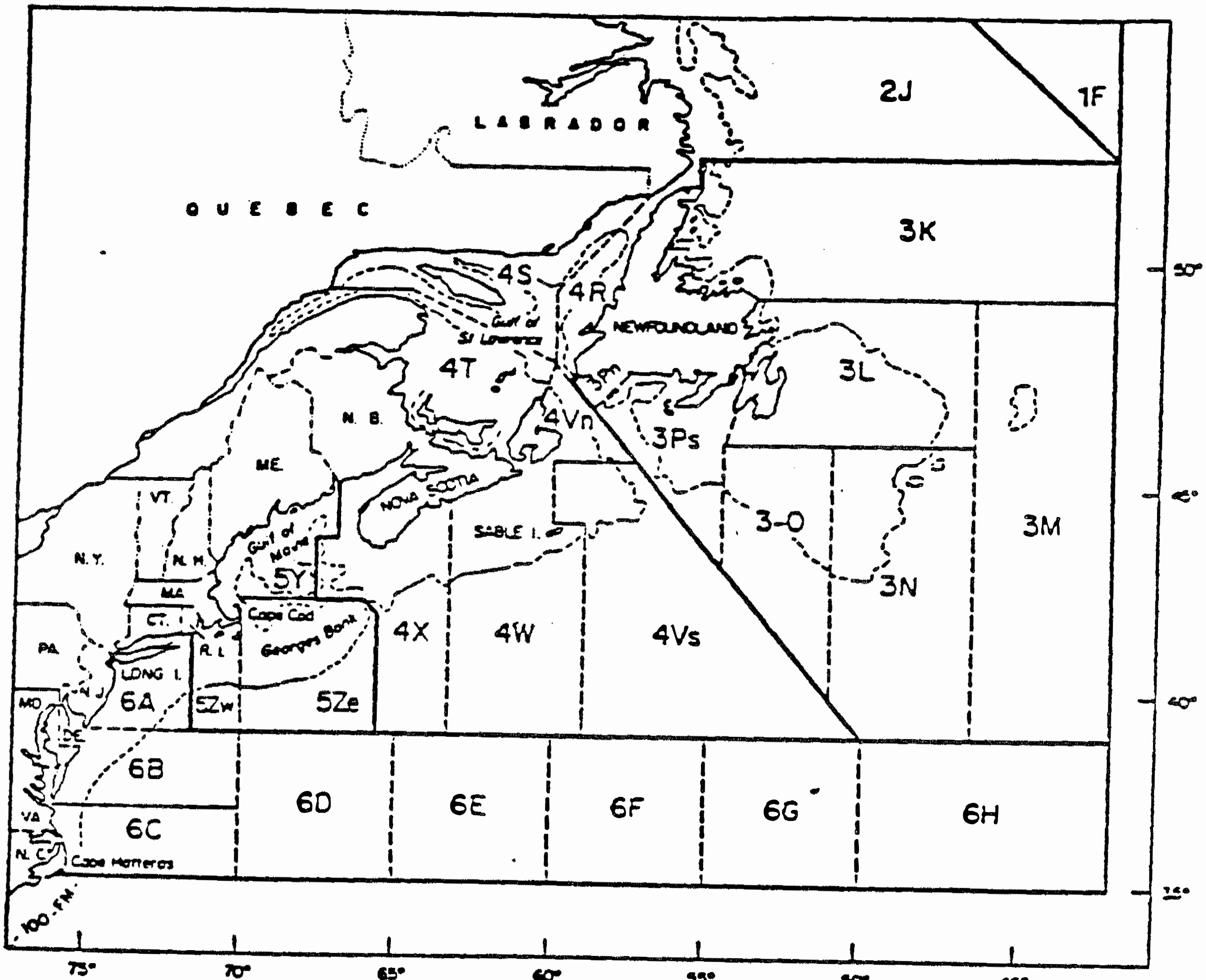
Source: University of Rhode Island, 1982.

Figure 1. Long-finned squid — distribution of NMFS 1973-74 research vessel trawl catches (dots) and spawning areas (shading) (spring-left, autumn-right)



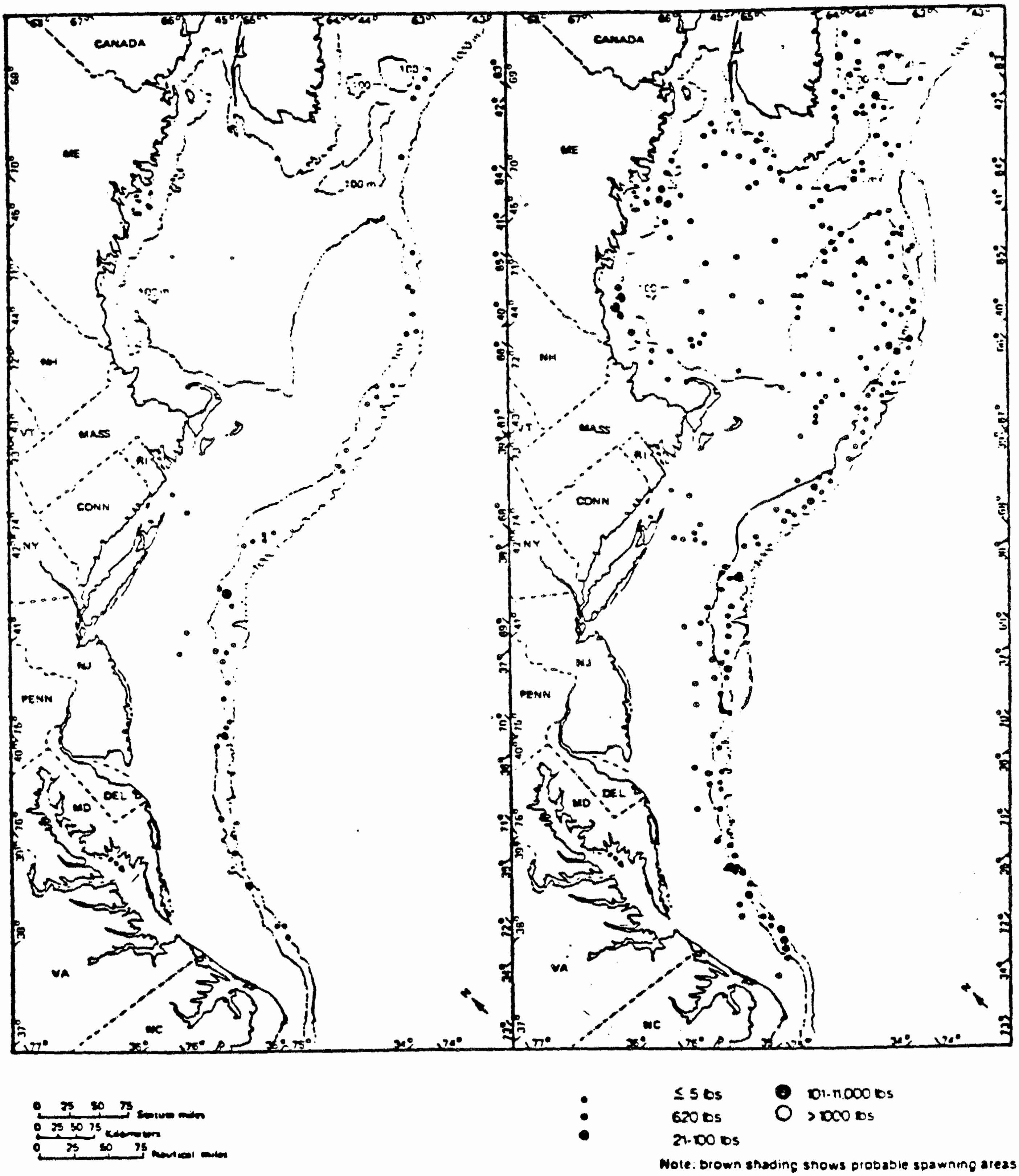
Source: Grosslein and Azarovitz, 1982.

Figure 2. Northwest Atlantic from Labrador to North Carolina showing NAFO SA 2-6.



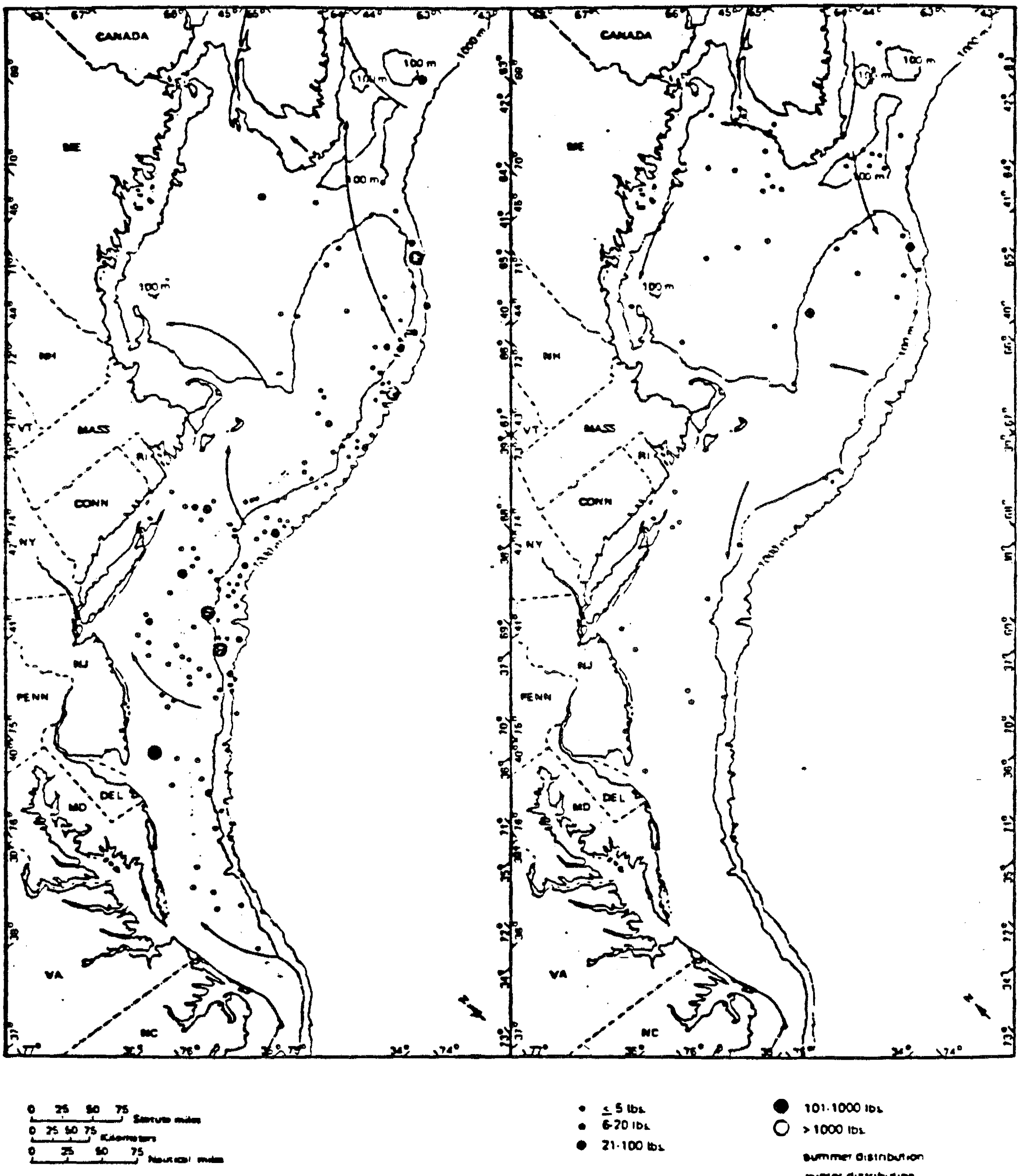
Source: Anderson, 1985

Figure 3. Short-finned squid — distribution of NMFS 1973-74 research vessel trawl catches (dots) and spawning areas (shading) (spring-left, autumn-right)



Source: Grosslein and Azarovitz, 1982.

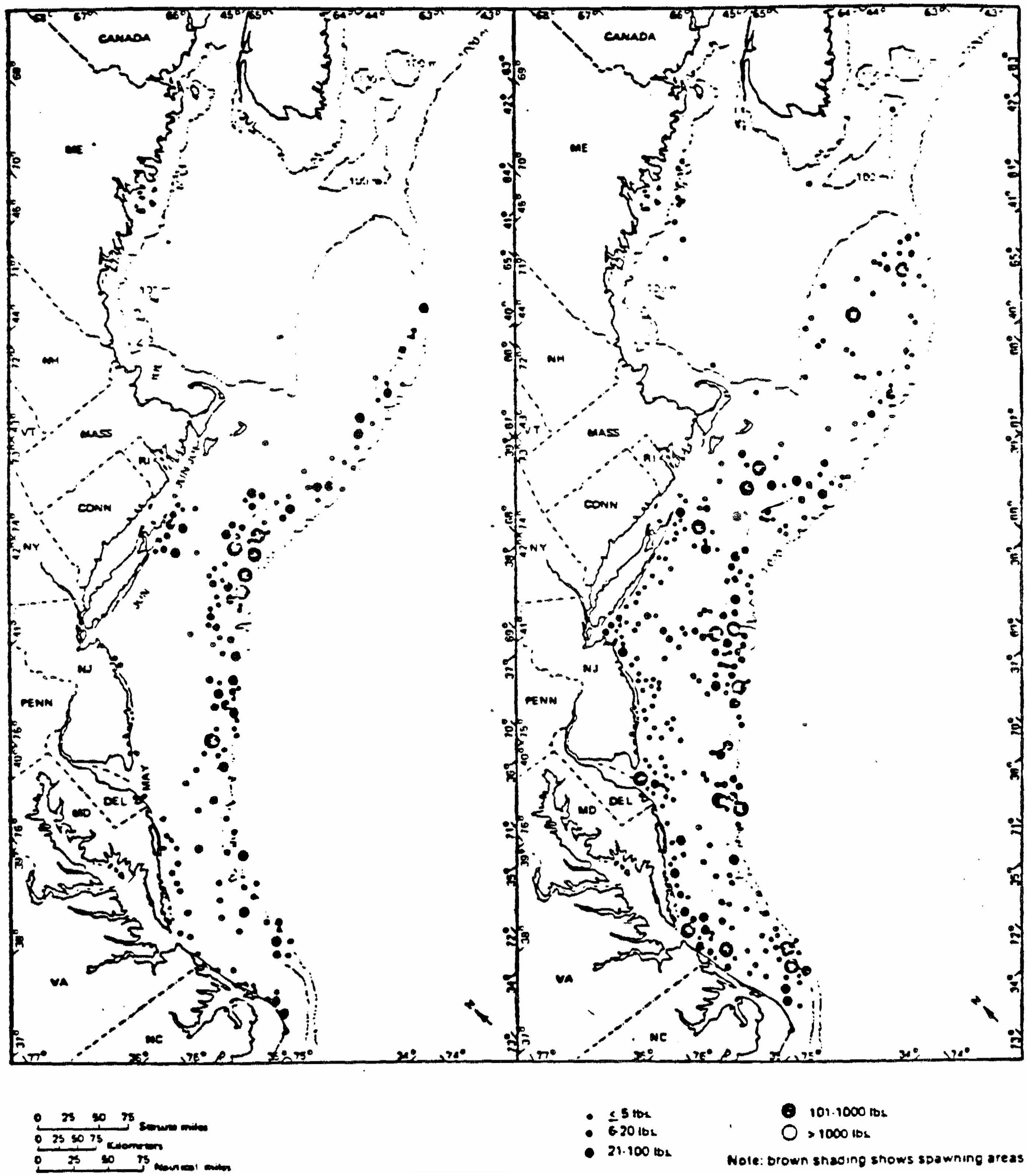
Figure 4. Atlantic mackerel — general distribution and spawning areas (shading) and distribution of NMFS 1973-74 trawl catches (dots)
(spring-left, autumn-right)



Source: Grosslein and Azarovitz, 1982.

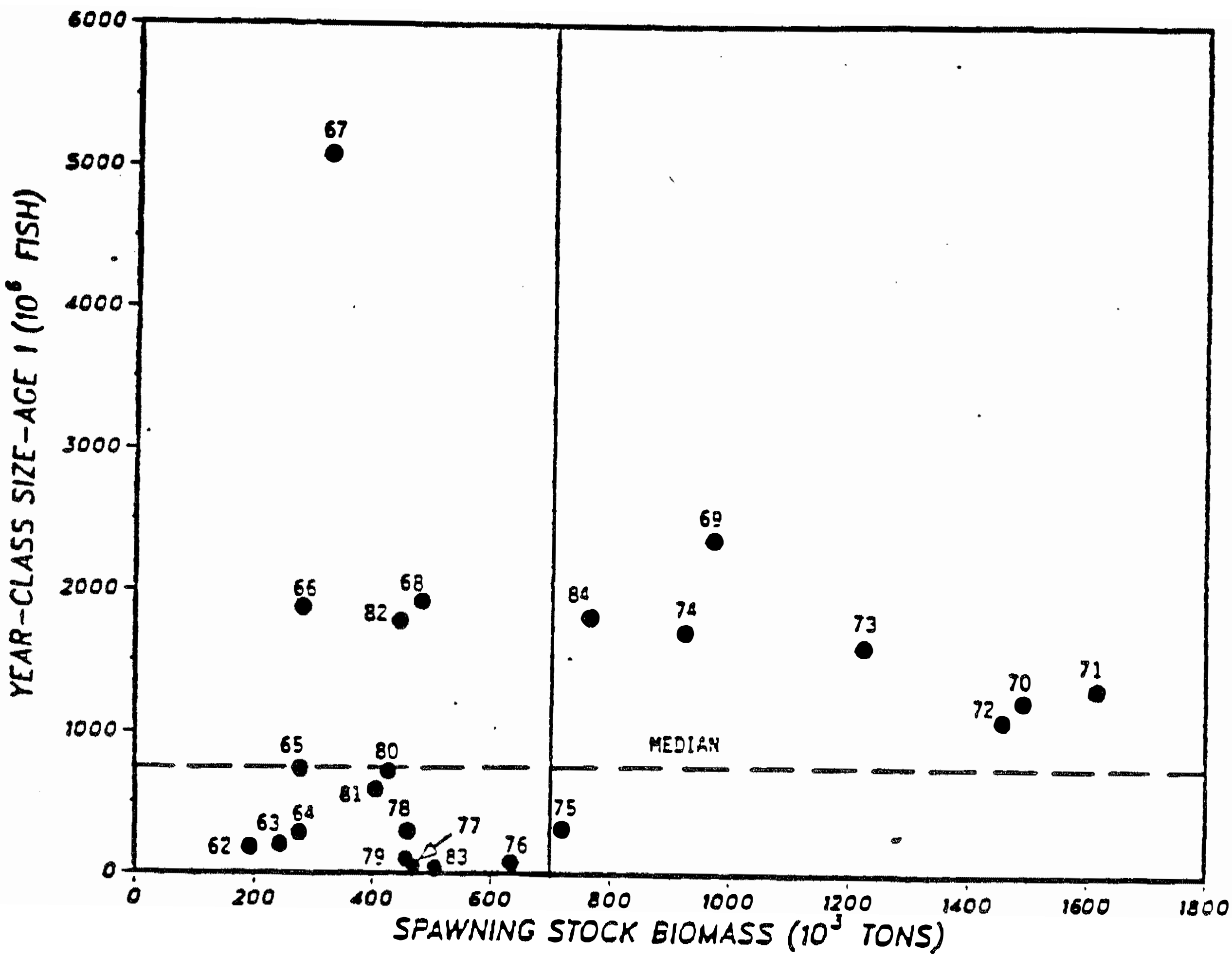
Note: brown shading shows spring spawning areas

Figure 5. Butterfish — distribution of NMFS 1973-74 research vessel trawl catches (dots) and spawning areas (shading)
(spring-left, autumn-right)



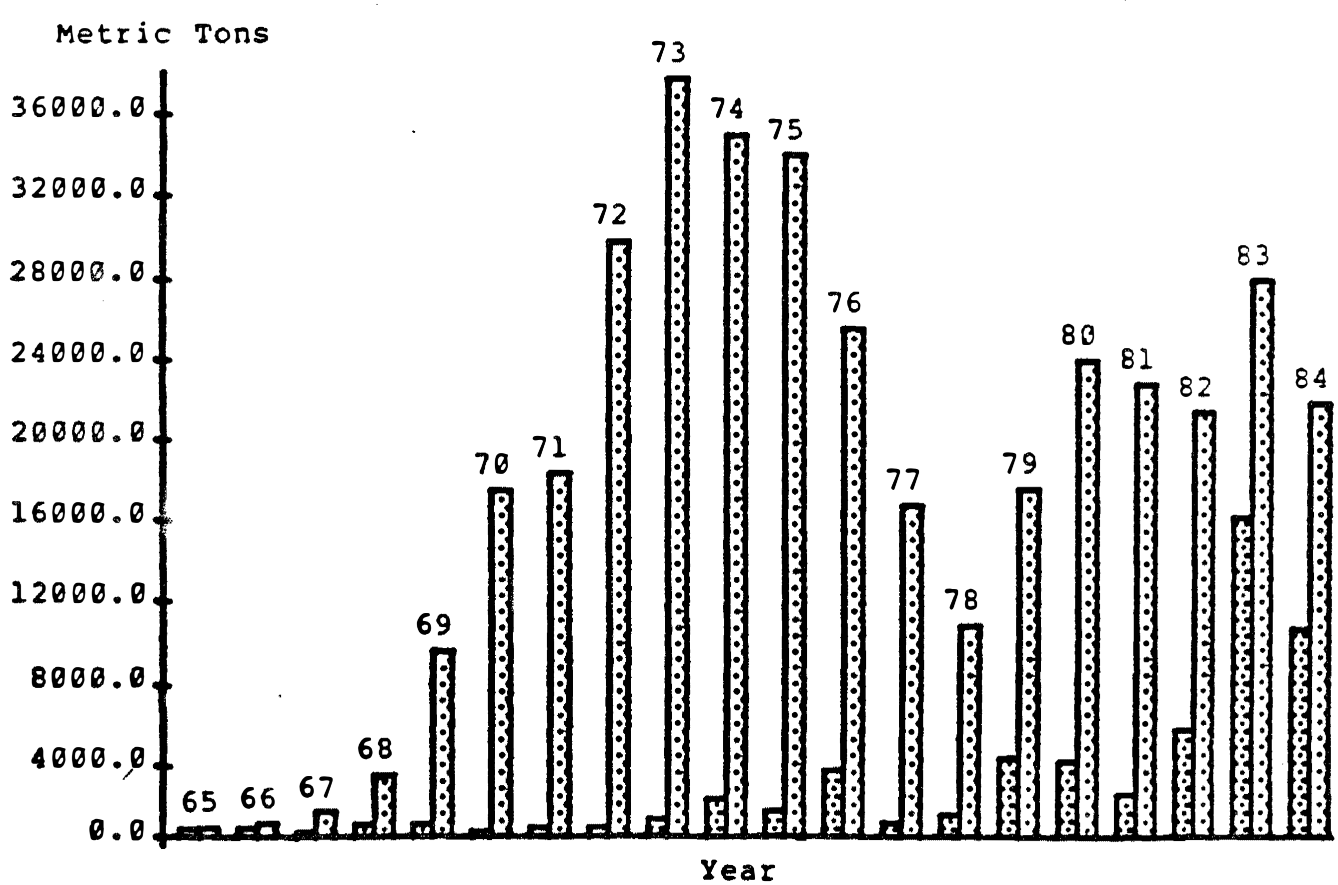
Source: Grosslein and Azarovitz, 1982.

Figure 6. Relationship between mackerel year-class size at age 1 and the parental spawning stock biomass during 1962-84 in NAFO SA 2-6.



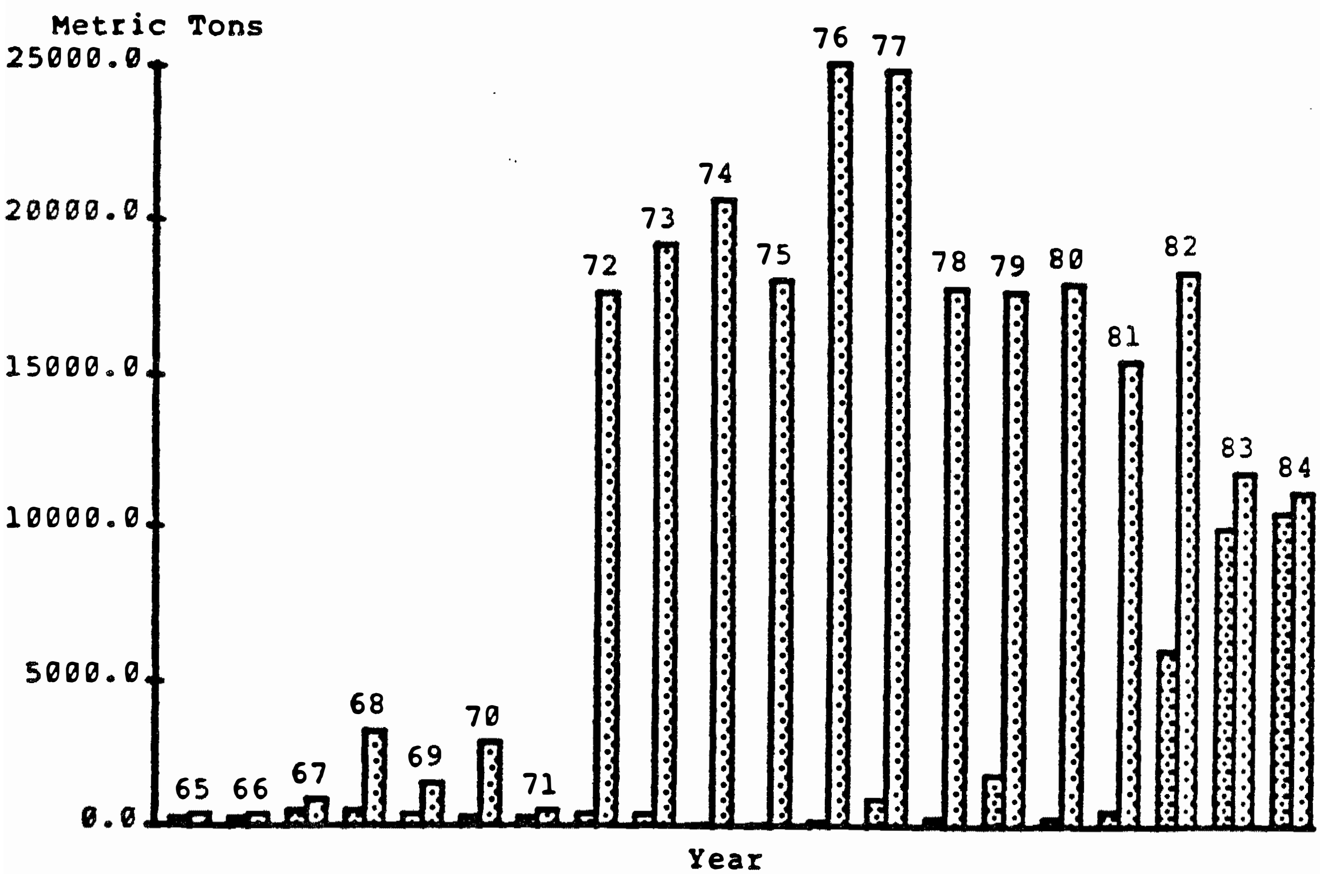
Source: Anderson, 1985.

Figure 7. US and Total <u>Loligo</u> Catch in US Waters, 1965-1984.



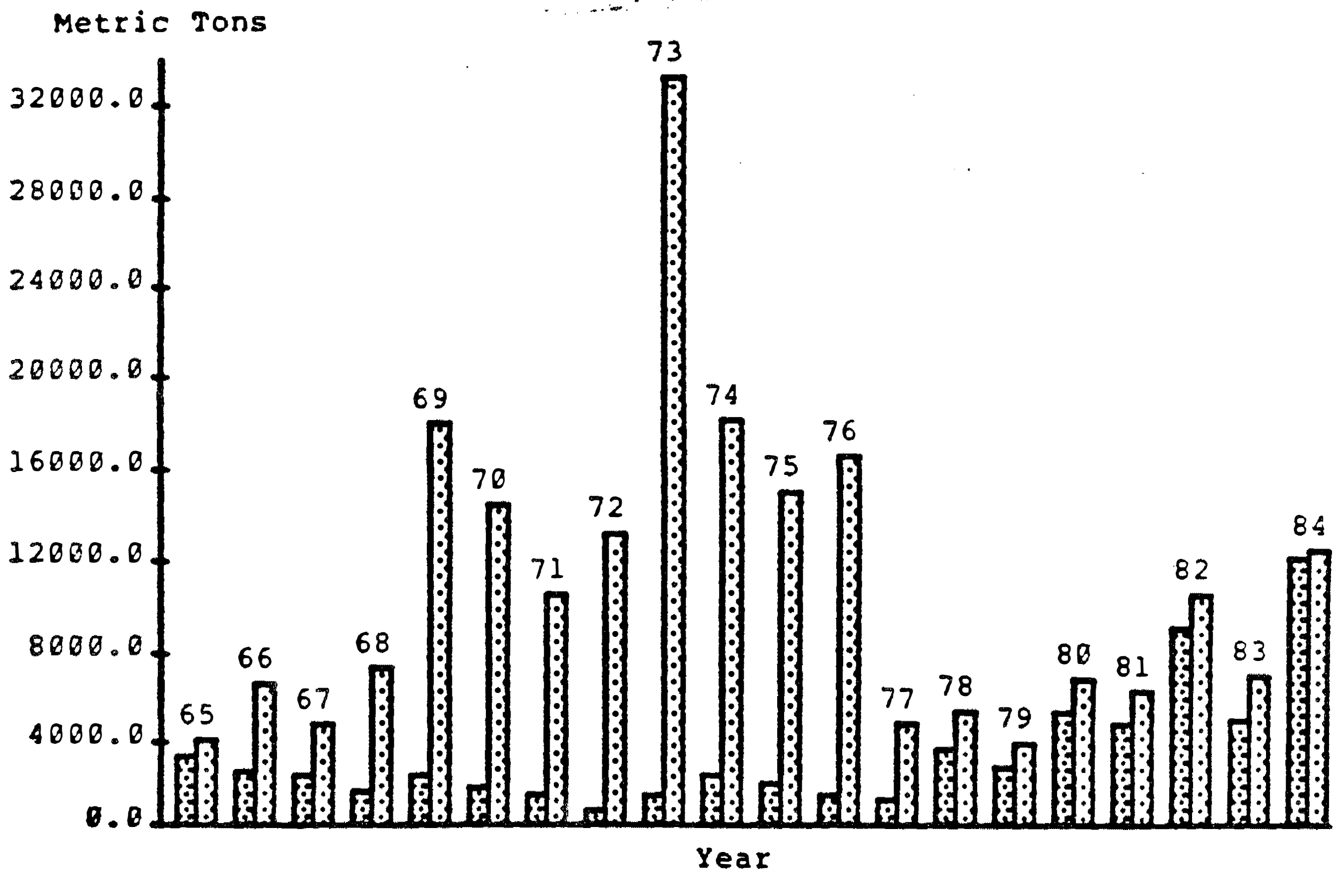
Source: Unpub. Prelim. NMFS data.

Figure 8. US and Total *Illex* Catch in US Waters, 1965-1984.



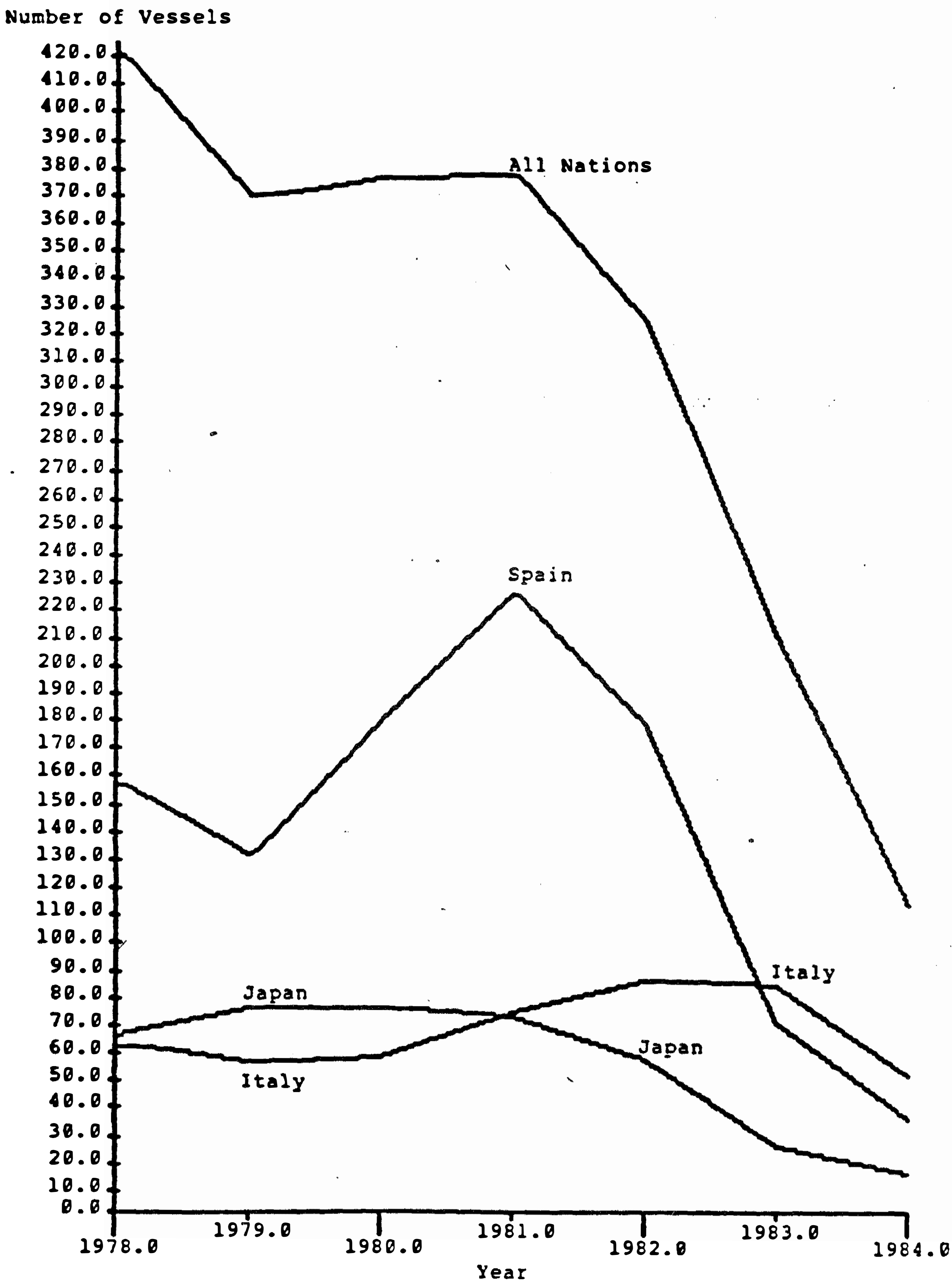
Source: Unpub. Prelim. NMFS data.

Figure 9. US and Total Butterfish Catch in US Waters, 1965-1984



Source: Unpub. Prelim. NMFS data.

Figure 10. Number Foreign Fishing Vessel by Months in the Atlantic FCZ, 1978-1984.



Source: Unpub. Prelim. NMFS data.

APPENDIX 1. ALTERNATIVES TO THE AMENDMENT

This Appendix contains the alternatives considered for Amendment #2. Alternatives 1 through 5 were alternatives in the public hearing draft of the Amendment. Alternative 6 was a part of the preferred alternative in the public hearing draft, but was removed from the FMP prior to final adoption by the Council.

ALTERNATIVE 1. TAKE NO ACTION AT THIS TIME

Description

This would mean that the FMP would continue in effect until 31 March 1986 unless otherwise amended. If it were not otherwise amended, management of mackerel, squid, and butterfish would revert to a PMP, with no management of the US fishery.

Beneficial and Adverse Impacts

No beneficial impacts can be identified for this alternative. Given recent harvest levels in the butterfish fishery, it is likely that no control over the US fishery could lead to overfishing. If the PMP included the same development policy as the FMP vis-a-vis foreign nations, than US fishing activity could lead to overfishing of *Loligo* and *Illex*. If the PMP did not include the same development policy as the FMP, then the gains made in the US fishery could be lost. Possibly directed foreign fishing in quantity would be allowed.

ALTERNATIVE 2. CONTINUE THE FMP UNCHANGED

Description

The provisions of the FMP are:

Loligo

The maximum OY for *Loligo* is 44,000 mt. The RD in consultation with the Council, determines annual specifications relating to Initial Optimum Yield (IOY), Domestic Annual Harvest (DAH), Domestic Annual Processing (DAP), Joint Venture Processing (JVP), and Total Allowable Level of Foreign Fishing (TALFF). The RD reviews yearly the most recent biological data pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower Allowable Biological Catch (ABC) for the fishing year. This level represents essentially the modification of the maximum sustainable yield (MSY) to reflect changed biological circumstances. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. The IOY is composed of an initial DAH and initial TALFF. The RD projects the DAH by reviewing the data concerning past domestic landings, projected amounts of *Loligo* necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The Joint Venture Processing (JVP) component of DAH is the portion of DAH which domestic processors either cannot or will not use. In assessing the level of IOY, the RD provides for a TALFF of at least a minimum bycatch of *Loligo* squid that would be harvested incidentally in other directed fisheries. This bycatch level is 1% of the allocated portion of the *Illex*, mackerel (if a directed fishery is allowed), silver hake, and red hake TALFFs. In addition, this specification of IOY is based on the application of the following factors:

1. total world export potential by squid producing countries;
2. total world import demand by squid consuming countries;
3. US export potential based on expected US harvests, expected US consumption, relative prices, exchange rates, and foreign trade barriers;
4. increased/decreased revenues to the US from foreign fees;
5. increased/decreased revenues to US harvesters (with/without joint ventures);
6. increased/decreased revenues to US processors and exporters;
7. increases/decreases in US harvesting productivity due to decreases/increases in foreign harvest;
8. increases/decreases in US processing productivity; and

9. potential impact of increased/decreased TALFF on foreign purchases of US products and services and US caught fish, changes in trade barriers, technology transfer, and other considerations.

Proposed annual specifications of the ABC and IOY and its component amounts are published in the *Federal Register* and provide for a public comment period. At the close of the public comment period, a notice of final annual specifications with the reasons therefore are published in the *Federal Register*.

The IOY may be adjusted by the RD, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs, including when the application of the above factors warrants an adjustment in TALFF. However, TALFF may not be adjusted to a quantity less than that already allocated to and accepted by foreign nations or less than that needed for bycatch. Any adjustments to the IOY are published in the *Federal Register* and may provide for a public comment period.

Illex

The maximum OY for *Illex* is 30,000 mt. The RD, in consultation with the Council, determines annual specifications relating to IOY, DAH, DAP, JVP, and TALFF. The RD reviews yearly the most recent biological data pertaining to the stock. If the RD determines that the stock cannot support a level of harvest equal to the maximum OY, he establishes a lower ABC for the fishing year. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

From the ABC, the RD, in consultation with the Council, determines the IOY for the fishing year. The IOY represents a modification of ABC, based on economic factors. It is intended to provide the greatest overall benefit to the nation by incorporating all relevant factors. The IOY is composed of an initial DAH and initial TALFF. The RD determines the IOY and any adjustments by the same procedures and factors set out above for *Loligo*, except that it provides for a minimum bycatch of *Illex* squid that would be harvested incidentally in other directed fisheries. This bycatch level is 10% of the allocated portion of the *Loligo* TALFF and 1% of the allocated portions of the mackerel (if a directed fishery is allowed), silver hake, and red hake TALFFs (MAFMC, 1982b).

Atlantic Mackerel

The specification of mackerel OY, DAH, DAP, and TALFF is based upon:

C = estimated mackerel catch in Canadian waters for the upcoming fishing year.

US = estimated US mackerel catch for the upcoming fishing year.

S = mackerel spawning stock biomass in the year after the upcoming fishing year.

Bycatch = 2% of allocated portion of the silver hake TALFF and 1% of the allocated portions of the *Loligo*, *Illex*, and red hake TALFFs.

AC = acceptable catch in US waters for the upcoming fishing year.

T = total catch in all waters (US and Canadian) for the upcoming fishing year.

If S less than or equal to 400,000 mt; use Case 1. If S greater than 400,000 mt; use Case 2.

Case 1: OY less than or equal to 30,000 mt; AC less than or equal to 30,000 mt; DAH less than or equal to 30,000 mt - Bycatch; DAP less than or equal to 30,000 mt - Bycatch; and TALFF = Bycatch.

Case 2: OY less than or equal to AC; AC = T - C such that S greater than or equal to 400,000 mt and that the fishing mortality associated with T less than or equal to F0.1; DAH is between 30,000 mt and AC - Bycatch; DAP is between 30,000 mt and AC - Bycatch; and TALFF is AC - DAH, but may be no less than Bycatch. If AC - DAH is equal to or greater than 10,000 mt, 1/2 is initially allocated to TALFF and 1/2 is initially allocated to Reserve.

The 30,000 mt minimum DAH and DAP in Case 2 may only be reduced to the extent necessary to assure that AC is not exceeded and the foreign fishery receives the bycatch requirements. OY and TALFF must be adjusted to account for the minimum US allocation. It must be recognized that while such an adjustment at the beginning of a fishing year may result in an initial OY less than that which is biologically acceptable (i.e., less than AC), if US landings during the year, including amounts authorized for joint ventures, increase above the initial estimates, DAH and OY may be increased by similar amounts up to the point where OY = AC. TALFF would not change from its value at the beginning of a year as a result of these adjustments to DAH and OY.

Butterfish

Butterfish MSY is 16,000 mt. OY is specified as whatever quantity of butterfish US fishermen harvest annually plus a bycatch TALFF equal to 6% of the allocated portion of the *Loligo* TALFF and 1% of the allocated portions of the *Illex*, Atlantic mackerel, silver hake, and red hake TALFFs, up to 16,000 mt. DAH would equal whatever quantity of butterfish US fishermen harvest, not to exceed 16,000 mt minus the TALFF. The Act provides that OY may differ from MSY for economic reasons. In this case, the reason for the difference is the development of the US fishery for export. The concept is simply that if foreign nations are not permitted to directly harvest butterfish, there will be a greater incentive to purchase the fish from US harvesters and processors. It is recognized that butterfish are a bycatch in other foreign fisheries and it is necessary, therefore, to provide a TALFF in keeping with those bycatch requirements. This specification is unchanged from the current FMP.

The precise specification of OY is: OY less than or equal to 16,000 mt; DAH less than or equal to 16,000 mt - bycatch; DAP less than or equal to 16,000 mt - bycatch; and TALFF = bycatch = 6% of the allocated portion of the *Loligo* TALFF and 1% of the allocated portions of the *Illex*, mackerel (if a directed fishery is allowed), silver hake, and red hake TALFFs.

Permit Requirements

Any owner or operator of a vessel desiring to take any Atlantic mackerel, squid, or butterfish within the FCZ, or transport or deliver for sale, any Atlantic mackerel, squid, and/or butterfish taken within the FCZ must obtain a permit for that purpose. Each foreign vessel engaged in or wishing to engage in harvesting the TALFF must obtain a permit from the Secretary of Commerce as specified in the Act. This section does not apply to recreational fishermen taking Atlantic mackerel, squid, or butterfish for their personal use, but it does apply to the owners of party and charter boats.

Reporting Requirements

NMFS has the responsibility to provide, on a timely basis, adequate commercial and recreational catch data to develop DAH for plan review and development and to implement the reallocation procedures of the FMP. At a minimum these data include amounts of fish landed, the capacity to process squid, Atlantic mackerel, and butterfish, and the amount of that capacity actually used. The Council does not require additional data to meet its planning needs, but NMFS should collect all data required by the Act. The Secretary may require further specific data relating to the harvesting of squid, Atlantic mackerel, and butterfish be submitted if necessary to manage or plan for management of the fishery.

Beneficial and Adverse Impacts

Maintaining the status quo has no identifiable beneficial impact on the US fishery. It would have some benefit to foreign nations since the current bycatch percentages and mackerel reserve procedures would be continued. The bycatch percentages in the current FMP are more generous than those proposed by the Amendment, allowing bycatch TALFFs larger than are actually needed based on the most recent data.

The mackerel reserve procedure would allow larger allocations for foreign fishing than would the Amendment, at least in the absence of actions by foreign nations to help with US fishery development.

Not changing the butterfish regime to allow quota reductions in response the stock declines could lead to overfishing.

ALTERNATIVE 3. SILVER AND RED HAKE

Description

This alternative would modify the FMP's management unit to add silver and red hake. Management of the hakes would be based on the same procedures used for the squids (ABC, IOY, etc.).

Beneficial and Adverse Impacts

The hake resources are generally considered to be less than fully exploited. As with squid, mackerel, and butterfish, development, particularly in the short run, is more likely in export than in US markets. Obviously, if there were substantial US markets, the fisheries likely would not be underdeveloped. Additionally, prior to the MFCMA, there were significant foreign hake fisheries. Therefore, the general development program contained in the FMP could provide an appropriate framework for the hakes. For example, Spain proposed a silver hake joint venture for 1985.

There is some relationship between the hakes and the New England mixed trawl fishery proposed to be managed by the New England Council's Multi-Species FMP.

Given the need to proceed with Amendment #2 because of the deadline on the current FMP (31 March 1986) and the need to develop appropriate management strategies for the hakes, the prudent course of action appears to be to not include the hakes in the FMP at this time, but to continue discussion of the issue for possible consideration in the next amendment to the FMP.

ALTERNATIVE 4. REVISE THE REGULATION OF FOREIGN FISHING

Description

The FMP, and the predecessor individual Atlantic Mackerel, Squid, and Butterfish FMPs, relied on the NMFS foreign fishing regulations for the management of the foreign fishery. This alternative would change that situation with regard to fishing areas and seasons.

Specifically, the FMP would provide that foreign vessels fishing for mackerel, squid, and butterfish could conduct such fisheries anywhere in the FCZ seaward of 20 nautical miles, north of 37°30' N. latitude, and south of some yet to be determined northern limit provided a NMFS observer was on board. Additionally, the FMP would provide that the RD, in consultation with the Council, could specify when directed fishing for mackerel and the squids could be conducted in order to achieve the objectives of the FMP.

The FMP would continue to rely on the foreign fishing regulations relative to data collection, reporting, and avoidance of gear conflicts.

Beneficial and Adverse Impacts

The primary purpose of this alternative is to facilitate the operation of foreign directed fisheries in conjunction with joint ventures. Exceptions have been granted to the existing regulations for certain ventures.

To the extent that these provisions would improve the effectiveness of foreign fishing and, thereby, result in better US fishery development projects, they would benefit the US industry. However, there is concern that the effect might be to increase conflicts with segments of the US fishery or to increase the foreign catch of certain US species. These concerns relate to the boundaries of the area where foreign fishing might be allowed and the seasons for foreign fishing.

Given the need to proceed with Amendment #2 so that it is implemented prior to 31 March 1986, it is considered preferable to continue to deal with this problem on a case by case basis and attempt to develop a comprehensive solution in the next Amendment.

ALTERNATIVE 5. REVISE REPORTING REQUIREMENTS

Description

This alternative would institute mandatory reports for US fishermen. The categories of data reported would be the same as in the proposed amendment. However, rather than sample reporting (unless an adequate sample does not report), this alternative would require that all vessel owners and operators report. This alternative would not change the existing permit requirements. That is, permits would not have a termination date as with the proposed amendment.

Beneficial and Adverse Impacts

The proposed Amendment would provide information on the fleet through the annual permit renewal process coupled with sample reporting. This alternative would meet the need by requiring that reports be filed for all vessels while continuing the current essentially perpetual permit system.

This alternative would clearly require more reporting that the proposed Amendment. Reports would need to be filed for all of the vessels every week. With the proposed Amendment, reports would need to be filed for all of the vessels once a year (the permit renewal application), while owners or operators of only 20% of the vessels would need to report weekly.

The only advantage to this alternative is that it would lessen the fishermen's anxiety that the annual permit renewal process could in some way evolve into an entry limitation system. However, introduction of any entry limitation system would necessarily require an Amendment to the FMP no matter what permitting system were in effect.

ALTERNATIVE 6. REGULATE THE USE OF MACHANICAL SORTERS.

Description

US harvesting vessels with permits in the Atlantic mackerel, squid, or butterfish fisheries may not have mechanical sorters on board. The Regional Director may grant exemptions to this provision if a NMFS observer is on board the vessel at the expense of the owner or operator of the vessel or if other provisions for determining presorting catch count sizes are developed

Beneficial and Adverse Impacts

The prohibition on sorting machines was considered necessary in order to minimize discarding of undersized fish at sea. It is understood that a small number of sorters are currently in use, so there should be little immediate negative impact on fishermen. Further, catchers (as opposed to catcher/processors) do not need to sort my market size at sea, since such sorting is done by the processors. The waiver provision is intended to recognize that catcher/processor vessels may need mechanical sorters to compete (i.e., sort the fish to market size at the lowest cost possible) while still preventing the use of sorters to facilitate the discard of undersized fish.

The use of observers would increase costs to fishermen and may present insurance problems. The regulation could also create a problem relative to foreign fishing since foreign vessels are allowed to use sorters without regulation.

ENVIRONMENTAL ASSESSMENT ON AMENDMENT #2 TO THE ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERY MANAGEMENT PLAN (FMP)

1. INTRODUCTION

In March, 1977, the Council initiated development of the Mackerel and Squid FMPs. The Council adopted the Mackerel FMP for hearings in September 1977 and the Squid FMP for hearings in October 1977. Hearings on Mackerel and Squid FMPs were held in December, 1977. The Mackerel and Squid FMPs were adopted by the Council in March 1978. The Mackerel FMP was submitted for NMFS approval in May 1978. The Squid FMP was submitted for NMFS approval in June 1978. However, based on NMFS comments, the Council requested that the Mackerel and Squid FMPs be returned.

The FMPs were revised, the revisions being identified as Mackerel FMP Supplement #1 and Squid FMP Supplement #1. These two Supplements, along with the original Butterfish FMP, were adopted for public hearings by the Council in July of 1978. Hearings on all three documents were held during September and October 1978 and all three FMPs were adopted in final form by the Council in November 1978. The Butterfish FMP was submitted for NMFS approval in December 1978. Mackerel FMP Supplement #1 and Squid FMP Supplement #1 were submitted for NMFS approval in January 1979. NMFS approved Squid FMP Supplement #1 in June 1979 and Mackerel FMP Supplement #1 in July 1979. Both FMPs were for fishing year (1 April - 31 March) 1979-80.

The Butterfish FMP was disapproved by NMFS in April 1979 because of a need for additional justification of the reasons for reducing OY below MSY. The Butterfish FMP was revised, adopted by the Council, and resubmitted for NMFS approval in June 1979. It was approved by NMFS in November 1979 for fishing year 1979-80.

The Council adopted Amendments #1 to both the Mackerel and Squid FMPs for hearings in August 1979. Hearings were held during October 1979. The Amendments were adopted by the Council and submitted for NMFS approval in November 1979. Both Amendments were approved by NMFS in March 1980. This extended the Squid FMP for an indefinite time beyond the end of fishing year 1979-80 and extended the Mackerel FMP through fishing year 1980-81. Butterfish FMP Amendment #1, extending the FMP through fishing year 1980-81, was adopted by the Council for hearings in December 1979 with hearings held during January 1980. During January 1980 the Amendment was adopted in final form by the Council and submitted for NMFS approval. It was approved in March 1980.

The Council began work on an amendment to merge the Mackerel, Squid, and Butterfish FMPs in March 1980 the document being identified as Amendment #2 to the Mackerel, Squid, and Butterfish FMP. The Amendment was adopted by the Council for public hearings in August 1980. However, NMFS commented that there were significant problems with the Amendment that could not be resolved prior to the end of the fishing year (31 March 1981). The Council then prepared separate Amendments #2 to both the Mackerel and Butterfish FMPs to extend those FMPs through fishing year 1981-82. Since Amendment #1 to the Squid FMP extended that FMP indefinitely, there was no need to take this action for the Squid FMP. Those drafts were adopted for public hearing by the Council in October 1980 with hearings held in November. The Amendments were adopted in final form by the Council and submitted for NMFS approval in November 1980. Amendment #2 to the Mackerel FMP was approved by NMFS in January 1981 and Amendment #2 to the Butterfish FMP was approved by NMFS in February 1981.

In October 1980 the merger amendment, previously designated as Amendment #2, was redesignated Amendment #3. The Council adopted draft Amendment #3 to the Squid, Mackerel, and Butterfish FMP in July 1981 and hearings were held during September. The Council adopted Amendment #3 in October 1981 and submitted it for NMFS approval. NMFS review identified the need for additional explanation of certain provisions of the Amendment. The revisions were made and the revised Amendment #3 was submitted for NMFS approval in February 1982.

The Amendment was approved by NMFS in October 1982. However, problems developed with the implementation regulations, particularly with the Office of Management and Budget through that agency's review under Executive Order 12291. In an effort to have the FMP in place by the beginning of the fishing year (1 April 1983) the FMP, without the squid OY adjustment mechanism, or a revised Atlantic mackerel mortality rate, and redesignated as the Atlantic Mackerel, Squid, and Butterfish FMP, was implemented by emergency interim regulations on 1 April 1983. By agreement of the Secretary of Commerce and the Council, the effective date of those emergency regulations was extended through 27 September 1983.

The differences between the FMP and the implementing regulations resulted in a hearing before the House Subcommittee on Fisheries and Wildlife Conservation and the Environment on 10 May 1983.

Amendment #1 to the Atlantic Mackerel, Squid, and Butterfish FMP was prepared to implement the squid OY adjustment mechanism and the revised mackerel mortality rate. That Amendment was adopted by the Council on 15 September 1983, approved by NMFS on 19 December 1983, and implemented by regulations published in the Federal Register on 1 April 1984.

2. PURPOSE OF AND NEED FOR ACTION

This Amendment is intended to revise the mackerel regime to remove the reserve provision, revise the butterfish regime to allow OY reductions in response to stock conditions, introduce a butterfish minimum size limit, revise the permitting and reporting requirements, and update the foreign fishery bycatch percentages. The management unit is all Atlantic mackerel, *Loligo pealei*, *Illex illecebrosus*, and butterfish under US jurisdiction, excluding the Gulf of Mexico and the Caribbean Sea. The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the US commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

The problems in the fishery are set forth in Section 4.2 of the FMP. The proposed management measures are presented in Section 9.1.

3. ALTERNATIVES

A description and evaluation of the alternatives considered, but not adopted for Amendment #2 is contained in Appendix I to the FMP.

4. ENVIRONMENTAL IMPACTS

The environmental impacts of the management regime instituted in the original FMP were described in the Environmental Impact Statement accompanying the FMP, and in the Supplemental Environmental Impact Statements or Environmental Assessments accompanying the Amendments.

Most of the changes made to the FMP by this Amendment are designed to develop the US fishery or to simplify administration of the FMP. However, the change in the butterfish regime to allow reduction in the quota in response to a stock decline has positive environmental impacts relative to the current FMP. The current FMP sets the annual butterfish maximum catch at 16,000 mt and provides for no quota reduction if there is a stock decline.

4.1. Annual Permit System

4.1.1. Introduction

The Council proposed the revisions to the permit system described in Section 9.1.2.1 to make the permit system a more effective support for the management of the four fisheries. The principal objective is to have the system operate in a manner which enables the Council and NMFS to know on an accurate and timely basis how many participants there are in the fishery during a given year.

This is a critical need of a program which depends on an accurate calculation of annual specifications for various users of the four fisheries managed under the FMP. To this end, the Council has proposed an annual permit system so that the participants can be identified on an annual basis. As an incentive for more accurate and timely reporting, those fulfilling the reporting requirements in substantially complete form will have their permits renewed automatically. In addition to usual permit data, information on the prior year's landings of squid, mackerel, and butterfish must be included in the annual permit application. The permit may be revoked for violations of the FMP, including failure to adhere to the mandatory reporting requirements. The Council will work with NMFS staff to develop an appropriate schedule of penalties to correspond to FMP violations of this section so that the Council's view of the seriousness of permit and reporting violations will be reflected in enforcement actions pursued under the FMP.

The permit system has also been revised to allow presentation of the permit at dockside rather than at-sea. The revision removes to only measure potentially requiring at-sea enforcement and represents a cost saving in the operation of the FMP.

4.1.2. Costs

Prior to this Amendment, all permits for the squid, mackerel, and butterfish fisheries were issued on a perpetual basis (having no expiration date). It is the intent of the Council that this system be modified to the extent that each permit be renewed annually by the applicant, and an estimation of the applicant's previous year's landings of squid, mackerel, and butterfish be included on the application form. The costs of using annually renewed permits must be considered in two parts: the first would be the initial "start-up costs" involved with putting a renewal system in place, and second would be the annual (recurring) costs of maintaining and executing it.

Start-up Costs. The start-up costs of instituting an annual permit system consist basically of the time and effort (labor costs) required to design it. At this stage, it would be premature to estimate how long NMFS will require to modify their operating procedures. However, it is important to note that NMFS is now receiving requests from both the Mid-Atlantic Council (regarding squid, mackerel, and butterfish) and the New England Council (regarding groundfish) for annually renewed permits. The best operational system for NMFS to use in dealing with these requests is clearly a matter best resolved within the Service itself. However, there is also little doubt that it would be most efficient for NMFS to change their system only once to accommodate all fisheries which will go to annual permits at the same time. Both Councils are currently discussing the logistical details of such a system with the NMFS Permit Office. It is anticipated that a system could be in place by 1 January 1987.

Annual Maintenance Costs. Once an annual permit system is in place, the process of maintaining it should be straightforward. A renewal application would be sent to each permit holder which contains all the standard information concerning his vessel. The owner or operator would simply update the form by writing corrections directly on it (e.g. change in gear, owner's address, etc.) and noting the vessels' catch of squid, mackerel, and butterfish for the past year. NMFS would process the application upon its return and issue a renewed permit. The following cost estimates for new and renewed permits were obtained from the NMFS Analytical Services Branch (Terrill, pers. comm.):

1) Costs to Issue Each NEW Permit:

Computer costs	2.88	
Labor costs	1.60	
Permit form & mailer	0.15	
Postage	0.22	
TOTAL		4.85 X 3,100 permits = $15,035 (maximum)

2) Costs to RENEW Each Permit:

Computer costs (half)	1.44
Labor costs	0.96
Permit form & mailer	0.15
Postage	0.22
TOTAL	2.77 X 3,100 permits = $8,587 (maximum)

Notes:

- The cost of mailing out permit application forms adds an additional $185.
- Labor costs equal 16 cents per minute. This is the wage rate for a government employee at Level GS-5 Step 1 ($14,390) plus overhead of 27.5% (benefits and taxes).

4.2.3. Benefits

The benefits of instituting an annual permit system are several. The first and most direct benefit is the value to managers of knowing how many participants are actively engaged in a given fishery, as well as basic information on how it is being executed (gear types, vessel sizes, etc.). Those who are familiar with the current (perpetual) permit system are aware that fishermen can obtain a permit for any fishery (except Surf Clams) simply by checking off boxes on the application form. The most common tendency is to check off all the boxes, regardless of whether a real interest exists for participating in any given fishery. This may be simply for the purpose of leaving all options open, or in some cases fishermen fear the prospect of a limited entry program being instituted at some point in the future, and wish to establish a record of having participated.

There is no current provision for discovering if a given vessel did indeed exercise its right to fish for any particular species. Nor is there any capability for updating this information across time. A vessel may actually have participated in a fishery, but then left it a short time later. Its name will still appear in the permit files on an equal basis with the rest.

In essence, the fishery manager is currently denied the most fundamental information on entry to and exit from the fishery. It should also be remembered that substantial costs were incurred in setting up the present system, and continue to accrue from maintaining it. Whereas the value of the information generated by the system is minimal. The modifications proposed by this Amendment not only greatly improve upon the system, but they will justify the investment that has already been made in it.

A second benefit from the new system is a vastly improved ability to conduct the Regulatory Impact Reviews of management plans which are required of the Councils by E.O. 12291. In order to assess the impacts of management measures on fishermen, it is clearly necessary to be able to identify who these fishermen are.

A third benefit is that the three-tier information collecting system used by NMFS is based on samples. The Permit File, theoretically, is the one data bank available which covers 100% of the population in question. Clearly it would be beneficial to fishery managers to be able to utilize its full potential.

Fourth, this Amendment proposes the use of logbooks by 20% of the vessels in the squid, mackerel, and butterfish fisheries. In order to determine how many vessels are required for this 20% sample, as well as which vessels should be included in the population, the information provided by the proposed annual permit system is necessary.

Finally, it should be recognized that the Permit Files have the potential for being an invaluable data base on the East Coast fishing fleet as a whole, not simply from the perspective of individual fisheries. If annual permits were required across *all* fisheries, a comprehensive and continually updated data base would be the resultant product.

4.1.4. OMB Approval

The Office of Management and Budget has already approved the use of annual permits as requested on Standard Form 83. The current system allows for a total of 9,400 responses per year across all fisheries in the Northeast. With a mean response rate of 30 minutes per application, a total of 4,700 Public Burden Hours have been approved.

Since the greater part of permit renewal will be simply verifying and correcting information already printed on the renewal form, response time should require less than the approved 30 minutes. With the total number of permits issued in the squid, mackerel, and butterfish fisheries currently numbering 3,100, the limit of 9,400 responses per year presents no problem.

The only modification of the permit system proposed by this Amendment which may require OMB approval is in providing space on the renewal form itself for the past year's landings of squid, mackerel, and butterfish. The Council believes that adding these questions will not increase public response time beyond the approved 30 minutes.

4.2. Changing the fishing year

Changing the fishing year to the calendar year should reduce costs for both industry and government. Foreign fishing permits are issued on a calendar year basis and all of the species in the Atlantic foreign fishery other than squid, mackerel, and butterfish are managed on a calendar year. The April-March fishing year has resulted in foreign nations processing two joint venture applications (particularly for mackerel) in order to rationalize the differences between the fishing year, calendar year, and mackerel fishing season, resulting in doubling the work of the foreign nation and US joint venture partner, the State and Commerce Departments, and the Councils. Putting all of the management systems on the same time basis will simplify procedures, as well as leading to a substantial administrative cost saving. There will also be a reduction in costs since there will no longer be a need to maintain data on both a fishing year and calendar year basis.

In order to obtain a rough estimate of the administrative cost savings from changing to a calendar year, separate calculations have to be made for the agencies in Washington, DC and the two Councils. The Permits and Regulations Office in Washington has calculated the average cost of processing a permit as being $167 (Freese and Bilik, pers. comm.). The Department of State would be expected to spend only a fraction of the time spent by the Councils or NMFS in processing permits, and a reasonable figure would be in the vicinity of one-third, or $56 per permit. At an annual average of 10 joint venture applications (or 20 permits given the current system) for the Northeast Region over the last 4 years (Table 29), the total administrative cost savings would come to $2,230 each year in Washington, D.C.

The Councils, however, require a more extensive analysis. Joint venture discussions are an important agenda item for at least 3 Council meetings occurring in the period December through March. Committee meetings occur prior to each Council meeting in order to formulate recommendations. To calculate the value of the man-hours invested in this process, the following estimates are provided:

At a COUNCIL MEETING:
- 20 Council members at an average $33.00 per hour ($263 per day compensation)
- 5 Council Staff at an average $15.00 per hour ($30,000 annual salary)
- 5 NMFS personnel at an average $20.00 per hour ($40,000 annual salary)

At a COMMITTEE MEETING:
- 5 Council members at an average $33.00 per hour ($263 per day compensation)
- 6 NMFS personnel and Council Staff at an average $20.00 per hour ($40,000 annual salary)

It is assumed that for Council meetings, each individual will have spent one hour preparing for joint venture discussions, and three hours in the actual discussions at the meeting. For Committee meetings, it is assumed that each individual will have spent three hours in preparation and three in discussions.

Making the required calculations, one arrives at a cost of $5,050 associated with Council and Committee deliberations on joint ventures for each meeting. Multiplying by 3 for each of the 3 meetings yields $15,150 per year per Council. Finally, adding the two Councils together brings the total annual cost to $30,300.

Clearly, however, this entire amount will not be saved by changing the fishing year and removing the need to issue permits twice. The Mid-Atlantic Council estimates that a time savings of approximately 50% will accrue from the change, yielding a value of $15,150 as the total administrative cost savings for the Councils. When the $2,230 from the agencies in Washington, D.C. is added, the total overall savings comes to $17,380. It should be noted, however, that this figure is a very conservative estimate. When a controversial application is under consideration, these costs (and corresponding savings) increase significantly.

Theoretically, changing the fishing year could affect US fishermen who fish in the October-March period. January-March constitute the end of the current fishing year and fishermen active in those months face a potential closure since any closure would come at the end of the year whereas with the revised fishing year these fishermen would be active in the first quarter, thus virtually eliminating the chances of a closure during their season. Fishermen active during the October-December period have faced relatively little chance of closure in the past, whereas with the changed fishing year their activity will be placed closer to the end, and have a greater chance of being affected if there is a closure. Reviewing seasonal catch data (Tables 14, 18, and 21) suggest that the chances of real negative impacts from changing the fishing year are minimal.

Additionally, the change in the fishing year will change the period during which earned TALFFs are allocated. During the last four months of fishing years 1983-84 and 1084-85 over 67% of the *Loligo* and 30% of the *Illex* TALFFs were allocated (Table 36). When the fishing year coincides with the calendar year this earned TALFF will be allocated during the fall season. The winter earned TALFF allocations result in foreign fishing on squid while they are concentrated just prior to their inshore migration. US fishermen report that just prior to and during this inshore migration the squid are easier to catch because they are schooled and larger. Should the US harvesting sector increase its capability to harvest these schools, a direct conflict will exist. Recent developments in the fishing industry suggest this may occur.

The fishing year change will allow for the existing pattern of limited TALFF allocations as part of joint ventures (or no "TALFFs except bycatch when the appropriate conditions develop) to be made early in the year. To the extent that foreign nations meet or exceed their commitments in a way that determinations are made that they have earned additional TALFF allocations, these allocations could be made and fished during the fall.

4.3. Revised bycatch TALFF percentages

The methodology for developing the revised bycatch TALFF percentages is set forth in section 7.3.2. The revisions reflect the average recent performance of the nations that have been in the foreign fishery and therefore should not have a negative impact on the foreign fishery. They should have a positive impact by making more fish available for directed fisheries by both US and foreign fishermen while maintaining the principle of assured bycatch TALFFs.

4.4. Revised mackerel regime

The changes to the mackerel OY setting processes should have no administrative cost impacts.

Revising the recreational catch forecasting equation should have no impacts. This change was made to incorporate the most recent recreational catch data so that the FMP is consistent with National Standard 2.

The increase in the minimum spawning stock size (Section 5.4.3) was made to incorporate the most recent available data which indicates that 7 of the 9 year classes produced when the spawning stock biomass exceeded 600,000 mt were above the median year class (Figure 6). Benefits should, therefore, be positive by increasing the probability of good year classes to provide the basis of a stable fishery over the buffer provided by the previous 400,000 mt minimum.

Revising the mackerel regime to replace the TALFF-Reserve system with the ABC-IOY system should assist in development of the US fishery. The rate or magnitude of such development cannot be quantified. However, it is clear, based on the butterfish and squid experiences, that so long as foreign nations can get unconditioned, direct fishing allocations for their fleets they will not purchase US harvested or processed fish. So long as a species can be caught in waters other than the US FCZ, or so long as there are substitutable species, there is no assurance that any foreign nation will purchase US caught or processed fish. Without some stimulus in terms of foreign purchases of US caught or processed fish, it is highly unlikely there will be significant fishery development.

The amended mackerel regime allows for increased flexibility in dealing with US and world market conditions at no additional cost. The revision consists of the elimination of reserves, basing TALFFs on a fish and chips policy, and the latitude to increase OY from the $F_{0.1}$ level on a yearly basis should US economic conditions warrant it. These changes will make the FMP compatible with the most recent amendments to the MFCMA and the NMFS Fish and Chips Policy (USDC, 1985a).

The market under consideration is that for raw (as yet unprocessed) mackerel harvested off the US east coast. Total demand in this market may be considered as having five components: US commercial, US recreational, joint ventures, foreign bycatch TALFFs, and requests for directed foreign fishing (TALFFs). Supply equals ABC, which may be specified in two ways pursuant to Amendment #2. The first specification of ABC/supply is an allowable catch bounded at the top by $F_{0.1}$ and at the bottom by a spawning stock biomass of 600,000 mt, which is essentially the same as the current FMP. The second specification of ABC/supply is an allowable catch bounded only by the 600,000 mt spawning stock biomass.

A sensitivity analysis was conducted examining three scenarios under the present and proposed regimes. The first is when total demand is less than or equal to ABC/supply at any level; the second is when US demand (commercial, recreational, and joint venture) and bycatch TALFFs combine to be equal to or greater than ABC/supply; and third, when total demand is greater than ABC/supply.

The first scenario of adequate or excess supply would completely satisfy both US and foreign demand under both the current and proposed regimes. However, under the new regime, the TALFF would not be automatically specified as half the difference between IOY and DAH. Instead, TALFF would be a negotiable amount based on criteria set forth in the MFCMA and the FMP.

In the second scenario, US demand and bycatch TALFF are equal to or greater than ABC/supply. If these are equal to the ABC/supply under the current FMP then there is no directed TALFF and if domestic demand is greater than ABC, only that amount in excess of bycatch TALFF is allowed for DAH. Under the revised regime US demand would still be considered first; the RD would have the option, however, based on economic considerations, to adjust OY up to the limit of ABC/supply calculated using only the 600,000 mt spawning stock biomass rule. This decision would have to be based on the specific demand criteria, their economic implications, and any current biological considerations.

The third scenario consists of total demand being greater than ABC/supply. By definition, the excess demand is caused by directed TALFF requests (all other possibilities are included in the second scenario). Under the current FMP there is a bargaining potential for the reserves and for the initial TALFF. However, under the revised regime all TALFF becomes negotiable. Since demand is high in this scenario this places the US in a stronger position to bargain for increased technology transfer, purchases of US harvested fish, research, etc.

The costs of revising the mackerel regime are primarily administrative. Most of these costs are already expended by the time the FMP is submitted and reviewed. Therefore, they must be considered sunk costs. They are costs that will be expended whether the measure is approved or not. There will be a marginal increase in permit review costs since TALFF will be negotiable. However, the system has informally operated in this mode for the past year, so costs are not expected to increase over the current level. Some foreign directed and joint venture mackerel fishing may not occur that otherwise would based on negotiable TALFF, but, again, this is probably only marginal since the proposed FMP merely institutionalizes an existing policy.

The benefits of the revised regime are demonstrated in Table 37. The option value of the change is neutral or positive throughout.

The scenario of supply being greater than total demand is the most probable case. In this scenario the situation under this FMP would mirror present policy and practices. There would be no change in US costs or allocations. However, this FMP formalizes Council policy and Council, NMFS, and State Department practice and therefore reduces confusion and discrepancies concerning joint venture and directed TALFF allocations.

The greatest possible gain to the US could come from scenario two if US demand were greater than ABC/supply while ABC/supply was at a high level. The second highest gain to the US is the third scenario at any ABC/supply level (under this circumstance foreign bidding for TALFFs and joint ventures would increase US gains).

The Council believes that setting ABC/supply greater than $F_{0.1}$ will occur most likely only if the northeast (European) Atlantic mackerel fishery collapses or is so reduced as to be unable to supply its markets. Should this occur it is expected that foreign dealers and processor will apply to the US for for combinations of direct purchases of US harvested mackerel, joint ventures, and directed TALFF. If the requests are of such a magnitude as to exceed the ABC/supply that would follow from the $F_{0.1}$ provision, the revised regime allows for exceptions on a one year at a time basis The TALFFs will be judged on an individual basis on the criteria set forth in this FMP and the MFCMA. The economic gains from each can then be evaluated and compared. The optimal situation would be to maximize each country's willingness to pay as exemplified in Crutchfield (1983) and Chen (1982). Under a situation of demand exceeding supply the maximum payment could be extracted from each country in fees, purchases of US harvested fish, technology transfer, etc. By allowing a greater supply to become available there could be a greater gain possible. This could only be determined at the time of the excess demand. The decision would have to depend on, among other items, the exact reasons fostering excess demand, the specific economic gains offered to the US, the projected duration of elevated demand, and the development potential of domestic industries.

After the economic considerations have been evaluated a decision would be arrived at to determine the actual harvest level allowed. If the spawning stock was lowered to 600,000 mt " cost" would be the number of years required for stock rebuilding to an acceptable level. This recovery period, of course, depends upon the fishing rate in the subsequent periods. With a spawning stock biomass of roughly 600,000 mt, if subsequent annual harvest reverted to levels of $F_{0.1}$ then there would be a slight (3% on average) stock rebuilding per year (Anderson, 1983). Of course, at levels below $F_{0.1}$, the rebuilding rate would be correspondingly increased as has been the case since the Atlantic Mackerel Supplement #1 was implemented in 1979. These costs and benefits could be evaluated at the margin to determine the optimal harvest level based on the specific criteria involved.

Recent review of data on the European segment of the species (Anonymous, 1985) indicate two well-separated overwintering areas and two major spawning grounds with both activities occurring in the Celtic Sea and the northern North Sea. The ICES hypothesis is that of separate European spawning stocks and thus they perform separate assessments. No reference identifying intermixing between European and American segments of Atlantic mackerel is known.

World landings of Atlantic mackerel have varied significantly from the mid-1970s to the mid-1980s (FAO, 1985). In 1975 there were nearly 1.1 million metric tons of Atlantic mackerel landed from both sides of the North Atlantic whereas in 1983 (the last year for which data are available) the landings were only slightly more than 600,000 mt. A slow by steady decline appears evident in landings for the total North Atlantic since 1979 when 671,400 mt of mackerel was landed (1980: 656,200 mt, 1981: 634,500 mt, and 1982: 624,800 mt). Since total North Atlantic landings of mackerel in US waters during 1979 to 1983 reached 15,000 mt (Table 4) the US controlled portion of the total Atlantic landings never exceeded 3%, and the decline in landings is attributable solely to activities in the Northeast Atlantic ocean. This apparent slow decreasing trend in total Atlantic mackerel landings is likely to continue for awhile since the ICES Mackerel Working Group (Anonymous, 1985) is interpreting recruitment indices to indicate very weak 1982 and 1983 year classes in European waters.

World demand for Atlantic mackerel primarily is supplied from northeast Atlantic catches. These catches by the European Community (EC) have varied from 829,100 to 572,100 mt over the past 10 years (FAO, 1985). In recent years the threat of overfishing this stock has been identified by scientists and commissions (Fishing News, 1984, 1985a). There seems to be a reluctance on the part of the EC to reduce quotas. In fact, some member countries are notorious for grossly overfishing their mackerel quotas (Eurofish, 1985 a and b). This would suggest that demand factors currently exist at sufficient level to induce overfishing.

The largest markets for Atlantic mackerel seem to be the USSR (at-sea deliveries of European Community catches) and West African countries (canned and frozen products) (Dunbar, 1981). In addition, demand is being cultivated in Europe where canned mackerel is replacing canned herring (Infopesca, 1981). Less developed countries, particularly along the African west coast and especially Nigeria, are viewed as having strong market potential depending on their specific economic (oil related) conditions (Dunbar, 1981).

Foreign nations which are direct purchasers of mackerel often use floating processors and transshipping fleets to transport the mackerel to market. The economics of operation dictate that the most efficient use of these fleets is for continuous operation. Due to the EEZs of most countries, these second parties purchase their catch directly from fishermen (Dunbar, 1981). Such mobile fleets represent "roving" demand which is able to respond to shifts in availability. Shore based processors are less able to respond to a shift in availability unless their catch can be or already is delivered in a frozen state.

Canned mackerel is used by many countries for food aid to less developed countries and to countries devastated by natural disasters (Dunbar, 1981. This is made possible by mackerel's high nutritional value and low harvesting cost.

Initially the EX subsidized mackerel exports to foreign countries. In late 1983 these subsidies were halted since it was determined that the foreign markets were strong enough to allow profitable unsubsidized exports (Fishing News, 1983). However, by 1985 UK mackerel prices were not as strong as expected even in the face of future supply decreases. One reason for lower prices was that the Eastern bloc countries "... have ruled by division to push the price down" (Fishing News, 1985b). This demonstrates the buying power of the Eastern bloc countries and their combined effect on the Atlantic mackerel market.

4.5. Revised butterfish regime

The changes to the butterfish OY setting processes should have no administrative cost impacts. This is because the procedure to establish annual OY under Amendment #1 is the same as utilized by this Amendment #2.

The revision to the butterfish ABC-OY process will reduce the chances of the stock being overfished because of the lack of flexibility of the current FMP.

The current and projected economic conditions in the butterfish fishery are such that the total ABC is harvestable by US vessels and the bycatch TALFF. However, with increased fishing effort it becomes necessary to allow modification for biological considerations in a timely manner. In order to evaluate the impacts of a reduced ABC due to biological reasons it is desirable to analyze the costs and revenues that would accrue to harvesters and processors under various scenarios. These figures could then be added across the number of participants to determine overall and marginal costs and revenues for butterfish. These data would give some indication of the change in producer surplus associated with a butterfish OY reduction.

At the present time the NEFC does not retain vessel identifiers across months (Peterson, pers. comm.). Therefore, it is impossible to acquire individual vessel cost, revenue, or effort data across time. Also, it is possible to determine the actual number of vessels involved in either the directed or incidental butterfish fishery. Likewise, the processor surveys conducted by NMFS are voluntary. Therefore, they tend to underestimate the actual number of processors and dealers involved in butterfish. NMFS's best estimate of the number of processor is described in Section 8.2. The cost, revenue, and volume data for the processors is not mandatorality reports. Therefore, accurate overall and marginal cost and revenue data are unavailable for this sector of the fishery also.

The best estimate of the number of vessels actually participating in the butterfish fishery is 719 (Frailey, pers. comm.). These vessels are distributed along the eastern seaboard from Maine to North Carolina. Most butterfish landings have been in Rhode Island. Therefore, it is expected that many of the vessels were based for all or part of the year in southern New England. Likewise, it is expected that the largest volume of processed butterfish occurred in southern New England. therefore, the processing plants there probably were the main handlers of butterfish. The fishery is expanding into the Mid-Atlantic.

A closure of the butterfish fishery due to a reduced ABC/OY would affect the fishery in two major ways. A reduced OY would only occur if the stock were reduced from present levels. Assuming a constant effort level, that would infer lower harvest throughout the year due to decreased abundance. The second major affect would be a possible closure sometime during the year. This may or may not occur depending on what reduction, if any, occurs in the catch.

Due to butterfish biology (Sections 5.3.4 and 5.4.4), an increased population could occur relatively rapid following one strong year class. If the harvest level is not adjusted downward then growth overfishing would probably occur and the stock would remain at lower levels.

The worst case foreseen is a reduction of ABC to zero (or more technically correct, to bycatch TALFF only levels). This would be caused by a severe reduction in both commercial landings per unit of effort (if measurable) and year class abundance. Such a severe reduction would certainly be proceeded by reduced landings per unit of effort. Likewise, total landings would not doubt have been reduced for some previous period. These reductions would be due to stock rather than market factors. A total elimination of US landings would therefore have to be compared to what the market had been at the time of restriction. If it is assumed that the total landings the year prior to the reduction were 8,000 mt or half of current landings, the revenues lost would be $4,384,000 (at the average 1984 ex-vessel price of $.27/lb; USDC, 1985a). The effort directed toward butterfish would be redirected to some extent. Therefore, new revenues would be obtained from other fish stocks by the same boats and crew. It is assumed that the net revenues obtained from this redirected effort would be less than that obtained from butterfish fishing. This is because the most lucrative fishery would probably be the first choice. The change in ex-vessel revenue, both gross and net, is not expected to be substantial. The actual change would depend on the number of boats still fishing for butterfish before the closure, their operating costs, catch, and profits, and the fisheries to which they redirect, including new costs, etc.

The dealers and processors still involved in butterfish marketing would be impacted also. They would either redirect to other species or close during their butterfish season. Since no operator is known to rely solely on butterfish and since any total closure would presumably be proceeded by a period of poor harvests, it is assumed that no dealer or processor would be forced out of business.

Overall producer and consumer surpluses would be reduced by the lack of butterfish. Producer surplus can only be determined if costs and revenues are known (which they are not). The largest impact may in fact be consumer surplus. Most of the butterfish are for the export market, specifically Japan, so the vast majority of consumer surplus is foreign. Foreign consumer surplus is unknown. The primary substitutes for Atlantic butterfish in the Japanese market is Pacific butterfish, sea bream, and jack mackerel (USDS, 1979). Based on world catch statistics (FAO, 1985), catches of these substitutes are at much higher levels than Atlantic butterfish. A total closure of Atlantic butterfish would reduce Japanese consumer surplus. The magnitude of this reduction in consumer surplus is unknown. In order to evaluate the reduction, domestic marketing studies (including demand variables, income levels, market prices, substitutes, etc.) of Atlantic butterfish consuming countries are necessary. US consumer surplus would be almost totally eliminated barring availability of substitutes. This surplus is unknown, but in total presumed to be not substantial. Domestic consumption is discussed in Section 8.2. Based on their reproductive capacity, butterfish could be expected to recover to a level sufficient to provide some harvest within, at most, two years, providing environmental conditions are not restrictive. Upon resumption of harvest it is likely that the ABC would be approximately equal to that assumed to exist before the closure. Within two or three additional years the population could be expected to have returned to its present level and the ABC would be the present 16,000 mt.

It is unknown whether the butterfish population could rebound to its present level from a severely depressed level without a reduced quota or closure. The directed effort at any point in time would be important. As stated previously, the current effort levels are unknown as are estimates of projected levels during any population decrease. If the population would not rebound on its own, the effect would be continued growth overfishing, reduced harvests, reduced profits, higher consumer prices, reduced consumer surplus, and reduced exports. This would continue until such time as the population did rebound. If the stock rebounded on its own without a regulated reduction in fishing effort, then these problems would be eliminated. The chance of a natural rebound in the face of growth overfishing is determined by the Council to be possible but not very likely.

4.6. Prices to consumers

The Amendment should have no effect on consumer prices. Any reporting cost increases should not be large enough to influence consumer prices. The butterfish size limit should not effect the US market, which generally uses fish considerably larger than

the small sizes. To the extent the butterfish size limit has a beneficial effect on the stock, the size limit lessens the chances of price increases resulting from future shortages.

4.7. Enforcement

The regulations revised by this FMP reduce overall enforcement costs. Cost of enforcement of the foreign fishing regulations does not change.

Effect on Endangered Species and on the Coastal Zone

Neither the Amendment or the alternatives would constitute an action that "may affect" endangered or threatened species or their habitat within the meaning of the regulations implementing Section 7 of the Endangered Species Act of 1973. Thus, consultation procedures under Section 7 will not be necessary on the Amendment.

Also, the Amendment will be conducted in a manner consistent, to the maximum extent practicable, with the Coastal Zone management Programs within the meaning of Section 307(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations. States with approved CZM programs are Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, and Maryland. Copies of this Amendment were mailed to states with CZM programs with a determination that the programs were either not affected by the Amendment or or were consistent with it. New Hampshire, Connecticut, New York, New Jersey, Pennsylvania, and Delaware have concurred with the Council's evaluation. Massachusetts acknowledged receipt of the Council's determination on 15 July 1985 but submitted no additional comments. Maine, Rhode Island, and Maryland made no response.

Effects on Flood Plains or Wetlands

The Amendment or its alternative will not adversely affect flood plains or wetlands, or trails and rivers listed or eligible for listing on the National Trails and Nationwide Inventory of Rivers.

List of Agencies and Persons Consulted in Formulating the Proposed Action

In preparing Amendment #2, the Council consulted with NMFS, the Fish and Wildlife Service, the Department of State, and the States of New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia through their membership on the Council. In addition to the States that are members of the Council, Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut will be consulted through the Coastal Zone Management Program consistency process. A list of the agencies and persons sent copies of the Amendment, including the EA and RIR, and notice of the public hearings is Exhibit A to this EA.

List of Preparers of Environmental Assessment and Plan Amendment

Amendment #2 was prepared by John C. Bryson, David R. Keifer, Thomas Hoff, Richard Tremaine, and Clay E. Heaton of the Council staff. The need for management and range of alternative solutions was determined from a variety of sources including NEFC assessments and several meetings of the Council's Squid, Mackerel, and Butterfish Committee, along with the New England Council's Foreign Fisheries Committee and industry advisors. The Squid, Mackerel, and Butterfish Committee is made up of Ray Richardson, Barbara Stevenson, Harry M. Keene, Joe MacMillan, and Ron Smith. The members of the Foreign Fisheries Committee are Jim Salisbury, Bob Smith, John Cronan, Phil Coates, Dan Reifsnyder, and Tony Verga. The industry advisors were Phil McSweeney, Rick Lofstad, Dan Cohen, Harry Axelsson, Jim Ruhle, David Martin, Henry Braithwaite, and Jim McCauley. Salvatore Testaverde (NMFS, NERO), Gordon Waring and Emory Anderson (NMFS, NEFC), and Ann Hochberg (NEFMC) also assisted with the Amendment.

Findings of No Significant Environmental Impact

For the reasons discussed above, it is hereby determined that neither approval and implementation of the proposed action nor the alternative would affect significantly the quality of the human environment, and that the preparation of an environmental impact statement on the Amendment is not required by Section 102(2)(c) of the National Environmental Policy Act nor its implementing regulations.

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Assistant Administrator for Fisheries, NOAA Date

APPENDIX 3. REGULATORY IMPACT REVIEW

1. INTRODUCTION

1.1. Purpose

The purpose of this document is to present an analysis of the proposed regulations for Amendment #2 (Amendment) to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (FMP). This document has been prepared in compliance with the procedures of the National Marine Fisheries Service (NMFS) to implement Executive Order (E.O.) 12291. The document also contains an analysis of the impacts of the Plan relative to the Regulatory Flexibility Act and the Paperwork Reduction Act of 1980.

The development of the FMP is discussed in Section 4.1 of the Amendment. The problems are discussed in Section 4.2 of the Amendment. The management unit is all Atlantic mackerel, *Loligo pealei*, *Illex illecebrosus*, and butterfish under US jurisdiction, excluding the Gulf of Mexico and the Caribbean Sea.

1.2. Description of User Groups

The fishery is described in Sections 7 and 8 of the Amendment.

1.3. Management Objectives

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the US commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

1.4. Provisions of the Amendment

The management measures are set forth in Section 9.1 of the Amendment.

2. REGULATORY IMPACT ANALYSIS

The benefits and costs of the proposed management measures are discussed in Section 9.2 of the Amendment. The Council has concluded that the benefits outweigh the costs.

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

1. Will the Plan have an annual effect on the economy of $100 million or more.
2. Will the Plan lead to an increase in the costs or prices for consumers, individual industries, Federal, State, or local government agencies or geographic regions.
3. Will the Plan have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of US based enterprises to compete with foreign based enterprises in domestic or export markets.

The Amendment should not have an annual effect of $100 million or more since the total fishery had a value of only about $15 million in 1983 (Tables 11,15, and 19).

The Amendment should not change prices. Cost impacts are discussed in Section 9.2 of the Amendment.

The Amendment should have positive effects on competition, employment, investment, productivity, innovation, and on the ability of US based enterprises to compete with foreign based enterprises in domestic or export markets.

3. IMPACTS OF THE FMP RELATIVE TO THE REGULATORY FLEXIBILITY ACT AND THE PAPERWORK REDUCTION ACT OF 1980.

The Regulatory Flexibility Act (RFA) requires the examination of the impacts on small businesses, small organizations, and small jurisdictions. Most of the fishing boats and businesses affected by this action are small entities for the purposes of the RFA. The summation of the direct costs of the regulations imposed by this FMP do not have a significant economic impact on the entities involved (section 9.2.2.2) and those public burden hours involved have already been approved by OMB. The imposition of a minimum butterfish count could have a financial effect on some small entities. However, due to the developing nature of the US harvesting fleet, the export market conditions, and the localized nature of the landings, the overall effect is expected to be neutral or positive (section 9.2.2.7). The impacts of the Amendment do not favor large businesses over small businesses. Both large and small businesses can benefit from the development of the fishery, from improved data collection, and from measures to protect the butterfish resource.

The Paperwork Reduction Act concerns the collection of information. The intent of the Act is to minimize the Federal paperwork burden for individuals, small business, State and local governments, and other persons as well as to maximize the usefulness of information collected by the Federal government. This Amendment changes the FMP's permitting requirements (Section 9.1.2.1) because of a need to obtain improved information about the fisheries. The revisions are designed to keep the costs as low as possible (Section 9.2.2.1). The system should not be burdensome. It was developed in consultation with industry advisors in order to improve its acceptability.

APPENDIX 4. PUBLIC HEARINGS SUMMARIES

24 July 1985, Norfolk, VA

The hearing began at 7:29 pm. The moderator was MAFMC member Dr. William Hargis, Jr. Also present were Dr. Robert Lippson, NMFS, David R. Keifer, MAFMC staff, and six members of the public.

Mr. Keifer reviewed the provisions of Amendment #2.

Mr. James Ruhle indicated that the 500 count minimum size limit for butterfish might hurt the fishery in the southern part of the Mid-Atlantic and suggested that a 600 count might be better. He also recommended that the Polish mackerel research program continue since research as part of a directed fishing/joint venture project would be inadequate because of the need to accomplish the objectives of the JV and also because of the experience of the Poles.

Mr. Charles Amory recommended improvements in JV arrangements so that foreign nations would not be able to complete their directed fishing operations prior to complying with other conditions (purchase of US processed fish or over the side purchases).

The hearing ended at 8:24 pm.

25 July 1985, Cape May, NJ

The hearing began at 7:29 pm. The moderator was MAFMC member Capt. David H. Hart. Also present were Dr. Robert Lippson and Pat Heying, NMFS, Stu Tweed, Cape May County Extension, Gef Flimlin, Ocean County Agriculture Center, David R. Keifer, MAFMC staff, and eight members of the public.

Mr. Keifer reviewed the provisions of Amendment #2.

Michael Genovese opposed prohibiting mechanical sorters because they improve efficiency and recommended the butterfish size limit be 600 to 700 count.

Dan Axelsson opposed prohibiting mechanical sorters because they improve efficiency and recommended the butterfish size limit be 600 count.

Lars Axelsson supported Amendment #2 except prohibiting mechanical sorters because they improve efficiency and the 500 count butterfish minimum size limit.

Harry Axelsson opposed prohibiting mechanical sorters because they improve efficiency and recommended the butterfish size limit be 600-675 count. He also felt that it would be very difficult to maintain fishing vessel records on a daily basis.

Gef Flimlin indicated that a strategy directed at developing export markets led to overcapitalization in US agriculture and questioned whether the export development strategy advocated by the objectives of the Atlantic Mackerel, Squid, and Butterfish FMP might have similar negative impacts on the fishery.

The hearing was closed at 8:25 pm.

29 July 1985, Fairhaven, MA

The hearing began at 7:14 pm. The moderator was MAFMC member Mr. Harry M. Keene. Also present were Mr. Edward MacLeod, NMFS, Robert Smith, New England Council; David Borden, RI Marine Fisheries; Ann Hochberg, NEFMC staff, David R. Keifer, MAFMC staff, and twenty members of the public.

Mr. Keifer reviewed the provisions of Amendment #2.Paul Gorman (Attachment A) advocated the use of mesh regulations rather than prohibiting sorters. He felt that the sorter prohibition would impact vessels that are being upgraded and would give onshore processors an advantage.

Chuck Michand stated that offshore boats should not have sorting machines in order to conserve the stocks.

Pat Young (Attachment B) proposed at 3" minimum mesh size rather than a butterfish size limit. He felt that sorting machines are necessary. If observers are necessary they should be paid by the government. Data is needed for management and a committee should be established to develop how data can be collected from the vessels.

Geir Monsen (Attachment A) indicated that the change to the fishing year is satisfactory as is the change to the bycatch TALFF percentages, but felt that some of the currently "prohibited" species should be added to the bycatch TALFF list. The change to the mackerel regime might increase the foreign catch, thereby hurting

US development efforts. The change to the butterfish regime is satisfactory but it should be possible to increase the OY to greater than 16,000 mt because the basis of the 16,000 mt is weak. The butterfish minimum size limit will not be effective since the fish are dead when they come on deck; a 3" minimum mesh size would be better. Sorters are necessary and the observer requirement is unconstitutional. NMFS personnel feel the 3-Tier System is adequate for management. Any data system should be voluntary for all or mandatory for all.

Richard Goodwin (Attachment A) favored a mesh regulation in place of a butterfish size limit and prohibition of sorters. Sorters are needed most when 60-80% of the catch is larger fish in order to remove the small percentage of small fish.

Donald Follett indicated that foreign buyers demand a graded product. Observers would be needed at the docks on a 24 hour basis in order to assure that the sorter ban for the vessels would not negatively impact the vessels to the benefit of the onshore processors.

Gerald Paquette (Attachment C) recommended that for joint ventures the US processed to directed foreign fishing ratio should improve every year beginning at 3:1. He stated a 3" mesh should be used in place of the 500 count limit and that grading machines should be legal. Additionally, he felt that freezer trawlers should not be singled out in reporting.

Peter Golten indicated that as long as buyers are willing to buy small fish they will be landed. He said small fish should be kept in the ocean.

The hearing ended at 8:28 pm.

30 July 1985, Galilee, RI

The hearing began at 7:00 pm. The moderator was MAFMC member Mr. Harry M. Keene. Also present were MAFMC member Barbara Stevenson, Robert Smith, New England Council; David Borden, RI Marine Fisheries; Ann Hochberg, New England Council staff, Pat Kirkle, NMFS RO, Liz Casey, NOAA GCNE, David R. Keifer, MAFMC staff, and 45 members of the public.

Mr. Keifer reviewed the provisions of Amendment #2.

Paul Gorman questioned whether the Amendment would remove the sorting machines from foreign fishing vessels. He indicated that a mesh regulation would allow more immature fish to live.

Brian Dorman (Attachment D) supported the use of grading machines and the 3" minimum mesh size for butterfish.

Fred Bensen supported the use of sorters so the fishermen know the value of their catch before it is sold and to maintain a competitive position.

Lucy Sloan (National Federation of Fishermen) indicated that vessel owners and operators would be liable for observers and this could create insurance problems.

Jack Wescott said mechanical sorters were bad and allow fishermen to discard 90% of their catch.

Guido Sambrini indicated that freezer/trawlers have a great potential for Rhode Island and could help make Davisville a major port. He expects Federal help in such development. Conservation is necessary. He supported a mesh regulation.

Jim McCaully stated the board of directors of the Pt. Judith Coop opposed sorters, but indicated the Coop would not put forth an official position until the membership had been polled.

Donald Follett questioned what enforcement would be like for the butterfish size limit. If sorters are prohibited on the boats they should also be prohibited on shore.

Capt. Loftes opposed the use of sorters.

Gerald Paquette stated that prohibiting grading machines will lower the price that freezer/processors are able to pay the vessels they buy from.

Thomas Faherty advocated the use of a mesh regulation in the butterfish fishery.

Alvin Stettbacher, Jr. (Attachment E) preferred a 600-650 count and a 3" minimum mesh for butterfish and opposed the prohibition of sorting machines.

The hearing ended at 7:50 pm.

31 July 1985, Riverhead, NY

The hearing began at 7:15 pm. The moderator was MAFMC member Mr. Harry M. Keene. Also present were MAFMC member Warren Hader, John Mason, NY DEC, Emerson Hasbrook, NMFS, David R. Keifer, MAFMC staff, and five members of the public.

Mr. Keifer reviewed the provisions of Amendment #2.

Floyd Carrington (Shinnecock Marlin and Tuna Club) recommended that the personal use exemption in the regulations be changed to match the FMP, that there be no directed foreign fishing, and that care be used in setting squid OYs to assure there is no overfishing because squid is a food for other fish.

Richard Miller (Long Island Fishermen's Assn.) stated that data needs should be met through the 3- Tier System, not through mandatory logs and that the butterfish size limit is unenforceable and will not help the resource or fishery.

Alan Macnow (Japan Fisheries Assn. and Japan Deepsea Trawlers Assn.) said there was inadequate justification for the reduction of bycatch TALFFs and that lowering bycatch TALFFS would work against achieving objective 3 since it would make it harder for foreign fishermen to catch their allocations and, hence, there would be less incentive for foreign nations to enter into joint ventures.

The hearing was closed at 8:05 pm.

APPENDIX 5. WRITTEN COMMENTS RECEIVED ON AMENDMENT #2

Three letters commenting on Amendment #2 to the Atlantic Mackerel, Squid, and Butterfish FMP were received by the Council. One was from the State Street Bank and Trust Company of Boston, MA (Attachment A), another was from the Region I (Boston) office of the Environmental Protection Agency (Attachment B), and the third was from the New England Fishery Management Council (NEFMC) (Attachment C).

STATE STREET BANK

The State Street Bank recommended that mechanical sorters be allowed. The sorter regulation proposed in the public hearing draft of Amendment #2 has been deleted in the final version of the Amendment.

ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency agreed with the Council's determination that Amendment #2 will not cause significant adverse impacts on the environment.

NEW ENGLAND FISHERY MANAGEMENT COUNCIL

The NEFMC commented on three issues relative to the Amendment: the reporting provisions, the regulation of mechanical sorters, and the wording of the butterfish size limit.

The comment on the butterfish limit recommended that "size" be changed to "count" since the provision is technically a count rather than a size limit. This change was made in the final version of the Amendment.

Concerning mechanical sorters, the regulatory provision was deleted in the final version of the Amendment. The Council did not introduce a requirement that fishermen accept NMFS observers to study the butterfish size discard problem. However, the Council has requested that NMFS study issues relating to butterfish size, including mesh selectivity.

Concerning reporting, the Council did not materially change the data collection program from the hearing draft. The NEFMC comment appears to confuse the special butterfish study with the need for improved fishery data. The Council's view is that the butterfish study can be accomplished by the NEFC using the traditional tools available to it.

A review of history may be useful in understanding the different opinions of the Council and the NEFMC on the reporting question. The original Atlantic Mackerel, Squid, and Butterfish FMPs and the regulations implementing them included mandatory logbooks. NMFS never implemented the logbook requirements although they included the requirements in the regulations, apparently because of problems associated with implementation of the mandatory logbook requirement in the original Groundfish FMP. The problems with the Groundfish FMP logbook led to a withdrawal of that logbook and the creation of a task force assigned to, among other things, solve the reporting problem. The task force developed what is known as the "Three-Tier System" with tier one being the NMFS program of interviewing dealers and fishermen, tier two being a voluntary logbook system to gather data from areas where the tier one interview program did not or would not work, and tier three being special data collection, possibly including voluntary embarcation of NMFS observers on fishing vessels.

Tier one was implemented to the extent that it was the pre-existing Weighout System, which was designed for the New England marketing system and apparently worked for New England because a network of port samplers had been developed over time since the mid-1960s. However, tier one implementation has been inadequate in the Mid-Atlantic because the marketing system on Long Island differs materially from the New England model (knowledge of Long Island vessels is critical in this FMP) and because of inadequate deployment of port samplers south of Long Island.

In theory, tier two logbooks should have been implemented to solve the Mid-Atlantic problems, but to date it is the Council's understanding that they have not been used in an organized program.When Amendment #1 to the Atlantic Mackerel, Squid, and Butterfish FMP was being prepared, the Three Tier System was being finalized. The Council debated whether to continue the mandatory logbook requirement or adopt the Three Tier System. Amendment #1 (adopted by the Council 15 September 1983) identified certain special data the Council felt it needed and stated that, additionally, "...NMFS should collect all data required by the Act." Amendment #1 further provided "No more specific data collection methods or procedures are suggested. It is anticipated that a uniform data collection system for the region will be in place prior to the expiration of this Amendment".

The Council has concluded that a reporting system with data available for analysis soon after it is reported is critical to the development of the fisheries subject to this FMP. The SSC also identified the urgent need for current, adequate data. This system is designed to furnish data heretofore not supplied from the Three-Tier System, even though Amendment #1 required the data.

APPENDIX 6. ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FMP REGULATIONS

AUTHORITY: 16 U.S.C. 1801 *et seq.*

Subpart A - General Provisions

§655.1 Purpose and scope.

(a) The regulations in this part govern fishing for Atlantic mackerel, *Illex, Loligo*, and butterfish by fishing vessels of the United States in the EEZ off the coasts of the Atlantic States.

(b) The regulations governing fishing for Atlantic mackerel, *Illex, Loligo,* and butterfish by vessels other than vessels of the United States are contained in 50 CFR Part 611.

(c) This part implements the Fishery Management Plan for the Atlantic Mackerel, Squid, and Butterfish Fisheries of the Northwest Atlantic Ocean.

§655.2 Definitions.

In addition to the definitions in the Magnuson Act and in §620.2 of this chapter, the terms used in this part have the following meanings:

Atlantic butterfish or *butterfish* means the species *Peprilus triacanthus.*

Atlantic mackerel or *mackerel* means the species *Scomber scombrus.*

Charter or *party boat* means any vessel which carries passengers for hire to engage in fishing.

Fishery management plan (*FMP*) means the Fishery Management Plans for the Atlantic Mackerel, Squid, and Butterfish Fisheries of the Northwest Atlantic Ocean, as consolidated by amendment 3 and revised by subsequent amendments.

Fishing trip or *trip* means a period of time during which fishing is conducted, beginning when the vessel leaves port and ending when the vessel returns to port.

Illex means the species *Illex illecebrosus* (short-finned or summer squid).

Joint venture harvest means U.S. harvested Atlantic mackerel, squid, or butterfish transferred to foreign vessels in the EEZ or in the internal waters of a State. Transfers to foreign vessels in the internal waters of a State are governed under section 306(c) of the Magnuson Act.

Loligo means the species *Loligo pealei* (long-finned or bone squid).

Metric ton (*mt*) means 1,000 kilograms or 2,204.6 pounds.

Regional Director means the Regional Director, Northeast Region, National Marine Fisheries Service, 14 Elm Street, Federal Building, Gloucester, MA, or a designee.

Squid means *Loligo pealei* and *Illex illecebrosus.*

Vessel length means that length set forth in U.S. Coast Guard or State records.

§655.3 Relation to other laws.

(a) The relation of this part to other laws is set forth in §620.3 of this chapter and paragraph (b) of this section.

(b) Vessels fishing within the regulated mesh area defined at §651.20 of this chapter with cod end mesh size of less than 5.5 inches must apply to fish under the exempted fishery program as set forth in §651.22 of this chapter.

§655.4 Vessel permits.

(a) *General.* Any vessel of the United States which catches Atlantic mackerel, *Illex* and *Loligo* squid, or butterfish must have a permit issued under this section except vessels used by recreational fishermen taking Atlantic mackerel, *Illex* and *Loligo* squid, or butterfish for the personal use of such recreational fishermen.

(b) *Application.*

(1) Each applicant must submit a permit application signed by ythe owner or operator of the vessel on an appropriate form obtained from the Regional Director before November 1 of each year or at least 30 days before the date on which the applicant desires to have the permit made effective.

(2) Applicants shall provide all the following information (approved by the Office of Management and Budget under OMB control number 0648-0097):

(i) The name, mailing address including zip code and telephone number of the owner of the vessel;

(ii) The name of the vessel;

(iii) The vessel's U.S. Coast Guard documentation number, or the vessel's State registration number for vessels not required to be documented under provisions of Title 46 of the U.S. Code;

(iv) The home port or principal port of landing, gross tonnage, radio call sign, and length of the vessel;

(v) The engine horsepower of the vessel and the year the vessel was built;

(vi) The type of construction, type of propulsion, and the type of echo sounder of the vessel;

(vii) The permit number of any current or previous Federal fishing permit issued to the vessel;

(viii) The approximate fish hold capacity of the vessel;

(ix) The type and quantity of fishing gear used by the vessel;

(x) The average size of the crew, which may be stated in terms of a range; and

(xi) The quantity of *Loligo* and *Illex* squid, Atlantic mackerel, and butterfish landed during the year prior to the year for which the permit is being applied; and

(xii) Any other information concerning vessel characteristics requested by the Regional Director.

(3) Any change in the information specified in paragraph (b)(2) of this section must be reported by the applicant in writing to the Regional Director within 15 days of the change.

(c) *Issuance.* The Regional Director will issue a permit to the applicant no later than 30 days from the receipt of a completed application.

(d) *Expiration.* A permit will expire upon any change in vessel ownership, registration, name, length, gross tonnage, fish hold capacity, home port, or the regulated fisheries in which the vessel is engaged or on December 31 of the year for which the permit was issued.

(e) *Duration.* A permit is valid until it expires or is revoked, suspended, or modified pursuant to Subpart D of 15 CFR Part 904.

(f) *Alteration.* Any permit which has been altered, erased, or mutilated is invalid.

(g) *Replacement.* Replacement permits may be issued by the Regional Director when requested in writing by the owner or operator stating the need for replacement, the name of the vessel, and the fishing permit number assigned. An application for a replacement permit will not be considered a new application.

(h) *Transfer.* Permits issued under this part are not transferable or assignable. A permit is valid only for the fishing vessel and owner for which it is issued.

(i) *Display.* Any permit issued under this part must be carried on board the fishing vessel at all times. The operator of a fishing vessel shall present the permit for inspection upon request by any Authorized Officer.

(j) *Sanctions*. Procedures governing permit sanctions and denials are found at Subpart D of 15 CFR Part 904.

(k) *Fees*. No fee is required for any permit issued under this part.

§655.5 Recordkeeping and reporting. (Reserved)

§655.6 Vessel identification.

(a) *Official number*. Each fishing vessel subject to this part over 25 feet in length must display its official number on the port and starboard sides of the deckhouse or hull, and on an appropriate weather deck so as to be visible from above.

(b) *Numerals*. The official number must contrast with the background and be in block Arabic numerals at least 18 inches in height for vessels equal to or over 65 feet, and at least 10 inches in height for all other vessels over 25 feet in length.

(c) The official number must be permanently affixed to or painted on the vessel. However, charter or party boats may use non-permanent markings to display the official number whenever the vessel is fishing for Atlantic mackerel, squid, or butterfish.

(d) *Duties of operator*. The operator of each vessel subject to this part shall:

(1) Keep the vessel name and official number clearly legible and in good repair; and

(2) Ensure that no part of the vessel, its rigging, its fishing gear, or any other object obstructs the view of the official number from an enforcement vessel or aircraft.

§655.7 General prohibitions.

In addition to the general prohibitions specified in §620.7 of this chapter, it is unlawful for any person to do any of the following:

(a) To fish commercially for Atlantic mackerel, squid, and butterfish without a permit issued pursuant to §655.4.

(b) To use any vessel for taking, catching, harvesting, or landing of any Atlantic mackerel, squid, or butterfish (except as provided in §655.4(a)) unless the vessel has on board a valid permit issued under §655.4.

(c) To fail to report to the Regional Director within 15 days any change in the information contained in the permit application for a vessel, as specified in §655.4(b).

(d) To falsify or fail to affix and maintain vessel markings as required by §655.6.

(e) To take and retain, or land more Atlantic mackerel, squid, or butterfish than specified under a notice issued under §655.24.

(f) To falsify the records and reports prescribed by these regulations.

(g) Violate any other provision of this part, the Magnuson Act, any notice issued under Subpart B of this part, or any other regulation or permit promulgated under the Magnuson Act.

(h) To make any false statement, written or oral, to an authorized officer, concerning the taking, catching, landing, purchase, sale, or transfer of any mackerel, squid, or butterfish.

(i) To interfere with, obstruct, delay, or prevent by any means the lawful investigation or search conducted in the process of enforcing this part.

§655.8 Facilitation of Enforcement.

See §620.8 of this chapter.

§655.9 Penalties. Any person or fishing vessel committing or used in the commission of a violation of this part is subject to the civil and criminal penalty provisions and civil forfeiture provisions of the Act and to 15 CFR Part 904 (Civil Procedures), and any other applicable laws.

Subpart B - Management Measures

§655.20 Fishing year. The fishing year is the 12-month period beginning on January 1 and ending on December 31

§655.21 Allowable levels of harvest.

(a) *Maximum optimum yields.*

(1) The optimum yields (OYs) during a fishing year may not exceed the following amounts:

Illex	30,000 mt
Loligo	44,000 mt
Butterfish	16,000 mt

(2) For Atlantic mackerel, the maximum OY is determined in accordance with paragraph (b)(2)(ii) of this section.

(b) *Annual specifications.* Total allowable biological catch (ABC), initial optimum yield (IOY), and amounts for domestic annual harvest (DAH), domestic annual processing (DAP), joint venture processing (JVP), and total allowable level of foreign fishing (TALFF) for each species will be determined annually by the Regional Director, in consultation with the Mid-Atlantic Fishery Management Council (Council), under the procedures specified in §655.22, consistent with the following:

(1) *Squid.*

(i) Total allowable biological catch (ABC) for any fishing year is either the maximum OY specified in paragraph (a)(1) of this section, or a lower amount determined by the Regional Director, in consultation with the Council, if stock assessments or other ecological data indicate that the potential yield is less than the maximum OY level.

(ii) The IOY consists of an initial DAH and initial TALFF and represents a modification of ABC, based on economic factors. These factors must include the following:

(A) Total world export potential by squid-producing countries;

(B) Total world import demand by squid-consuming countries;

(C) U.S. export potential based on expected U.S. harvests, expected U.S. consumption, relative prices, exchange rates, and foreign trade barriers;

(D) Increased or decreased revenues to the U.S. from foreign fishing fees;

(E) Increased or decreased revenues to U.S. harvesters (with or without joint ventures);

(F) Increased or decreased revenues to U.S. processors and exporters;

(G) Increases or decreases in U.S. harvesting productivity due to decrease or increase in foreign harvest;

(H) Increases or decreases in U.S. processing productivity; and

(I) Potential impact of increased or decreased TALFF on foreign purchases of U.S. products and services and U.S.-caught fish, changes in trade barriers, technology transfer, and other considerations.

(iii) The DAH, DAP, and JVP must be based on data from sources specified in §655.22(e) and other relevant data including past domestic landings, the capacity and intent of U.S. processors to process U.S.-harvested squid, and projected amounts of squid necessary for joint ventures during the fishing year.

(iv) IOY must be set at a level that will produce the greatest overall net benefit to the United States. In determining this amount, the Regional Director, in consultation with the Council, will provide for a TALFF of at least a minimum incidental catch in other directed fisheries. TALFF may be greater than an incidental catch level, if the IOY determined to produce the greatest overall benefit to the United States is sufficiently greater than DAH.

(A) *Loligo*: The incidental catch level is 1.0 percent of the allocated portion of the *Illex*, 0.04 percent of the allocated portion of the mackerel (if a directed fishery is allowed), and 0.5 percent of the allocated portions of the silver and red hake TALFFs.

(B) *Illex*: The incidental catch level is 10.0 percent of the allocated portion of the *Loligo* TALFF and 0.2 percent of the allocated portions of the silver and red hake TALFFs.

(v) The IOY may be adjusted by the Regional Director, in consultation with the Council, at any time during the fishing year, under §655.22(f). The basis for any adjustment may be that new information or changed circumstances indicate that U.S. fishermen will exceed the initial DAH, or that the IOY should be increased to produce maximum net benefits to the United States based upon an application of the factors above. The IOY may be increased by the amount that DAH or TALFF, or both, are increased, but IOY may not exceed ABC. An adjustment to IOY may not result in TALFF being reduced to a quantity less than that allocated to and accepted by foreign nations or to a quantity less than the incidental catch levels specified in paragraph (b) of this section.

(2) *Atlantic mackerel.* For Atlantic mackerel the maximum OY may not exceed ABC. Mackerel amounts are derived using the following terms:

C = Estimated mackerel catch in Canadian waters for the upcoming fishing year.

US = Estimated U.S. mackerel catch for the upcoming year.

S = Mackerel spawning-stock size in the year after the upcoming fishing year.

Bycatch = 0.4 percent of the allocated portion of the silver hake and red hake TALFFs and 1 percent of the allocated portion of the *Loligo* and 0.1 percent of the allocated portion of the *Illex* TALFFs.

ABC = Acceptable biological catch in U.S. waters for the upcoming fishing year.

T = Total catch in all waters (U.S. and Canadian) for the upcoming fishing year.

(i) ABC in U.S. waters for the upcoming fishing year is that quantity of mackerel that could be caught in U.S. and Canadian waters (T) minus the estimated catch in Canadian waters (C) and still maintain a spawning stock size (S) in the year following the year for which catch estimates and quotas are being prepared equal to or greater than 600,000 mt.

(A) IOY represents a modification of ABC, based on biological and economic factors, intended to provide the greatest overall benefit to the nation by incorporating all relevant factors.

(B) IOY will be specified so that the fishing mortality rate associated with T is less than or equal to $F_{0.1}$. If the Council determines that development of the U.S. fishery requires a fishing mortality rate greater than $F_{0.1}$, but still less than or equal to ABC, IOY may be set at the higher level. Such modification will be for that fishing year only and revert to $F_{0.1}$ unless modified again in subsequent years.

(ii) The IOY is composed of an initial DAH and initial TALFF. The Regional Director projects the DAH by reviewing data concerning past domestic landings, projected amounts of mackerel necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The recreational fishery component of DAH is determined by the equation $Y = (0.01)(X) - (166)$ where Y is the predicted recreational catch and X is the mackerel spawning stock size in the upcoming fishing year, in metric tons. The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use. In addition, this specification of IOY is based on such criteria as contained in the Magnuson Act, specifically section 201(e), and the application of the following factors --

(A) Total world export potential by mackerel producing countries;

(B) Total world import demand by mackerel consuming countries;

(C) U.S. export potential based on expected U.S. harvests, expected U.S. consumption, relative prices, exchange rates, and foreign trade barriers;

(D) Increased/decreased revenues to the U S. from foreign fees;

(E) Increased/decreased revenues to U.S. harvesters (with/without joint ventures);

(F) Increased/decreased revenues to U.S. processors and exporters;

(G) Increases/decreases in U.S. harvesting productivity due to decreases/increases in foreign harvest;

(H) Increases/decreases in U.S. processing productivity; and

(I) Potential impact of increased/decreased TALFF on foreign purchases of U.S. products and services and U.S. caught fish, changes in trade barriers, technology transfer, and other considerations.

(iii) The DAH, DAP, and JVP must be based on data from sources specified in §655.22(e) and other relevant data including past domestic landings, the capacity and intent of U.S. processors to process U.S. harvested squid and projected amounts of squid necessary for joint ventures during the fishing year.

(iv) IOY must be set at a level that will produce the greatest overall net benefit to the United States. In determining this amount, the Regional Director, in consultation with the Council, will provide for a TALFF of at least a minimum incidental catch in other directed fisheries. TALFF may be greater than an incidental catch level, if the IOY determined to produce the greatest overall benefit to the U.S. is sufficiently greater than

DAH. The incidental level is 0.4 percent of the allocated portion of the silver and red hake, 1.0 percent of the allocated portion of the *Loligo*, and 0.1 percent of the allocated portion of the *Illex* TALFFs.

(v) The IOY may be adjusted by the Regional Director, in consultation with the Council, at any time during the fishing year, under §655.22(f). The basis for any adjustment may be that new information or changed circumstances indicate that U.S. fishermen will exceed the initial DAH, or that the IOY should be increased to produce maximum net benefits to the United States based upon an application of the factors above. The IOY may be increased by the amount that DAH or TALFF, or both, are increased, but IOY may not exceed ABC. An adjustment to IOY may not result in TALFF being reduced to a quantity less than that allocated to and accepted by foreign nations or to a quantity less than the incidental catch levels specified in paragraph (iv) of this section.

(3) *Butterfish*.

(i) The Regional Director will review yearly the most recent biological data, including data on discards, pertaining to the stock. If the Regional Director determines that the stock cannot support a level of harvest equal to the maximum OY, he will establish a lower ABC for the fishing year. This level represents essentially the modification of MSY to reflect changed biological circumstances. If the stock is able to support a harvest level equivalent to the maximum OY, the ABC is set at that level.

(ii) From the ABC, the Regional Director, in consultation with the Council, will determine the IOY for the fishing year. The IOY represents a modification of ABC. The IOY is composed of an initial DAH and initial bycatch TALFF. The Regional Director will project the DAH by reviewing the data concerning past domestic landings, projected amounts of butterfish necessary for domestic processing and for joint ventures during the fishing year, and other data pertinent for such a projection. The JVP component of DAH is the portion of DAH which domestic processors either cannot or will not use.

(iii) In assessing the level of IOY, the Regional Director will provide for a bycatch TALFF equal to 3.0 percent of the allocated portion of the *Loligo* TALFF and 0.5 percent of the allocated portion of the *Illex*, 0.08 percent of the allocated portion of the Atlantic mackerel, and 0.1 percent of the allocated portion of the silver and red hake TALFFs.

(iv) The IOY may be adjusted by the Regional Director, in consultation with the Council, upward to the ABC at any time during the fishing year. An adjustment may be made to IOY to accommodate DAH needs. However, TALFF may not be adjusted to a quantity less than that needed for bycatch. Any adjustments to the IOY will be published in the FEDERAL REGISTER and may provide for a public comment period.

(c) *Allowable domestic harvest*. Fish taken within State jurisdiction will be counted against the domestic harvests specified under this section. The allowable domestic harvest for each species is the OY (including OY as increased under paragraph (b)(1)(v) of this section) minus TALFF.

§655.22 Procedures for determining initial annual amounts and adjustments.

(a) On or about October 15 of each year, the Council will prepare and submit recommendations to the Regional Director of the initial annual amounts for the fishing year beginning January 1, based on information gathered from sources specified in paragraph (e) of this section.

(b) On or about November 1 of each year, the Secretary will publish a notice in the FEDERAL REGISTER that specifies preliminary initial amounts of OY, DAH, DAP, JVP, TALFF, and reserve (if any) for each species. The amounts will be based on information submitted by the Council and from the sources specified in paragraph (e) of this section; in the absence of a Council report, the amounts will be based on information gathered from sources specified in paragraph (e) of this section and other information considered appropriate by the Regional Director. The FEDERAL REGISTER notice will provide for a 30-day comment period.

(c) The Council's recommendation and the information listed in paragraph (e) of this section will be available in aggregate form for inspection at the office of the Regional Director during the public comment period.

(d) On or about December 15 of each year, the Secretary will make a final determination of the initial amounts for each species, considering all relevant data and any public comments, and will publish a notice of the final determination and response to public comments in the FEDERAL REGISTER.

(e) Sources used to establish initial annual specifications include:

(1) Results of a survey of domestic processors and joint venture operators of estimated processing capacity and intent to use that capacity (approved by the Office of Management and Budget under OMB control number 0648-0114);

(2) Results of a survey of fishermen's trade associations of estimated fish harvesting capacity and intent to use that capacity (approved by the Office of Management and Budget under OMB control number 0648-0114);

(3) Landings and catch statistics;

(4) Stock assessments; and

(5) Relevant scientific information.

(f) Any adjustments to the IOY for squid must be published in the FEDERAL REGISTER with the reasons for such adjustment. Any notice of adjustment may provide for a public comment period.

§655.23 Closure of the fishery.

(a) *General.* The Secretary shall close any domestic fishery in the EEZ for any species when U.S. fishermen have harvested 80 percent of the allowable domestic harvest (see §655.21(c)), if such closure is necessary to prevent the allowable domestic harvest from being exceeded. The closure will be in effect for the remainder of the fishing year.

(b) *Notice.* If the Secretary determines that a closure is necessary, he will:

(1) Notify in advance the Executive Directors of the Mid-Atlantic, New England, and South Atlantic Councils;

(2) Mail notifications of the closure to all holders of permits issued under §655.5 at least 72 hours before the effective date of the closure;

(3) Provide for adequate notice of the closure to recreational fishermen in the fishery; and

(4) Publish a notice of closure in the FEDERAL REGISTER.

(c) *Incidental catches.* During a period of closure, the trip limit for the species for which the fishery is closed is 10 percent by weight of the total amount of fish on board.

APPENDIX 7. ABBREVIATIONS AND DEFINITIONS OF TERMS

Act (MFCMA) - the Magnuson Fishery Conservation and Management Act of 1976, as amended, 16 USC 1801 et seq.

allocated portion - that portion of the TALFF actually distributed to foreign nations.

Allowable Biological Catch (ABC) - the maximum allowable catch for a particular fishing year developed by reducing the maximum OY as necessary based on stock assessments.

Amendment - Amendment #2 to the Atlantic Mackerel, Squid, and Butterfish FMP (FMP).

Annual Fishing Level - a foreign fishing allocation set pursuant to Section 201(d)(3) of the Act.

Atlantic mackerel (mackerel) - the species *Scomber scombrus*.

butterfish - the species *Peprilus triacanthus*.

CFR - Code of Federal Regulations.

Council (MAFMC) - the Mid-Atlantic Fishery Management Council.

CPUE - catch per unit of effort.

Domestic Annual Harvest (DAH) - the capacity of US fishermen, both commercial and recreational, to harvest and their intent to use that capacity.

Domestic Annual Processing (DAP) - the capacity of US processors to process, including freezing, and their intent to use that capacity.

F - instantaneous rate of fishing mortality (The proportion of the population caught in a small period of time.). This mortality occurs in the presence of mortality from other causes and is usually given as averages for a year.

$F_{0.1}$ - the rate of fishing mortality for a given method of fishing at which the increase in yield per recruit for a small increase in fishing mortality results in only 10% increase in yield per recruit for the same increase in fishing mortality from a virgin fishery.

FMP - fishery management plan.

Fishery Conservation Zone (FCZ) - the zone contiguous to the territorial sea of the US, the inner boundary of which is a line coterminous with the seaward boundary of each of the coastal States and the outer boundary of which is a line drawn in such a manner that each point on it is 200 nautical miles from the baseline from which the territorial sea is measured.

GIFA - Governing International Fishery Agreement.

GRT - gross registered ton.

ICNAF - International Commission for the Northwest Atlantic Fisheries (replaced by NAFO).

Initial Optimum Yield (IOY) - the initial annual specification amounts as determined by the Northeast Regional Director, in consultation with the Council, modifying the ABC on the basis of economic considerations.

internal waters - marine waters landward of the territorial sea.

joint venture - an arrangement through which US fishermen transfer their catch at sea to foreign vessels.

metric tons (mt) - 2204.6 pounds.

MSY - maximum sustainable yield. The largest average catch of yield that can continuously be taken from a stock under existing environmental conditions, while maintaining the stock size.

NAFO - Northwest Atlantic Fisheries Organization.

natural mortality - deaths from all causes except fishing, including predation, senility, epidemics, pollution, etc.

NEFC - the Northeast Fisheries Center of the NMFS.

NMFS - the National Marine Fisheries Service of NOAA.

NOAA - the National Oceanic and Atmospheric Administration of the US Dept. of Commerce.

OY - Optimum Yield.

Regional Director (RD) - the Regional Director, Northeast Region, NMFS.

SA - Subarea or Statistical Area.

SSC - the Scientific and Statistical Committee of the Council.

Secretary - the Secretary of Commerce, or his designee.

squid - the species *Loligo pealei* (*Loligo* or *L. pealei*) and *Illex illecebrosus* (*Illex* or *I. illecebrosus*).

state waters - internal waters and the Territorial Sea.

stock assessment - the NMFS yearly biological assessment of the status of the resources. This analysis provides the official estimates of stock size, spawning stock size, fishing mortalities, recruitment, and other parameters used in this Plan. The data from these assessments shall constitute the "best scientific information currently available" as required by the Act.

Territorial Sea - marine waters from the shoreline to 3 miles seaward.

Total Allowable Level of Foreign Fishing (TALFF) - that portion of the Optimum Yield made available for foreign fishing.

USDC - US Department of Commerce.

year-class - the fish spawned or hatched in a given year.

yield per recruit (YPR) - the expected yield in weight from a single recruit.