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30th Northeast Regional Stock Assessment Workshop (30th SAW)

Public Review Workshop

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A Report of the 30th Northeast Regional Stock Assessment Workshop

30th Northeast Regional Stock Assessment Workshop (30th SAW)

Public Review Workshop

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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00-02 **An Overview of the Biology, Ecology, and Fisheries of the Clupeoid Fishes Occurring in the Gulf of Maine.** By T.A. Munroe. March 2000.

00-03 **Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.** [By Northeast Regional Stock Assessment Workshop No. 30.] April 2000.

OVERVIEW

Introduction

The Public Review Workshop of the 30th Northeast Regional Stock Assessment Workshop (SAW 30) was held in four sessions. The purpose of the Workshop was to present assessment results and management advice for weakfish, the skate complex, tautog, Atlantic mackerel, and surfclams. Assessments for the five stocks were peer reviewed by the 30th Stock Assessment Review Committee (SARC) at its November 29 - December 3, 1999 meeting in Woods Hole, MA.

The first session was on January 18, 2000 at a meeting of the New England Fishery Management Council in Danvers, MA and focused on the assessment review of the skate complex. The second and third sessions occurred on February 10 at a meeting of the Atlantic States Marine Fisheries Commission in Alexandria, VA where presentations on the weakfish and tautog assessments were provided to the ASMFC's Weakfish and Tautog Management Boards. The fourth session was before the Mid-Atlantic Fishery Management Council on March 15, 2000 at a meeting in Annapolis, MD where the presentation was devoted to assessments for surfclam and Atlantic mackerel.

Copies of the SAW 30 Draft *Advisory Report on Stock Status* and SAW 30 Draft *Consensus Summary of Assessments* had been distributed to members of each Council or Board prior to the Workshops.

All presentations were provided by the SAW Chairman, Dr. Terry Smith of the Northeast Fisheries Science Center (NEFSC), NMFS. The Workshops summarized the assessment results and management advice for the relevant stocks using information contained in this report and supporting information contained in the *Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.*

Status Summaries

Weakfish

The weakfish stock is currently at a high level of biomass. Stock biomass has been increasing steadily since 1993 and stock numbers have been increasing since 1989. The stock is fully exploited. Fishing mortality (F) on the fully recruited ages declined from 1.03 in 1992 to 0.22 in 1995, and has remained low through 1998. The 1998 F estimate of 0.21 is below the management plan's projected 1998 rebuilding goal and below the long-term target of F=0.50. Landings in 1997 and 1998 were only about 60% of landings of the 1980s. Spawning stock biomass (SSB) increased sharply after 1993 and is at the highest levels in the time series. Biomass is above the B_{MSY} proxy. Recruitment increased from a low point in 1989 and has been at a high level since the mid-1990s. Although stock rebuilding is occurring, size and age structure has not been fully restored. Maintenance of low fishing mortality rates should enhance this expansion.

Skate Complex

Taken as a group, the biomass for the seven skate species in the Northeast Region (barndoor, winter, thorny, little, clearnose, rosette, smooth) is at a medium level of abundance. For the aggregate complex, the NEFSC spring survey index of biomass was relatively constant from 1968 to 1980, then increased significantly to peak levels in the mid to late 1980s. The index of skate complex biomass then declined steadily until 1994, but has recently increased. The large increase in skate biomass in the mid to late 1980s was dominated by winter and little skate. The biomass of large sized skates (>100 cm maximum length; barndoor, winter, and thorny) has steadily declined since the mid-1980s. The recent increase in aggregate skate biomass has been due to an increase in small sized skates (<100 cm maximum length; little, clearnose, rosette, and smooth), primarily little skate

All large-bodied skates (winter, barndoor, and thorny) and the primary skate species in the Gulf of Maine (thorny and smooth) are currently overfished, and overfishing is occurring on winter skate. Reductions in fishing mortality are required to eliminate overfishing of winter skate and to promote rebuilding of other overfished skate species.

As a special term of reference, the SARC reviewed the barndoor skate assessment with respect to the 5 Endangered Species Act listing factors and found that, from a stock status perspective, there was no evidence that the stock was in danger of extinction or likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tautog

Total biomass, spawning stock biomass and recruitment for tautog have declined and remain at very low levels. Estimated fishing mortality rates increased in the 1980's and early 1990's, then decreased to 0.29 in 1998. Relative to the interim overfishing reference point (F=0.24), overfishing is occurring. The estimated reduction in fishing mortality is consistent with the adoption of fishery management measures by the Atlantic States Marine Fisheries Commission in 1996 and subsequent implementation by the individual states. However, fishing mortality rates need to be reduced to meet both the interim fishing mortality (F=0.24), and final plan targets (F=0.15) and to begin rebuilding the stock.

Atlantic Mackerel

The northwest Atlantic mackerel stock is at a high level of biomass and is under exploited. Fishing mortality on this stock is very low and Spawning Stock Biomass likely large. Based on trends in survey indices, recruitment has been well above average throughout most of the 1990s. Current annual landings are considerably below the long-term potential yield estimated to be 150,000 mt. The forgone yield is in excess of 100,000 mt and the fishery can be increased substantially.

Surfclams

The surfclam stock in waters beyond 3 mile state limits is at a high level of biomass and under-exploited. Fishing mortality is low. Estimated mean annual fishing mortality rates from 1997-1999 were 0.02 for the entire offshore resource, 0.03 - 0.04 for the northern New Jersey region, and 0.04 - 0.07 for the southern New Jersey region. The majority of the catch is derived from northern New Jersey, which contains about 39% of the stock biomass. Recent F's are less than the current overfishing definition or a new overfishing definition recommended by the SARC. Fishing mortality can be increased for the surfclam resource taken as a whole. However it may be advantageous to avoid localized depletion.

ADVISORY REPORT ON STOCK STATUS

INTRODUCTION

The *Advisory Report on Stock Status* is one of two reports produced by the Northeast Regional Stock Assessment Workshop process. The *Advisory Report* summarizes the technical information contained in the *Stock Assessment Review Committee (SARC) Consensus Summary of Assessments* and is intended to serve as scientific advice for fishery managers on resource status.

An important aspect of scientific advice on fishery resources is the determination of current stock status. The status of the stock relates to both the rate of removal of fish from the population – the exploitation rate – and the current stock size. The exploitation rate is simply the proportion of the stock alive at the beginning of the year that is caught during the year. When that proportion exceeds the amount specified in an overfishing definition, overfishing is occurring. Fishery removal rates are usually expressed in terms of the instantaneous fishing mortality rate, F, and the maximum removal rate is denoted as $F_{THRESHOLD}$.

Another important factor for classifying the status of a resource is the current stock level, for example, spawning stock biomass (SSB) or total stock biomass (TSB). Overfishing definitions, therefore, characteristically include specification of a minimum biomass threshold as well as a maximum fishing threshold. If a stock's biomass falls below the threshold ($B_{THRESHOLD}$) the stock is in an overfished condition. The Sustainable Fisheries Act mandates plans for rebuilding the stock should this situation arise.

Since there are two dimensions to the status of the stock – the rate of removal and the biomass level – it is possible that a stock not currently subject to overfishing in terms of exploitation rates is in an overfished condition, that is, has a biomass level less than the threshold level. This may be due to heavy exploitation in the past, or a result of other factors such as unfavorable environmental conditions. In this case, future recruitment to the stock is very important and the probability of improvement is increased greatly by increasing the stock size. Conversely, fishing down a stock that is at a high biomass level should generally increase the long-term sustainable yield. This philosophy is embodied in the Sustainable Fisheries Act — stocks should be managed on the basis of maximum sustainable yield (MSY). The biomass that produces this yield is called B_{MSY} and the fishing mortality rate that produces MSY is called F_{MSY}.

Given this, stocks under review are classified with respect to SFA criteria. A stock is overfished if its current biomass is below $B_{THRESHOLD}$ and overfishing is occurring if current F is greater than $F_{THRESHOLD}$.

Overfishing guidelines are based on the precautionary approach to fisheries management and encourage the inclusion of a control rule in the overfishing definition. Control rules, when they exist, are discussed in the Advisory Report chapter for the stock under consideration. Generically, the control rules suggest actions at various levels of stock biomass and incorporate an assessment of risk, in that F targets are set so as to avoid exceeding F thresholds. The schematic below depicts a generic control rule of this nature.

		BIOMASS		
		$\mathbf{B} < B_{THRESHOLD}$	$B_{THRESHOLD} < \mathbf{B} < B_{MSY}$	$\mathbf{B} > B_{MSY}$
EXPLOITATION RATE	THRESHOLD	F = 0 or F min (The minimal achievable mortality rate.)	$F = F_{THRESHOLD}$ (The maximum mortality rate that defines overfishing at various levels of biomass.)	F_{MSY}
	TARGET	F = 0 or F min (The minimal achievable mortality rate.)	$F = F_{TARGET}$ (Where F_{TARGET} is chosen to minimize the risk of exceeding $F_{THRESHOLD}$)	F_{TARGET}

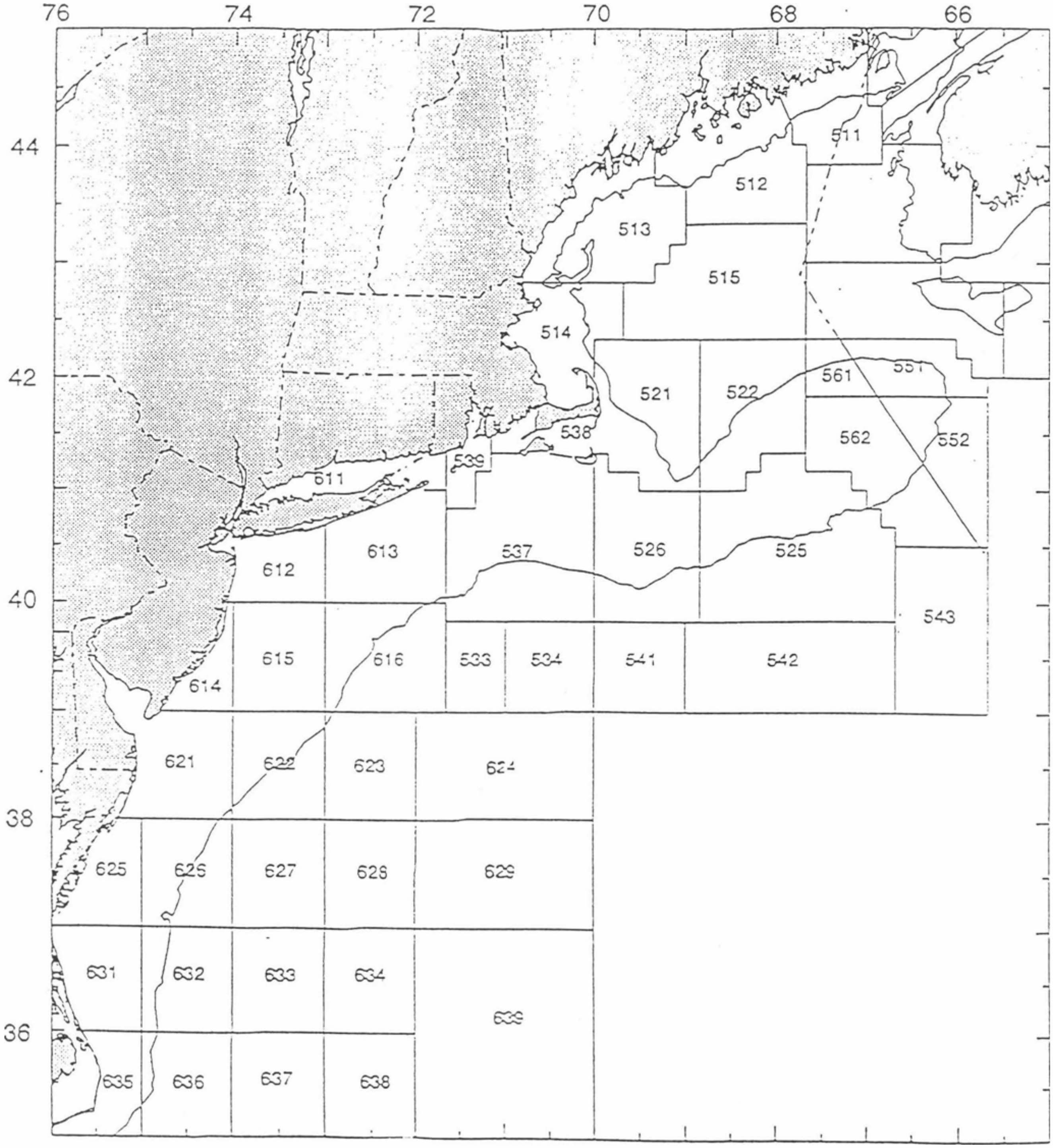


Figure 1. Statistical areas used for catch monitoring in offshore fisheries in the Northeast United States.

GLOSSARY OF TERMS

ADAPT. An assessment package used to optimally fit a Virtual Population Assessment (VPA, see below) to abundance data.

Availability. Refers to the distribution of fish of different ages or sizes relative to that taken in the fishery.

Biological reference points. Specific values for the variables that describe the state of a fishery system which are used to evaluate its status. Reference points are most often specified in terms of fishing mortality rate and/or spawning stock biomass. The reference points may indicate 1) a desired state of the fishery, such as a fishing mortality rate that will achieve a high level of sustainable yield, or 2) a state of the fishery that should be avoided, such as a high fishing mortality rate which risks a stock collapse and long-term loss of potential yield. The former type of reference points are referred to as "target reference points" and the latter are referred to as "limit reference points" or "thresholds". Some common examples of reference points are $F_{0.1}$, F_{max}, and F_{msy}, which are defined later in this glossary.

B_0. Virgin stock biomass, i.e., the long-term average biomass value expected in the absence of fishing mortality.

B_{MSY}. Long-term average biomass that would be achieved if fishing at a constant fishing mortality rate equal to F_{MSY}.

Biomass Dynamics Model. A simple stock assessment model that tracks changes in stock biomass rather than numbers. Biomass dynamic models employ assumptions about growth (in weight) and can be tuned to abundance data such as commercial catch rates, research survey trends or biomass estimates.

Catchability. Proportion of the stock removed by one unit of effective fishing effort (typically age-specific due to differences in selectivity and availability by age).

Control Rule. Describes a plan for pre-agreed management actions as a function of variables related to the status of the stock. For example, a control rule can specify how F or yield should vary with biomass. In the National Standard Guidelines (NSG), the "MSY control rule" is used to determine the limit fishing mortality, or Maximum Fishing Mortality Threshold (MFMT). Control rules are also known as "decision rules" or "harvest control laws" in some of the scientific literature.

Catch per Unit of Effort (CPUE). Measures the relative success of fishing operations, but also can be used as a proxy for relative abundance based on the assumption that CPUE is linearly related to stock size. The use of CPUE that has not been properly standardized for temporal-spatial changes in catchability should be avoided.

Exploitation pattern. The fishing mortality on each age (or group of adjacent ages) of a stock relative to the highest mortality on any age. The exploitation pattern is expressed as a series of values ranging from 0.0 to 1.0. The pattern is referred to as "flat-topped" when the values for all the oldest ages are about 1.0, and "dome-shaped" when the values for some intermediate ages are about 1.0 and those for the oldest ages are significantly lower. This pattern often varies by type of fishing gear, area, and seasonal distribution of fishing, and the growth and migration of the fish. The pattern can be changed by modifications to fishing gear, for example, increasing mesh or hook size, or by changing the proportion of harvest by gear type.

Mortality rates. Populations of animals decline exponentially. This means that the number of animals that die in an "instant" is at all times proportional to the number present. The decline is defined by survival curves such as:

$$N_{t+1} = N_t e^{-z}$$

where N_t is the number of animals in the population at time t and N_{t+1} is the number present in the next time period; **Z** is the **total instantaneous mortality rate** which can be separated into deaths due to fishing (**fishing mortality or F**) and deaths due to all other causes (**natural mortality or M**) and e is the base of the natural logarithm (2.71828). To better understand the concept of an instantaneous mortality rate, consider the following example. Suppose the instantaneous total mortality rate is 2 (i.e., Z = 2) and we want to know how many animals out of an initial population of 1 million fish will be alive at the end of one year. If the year is apportioned into 365 days (that is, the 'instant' of time is one day), then 2/365 or 0.548% of the population will die each day. On the first day of the year, 5,480 fish will die (1,000,000 x 0.00548), leaving 994,520 alive. On day 2, another 5,450 fish die (994,520 x 0.00548) leaving 989,070 alive. At the end of the year, 134,593 fish [$1{,}000{,}000 \times (1 - 0.00548)^{365}$] remain alive. If, we had instead selected a smaller 'instant' of time, say an hour, 0.0228% of the population would have died by the end of the first time interval (an hour), leaving 135,304 fish alive at the end of the year [$1{,}000{,}000 \times (1 - 0.00228)^{8760}$]. As the instant of time becomes shorter and shorter, the exact answer to the number of animals surviving is given by the survival curve mentioned above, or, in this example:

$$N_{t+1} = 1{,}000{,}000e^{-2} = 135{,}335 \text{ fish}$$

Exploitation rate. The proportion of a population alive at the beginning of the year that is caught during the year. That is, if 1 million fish were alive on January 1 and 200,000 were caught during the year, the exploitation rate is 0.20 (200,000 ÷ 1,000,000) or 20%.

F_{MAX}. The rate of fishing mortality that produces the maximum level of yield per recruit. This is the point beyond which growth overfishing begins.

$F_{0.1}$. The fishing mortality rate where the increase in yield per recruit for an increase in a unit of effort is only 10% of the yield per recruit produced by the first unit of effort on the unexploited stock (i.e., the slope of the yield-per-recruit curve for the $F_{0.1}$ rate is one-tenth the slope of the curve at its origin).

$F_{10\%}$. The fishing mortality rate which reduces the spawning stock biomass per recruit (**SSB/R**) to 10% of the amount present in the absence of fishing. More generally, Fx%, is the fishing mortality rate that reduces the SSB/R to x% of the level that would exist in the absence of fishing.

F_{MSY}. The fishing mortality rate that produces the maximum sustainable yield.

Fishery Management Plan (FMP). Plan containing conservation and management measures for fishery resources, and other provisions required by the MSFCMA, developed by the Fishery Management Councils or the Secretary of Commerce.

Generation Time. In the context of the National Standard 1 Guidelines, generation time is a measure of the time required for a female to produce a reproductively-active female offspring for use in setting maximum allowable rebuilding time periods.

Growth Overfishing. The situation existing when the rate of fishing mortality is above F_{MAX} and when the loss in fish weight due to mortality exceeds the gain in fish weight due to growth.

Limit Reference Points. Benchmarks used to indicate when harvests should be constrained substantially so that the stock remains within safe biological limits. The probability of exceeding limits should be low. In the National Standard 1 Guidelines, limits are referred to as thresholds. In much of the international literature (e.g., FAO documents), "thresholds" are used as buffer points that signal when a limit is being approached.

Landings per Unit of Effort (LPUE). Analogous to CPUE and measures the relative success of fishing operations, but is also sometimes used a proxy for relative abundance based on the assumption that LPUE is linearly related to stock size.

MSFCMA.(Magnuson-Stevens Fishery Conservation and Management Act). U.S. Public Law 94-265, as amended through October 11, 1996. Available as NOAA Technical Memorandum NMFS-F/SPO-23, 1996.

Maximum Fishing Mortality Threshold (MFMT, $F_{threshold}$). One of the Status Determination Criteria (SDC) for determining if overfishing is occurring. It will usually be equivalent to the F corresponding to the MSY Control Rule. If current fishing mortality rates are above $F_{threshold}$ overfishing is occurring.

Minimum Stock Size Threshold (MSST, $B_{threshold}$). Another of the Status Determination Criteria. The greater of (a) $\frac{1}{2}B_{MSY}$, or (b) the minimum stock size at which rebuilding to B_{MSY} will occur within 10 years of fishing at the MFMT. MSST should be measured in terms of spawning biomass or other appropriate measures of productive capacity. If current stock size is below $B_{threshold}$, the stock is overfished.

Maximum Spawning Potential (MSP). This type of reference point is used in some fishery management plans to define overfishing. The MSP is the spawning stock biomass per recruit (SSB/R) when fishing mortality is zero. The degree to which fishing reduces the SSB/R is expressed as a percentage of the MSP (i.e., %MSP). A stock is considered overfished when the fishery reduces the %MSP below the level specified in the overfishing definition. The values of %MSP used to define overfishing can be derived from stock-recruitment data or chosen by analogy using available information on the level required to sustain the stock.

Maximum Sustainable Yield (MSY). The largest average catch that can be taken from a stock under existing environmental conditions.

Overfishing. According to the National Standard Guidelines, "overfishing occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis." Overfishing is occurring if the MFMT is exceeded for 1 year or more.

Optimum Yield (OY). The amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems. MSY constitutes a "ceiling" for OY. OY may be lower than MSY, depending on relevant economic, social, or ecological factors.

In the case of an overfished fishery, OY should provide for rebuilding to B_{MSY}.

Partial Recruitment. Patterns of relative vulnerability of fish of different sizes or ages due to the combined effects of selectivity and availability.

Rebuilding Plan. A plan that must be designed to recover stocks to the B_{MSY} level within 10 years when they are overfished (i.e. when B < MSST). Normally, the 10 years would refer to an expected time to rebuilding in a probabilistic sense.

Recruitment. This is the number of young fish that survive (from birth) to a specific age or grow to a specific size. The specific age or size at which recruitment is measured may correspond to when the young fish become vulnerable to capture in a fishery or when the number of fish in a cohort can be reliably estimated by a stock assessment.

Recruitment overfishing. The situation existing when the fishing mortality rate reaches a level that causes a significant reduction in recruitment to the spawning stock. This is caused by a greatly reduced spawning stock and is characterized by a decreasing proportion of older fish in the catch and generally very low recruitment year after year.

Recruitment per spawning stock biomass (R/SSB). The number of fishery recruits (usually age 1 or 2) produced from a given weight of spawners, usually expressed as numbers of recruits per kilogram of mature fish in the stock. This ratio can be computed for each year class and is often used as an index of pre-recruit survival, since a high R/SSB ratio in one year indicates above-average numbers resulting from a given spawning biomass for a particular year class, and vice versa.

Reference Points. Values of parameters (e.g. B_{MSY}, F_{MSY}, $F_{0.1}$) that are useful benchmarks for guiding management decisions. Biological reference points are typically limits that should not be exceeded with significant probability (e.g., MSST) or targets for management (e.g., OY).

Risk. The probability of an event times the cost associated with the event (loss function). Sometimes "risk" is simply used to denote the probability of an undesirable result (e.g. the risk of biomass falling below MSST).

Status Determination Criteria (SDC). Objective and measurable criteria used to determine if overfishing is occurring or if a stock is in an overfished state according to the National Standard Guidelines.

Selectivity. Measures the relative vulnerability of different age (size) classes to the fishing gears(s).

Spawning stock biomass. The total weight of all sexually mature fish in a stock.

Spawning stock biomass per recruit (SSB/R). The expected lifetime contribution to the spawning stock biomass for each recruit. SSB/R is calculated assuming that F is constant over the life span of a year class. The calculated value is also dependent on the exploitation pattern and rates of growth and natural mortality, all of which are also assumed to be constant.

Survival Ratios. Ratios of recruits to spawners (or spawning biomass) in a stock-recruitment analysis.

TAC. Total allowable catch is the total regulated catch from a stock in a given time period, usually a year.

Target Reference Points. Benchmarks used to guide management objectives for achieving a desirable outcome (e.g., OY). Target reference points should not be exceeded on average.

Uncertainty. Uncertainty results from a lack of perfect knowledge of many factors that affect stock assessments, estimation of reference points, and management. Rosenberg and Restrepo (1994) identify 5 types: measurement error (in observed quantities), process error (or natural population variability), model error (mis-specification of assumed values or model structure), estimation error (in population parameters or reference points, due to any of the preceding types of errors), and implementation error (or the inability to achieve targets exactly for whatever reason).

Virtual population analysis (VPA) (or cohort analysis). A retrospective analysis of the catches from a given year class which provides estimates of fishing mortality and stock size at each age over its life in the fishery. This technique is used extensively in fishery assessments.

Year class (or cohort). Fish born in a given year. For example, the 1987 year class of cod includes all cod born in 1987. This year class would be age 1 in 1988, age 2 in 1989, and so on.

Yield per recruit (Y/R or YPR). The average expected yield in weight from a single recruit. Y/R is calculated assuming that F is constant over the life span of a year class. The calculated value is also de-pendent on the exploitation pattern, rate of growth, and natural mortality rate, all of which are also assumed to be constant.

A. WEAKFISH ADVISORY REPORT

State of Stock: The weakfish stock is currently at a high level of biomass. Stock biomass has been increasing steadily since 1993 and stock numbers have been increasing since 1989. The stock is fully exploited. Fishing mortality (F) on the fully recruited ages (ages 4 and 5) declined from 1.23 in 1993 to 0.22 in 1995, and has remained low through 1998. The 1998 F estimate of 0.20 is below the management plan's projected 1998 rebuilding goal (F=1.01) and below the long-term target (F=0.50; probability = 95%). Landings in 1997 and 1998 were only about 60% of landings of the 1980s. Spawning stock biomass (SSB) increased sharply after 1993 and is at the highest level in the time series. Biomass is above the MSY proxy. Recruitment increased from a low point in 1989 and has been at a high level since the mid-1990s.

Management Advice: Fishing mortality in 1998 was below the management target for the year 2000 ($F_{TARGET\ 2000} = 0.50$). Although stock rebuilding is occurring, size and age structure has not been fully restored. Maintenance of low fishing mortality rates should enhance this expansion.

Forecast for 2000: No forecasts were performed.

Catch and Status Table (weights in 1,000s of mt, recruitment in millions of fish): Weakfish

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	Max[1]	Min[1]	Mean[1]
Commercial landings	4.3	3.9	3.4	3.1	2.9	3.2	3.3	3.3	3.8	9.6	2.9	5.7
Recreational landings	0.6	1.1	0.7	0.6	1.1	1.3	1.8	2.1	2.3	5.4	0.6	2.2
Total landings	4.9	5.0	4.1	3.7	4.0	4.5	5.1	5.4	6.2	14.4	3.7	7.3
SSB	7.2	7.4	7.2	6.9	16.3	23.3	30.6	32.6	38.9	38.9	6.9	16.3
Recruitment (age 1)	26.0	28.9	38.5	42.3	70.7	40.0	55.5	51.7	54.0	70.7	26.0	44.4
F (age 4-5,u)	0.79	0.85	1.03	1.23	0.73	0.22	0.30	0.25	0.20	1.23	0.20	1.08
Exploitation rate	49%	52%	58%	64%	47%	18%	23%	20%	16%	64%	16%	53%

[1] Over period 1982-1998

Stock Distribution and Identification: Weakfish range from Florida north to Massachusetts. Peak abundance occurs from North Carolina through the Mid-Atlantic region. Recent genetic studies have concluded that weakfish constitute a single stock.

Catches: Coast-wide landings peaked at about 14,400 mt in 1986 (Figure A1) and declined steadily thereafter to about 3,700 mt by 1993. Landings have since increased steadily to 6,160 mt in 1998 following management restrictions on commercial effort and recreational bag and size limits.

Data and Assessment: The assessment is based on a virtual population analysis (VPA) of 1982-1998 total catch at age. Age-based survey indices, and discard mortality estimates were utilized. Scale-based ages from 1982 through 1989 were converted to otolith-based ages using data from weakfish aged with both structures. The final VPA run used only tuning indices from the core New Jersey to North Carolina area.

Biological Reference Points: A yield per recruit model indicated that $F_{max} = 0.27$ and $F_{0.1} = 0.18$ (Figure A3). MSY was estimated from yield per recruit and stock-recruit data: MSY=15,000 mt; $F_{MSY} = 0.60$; $B_{MSY} = 53,600$ mt; and $SSB_{MSY} = 28,200$ mt.

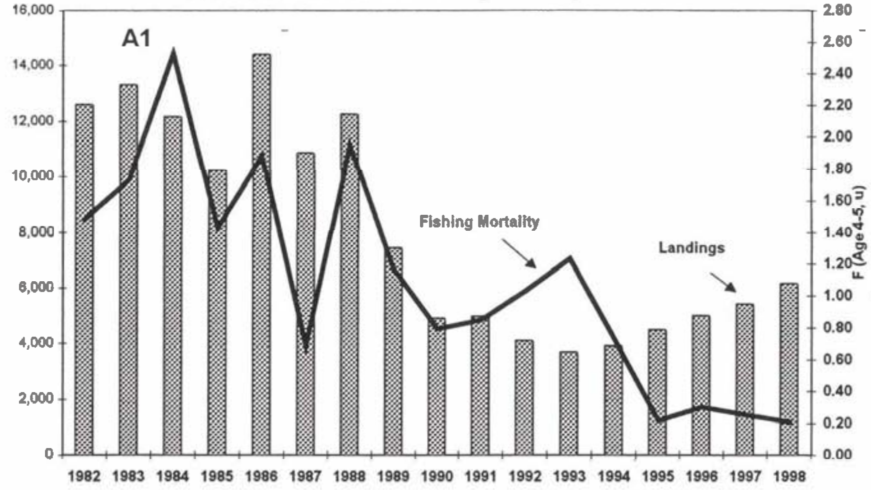
Fishing Mortality: Prior to 1995, fishing mortality on fully recruited ages (ages 4-5) was high and variable with peak levels exceeding 2.0 (Figure A1). F then decreased to an average of 1.0 from 1992-1994. The fishing mortality further decreased to F = 0.20 in 1998. The 80% bootstrap confidence interval of 1998 F is 0.17 to 0.31 (Figure A5).

Recruitment: Age-1 recruitment peaked at 71 million in 1994 (1993 year class) and was relatively constant from 1995 to 1998 averaging 50 million fish (Figure A2). Recruitment in 1999 was estimated at 68.2 million fish with an 80% confidence interval of 50.5 - 99.5 million fish.

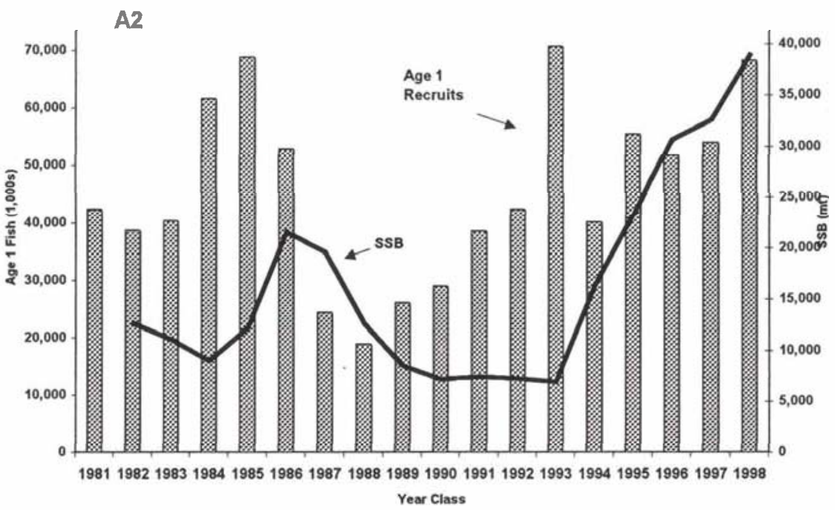
Spawning Stock Biomass: Using mean 1990-1998 otolith weights at age to estimate spawning stock biomass, SSB decreased in 1993 to 6,897 mt and then increased steadily to 38,863 mt by 1998. The 80% bootstrap confidence interval of 1998 SSB is 33,500 mt to 46,500 mt (Figure A4).

Source of Information: Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessment, NEFSC Ref. Doc. 00-03.

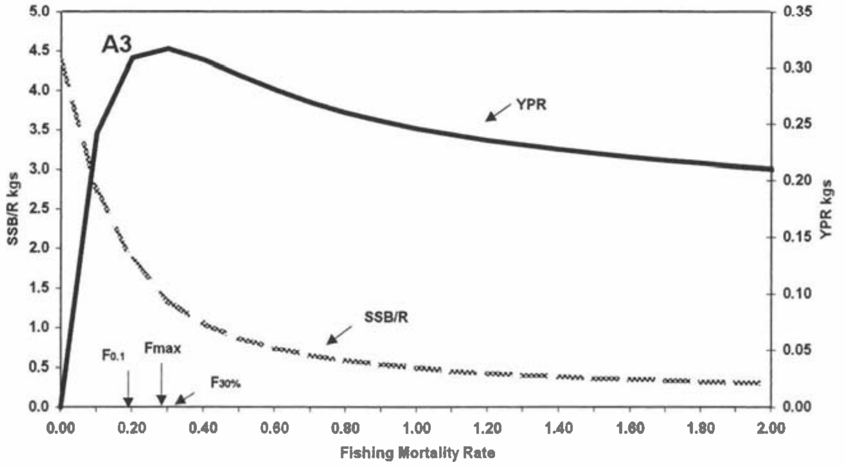
Trends in Atlantic Weakfish Landings and Fully Recruited F



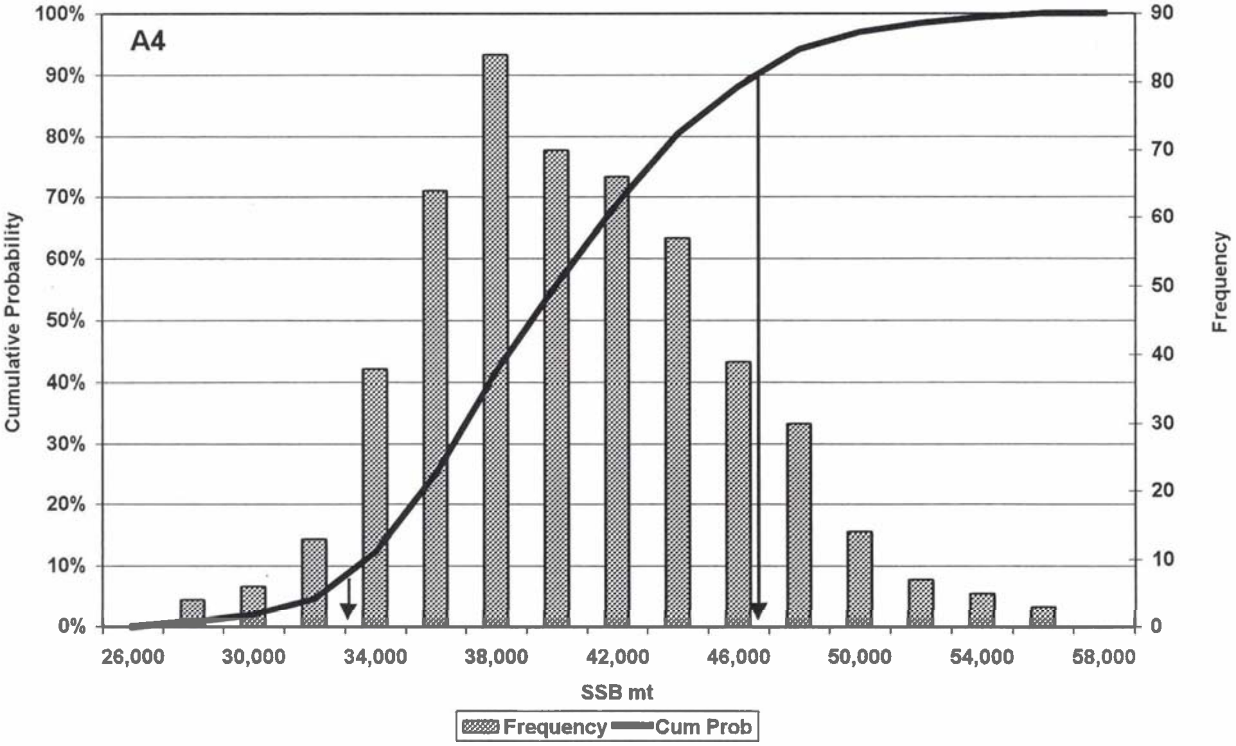
Trends in Weakfish Recruitment and Spawning Stock Biomass



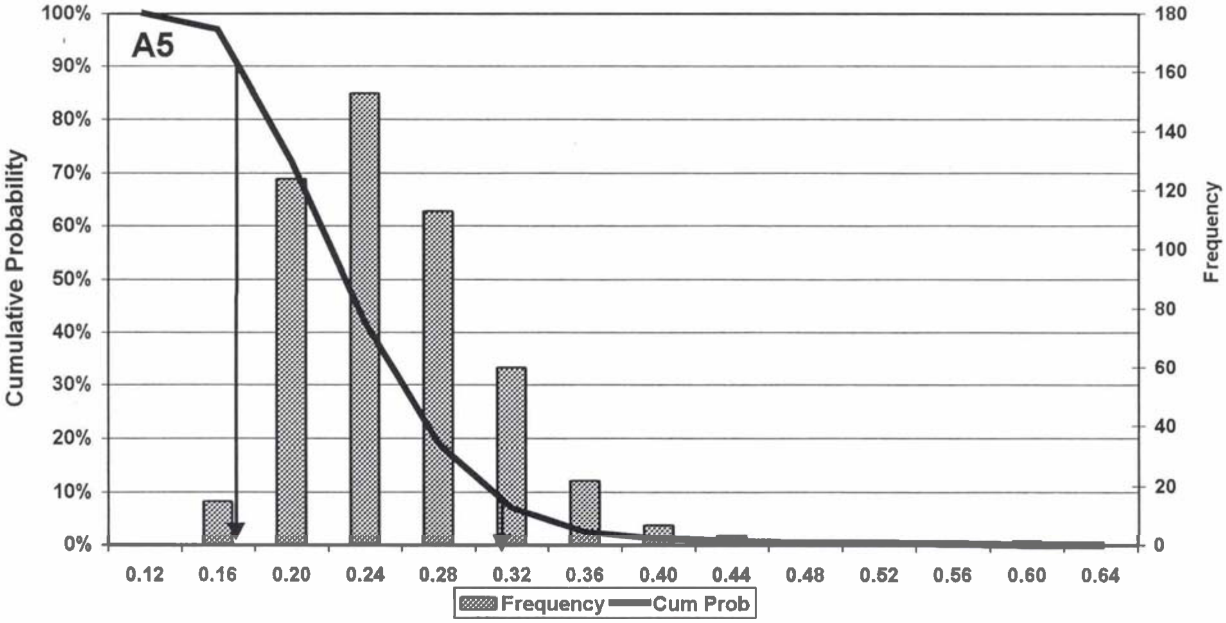
Atlantic Weakfish Yield and Spawning Biomass per Recruit



Precision of 1998 Weakfish SSB Estimate



Precision of 1998 Weakfish Fishing Mortality Rate Estimate



B. SKATE COMPLEX ADVISORY REPORT

State of Stock: Taken as a group, the biomass for the seven skate species in the Northeast Region (barndoor, winter, thorny, little, clearnose, rosette, smooth) is at a medium level of abundance. For the aggregate complex, the NEFSC spring survey index of biomass was relatively constant from 1968 to 1980, then increased significantly to peak levels in the mid to late 1980s. The index of skate complex biomass then declined steadily until 1994, but has recently increased again (Figure B1). The large increase in skate biomass in the mid to late 1980s was dominated by winter and little skate. The biomass of large sized skates (>100 cm maximum length; barndoor, winter, and thorny) has steadily declined since the mid-1980s (Figure B2). The recent increase in aggregate skate biomass has been due to an increase in small sized skates (<100 cm maximum length; little, clearnose, rosette, and smooth), primarily little skate (Figure B2).

<u>Winter skate</u>. Winter skate abundance is currently about the same as in the early 1970s, at about 25% of the peak observed during the mid 1980s. Comparison of the current fishing mortality rate (NEFSC spring survey; F = 0.39) to the proposed SFA threshold fishing mortality reference point (F = M = 0.1) indicates that overfishing for winter skate is occurring (Figure B3). The 1996-1998 NEFSC autumn survey biomass index average of 2.83 kg/tow is below the proposed SFA biomass threshold reference point of 3.23 kg/tow (Figure B4). Winter skate is overfished.

<u>Little skate</u>. Little skate abundance began to increase in the early 1980s, and has increased to the highest abundance since 1975. Relative to the current fishing mortality rate (NEFSC spring survey; F = 0.34) and the proposed SFA threshold fishing mortality reference point (F = M = 0.4) overfishing for little skate is not occurring (Figure B3). The 1997-1999 NEFSC spring survey biomass index average of 6.72 kg/tow is above the proposed SFA biomass threshold reference point of 3.27 kg/tow (Figure B4). Little skate is not overfished.

<u>Barndoor skate.</u> The abundance of barndoor skate declined continuously through the 1960s to historic lows during the early 1980s. Since 1990, the abundance of barndoor skate has increased slightly on Georges Bank, the western Scotian Shelf and in Southern New England, although the 1999 current NEFSC autumn survey biomass index is less than 5% of the peak observed in 1963. The fishing mortality rate could not be estimated for the stock nor could a fishing mortality reference point be determined. The 1996-1998 NEFSC autumn survey biomass index of 0.08 kg/tow is below the proposed SFA biomass threshold reference point of 0.81 kg/tow (Figure B4). Barndoor skate is overfished.

<u>Thorny skate</u>. The abundance of thorny skate has declined to recent historic lows. Current abundance is about 10%-15% of the peak observed in the late 1960s to early 1970s. The fishing mortality rate could not be estimated for the stock nor could a fishing mortality reference point be determined. The

1996-1998 NEFSC autumn survey biomass index of 0.77 kg/tow is below the proposed SFA biomass threshold reference point of 2.20 kg/tow (Figure B4). Thorny skate is overfished.

Smooth skate. The abundance of smooth skate was highest during the early 1960s and late 1970s. The fishing mortality rate could not be estimated for the stock nor could a fishing mortality reference point be determined. The 1996-1998 NEFSC autumn survey biomass index of 0.15 kg/tow is below the proposed SFA biomass threshold reference point of 0.16 kg/tow (Figure B4). Smooth skate is overfished.

Clearnose skate. The abundance of clearnose skate has been increasing since the mid-1980s. The fishing mortality rate could not be estimated for the stock nor could a fishing mortality reference point be determined. The 1996-1998 NEFSC autumn survey biomass index of 0.72 kg/tow is above the proposed SFA biomass threshold reference point of 0.28 kg/tow (Figure B4). Clearnose skate is not overfished.

Rosette skate. The abundance of rosette skate has been increasing since 1986. The fishing mortality rate could not be estimated for the stock nor could a fishing mortality reference point be determined. The 1996-1998 NEFSC autumn survey biomass index of 0.04 kg/tow is above the proposed SFA biomass threshold reference point of 0.01 kg/tow (Figure B4). Rosette skate is not overfished.

Management Advice: All large-bodied skates (winter, barndoor, and thorny) and the primary skate species in the Gulf of Maine (thorny and smooth) are currently overfished, and overfishing is occurring on winter skate. Reductions in fishing mortality are required to eliminate overfishing of winter skate and to promote rebuilding of other overfished skate species.

Summary SFA Status Table – Northeast Skate Species

	Proposed				Proposed			
Species	B_{target}	$B_{threshold}$	Current B	Biomass Status	F_{target}	$F_{threshold}$	Current F	F Status
Winter	6.46	3.23	2.83	Overfished	0.10	0.10	0.39	Overfishing
Little	6.54	3.27	6.72	Not Overfished	0.40	0.40	0.34	Not Overfishing
Barndoor	1.62	0.81	0.08	Overfished	----	----	----	Unknown
Thorny	4.41	2.20	0.77	Overfished	----	----	----	Unknown
Smooth	0.31	0.16	0.15	Overfished	----	----	----	Unknown
Clearnose	0.56	0.28	0.72	Not Overfished	----	----	----	Unknown
Rosette	0.03	0.01	0.04	Not Overfished	----	----	----	Unknown

Special Advice for barndoor skate relative to ESA Listing Factors: The SARC reviewed barndoor skate with respect to the 5 Endangered Species Act listing factors and found that there was no evidence that barndoor skate were in danger of extinction or likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Research surveys indicate that barndoor skate biomass in waters off the east coast of North America has declined substantially from peak levels prior to the 1960s to very low levels during the 1970s and 1980s. Recently, barndoor skate abundance and biomass have begun to increase in surveys in USA and Canadian waters. Barndoor skate also occur in waters deeper than covered by these surveys and the surveys under-represent the abundance of larger barndoor skate. Under Section 4(a)(1) of the ESA, a species can be determined to be endangered or threatened for any of the following factors: (1) Present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific; or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence. Listing determinations are based on the best scientific and commercial data available after taking into account any efforts being made by any state or foreign nation to protect the species. With regard to each of these 5 listing factors:

(1) Barndoor skate have persisted in their core habitat in USA waters at very low abundance since the late 1960s. Although barndoor skate were not observed in survey catches in many parts of its potential range during the past two decades, it is now occurring in some areas, particularly on the western Scotian Shelf, on Georges Bank, and in offshore waters off Southern New England. There is no evidence of a contraction in range, but present low abundance may reflect local reductions in area of occupancy. Thus, the available evidence does not suggest that the habitat or range of barndoor skate has been destroyed, modified, or curtailed to an extent that threatens the existence of the species.

(2) Given the high level of distant water fleet and domestic fishing effort that occurred in the barndoor skate habitat during the last 40 years (Figure B5), fishing mortality, mainly as bycatch, was likely a factor contributing to the decline in barndoor skate abundance. Although fishing and natural mortality rates of barndoor skate cannot be quantified, the small but sustained increase in research survey catches indicates that annual survival rates are currently high enough to allow for some recovery. Therefore, it appears that barndoor skate are not currently over-utilized for commercial, recreational, scientific or educational purposes.

(3) There is no scientific evidence to suggest that barndoor skate in the waters of the Northeast Coast of the USA are subject to an unusual degree of disease or predation.

(4) There are no current regulations specifically governing the harvest of barndoor skate. However, fisheries in which barndoor skate are taken as bycatch have been subject to increasingly restrictive regulations over the past decade which may have provided some protection over some parts of its range. Following the progressive implementation of the regulations, survivorship of barndoor skate has recently been high enough to allow abundance and biomass to increase to some

extent. However, if current effort limitation and closed area restrictions on Georges Bank and southern New England are relaxed, continued increases in abundance may be hindered.

(5) Although the combination of continued low abundance, suspected low intrinsic rate of increase and suspected late age of maturity make barndoor skate vulnerable to extirpation, the species has persisted at low levels in USA waters over the past 30-40 years. Thus, there is no scientific evidence to suggest that barndoor skate have been subject to unusual natural or anthropogenic factors that threaten its continued existence.

Forecast for 2000-2001: No forecasts were made for any of the species in the skate complex.

Landings and Status Table (weights in '000 mt, recruitment in millions): Skate complex

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	Max[1]	Min[1]	Mean[1]
Commercial landings	11.3	12.5	12.9	8.8	7.2	14.2	11.0	16.9		16.9	6.7	11.3
Commercial discards[2]	46.1	45.3	25.2	14.7	28.6	41.3	28.5	25.9		69.2	14.7	37.6
Recreational landings	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1
Recreational discards[3]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1
Total catch	11.3	12.5	12.9	8.8	7.2	14.2	11.0	16.9		16.9	6.7	11.3
Complex biomass index[4]	13.1	12.3	12.3	4.8	5.5	11.3	5.6	7.0	12.0	25.34	3.64	11.74
Little Skate												
Fishing mortality	0.26	0.24	0.26	0.30	0.30	0.27	0.24	0.28	0.34	0.34[5]	0.22[5]	0.27[5]
Exploitation rate	19%	18%	19%	22%	22%	20%	18%	20%	24%	24%	16%	20%
Winter skate												
Fishing mortality	0.10	0.11	0.14	0.16	0.20	0.32	0.37	0.41	0.39	0.41[6]	0.10[6]	0.24[6]
Exploitation rate	9%	10%	12%	14%	17%	26%	30%	32%	31%	32%	9%	20%

[1] Over the period 1989-1998; [2]Commercial fishery discard mortality rate unknown; [3]Assuming 15% recreational fishery release mortality; [4] kg/tow; [5]Over the period 1984-1999; [6]Over the period 1972-1999.

Stock Distribution and Identification: The seven species comprising the northeast skate complex are distributed from near the tide line to depths exceeding 700 m (383 fathoms). The species are: little skate (*Raja erinacea*), winter skate (*R. ocellata*), barndoor skate (*R. laevis)*, thorny skate (*R. radiata*), smooth skate (*R. senta*), clearnose skate (*R. eglanteria*), and rosette skate (*R. garmani*). Off the northeast coast of the United States, the center of distribution for the little and winter skates is Georges Bank and Southern New England (Figure B6). The barndoor skate are found in the Gulf of Maine, on Georges Bank, and in Southern New England. The thorny and smooth skates occur in the Gulf of Maine (Figures B7 and B8). The clearnose and rosette skates have a more southern distribution, and are found primarily in Southern New England and the Chesapeake Bight (Figures B8 and B9). Skates are not known to undertake large-scale migrations, but they do move seasonally in response to changes in water temperature, moving offshore in summer and early autumn and returning inshore during winter and spring. Information on stock structure for all skate species is lacking, however, the trend in serial depletion of the barndoor skate resource from Canadian and USA waters (Casey and Myers, 1998) suggests some regional fidelity.

Catches: The principal commercial fishing method in the directed skate fishery is otter trawling. Skates are frequently taken as bycatch and discarded during groundfish trawling and scallop dredge operations. Recreational and foreign landings are currently insignificant. There are currently no regulations specifically governing the harvesting of skates in U.S. waters. Skates have been reported in New England fishery landings since the late 1800s. Reported commercial fishery landings, primarily from off Rhode Island, however, never exceeded several hundred metric tons until the advent of distant-water fleets during the 1960s. Skate landings reached 9,500 mt in 1969, primarily from the distant water fleet, but declined quickly during the 1970s, falling to 800 mt in 1981. Landings have since increased substantially, partially in response to increased demand for lobster bait, and more significantly, to the increased export market for skate wings. Landings are not reported by species, with over 99% of the landings reported as "unclassified skates." Wings were likely taken from large-bodied skates (winter, thorny and barndoor), with winter and thorny currently known to be used for human consumption. Bait landings are presumed to be primarily from little skate, based on areas fished and known species distribution patterns. Landings increased to 12,900 mt in 1993 and then declined somewhat to 7,200 mt in 1995. Landings have increased again since 1995, and the 1998 reported commercial landings of 17,000 mt were the highest on record. Preliminary estimates of discards are difficult to make, but preliminary analyses suggest they may be 2-3 times larger than the average landings. The commercial fishery discard mortality rate is unknown.

Data and Assessment: The complex was last assessed in SAW 1. Conclusions about the status of the seven species in the northeast US region skate complex are based mainly on standardized research trawl survey data collected by the US and Canada during 1963-1999. Sufficient data (growth parameters and survey length frequencies) were available to estimate mortality rates for winter and little skate. Mortality estimates were derived from survey length data using an equilibrium method based on the declines in average size.

Biological Reference Points: Fishing mortality reference points are proposed for winter and little skate based on the estimate of the natural mortality rate (M), due to uncertainty in the estimation of yield based reference points. Stock biomass reference points are proposed for all seven species in the complex, based on NEFSC research trawl survey biomass indices. Due to the variability in NEFSC survey indices for skates, the most recent 3 year averages of the biomass indices are used to assess current status with respect to the stock biomass reference points.

For winter skate, the SARC recommends F = M = 0.10 as a proxy for the SFA threshold fishing mortality reference point. The SARC recommends against F_{MAX} as a proxy for Fthreshold due to life history considerations. The SARC proposes use of the 75th percentile value of the NEFSC autumn biomass indices for the GOM-MA offshore region during 1967-1998 as a proxy for the SFA target biomass reference point for winter skate (6.46 kg/tow).

For little skate, the SARC recommends F = M = 0.40 as a proxy for the SFA threshold fishing mortality reference point. The SARC proposes use of the 75th percentile value of the NEFSC spring biomass indices for the GOM-MA inshore and offshore regions during 1982-1999 as a proxy for the SFA target biomass reference point for little skate (6.54 kg/tow).

For barndoor skate, there are insufficient data on age and growth to determine fishing mortality rates or propose SFA fishing mortality reference points. The SARC proposes use of the mean value of the NEFSC autumn biomass indices for the GOM-SNE offshore region during 1963-1966 as a proxy for the SFA target biomass reference point for barndoor skate (1.62 kg/tow).

For thorny skate, there are insufficient data on age and growth to determine fishing mortality rates or propose SFA fishing mortality reference points. The SARC proposes use of the 75th percentile value of the NEFSC autumn biomass indices for the GOM-SNE offshore region during 1963-1998 as a proxy for the SFA target biomass reference point for thorny skate (4.41 kg/tow).

For smooth skate, there are insufficient data on age and growth to determine fishing mortality rates or propose SFA fishing mortality reference points. The SARC proposes use of the 75th percentile value of the NEFSC autumn biomass indices for the GOM-SNE offshore region during 1963-1998 as a proxy for the SFA target biomass reference point for smooth skate (0.31 kg/tow).

For clearnose skate, there are insufficient data on age and growth to determine fishing mortality rates or propose SFA fishing mortality reference points. The SARC proposes use of the 75th percentile value of the NEFSC autumn biomass indices for the Mid-Atlantic inshore and offshore regions during 1975-1998 as a proxy for the SFA target biomass reference point for clearnose skate (0.56 kg/tow).

For rosette skate, there are insufficient data on age and growth to determine fishing mortality rates or propose SFA fishing mortality reference points. The SARC proposes use of the 75th percentile value of the NEFSC autumn biomass indices for the Mid-Atlantic offshore region during 1967-1998 as a proxy for the SFA target biomass reference point for rosette skate (0.03 kg/tow).

Special Comments: The species composition and size structure of landings are unknown. Although discard rates are imprecisely known and likely underestimated and discard mortality rates are unknown, the absolute level of discards is high relative to the landings (2-3 times). Yield per recruit based reference points and fishing mortality estimates for winter skate are based on preliminary growth parameters from Canadian waters. Yield per recruit based reference points and fishing mortality rates for little skate are based on growth parameters from NEFSC survey data sampled during 1960s and 1970s. A lack of information on the stock structure of the species in the skate complex has increased the uncertainty of conclusions about historical trends in abundance, recommendations of appropriate biological reference points, and conclusions about the status of barndoor skate relative to ESA listing factors. As with most species of elasmobranchs the large species of skates have slow growth, late maturity and low fecundity compared to other fishes and therefore are potentially more vulnerable to overexploitation. Evidence of differences in life history strategies (e.g., growth rate, maximum potential age, age of maturity) imply that the seven individual species should not be managed as a complex.

Sources of Information: Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC Ref. Doc. 00-03. Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fish. Bull., U.S. Fish. Wildlife Serv. 74(53). Casey, Jill and Ransom Myers. 1998. Near extinction of a large, widely distributed fish. Science 281:690-692.

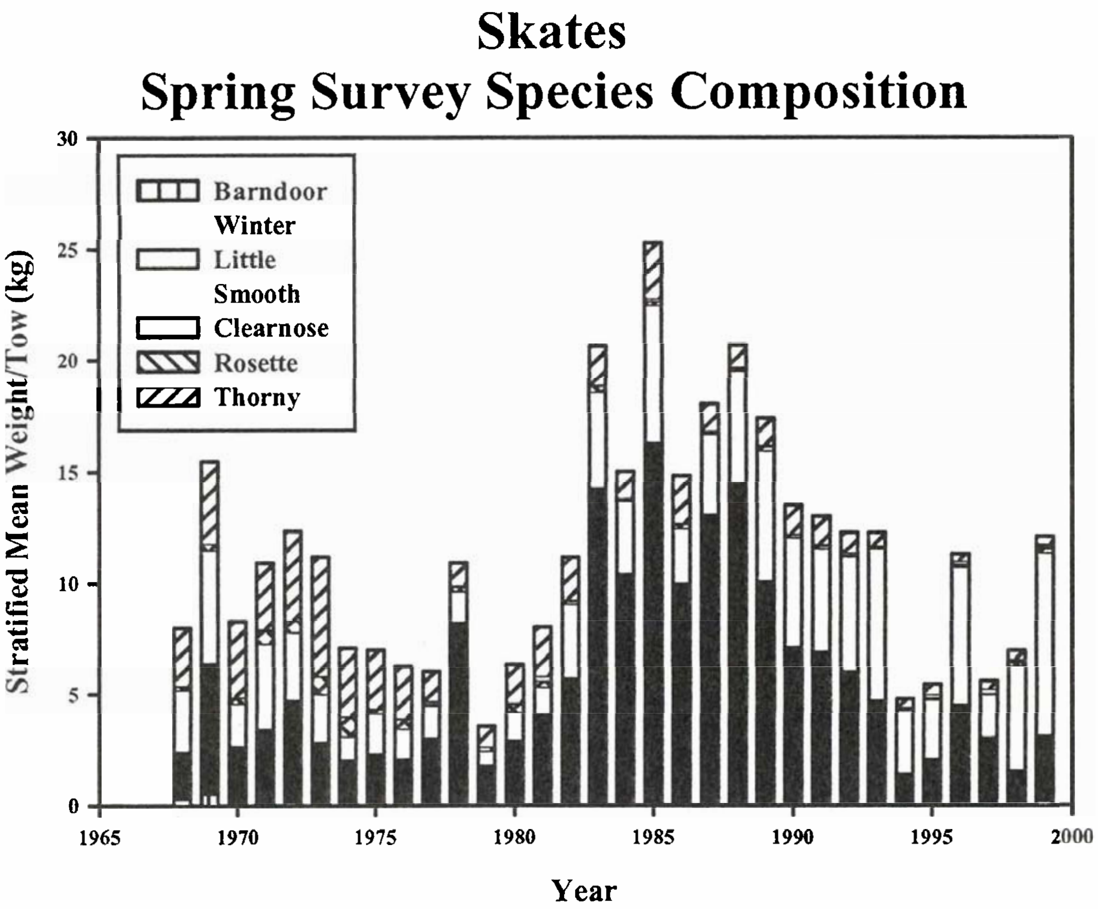
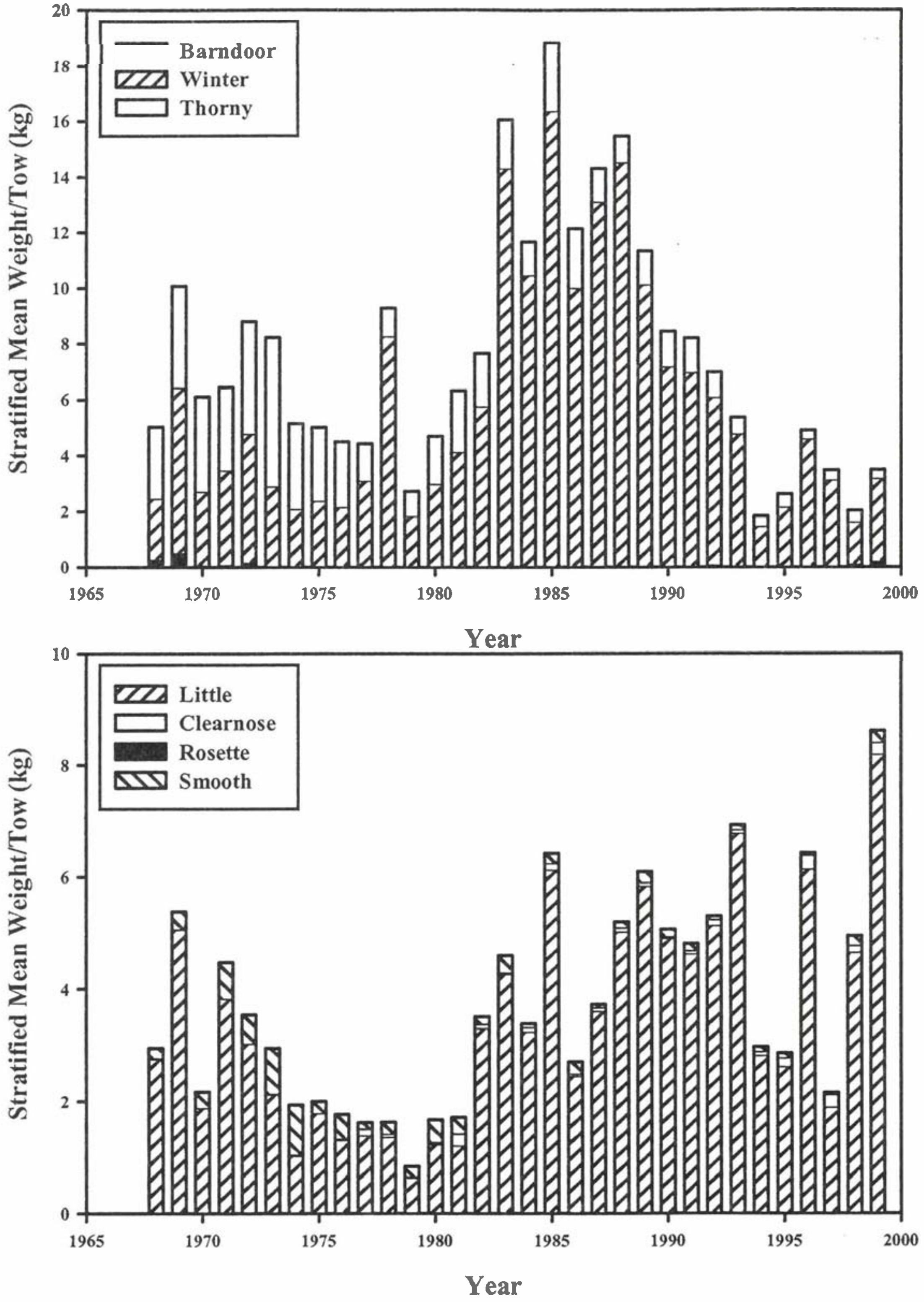


Figure B1. Species composition of skates from the spring survey



Skates
Spring Survey Species Composition

Figure B2. Species composition of skates from the spring survey. The top panel shows the composition of large species (>100 cm maximum length) while bottom panel shows the composition of the small species (maximum length <100 cm).

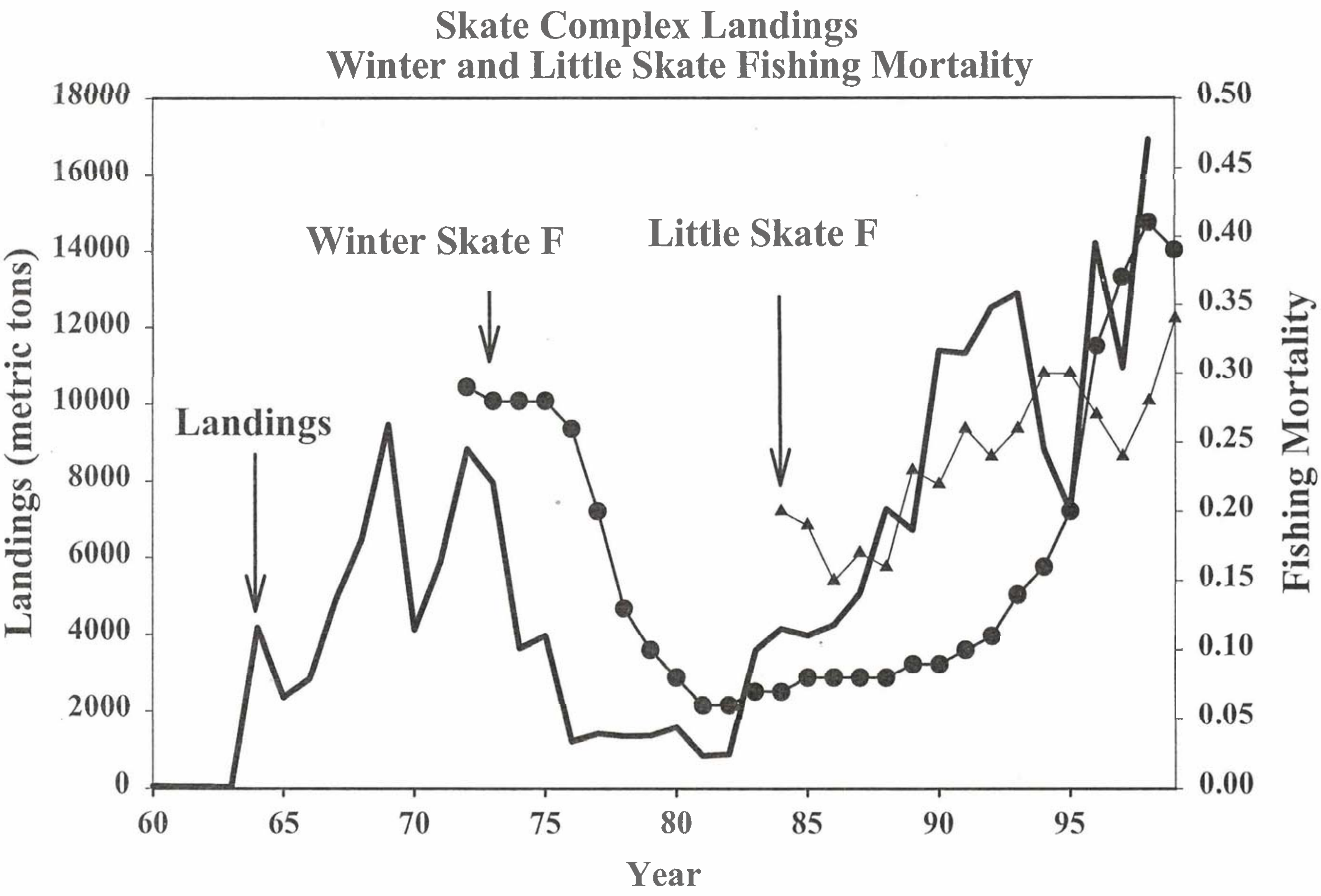


Figure B3. Commercial fishery landings of skates (all species) in the Northeast Region. Winter and little skate fishing mortality rates calculated from NEFSC spring survey length distributions.

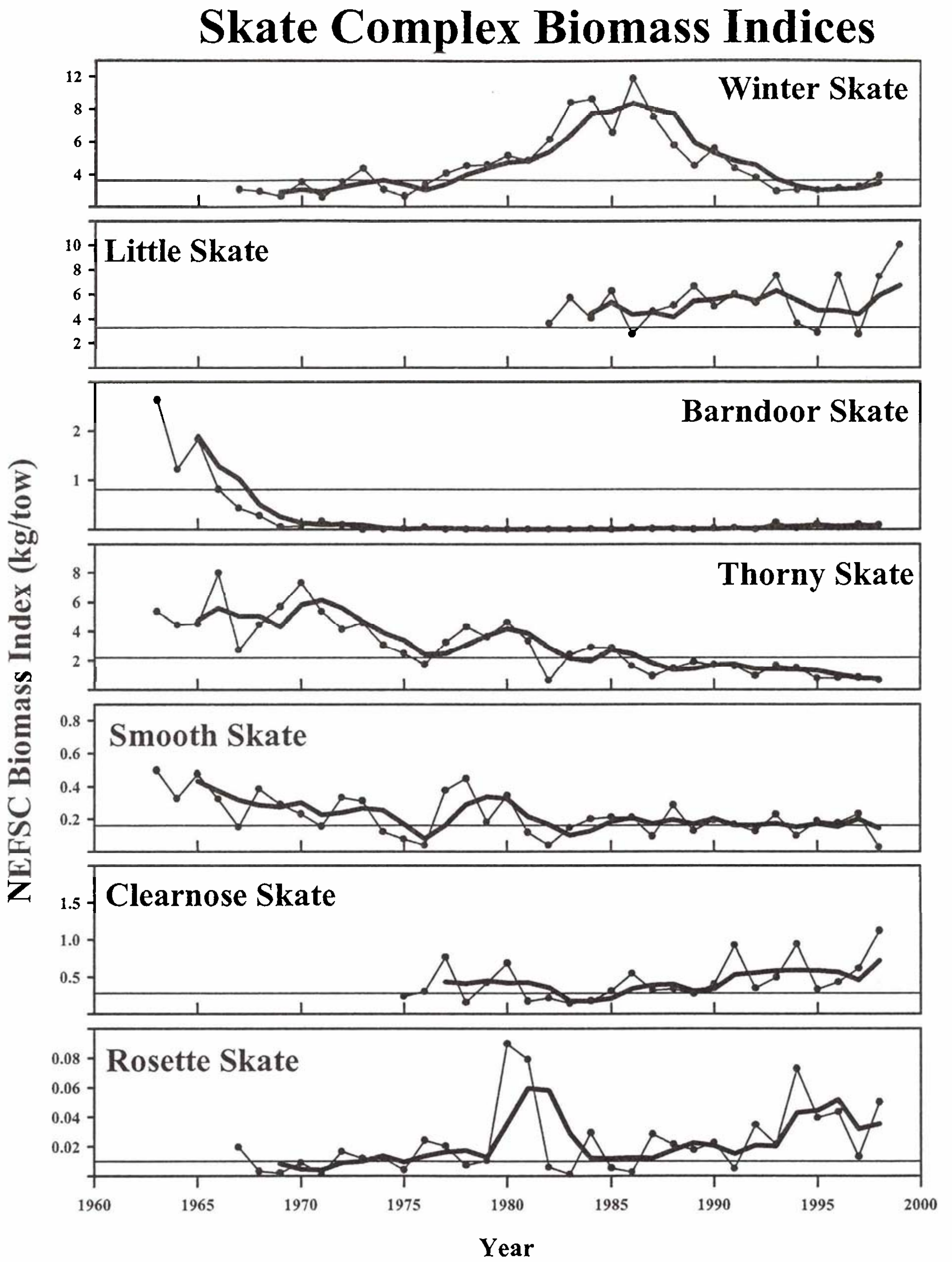
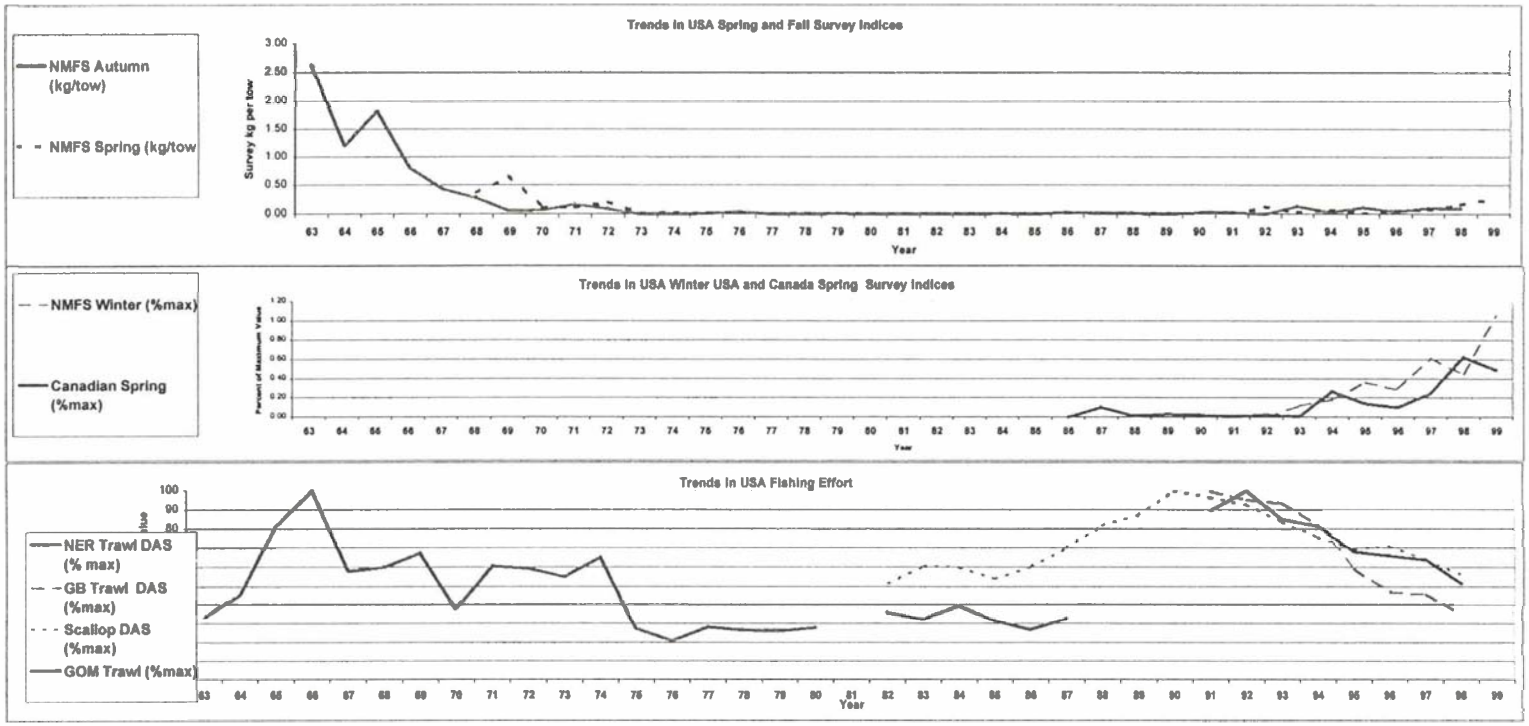


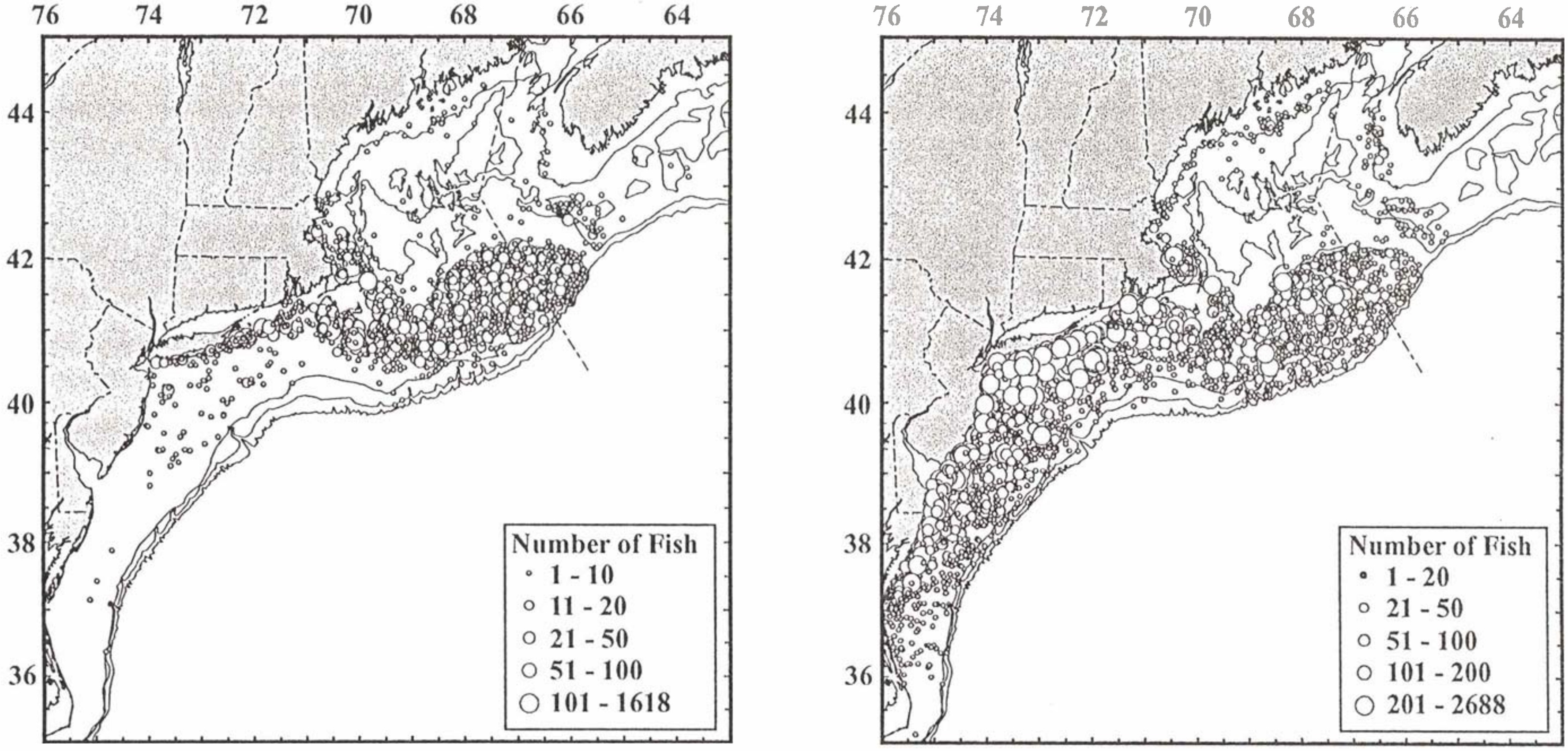
Figure B4. NEFSC survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal line are the biomass thresholds.

Figure B5. Summary of Regulatory Measures that may have improved the survivorship of barndoor skates in the Northwest Atlantic.



	Regulatory Measures	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
USA	Seasonal Haddock Spawning Areas - GB								●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Seasonal Yellowtail Closed Areas - SNE																								●	●	●	●	●	●	●	●						
	Year-Round Closures - GB & SNE																																●	●	●	●	●	●
	Year-Round Closure GOM																																			●	●	●
	Rolling Closures, Gulf of Maine																														●	●	●	●	●	●	●	●
	TACs for Groundfish								●	●	●	●	●	●	●	●	●	●	●	●	●																	
	Groundfish Days at Sea Restrictions																																●	●	●	●	●	●
	Effort Buy-Out																																●	●	●	●	●	●
	Scallop DAS Reduction																														●	●	●	●	●	●	●	●
	Summer Flounder FMP Amendment 2																															—	—	—	—	—	—	—
Both	Distant Water Fleets Excluded															●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Extended Jurisdiction USA & Canada															●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Partitioning of Georges Bank USA-Can																							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Canada	Grand Bank Closure																														●	●	●	●	●	●	●	●
	Seasonal Browns Bank Closure - Mar-April								●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Seasonal Georges Bank closure - Mar-April								●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Georges Bank Closure - Jan-June																																●	●	●	●	●	●
	ITQ Fishery in Div 4X/5Z																													●	●	●	●	●	●	●	●	●

Skates

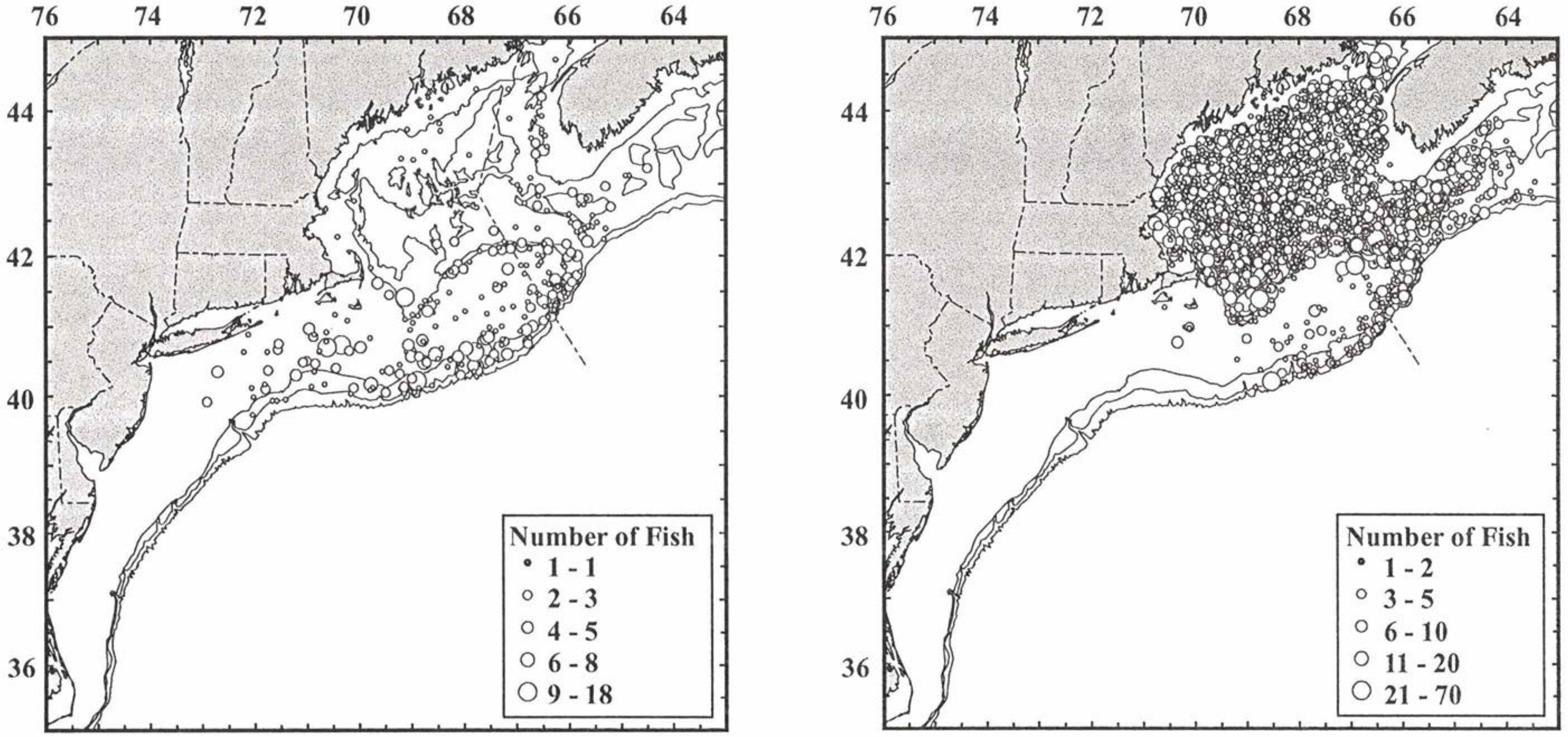


Winter Skate
NEFSC Autumn Surveys 1967-1998

Little Skate
NEFSC Spring Surveys 1982-1999

Figure B6. Distribution of winter skate and little skate in the NEFSC surveys which correspond to the series from which target and threshhold biomass reference points are determined.

Skates

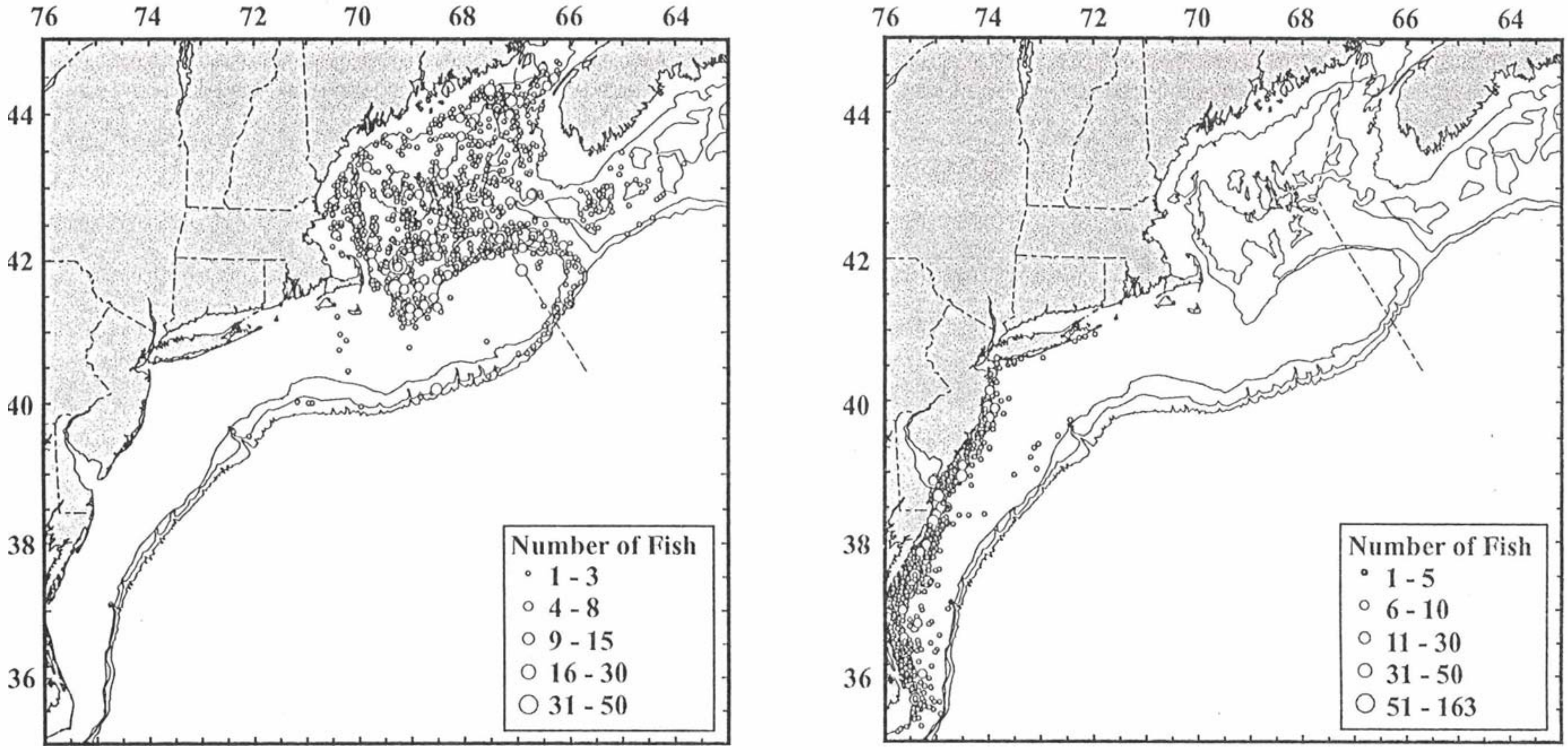


Barndoor Skate
NEFSC Autumn Surveys 1963-1998

Thorny Skate
NEFSC Autumn Surveys 1963-1998

Figure B7. Distribution of barndoor skate and thorny skate in the NEFSC surveys which correspond to the series from which target and threshhold biomass reference points are determined.

Skates

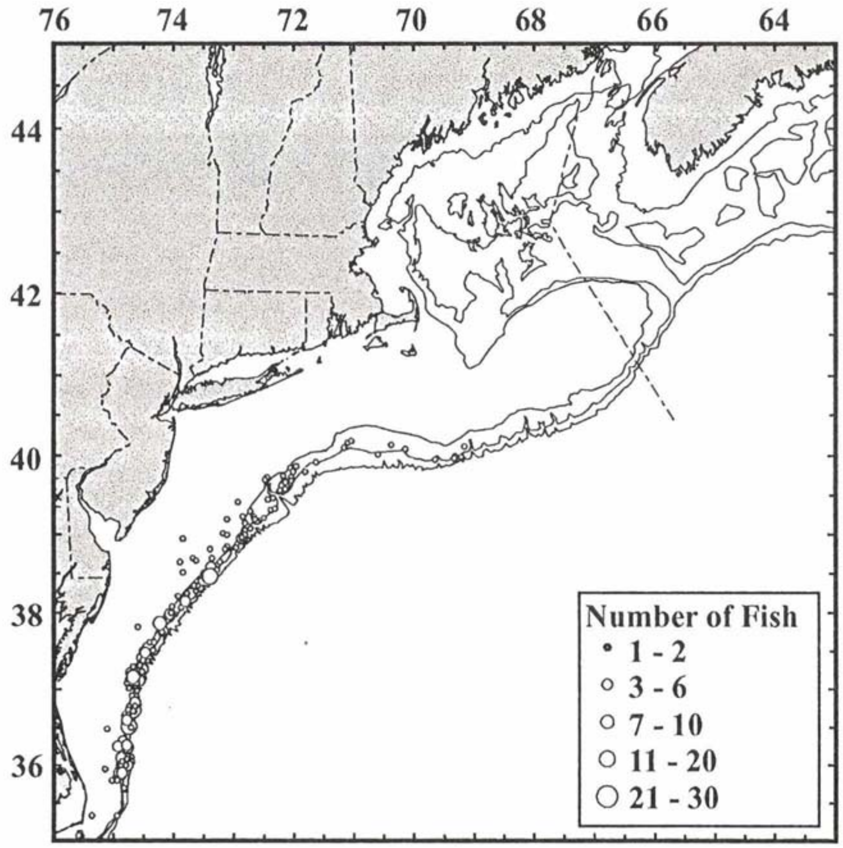


Smooth Skate
NEFSC Autumn Surveys 1963-1998

Clearnose Skate
NEFSC Autumn Surveys 1975-1998

Figure B8. Distribution of smooth skate and clearnose skate in the NEFSC surveys which correspond to the series from which target and threshhold biomass reference points are determined.

Skates



Rosette Skate
NEFSC Autumn Surveys 1967-1998

Figure B9. Distribution of rosette skate in the NEFSC surveys which correspond to the series from which target and threshhold biomass reference points are determined.

C. TAUTOG ADVISORY REPORT

State of Stock: Total biomass, spawning stock biomass (SSB) and recruitment for tautog have declined and remain at very low levels. Estimated fishing mortality rates (F) increased in the 1980's and early 1990's, then decreased to 0.29 (23.5% exploitation rate) in 1998. Relative to the interim overfishing reference point (F=0.24) overfishing is occurring (probability = 90%). The reduction in fishing mortality from 0.71 (47% exploitation rate) to 0.29 is consistent with the adoption of fishery management measures by the Atlantic States Marine Fisheries Commission in 1996, and subsequent implementation by the individual states.

Management Advice: Fishing mortality rates need to be reduced to meet both the interim fishing mortality (F=0.24) and final plan targets (F=0.15) and to begin rebuilding the stock.

Forecast for 2000: No forecasts were performed.

Catch and Status Table (landings and biomass in metric tons, recruitment in '000s of fish): Tautog

Year	1991	1992	1993	1994	1995	1996	1997	1998	Max[1]	Min[1]	Mean[1]
Commercial landings	503	459	317	208	170	161	137	114	524	114	307
Recreational landings	3664	3474	2679	1118	2070	1439	974	659	7667	659	2780
Total landings	4167	3933	2996	1326	2240	1600	1111	774	8093	774	3087
SSB	16863	13833	10277	7842	7389	6887	6834	7508	42776	6834	18822
Recruitment (age 1)	3069	2611	226.5	2037	2248	2445	2247	2101	8896	2037	4525
F (age 7-11,u)	39.5	43.2	47.6	34.4	46.7	40.5	30.8	23.5	47.6	10.5	31.5
Exploitation rate	0.55	0.62	0.71	0.46	0.69	0.56	0.47	0.29	0.71	0.12	0.41

[1] For the period 1981-1998

Stock Distribution and Identification: Tautog are distributed in near shore waters from Massachusetts to Virginia and were considered a unit stock for assessment purposes. The animal is normally found on hard bottom and is non-migratory.

Landings: On average (1981-1998) the recreational fishery has accounted for 89% of reported landings. Total recreational landings averaged approximately 2,500 mt before 1986, rising abruptly to 7,700 mt in 1986 (Figure C1). Total landings have since declined and were below the time series mean in 1995 and have further declined to 770 mt in 1998. Total commercial landings were low prior to 1984 (average 177 mt), increased to a peak of 524 mt in 1987, and have since declined to the lowest level noted in the time series, 114 mt in 1998.

Data and Assessment: Trends in fishery independent surveys, tagging data and analytical assessment of 1981-1998 total landings and coast-wide catch-at-age data were examined using an ADAPT VPA. All catches (trawl surveys, recreational and commercial) were aged using pooled age length keys from Massachusetts to New York for Northern Region states and Virginia and Delaware for Southern Region states. Length frequencies of recreational discards were estimated from the Marine Recreational Fishery Statistical Survey (MRFSS), and New York and New Jersey party boat sampling. A discard mortality rate of 2.5% was applied to recreational discards. No discard mortality rate values or discard catch numbers were available for commercial fisheries. Length frequencies for commercial fisheries were estimated using recreational length frequency data. Natural mortality, M, was assumed to be 0.15. Using total mortality estimates from American Littoral Society tagging data and this M, implies a 1996-1998 F of 0.20.

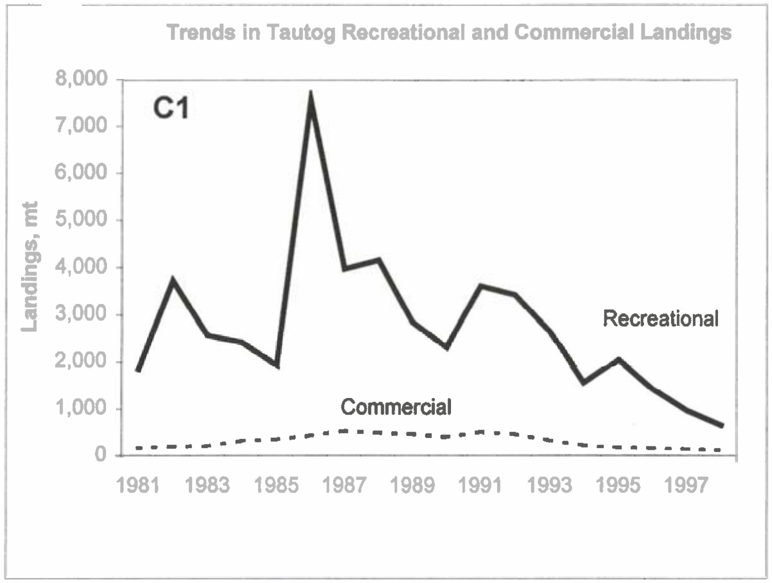
Biological Reference Points: Estimates of biological reference points based on yield and SSB per recruit analyses using the selectivity pattern from the VPA are: $F_{0.1} = 0.14$, $F_{40\%} = 0.17$, and $F_{max} = 0.36$ (Figure C4).

Fishing Mortality: Average fishing mortality rates (ages 7-11, unweighted) increased from a low of 0.12 (10% exploitation rate) in 1981 to a time series high of 0.71 (48% exploitation rate) in 1993, and have since declined steadily to 0.29 (24% exploitation rate) in 1998 (Figure C2). Bootstrap analysis of the 1998 fishing mortality estimates indicate that there is a 90% probability that F in 1998 was above the interim target (F=0.24) (Figure C5).

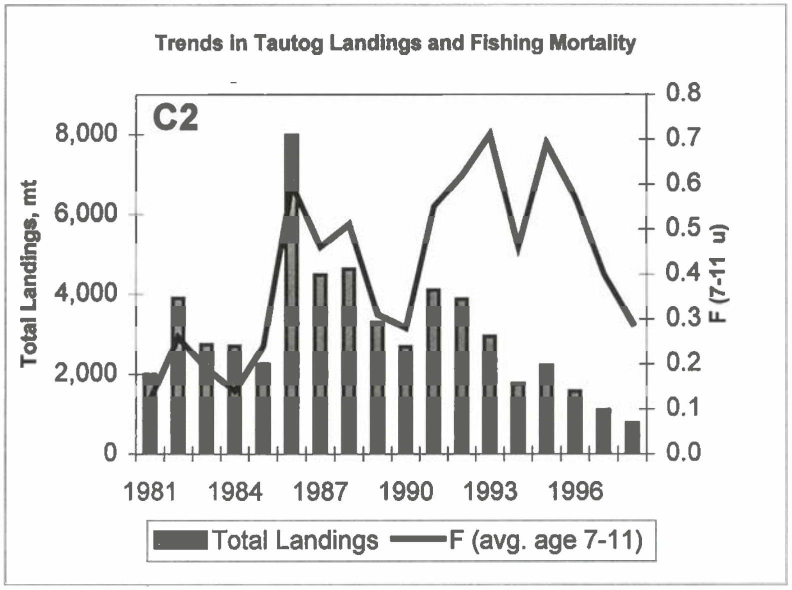
Recruitment: Age 1 stock size has declined from high levels in 1981 to the lowest level in the time series in 1994 (Figure C3). Recent juvenile surveys indicate a good year class in 1998.

Spawning Stock Biomass: Spawning stock biomass has continually declined from a time series high of approximately 43,000 mt in 1984 to 6,800 mt in 1997 (Figure C3). The SSB has stabilized at a low level in recent years (Figure C3). Bootstrap analysis for the 1998 SSB estimates indicate that there is an 90% probability that SSB was below 8,100 mt in 1998 (Figure C6).

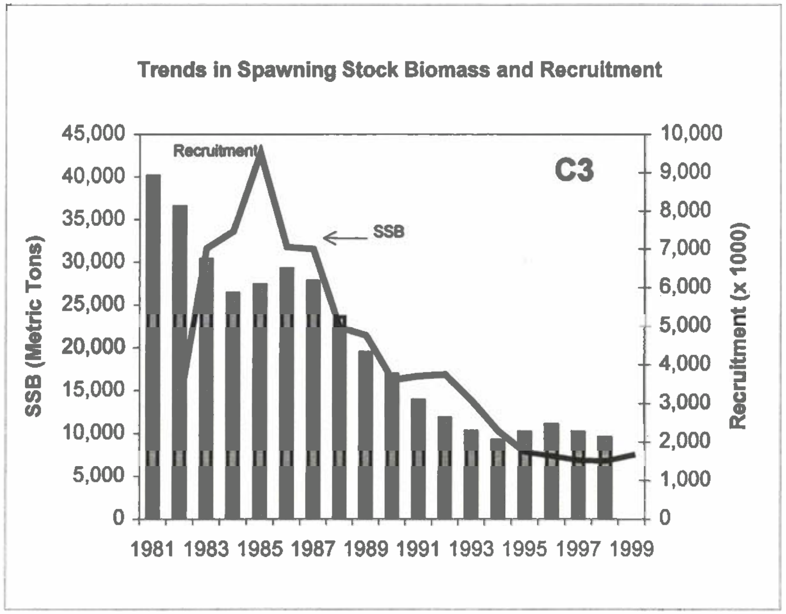
Source of Information: Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessment, NEFSC Ref. Doc. 00-03, Assessment of tautog (*Tautoga onitis*). Najih Lazar and Matthew Mitro (1999) Tag-based estimates of fishing mortality of tautog in the Mid-Atlantic Bight. Report to the ASMFC technical committee and to the 30th SAW/SARC. Report of the 20th Northeast Regional Stock Assessment Workshop (20th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessment, NEFSC Ref. Doc. 95-18, Assessment of tautog (*Tautoga onitis*).



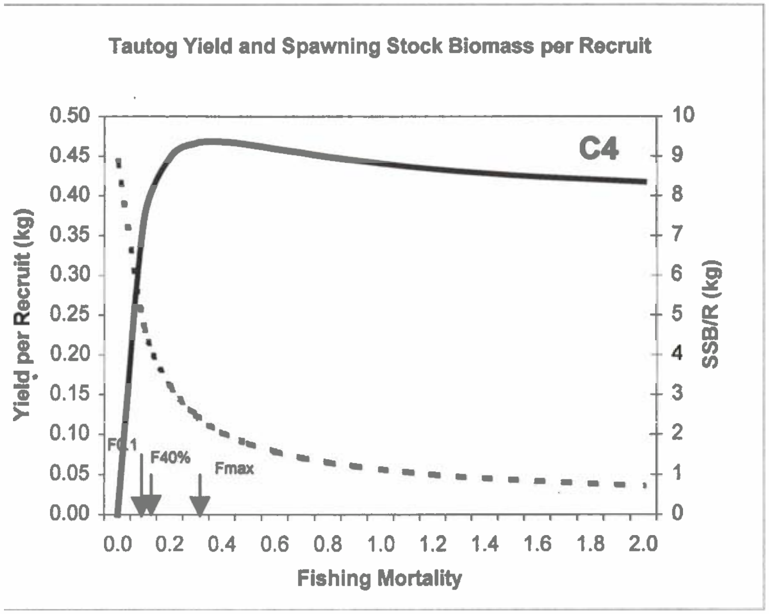
Trends in Tautog Recreational and Commercial Landings



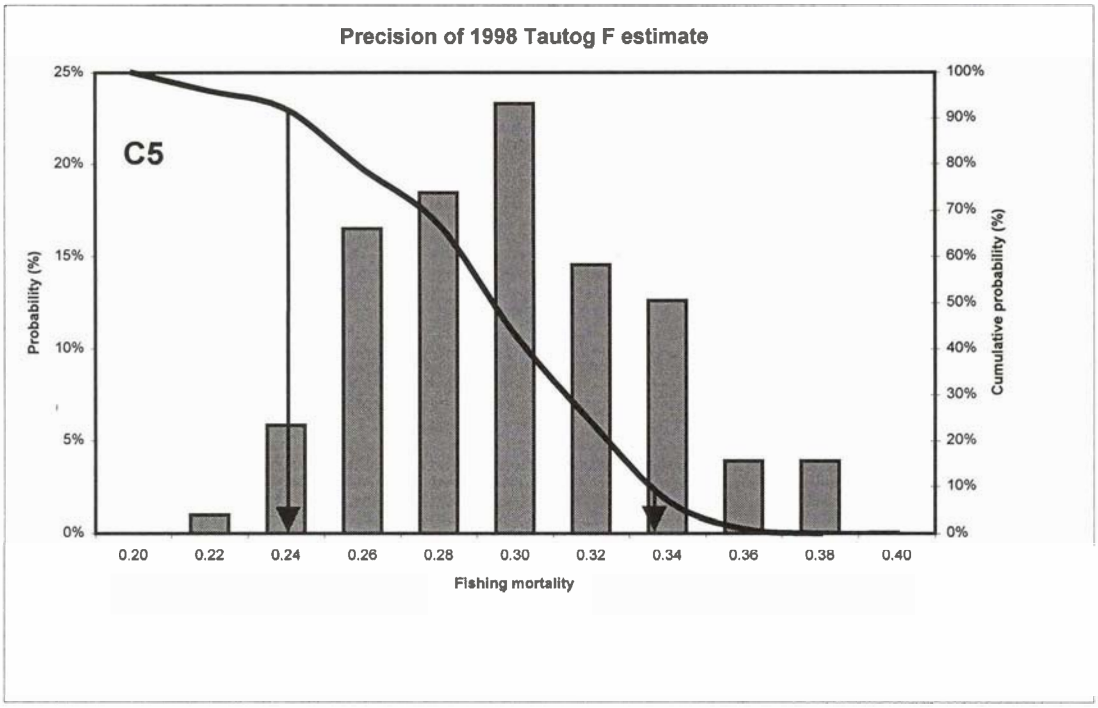
Trends in Tautog Landings and Fishing Mortality

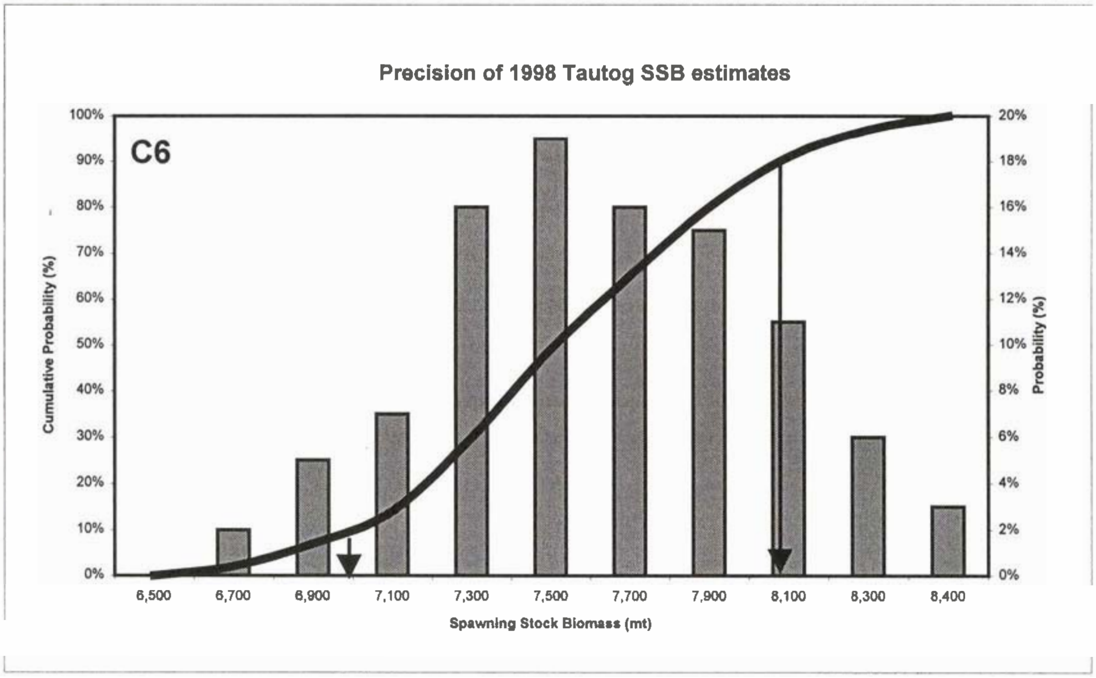


Trends in Spawning Stock Biomass and Recruitment



Tautog Yield and Spawning Stock Biomass per Recruit


Precision of 1998 Tautog F estimate
C5
Probability (%)
25%
20%
15%
10%
5%
0%
Cumulative probability (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.20
0.22
0.24
0.26
0.28
0.30
0.32
0.34
0.36
0.38
0.40
Fishing mortality


Precision of 1998 Tautog SSB estimates
C6
Cumulative Probability (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability (%)
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
6,500
6,700
6,900
7,100
7,300
7,500
7,700
7,900
8,100
8,300
8,400
Spawning Stock Biomass (mt)

D. ATLANTIC MACKEREL ADVISORY REPORT

State of Stock: The northwest Atlantic mackerel stock is at a high level of biomass and is under exploited. Fishing mortality on this stock is very low and SSB is likely large. Based on trends in survey indices, recruitment has been well above average throughout most of the 1990s. Landings in 1998 (30,100 mt) were the second lowest since 1991, and landings have been well below the long-term potential yield for the stock (150,000 mt) since 1976.

Management Advice: Current annual levels of landings (< 35,000 mt) are considerably below the long-term potential yield estimated to be 150,000 mt. The forgone yield is in excess of 100,000 mt and the fishery can be increased substantially.

Forecast Table: No forecasts were completed for 2000.

Catch and Status Table (Catch weights in '000 of mt): Atlantic Mackerel

									(1962-1998)		
Year	1991	1992	1993	1994	1995	1996	1997	1998	Max	Min	Mean
U.S. Commercial Landings	27.0	11.8	4.7	8.9	8.5	16.1	15.4	14.4	31.3	0.9	6.8
Can. Commercial Landings	20.9	25.5	26.9	20.5	17.7	20.4	18.5	15.0	44.6	5.5	22.0
Other Commercial Landings	15.7	-	-	-	-	-	-	-	396.8	0.2	72.9
Commercial Discards[1]	-	-	-	-	-	-	-	-	-		-
Recreational Landings	2.4	0.3	0.5	1.7	1.2	1.4	1.7	0.7	16.0	0.3	2.2
Recreational Discards[1]	-	-	-	-	-	-	-	-	-	-	-
Catch used in Assessment	66.0	37.6	32.1	31.1	27.4	37.9	35.6	30.1	436.6	7.9	102.9

[1] Assumed to be minimal.

Stock Distribution and Identification: Atlantic mackerel in the northwest Atlantic comprise a single biological stock that ranges from North Carolina to Labrador. There are two primary spawning grounds for the stock: the Gulf of St. Lawrence and U.S. coastal waters from New Jersey to Long Island. There is no indication that these spawning groups constitute genetically discrete populations with temporal and spatial integrity. This transboundary stock is highly migratory and its seasonal distribution patterns are thought to be influenced by oceanographic thermal regimes. In the spring the stock migrates northward in response to vernal warming, while in the fall it migrates southward and offshore to avoid seasonal cooling of shelf waters.

Catches: Atlantic mackerel were heavily exploited by distant water fleets during the 1970's. Total landings in NAFO subareas 2-6 averaged 350,000 mt during 1970-1976, but this level was not sustained (Figure D1). Annual landings decreased to less than 50,000 mt during 1978-1984 and, since 1984, landings have remained below 40,000 mt. In recent years the majority of landings have come from Canadian waters. U.S. commercial landings were less than 9,000 mt per year during 1993-1995, but have increased during 1996-1998 to an average of 15,300 mt per year.

Data and Assessment: An Atlantic mackerel assessment was last reviewed at the 20th SAW in 1995. A trial VPA was done for this SARC but not used to characterize the current state of the stock. The current assessment provides an update through 1998 with commercial and recreational catch-at-age data (landings) and NEFSC winter and spring bottom trawl abundance indices. Natural mortality (M) for this assessment was assumed to be 0.20.

Biological Reference Points: Fishing mortality based biological reference points (BRP's) were not re-estimated at SARC 30, but were carried over from yield and spawning stock biomass per recruit analyses conducted during SARC 20. Fishing mortality reference points were $F_{0.1} = 0.27$ and $F_{20\%} = 0.72$. Long-term potential yield as estimated during SARC 20 is approximately 150,000 mt with an associated SSB of 1 million mt. Stock-recruitment BRP's were estimated prior to this SARC using a bootstrap method as F_{msy}=0.45, F_{target}=0.25, MSY=326,000 mt, and SSB_{msy}=887,000 mt (NEFMC 1998)

SFA Considerations: Because estimates from the VPA were not reliable, the position of the current SSB and fishing mortality rate with respect to the Harvest Control Rule for this stock could not be established. However, because of the strong increasing trend in survey indices, it was felt that biomass is currently at or near carrying capacity.

Fishing Mortality: Although absolute estimates of fishing mortality could not be determined, the trial VPA indicated that current F is very low. This trend was confirmed by calculating a relative exploitation index (landings/survey biomass) during 1970-1998 (Figure D1).

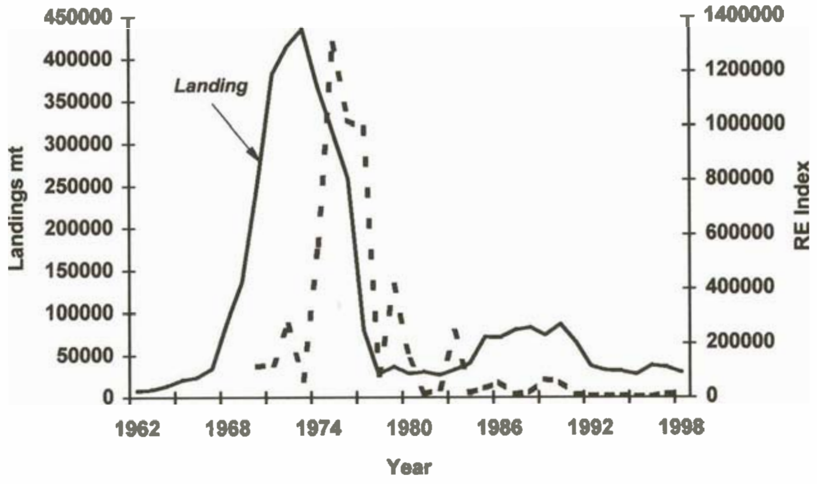
Recruitment: Recruitment (spring survey, age 1) was relatively low during the 1970s and early 1980s, but has improved dramatically during the 1990s (Figure D2).

Stock Biomass: Although absolute estimates of stock biomass could not be determined, the VPA indicated that current biomass is large. Survey trends (kg/tow) also suggest that biomass is probably at or near a historic high (Figure D3).

Special Comments: Uncertainty in the VPA calibration due to lack of convergence, survey variability, and a large retrospective pattern in SSB preclude the use of absolute estimates from the VPA. Under current conditions of low catches and high stock biomass, an annual analytical stock assessment for mackerel is not needed. Alternative survey approaches would be useful for estimating biomass. Such methods may include hydroacoustics, egg and larval survey analysis, and mid-water trawl surveys. Several years of increased catches would likely cause the VPA to converge much more rapidly, allowing for more stable estimates of fishing mortality and stock size. Given the lack of a reliable VPA, the existing harvest control rule (based on a VPA) needs to be reconsidered.

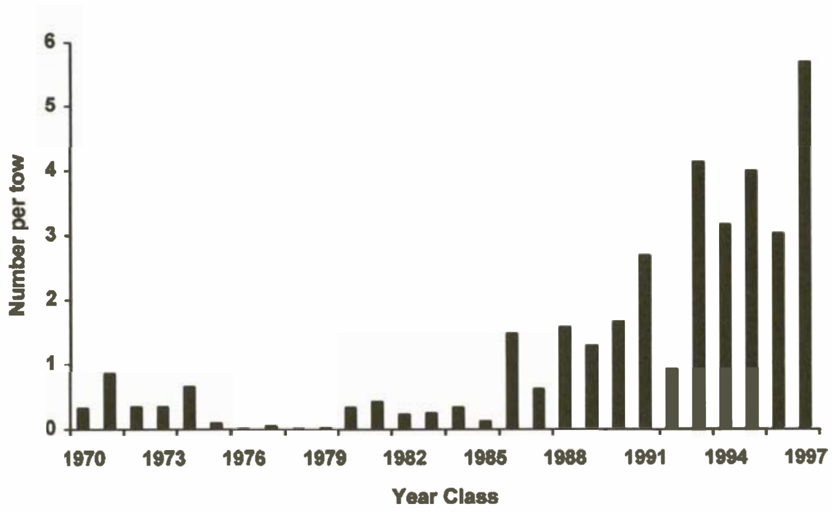
Source of Information: Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW), Stock Assessment Review Committee, NEFSC Lab. Ref. Doc. 00-03. New England Fishery Management Council. 1998. Evaluation of existing overfishing definitions and recommendations for new overfishing definitions to comply with the SFA. Final Report June 17th, 1998. 179 pp. Report of the 20th Northeast Regional Stock Assessment Workshop (20th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NOAA/NMFS/NEFSC Ref. Doc. 95-18; Overholtz, W.J. 1991. Stock assessment of the northwest Atlantic mackerel stock. Papers of the 12th Northeast Regional Stock Assessment Workshop, Appendix to CRD 91-02. NEFSC, Woods Hole, MA, 02543.

D1



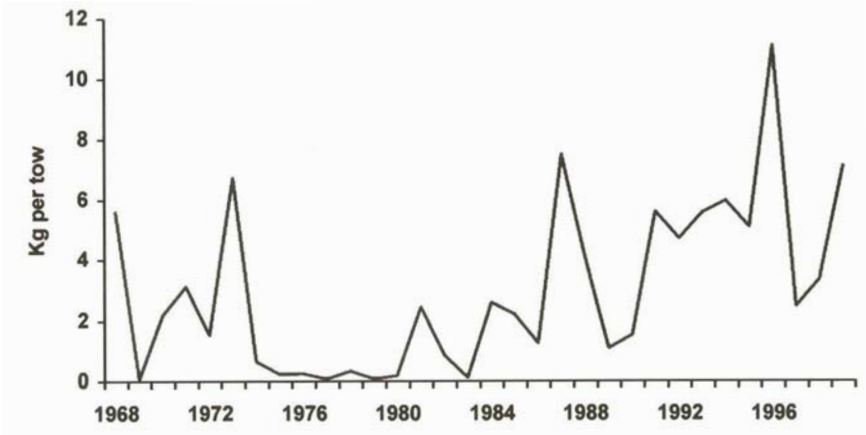
Trends in Landings and Relative Exploitation Index

D2



Trends in Recruitment

D3



Trends in Biomass

E. SURFCLAM ADVISORY REPORT

State of Stock: The EEZ surfclam stock (animals in waters beyond 3 mile state limits) is at a high level of biomass (Figure E1) and under-exploited. Surfclam in state waters were not assessed. Fishing mortality is low. Estimated mean annual fishing mortality rates (F) from 1997-1999 were 0.02 for the entire EEZ resource, 0.03 – 0.04 for the northern New Jersey (NNJ) region, and 0.04 - 0.07 for the southern New Jersey (SNJ) region (Figure E4). The majority of the catch is derived from NNJ, which contains about 39% of the stock biomass. Recent F's are less than the current overfishing definition ($F_{20\%}$ = 0.18, estimated in the previous assessment assuming M=0.05) or a new overfishing definition recommended by the SARC (an F_{MSY} proxy of F=M=0.15).

Management Advice: Fishing mortality can be increased for the surfclam resource taken as a whole. However, it may be advantageous to avoid localized depletion.

Forecasts: Short term deterministic projections for 1999-2002 were performed using recent catch (average 1997-1999) with 20% non-catch mortality from fishing, recent recruitment levels (average 1997-1999) and assuming M=0.15 y^{-1}. Projections suggest little change (4%) in total clam biomass during 1999-2002, although larger changes in some regions are possible. Biomass and recruitment are in metric tons.

Stock Assessment Region[1,2]	Biomass 1999	CV	Recent Mean Catch+ 20%	Recent Mean Recruitment	Biomass 2002	% Change in Biomass
SVA	2,500	71%	2	0	1,600	-36%
DMV	320,000	52%	900	23,000	331,000	3%
SNJ	68,000	114%	4,000	12,000	81,000	19%
NNJ	480,000	26%	16,000	42,000	441,000	-8%
LI	47,000	72%	100	3,000	48,000	1%
SNE	84,000	40%	90	4,900	82,000	-3%
GBK	265,000	34%	0	29,000	334,000	26%
Total	1,268,000	19%	21,000	114,000	1,319,000	4%

[1] SVA = southern Virginia, DMV = Delmarva, NNJ = Northern New Jersey, SSJ= Southern New Jersey, LI = Long Island, SNE = southern New England, GBK = Georges Bank

[2] Source: KLAMZ assessment model.

Catch and Status Table (weights in '000 mt): Surfclams

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	Max [1,2]	Min [1,2]	Mean [1,2]
Quota:												
EEZ	22.0	22.0	22.0	22.0	19.8	19.8	19.8	19.8	19.8			
Landings [3,4]												
EE	20.6	21.7	21.9	21.9	19.6	19.8	18.6	18.2	18.2 [5]	24.5	13.2	19.9
SNJ	1.3	2.1	2.0	0.7	0.7	1.3	2.9	3.6	-	3.6	0.1	1.1
NNJ	17.6	18.3	16.3	17.8	15.7	16.1	14.1	13.1	-	19.2	1.3	12.1
Other (EEZ)	1.7	1.3	3.5	3.5	3.2	2.4	1.6	1.5	-	13.9	1.3	6.7
State	9.4	11.7	11.6	9.1	9.4	8.9	7.7	6.3	-	11.7	1.4	7.2
Biomass [6,7]:												
EEZ	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,300	1,300	1,400	900	1,200
SNJ	33	35	37	39	44	50	57	62	68	68	29	40
NNJ	520	510	510	520	520	520	520	510	480	560	200	450
Other (EEZ)	660	650	630	630	630	640	670	700	720	790	630	700
Recruitment[6,7]:												
EEZ	82	90	100	110	110	120	130	110	90	170	46	100
SNJ	5	6	7	7	8	9	11	12	14	14	2	6
NNJ	50	54	64	63	62	61	58	42	26	110	7	55
Other (EEZ)	27	30	34	38	44	50	59	58	49	81	26	45
Fishing Mortality Rate (F) Yr^{-1}:[6,7]												
EEZ	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.03	0.02
SNJ	0.05	0.08	0.07	0.02	0.02	0.04	0.07	0.08	0.07	0.00	0.08	0.04
NNJ	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.03	0.04	0.01	0.05	0.04
Other (EEZ)	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.01

[1] 1978-98 for landings. [2] 1978-99 for biomass and fishing mortality estimates. [3] Landed catch only, excluding clams assumed killed by fishing but not landed (20% of landings in assessment models). [4] Discards near zero since 1992. [5] Assumed same as 1998 because data incomplete. [6] From KLAMZ delay-difference biomass dynamics model. [7] For surfclams, 120+ mm in NNJ and SNJ and 100+ mm in other areas.

Stock Distribution and Identification: The Atlantic surfclam occurs from the subtidal zone to 50 m depth. Its range includes state waters and the US EEZ along the Atlantic seaboard from Maine through North Carolina. Surfclam larvae are planktonic for 2-3 weeks and may disperse sufficiently to cause gene flow throughout their geographical range.

Catches: Since 1978, total EEZ annual landings of surfclams have varied between 13,200 mt and 24,900 mt (meat weight). The fishery is managed with an annual catch quota, which constrained catches in years prior to 1997. Since 1983, 90-100% of the EEZ landings have been taken from the Mid-Atlantic region. During 1986-1999, 74-91% of the Mid-Atlantic landings came from the Northern New Jersey region, 1-16% came from the Delmarva region, and 0-24% came from the Southern New Jersey region (SNJ). Catches in SNJ have increased since 1995. Discarding reached substantial levels (e.g., 33% by weight of the total catch in the NJ region) in the early 1980s because of minimum size limits, declined through the mid- to late-1980s, and was low in the 1990s when minimum size limits were absent.

Data and Assessment: Surfclams were last assessed in 1998 (SAW-26). The present assessment used efficiency corrected swept area biomass estimates for the EEZ from the 1997 and 1999 surveys. The catch-swept area assessment model estimated recent fishing mortality rates by dividing recent catches (mean catches during 1997-1999) by recent biomass (the mean of 1997 and 1999 swept area biomass). The new biomass dynamics model (KLAMZ) used discard, landings per unit effort (LPUE), region specific growth curves and shell length-meat weight relationships, and research survey data to estimate surfclam biomass, recruitment biomass and fishing mortality rates during 1978-1999. Unobserved mortality of surfclam due to fishing was assumed equal to 20% of landings (by weight) in all analyses. The ten-year supply model and production model for surfclam, used in previous assessments, were examined but not used for assessment purposes.

Biological Reference Points: SARC-26 calculated reference points under the assumption that M = 0.05, but stated that M "should be reconsidered in the next full assessment." In the present assessment, the SARC adopted M = 0.15 from analyses based on age and growth studies. Although there are minor differences among regions in reference points calculated in this assessment, the SARC chose stock-wide reference points (Figure E5) $F_{MAX} = 0.70$, and $F_{0.1} = 0.19$ (assuming recruitment to the fishery at 120 mm). Assuming M=0.15, the reference point $F_{20\%}$ was estimated as 0.96 (instead of 0.18 with M=0.05 as in SARC-26). The current best proxy for F_{MSY} is F = M = 0.15.

SFA Control Rule: According to the current definition, overfishing occurs whenever fishing mortality rates are larger than $F_{20\%}$. The current definition is not compatible with SFA requirements. A new control rule was developed by the SARC which is compatible with SFA requirements, has a target biomass of B_{MSY}, a biomass threshold of ½ B_{MSY} and a fishing mortality rate threshold of F_{MSY} at biomass levels above the biomass threshold (Figure E6). When stock biomass is less than the biomass threshold, the fishing mortality rate threshold is reduced from F_{MSY} in a linear fashion to zero. By definition, overfishing occurs whenever fishing mortality exceeds the threshold fishing mortality rate and the stock is overfished whenever stock biomass falls below the biomass threshold value.

Fishing Mortality: Based on the catch-swept area model (estimates from KLAMZ model were similar) for the Northern New Jersey region, where 74-91% of the catch is typically taken, recent (mean 1997-1999) F = 0.04 (Figure E4). For Southern New Jersey recent F = 0.07. Other regions, which are largely unfished, had smaller estimated recent Fs. For the entire EEZ stock, recent F = 0.02.

Recruitment: Survey data are used to track trends in abundance of recruits. In the NNJ and DMV regions, and in the stock as a whole, recruitment was low in 1978-1980, high from 1980-1984, and moderate from 1985 to 1999 (Figures E1, E2). In SNJ, recruitment has increased since 1985 (Figure E3).

Stock Biomass: Based on the KLAMZ model, recent (mean 1997-1999) recruited biomass (in mt) and 95% confidence intervals (CI) were 500,000 (310,000-820,000) in the Northern New Jersey region, 320,000 (120,000-840,000) in the Delmarva region, 240,000 (120,000-450,000) on Georges Bank, 85,000 (40,000-180,000) in Southern New England, 60,000 (10,000-370,000) in Southern New Jersey, 46,000 (13,000-170,000) off Long Island, and 3,000 (1,000-10,000) off Southern Virginia - North Carolina. Surfclams included in the biomass estimates were 120 mm+ shell length for NNJ and SNJ, and 100 mm+ elsewhere. Biomass estimates and confidence intervals from the catch-swept area model were similar.

Special Comments: Biomass and F estimates from the catch-swept area and KLAMZ models depend heavily on swept-area biomass estimates from NMFS surfclam surveys calibrated for dredge efficiency and tow-path length. The information required for these calibrations was based on a joint NMFS-industry research program conducted in 1997 and 1999.

Overfishing definition and harvest policy choices for surfclam were developed for biomass targets, biomass thresholds and fishing mortality thresholds using the generic MSY control rule implied by the SFA, National Standard 1, and National Standard 1 Guidelines. The biomass target in the MSY control rule is B_{MSY}.

Under the definition recommended by the SARC, overfishing occurs whenever F exceeds the threshold fishing mortality rate. The threshold fishing mortality rate is F_{MSY} but reduced in a linear fashion towards zero when stock biomass falls below the biomass threshold value (½ B_{MSY}). The surfclam stock is overfished whenever stock biomass falls below the biomass threshold level. Estimates of fishing mortality and biomass thresholds and the biomass target based on MSY can be expected to change in each assessment as data accumulate and models improve.

According to the Sustainable Fisheries Act, overfishing definitions must apply to the entire surfclam stock. In practice, the surfclam stock is assessed based on a number of smaller stock assessment areas, with B_{MSY} and F_{MSY} estimated for each. Under these circumstances, best estimates of MSY parameters for the entire surfclam stock might be sums or weighted averages of the estimates for each stock assessment area.

B, $B_{threshold}$ and B_{MSY}, F, $F_{threshold}$ and F_{MSY} estimates may not be reliable or available for all stock areas. In such cases, proxies or proxies for ratios (e.g. for B/B_{MSY} or F/F_{MSY}) based on the best available information should be used instead. In most areas, with the possible exception of NNJ and SNJ, the surfclam resource is only lightly harvested. Given this situation, the current total biomass can be used as a lower bound estimate for the carrying capacity, and half the total current biomass can serve as a proxy for B_{MSY}.

Sources of Information: Report of the 30th Northeast Regional Stock Assessment Workshop (30th SAW), Stock Assessment Review Committee, NEFSC Lab. Ref. Doc 00-03. SAW Consensus Summary Report of the 26th Northeast Regional Stock Assessment Workshop (26th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC Ref. Doc. 98-03; Weinberg, J.R. 1998. Density-dependent growth in the Atlantic Surfclam, *Spisula solidissima*, off the coast of the Delmarva Peninsula, USA. Mar. Biol. 130:621-630. Weinberg, J.R. 1999. Age-structure, recruitment, and adult mortality in populations of the Atlantic Surfclam, *Spisula solidissima*, from 1978 to 1997. Mar. Biol. 134:113-125.

Figure E1. Surfclam-EEZ Biomass, Recruitment, Fishing Mortality and Catch

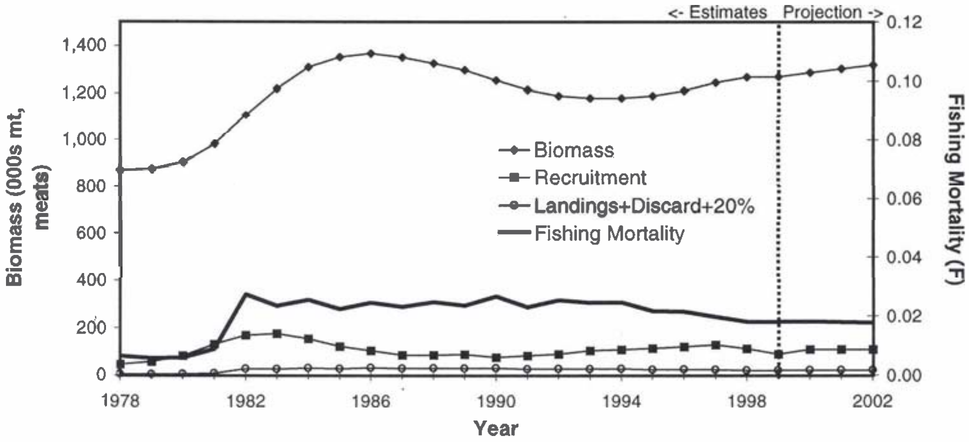


Figure E2. Surfclam-NNJ Biomass, Recruitment, Fishing Mortality and Catch

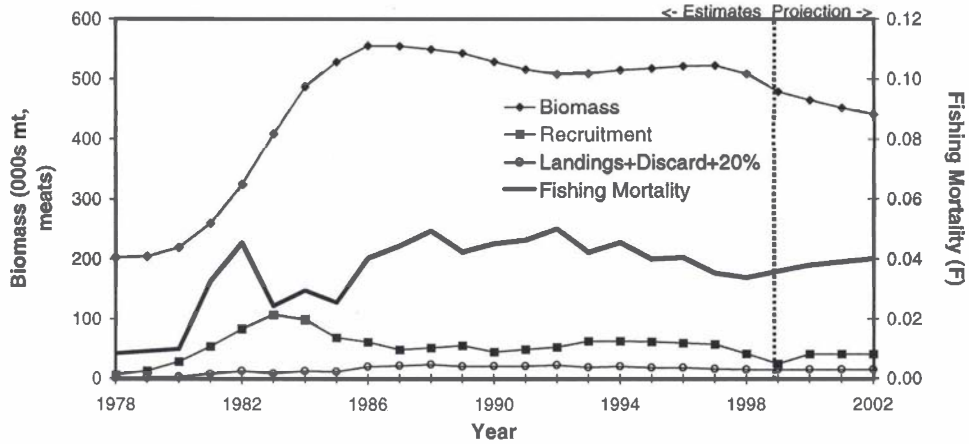


Figure E3. Surfclam-SNJ Biomass, Recruitment, Fishing Mortality and Catch

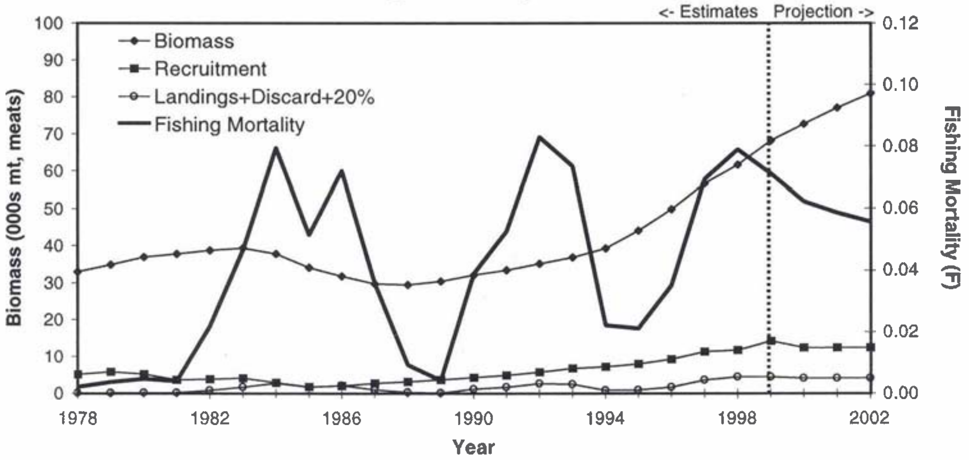


Figure E4. Cumulative Probabilities for Recent (1997-1999) Mean F on Surfclam

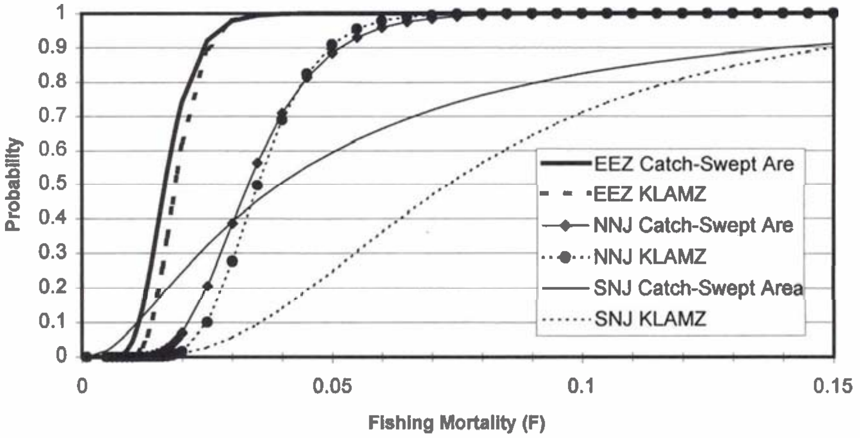


Figure E5. Yield per Recruit, NNJ (M=0.15, Recruit at 120 mm)

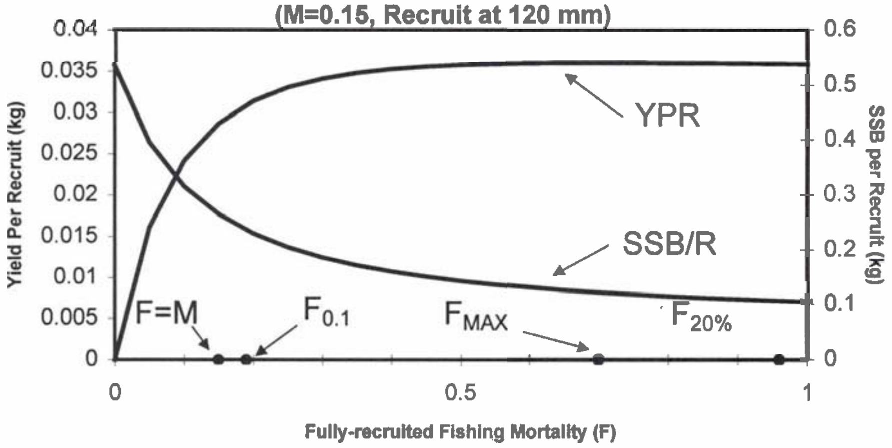
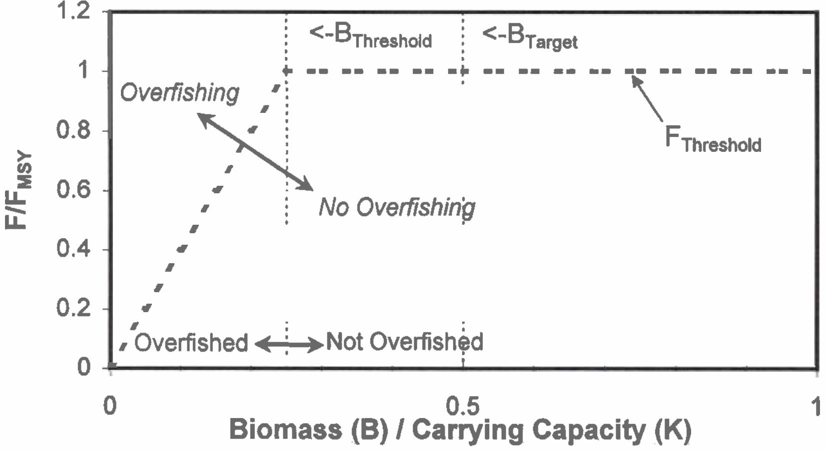


Figure E6. Surfclam MSY Control Rule Recommended by the SARC



CONCLUSIONS OF THE SAW STEERING COMMITTEE MEETING

Meeting of February 15, 2000

The Steering Committee for the Northeast Regional Stock Assessment Workshop (SAW) met on February 15, 2000 at the Sheraton-Providence Airport Hotel. Participating were Jack Dunningan and Lisa Kline of the ASMFC; Dan Furlong and Chris Moore of the MAFMC; Paul Howard of the NEFMC; Steve Clark, Fred Serchuk, Mike Sissenwine, Terry Smith (SAW Chair), and Pie Smith (SAW Coordinator) of the NEFSC; and Harry Mears of the NER.

Concluding the SAW 30 Cycle

The Committee discussed whether the SAW Public Review workshops were the appropriate venue for rigorously defending an assessment agreed to by an independent panel (the SARC) that had met some two months earlier. It was noted that the SARC provides the opportunity for scientific, factual discussion and resolution and that Public Review Workshop sessions appear to be evolving into more of a presentation opportunity. The Steering Committee recognized that the proposed revisions to the SAW process (see below) could lead to changes in the context of the Public Review presentations.

Concern about the excessive amount of time spent on editing draft documents after the SARC was discussed by the Committee. Some Working Groups have had difficulty meeting post-SARC editing deadlines. Delays have resulted in reports not getting circulated to Councils/Commissions, industry, and the general public in time for the Public Review Workshops. Also discussed was the fact that, on occasion, the results of the SARC are unofficially circulated prior to publication of the draft SAW reports.

TRAC Discussions

Steve Clark, the TRAC co-chairman, briefed Committee members on the history and process of the Transboundary Resources Assessment Committee (TRAC). The joint peer review process consists of a Transboundary Assessment Working Group (TAWG) and the TRAC. Stock assessments produced by the TAWG are reviewed by the TRAC which is responsible for producing final, approved assessment and resulting documentation on the status of the transboundary resources.

This year the TAWG will meet in St. Andrews on April 1 and the TRAC in Woods Hole on April 26-28. Stocks to be assessed include Georges Bank cod, Georges Bank haddock, and Georges Bank yellowtail flounder as well as Eastern Georges Bank (Canadian waters) cod and haddock.

Dr. Clark will ask the TRAC to consider, in the future, reviewing assessments for Gulf of Maine cod and Southern New England yellowtail flounder in the joint process.

SAW 31 (31st SARC, June 2000)

At its previous meeting, the SAW Steering Committee suggested review of assessments for ocean quahog, summer flounder, pollock, bluefish and goosefish (monkfish).

After considerable discussion the Steering Committee agreed that a bluefish assessment review should be postponed (likely SAW 33); and that ocean quahog, summer flounder, scup and monkfish will be assessed at SAW 31.

Terms of Reference for these stocks will be elicited from NEC/Council/Commission staff as soon as possible. Dates for the 31st SARC were tentatively set for 26-30 June, 2000 in Woods Hole, MA

SAW 32 (32nd SARC, November 2000)

At the last meeting of the Steering Committee, assessments of silver hake, Gulf of Maine haddock, redfish, sea scallops and Gulf of Maine cod were suggested for the fall 2000 SARC.

The Steering Committee determined that silver hake (whiting) will be assessed at SAW 32; Gulf of Maine haddock, and redfish can be updated this fall as well but need not go through the SARC process. Sea scallops and Gulf of Maine cod assessments will also be reviewed by the SARC. Dates for the 32nd SARC were tentatively set for 27 November - 1 December, 2000 in Woods Hole, MA.

SAW 33

Given possible revisions to the SAW process model, discussed below, it would be more advantageous to wait until the next meeting of the Steering Committee to discuss the agenda for SAW 33 (SARC, June 2001). At this point in time, candidate assessments include bluefish and, perhaps, pollock, depending on the timing of a joint assessment for this stock.

SAW Model Revisions

Terry Smith presented a draft discussion paper (see below) suggesting revisions to the SAW/SARC model in recognition of the commitment to an annual assessment update process mandated by the SFA. The concept of the proposed model was accepted by the Committee but members cautioned that Council and SFA requirements would affect how the SAW evolves into this new entity, with data and timing issues affecting how a new type of an annual update would take place. It was agreed a "team" method of assessing stocks is preferred to maintain a standardized format and it was realized that there would be costs, both fiscal and personnel, associated with any changeover to a new model.

The Committee agreed that a matrix of dimensions, similar to a "transition plan" should be developed for review by the Committee. Terry Smith, for the NEFSC, and Council/Commission Directors will assign staff to work, as an *ad hoc* group, on a Transition Plan.

SAW Publication Policy

It was agreed that a consistent numbering system for assessment-related documents published by the Councils, Commission, and Northeast Center will be devised to permit cross referencing of all documents. The Center intends to put the final SAW 31 documents on the Center's website for quicker access by the public. The NEFSC also intends to have all previous SAW documents catalogued in the this proposed numbering/cross referenced system.

MARFIN

Harry Mears, Program Office Director for State, Federal and Constituent Programs - Northeast Region, briefly described the Marine Fisheries Initiative (MARFIN). A MARFIN Steering Committee, comprised of the SAW Steering Committee members, helps to advise how to best use the appropriated funds. In FY98, $500K was appropriated to WHOI and MIT for joint socio-economic studies; in FY99, $250K was appropriated to work on stock identification issues pertinent to fisheries managed in the Northeast including investigative studies on yellowtail flounder, cod, and striped bass.

It is anticipated that the Northeast will receive $200-250K for this fiscal year and Mr. Mears asked the Committee to consider three possible options:

1. Atlantic herring research focusing on assessment via hydroacoustic methods and sub-stock identification work.

2. Cooperative research with commercial fishermen.

3. Seed money to address criticisms of stock assessment process and bolster the peer review process to encourage more people to get involved..

The Committee felt that option 3 was not appropriate for MARFIN funding.

After considerable discussion the Committee suggested that the second option had the most promise. On the one hand it might be possible to secure long term support from Congress for such an initiative and to have the MARFIN program become an institutionalized process in the northeast region. Secondly, such a initiative would allow MARFIN to fund cooperative research in areas other than groundfish.

The Northeast Regional Stock Assessment Workshop Model: A New Perspective

DISCUSSION PAPER

Terry Smith, SAW Chair

The Northeast Regional Stock Assessment Workshop or SAW is a protocol for developing, reviewing, publishing and presenting assessments of the region's fishery stocks. The SAW has been in place since 1985 and is now in its 31st cycle. The process was designed to assist the region's managers – the New England and Mid-Atlantic Fishery Management Councils and the Atlantic States Marine Fisheries Commission – as well as the NMFS in providing for a high-quality, standard and objective approach to assessing stocks, peer reviewing those assessments and delivering reports on the assessments to managers, the fishing industry and the interested public.

Over the last 15 years the process has served the region's managers well. That is not to say the model has been static. As with any long-standing institution, the SAW has evolved to meet changing needs.

Part of the force for change has been to redress perceived problems. To a large extent this has been successful. A more significant agent for change, however, has been the need to respond to changes in the fishery management system the SAW was designed to serve.

Perhaps the most significant of these recent assessment-perspective changes is the Sustainable Fisheries Act of 1996. The SFA introduced a number of revisions to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and other relevant U.S. law. For the purposes of this discussion, the most important change was the modification of the definition of 'optimum yield' to include the concept of rebuilding a stock to levels consistent with producing maximum sustainable yield. This change, in turn, led to the adoption of new guidelines for National Standard 1[1] and implementation of an annual exercise which reports to Congress on the status of the region's fisheries (with respect to the SFA).

More specifically, for a stock, the annual status determination focuses on whether or not overfishing is occurring (the current fishing mortality rate or F is above an overfishing threshold specified in the relevant Fishery Management Plan or FMP) and whether or not the stock is overfished (current biomass is below a biomass threshold level specified in the FMP). Under National Standard 1 Guidelines, if overfishing is occurring, the relevant Council has one year to eliminate that overfishing. If the stock is overfished the Council must adopt (within a year) a plan which will rebuild biomass to the target level within ten years.[2]

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[1] Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

[2] If the stock can not be rebuilt in 10 years (at F=0), the rebuilding time horizon can not exceed 10 years plus one generation.

In sum, the annual status determination and the non-discretionary course of action, should it be found that either overfishing is occurring or that a stock is overfished, has created a situation requiring annual assessment information.

Since there are approximately 40 stocks assessed in the region and since it has not been possible to accommodate more than 4-6 stock assessment reviews in the week long peer review meeting of the Stock Assessment Review Committee (SARC), a new approach matching peer review production and management needs is called for.

BACKGROUND

A history of the Stock Assessment Workshop models is provided in Anderson (1997). For the purposes of the present discussion, the most significant changes occurred at SAW 10 (June 1990) which led to the creation of the SAW Steering Committee, the two-level peer review model (working group, SARC) and the SAW Plenary session. In March 1993 (following SAW 15) the SAW Steering Committee adopted the essential model still in use today (Steering Committee sets priorities, selects stocks for review, establishes Terms of Reference, dates and places for meetings, and evaluates sufficiency and style of printed and oral SAW communications).

More recently, the Steering Committee, partly in response to the SFA, partly because of a need to formalize the production of an annual Stock Assessment and Fishery Evaluation (SAFE) report, and partly as a way to better accommodate priority needs and workloads, considered a more formal schedule for review of benchmark assessments of all regional stocks (see Anderson 1998 and NEFSC 1999).

Discussions of a new model continued in 1999 where the Steering Committee at a March meeting in Providence, RI adopted several process principles (NEFSC 1999). These included a division of assessments into analytical or index-based and a commitment to thoroughly review analytical assessments on a periodic basis such that all such assessments are reviewed over a three-five year cycle (Table 1). Index-based assessments would be benchmarked by the SARC every five years. Moreover, the Committee agreed that all assessments (analytical and index-based) should be updated annually.

Additionally, the Steering Committee agreed to a general ‘scheduling’ model for an annual cycle whereby there would be a 3 month period following the end of a fishing year during which fishery-independent and fishery-dependent data sets for the previous year would be closed out and made available; a 3 month period devoted to developing, reviewing and reporting on an assessment; and, finally, a 6 month period where the relevant regional management council would adopt appropriate management measures consistent with the stock status report, and pass them along to the Secretary of Commerce for implementation.

Unresolved at the 1999 meeting were FMP specific timing decisions related to this generic 3—3—6 month management cycle. It’s important to note that timing considerations for the New England and Mid-Atlantic councils differ. The MAFMC uses a single fishery management year that coincides with the calendar year (with the exception of dogfish where the fishing year commences in

May). The NEFMC FMPs use different fishing years, with the groundfish and monkfish fishing year starting in May and the scallop fishing year in March. The ASMFC uses a calendar year as the fishing year.

Decisions on the timing for assessing and reporting on the condition of the NEFMC's groundfish stocks is also complicated by the need for joint assessment with Canada for a number of important Georges Bank stocks (cod, haddock and yellowtail flounder), differences in the Canadian fishing year, and differences in the timing of the Canadian assessment/management cycle.

Discussion on the timing of the U.S.- Canada joint assessment process (i.e., TRAC) with possible changes in fishing years is ongoing and not yet resolved. It will be necessary to finalize scheduling plans, however, to accommodate the changes in the SAW process model discussed in the next section. More generally, the scheduling issues are the 'nuts and bolts' of the proposed modified SAW/SARC model. In the interim, however, policy issues can be resolved and a commitment toward a common endpoint reaffirmed.

A NEW PERSPECTIVE

Given this background, we acknowledge that substantive discussion and development (and potentially FMP amendments) will need to occur to effect a more efficient assessment, review, and decision cycle. That is, looking forward from the decisions made by the Steering Committee last year which have yet to be fully implemented, we consider the implications of an annual assessment update model with respect to the traditional twice-a-year meeting of the SARC.

The essential conclusion is that, if there is a process developed that will provide for annual assessment updates in a manner and with timing consistent with the needs of specific FMPs and the annual SFA status determination cycle, it will no longer be necessary to tie the benchmark assessments reviewed by the SARC to the annual management cycle.

This has several implications including:

> The timing of the SARC meetings can become partially independent of the management (FMP) cycle. Meetings need not always occur the last week in June or the last week in November.
>
> The necessity of conducting two meetings a year is lessened. It may be appropriate to meet three times in a year or perhaps once.
>
> The need to accommodate as many assessments as possible in a SARC so as to maximize the number of management updates per year no longer holds. Thus, it may be possible to hold more frequent, more narrowly focused meetings, e.g., a SARC to assess the skate complex, or a SARC to look at benchmark assessments for surfclam and ocean quahog.
>
> For the more specialized SARC meeting mentioned above, it would be possible to appoint a smaller, more specialized review panel, to designate a chair from among the panelists, and to give the panel more autonomy in both the content and the timing of the assessment report.
>
> The separation of the update and the benchmark reviews (in the process sense) would provide for more independence and less time-pressure for the SARC panel.

Reporting to the Councils will not occur via the SAW Public Review Workshop but in the context of a stock status update using timing consistent with the relevant FMP. Indeed, the report may not need to be delivered by the SAW at all but could become part of a Monitoring Committee or SAFE report.

Basically, by de-coupling the SARC and the assessment updates the SARC will be allowed to evolve to be both more specialized and more flexible. The revised SARC would be more akin to a peer-review panel convened by the National Research Council or the ASMFC's special peer-review process.

RECOMMENDATIONS AND ISSUES

If the Steering Committee views such a re-alignment of the SARC as appropriate, several things must occur. First, the work of the NEFMC in developing recommendations for revised fishing years must be completed. It is also useful that the New England Council attempt to establish a uniform set of fishing years for their FMPs or perhaps a set of two fishing years to which all FMPs must adhere. It would also be efficient for the NEFMC to either completely subscribe to or entirely avoid a calendar year fishing year model.

The timing considerations for the fishing year, however, are somewhat independent of the SARC timing cycle if the premises of the preceding section are accepted. Fishing year, assessment and management cycle alignment is more relevant to the annual update process and to the timing of delivery of assessment update reports and subsequent management action.

There are significant internal workload, scheduling and personnel issues for the Northeast Fisheries Science Center associated with a commitment to annual updates. These include staffing and workload considerations for the Population Dynamics Branch, the Age & Growth Unit and the Resource Surveys Investigation. It is unclear, at this point in time, whether current fiscal and hiring constraints will allow any commitment to increased staff.

In sum, to effect a change such as outlined above, several parallel processes need to occur. These include

- Re-examination of the NEFMC FMP fishing years, on an FMP-by-FMP basis.

- Realignment of the NEFMC fishing years to a one-year or two-year model.

- A workload analysis for the NEFSC, Councils and Commission staff with respect to the requirements for annual assessment updates.

- A structural needs assessment for the NEFSC with respect to the organization of Center staff and a revised assessment-related workload.

- An examination of reporting requirements (oral as well as published documentation) for an annual update system.

- Continued discussion with Canada with respect to the timing of the TRAC process, the Canadian management cycle and the Canadian groundfish fishing year.

- Further development of a semi-independent SARC process with the development of a tie-in to the overall benchmark assessment turnover cycle.

TRANSITIONAL ISSUES

If the Steering Committee decides to proceed in the direction outlined above it is not clear how the annual update and the SARC process can be de-coupled. One possibility is to institute, as soon as possible, an update timing model that would provide one set of updates for all the MAFMC (and ASMFC) stocks at one time of the year and another update set for NEFMC groundfish stocks at another time of the year. This could be done next year providing staffing issues can be resolved. Under this scenario, two 'Stock Status' reports would be issued, one for the NEFMC and one for the MAFMC (and ASMFC if appropriate). The assessment update reports could be peer reviewed by a special SARC (suspending the typical benchmark meeting or scheduling a 'special' third SARC to accommodate one or two critically important benchmark reviews), by the Council's S&S Committees or by some special peer-review panel. In any case, the update report could be published as a SAW reference document.

As the individual scheduling and timing issues become resolved, the process could become more inclusive and, over time (which may involve processing FMP amendments), more consistent and standardized.

Such a change will be more reflective of the current fishery management context, more responsive to managers and the regulated industry and more efficient in delivering assessment results to interested constituents.

REFERENCES

Anderson, E. D. 1997. "Modifying the SAW Peer-Review Process to Meet Changing Expectations", Appendix I to the 24th Northeast Regional Stock Assessment Workshop (24th SAW): Public Review Workshop. NEFSC Ref. Doc. 97-11.

Anderson, E. D. 1998. "Towards a More Comprehensive Stock Assessment Process in the Northeast Region", Appendix I to the 27th Northeast Regional Stock Assessment Workshop (27th SAW): Public Review Workshop. NEFSC Ref. Doc. 98-14.

NEFSC. 1999. "Conclusions of the SAW Steering Committee Meeting", in 28th Northeast Regional Stock Assessment Workshop (28th SAW): Public Review Workshop.

Table 1. Northeast Stocks, Assessment Classification and Status

STOCK	Assessment Type	Last Assessed	Assessment Frequency	Next Assessment
BLUEFISH	Analytical	1996	3	2000
FLDR, SUMMER	Analytical	1999	2	2000
LOBSTER	Analytical	1996	3	2000
COD. Georges Bank	Analytical	1999	2	2000
COD, Gulf of Maine	Analytical	1999	2	2001
FLDR, WINTER, GB	Analytical	1999	2	2000
FLDR. Yellowtail. GB	Analytical	1999	2	2000
FLDR, Yellowtail, SNE	Analytical	1999	2	2001
HADDOCK-Georges Bank	Analytical	1999	2	2000
HERRING	Analytical	1998	3	2001
SHRIMP, NORTHERN	Analytical	1997	5	2002
STRIPED BASS	Analytical	1997	5	2002
FLDR, AM. PLAICE	Analytical	1998	3	2001
FLDR, WINTER, SNE	Analytical	1998	3	2001
FLDR, Yellowtail, CC	Analytical	1998	3	2001
OCEAN QUAHOG	Analytical	1998	3	2000
SCALLOPS	Analytical	1999	2	2001
WHITE HAKE	Analytical	1998	3	2001
FLDR, WITCH	Analytical	1999	3	2002
POLLOCK	Analytical	1997	5	2000
SPINY DOGFISH	Analytical	1999	5	2004
SQUID, ILLEX	Analytical	1999	5	2004
SQUID, LOLIGO	Analytical	1999	5	2004
SURFCLAM	Analytical	2000	3	2003
MACKEREL, ATLANTIC	Analytical	2000	3	2003
WEAKFISH	Analytical	2000	5	2005
CUSK	Index	1995	5	2000
SCUP	Index	1998	5	2004
TILEFISH	Index	1999	5	2004
WOLFFISH	Index	1995	5	2000
BLACK SEA BASS	Index	1998	5	2003
RIV. HERRING/SHAD	Index	1988	5	TBD
BUTTERFISH	Index	1993	5	1998
FLDR, Windowpane, GB	Index	1997	5	2002
FLDR, Windowpane, Mid-Atlantic	Index	1997	5	2002
FLDR, WINTER, GOM	Index	1995	5	2000
GOOSEFISH	Index	1996	5	2001
HADDOCK-Gulf of Maine	Index	1995	5	2000
OCEAN POUT	Index	1990	5	TBD
RED HAKE, Northern	Index	1990	5	2000
RED HAKE, Southern	Index	1990	5	2000
REDFISH	Index	1992	5	TBD
SILVER HAKE, Northern	Index	1995	5	2000
SILVER HAKE, Southern	Index	1995	5	2000
SKATES	Index	2000	5	2005
TAUTOG	Index	2000	5	2005

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To obtain a copy of a technical memorandum or a reference document, or to subscribe to the fishermen's report, write: Research Communications Unit, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543-1026. An annual list of NEFSC publications and reports is available upon request at the above address. Any use of trade names in any NEFSC publication or report does not imply endorsement.