Northeast Fisheries Science Center Reference Document 02-07

34th Northeast Regional Stock Assessment Workshop (34th SAW)

Public Review Workshop

April 2002

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A Report of the 34th Northeast Regional Stock Assessment Workshop

34th Northeast Regional Stock Assessment Workshop (34th SAW)

Public Review Workshop

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
Northeast Fisheries Science Center
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Northeast Fisheries Science Center Reference Documents

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The 34th Northeast Regional Stock Assessment Workshop

The Northeast Stock Assessment Workshop (SAW) is a process for preparing, peer reviewing and presenting stock assessment information. A SAW cycle is six months, thus, twice a year, a number of fishery stock assessments are prepared and presented to a panel of assessment experts. The panel, the Stock Assessment Review Committee (SARC), prepares two reports. The first is the *SAW Advisory Report*; a brief summary of the stock status, management advice, short term stock forecasts, and other relevant assessment information for each stock assessed and reviewed.. The second report, the SARC *Consensus Summary of Assessments*, is more detailed, containing specific assessment data, results and SARC discussion and research recommendations.

The Advisory report is presented to the public in a series of Public Review Workshops, described below. Subsequent to the Workshops, the draft Advisory Report is finalized and folded into a larger document known as the Public Review Workshop Report. The Public Review Worskhop (PRW) Report also includes a summary of any meetings of the Northeast Coordinating Council (consisting of the Region's executives and responsible for establishing SAW policy and scheduling assessments for review) that may have occurred during the SAW cycle.

This is the Public Review Workshop Report for SAW 34 and the 34th SARC and includes the final version of the Advisory Report and a report from the October 23, 2001 meeting of the Northeast Regional Coordinating Council.

The 34th SARC reviewed assessments for long-finned (loligo) squid, Georges Bank winter flounder and goosefish (monkfish). Assessments were peer reviewed by the SARC panel at its November 26-30, 2001 meeting in Woods Hole, MA. The Public Review Workshop of the 34th Northeast Regional Stock Assessment Workshop (SAW 34) was held in two sessions. The first was at a meeting of the New England Fishery Management Council on January 15, 2002 in Portsmouth, NH and the second on January 30, 2002 at a meeting of the Mid-Atlantic Fishery Management Council in Meadowlands, NJ.

Copies of the 34th SAW Draft *Advisory Report on Stock Status* and the 34th SAW Draft *Consensus Summary of Assessments* had been distributed to members of each Council prior to the Workshops.

The SAW Chairman, Dr. Terry Smith of the Northeast Fisheries Science Center (NEFSC), NMFS, conducted both Workshops.

Status Summaries

Longfin Squid

Stock biomass has fluctuated around 20,000 mt since 1987 and current biomass appears to be near the long term average (the 2000 estimate is 24,000 mt). The (quarterly) fishing mortality rate has fluctated widely about a mean value of 0.2 over the same period. Relative to a proposed fishing mortality rate threshold, and current estimates of fishing mortality, overfishing is not occurring.

Georges Bank Winter Flounder

As of 2000, the stock was not overfished nor was overfishing occurring. Stock biomass was 92% of the re-estimated B_{MSY} target and fishing mortality was 71% of the re-estimated fishing mortality rate target. Biomass has been increasing since 1994 but recruitment has been below average.

Goosefish (Monkfish)

Relative to existing reference points, monkfish is overfished and overfishing is occurring in both stock management areas (north and south). Biomass was estimated to be close to the $B_{THRESHOLD}$ in the northern area and below the $B_{THRESHOLD}$ in the southern area. Estimates of fishing mortality indicate that current F exceeds F_{MAX}.

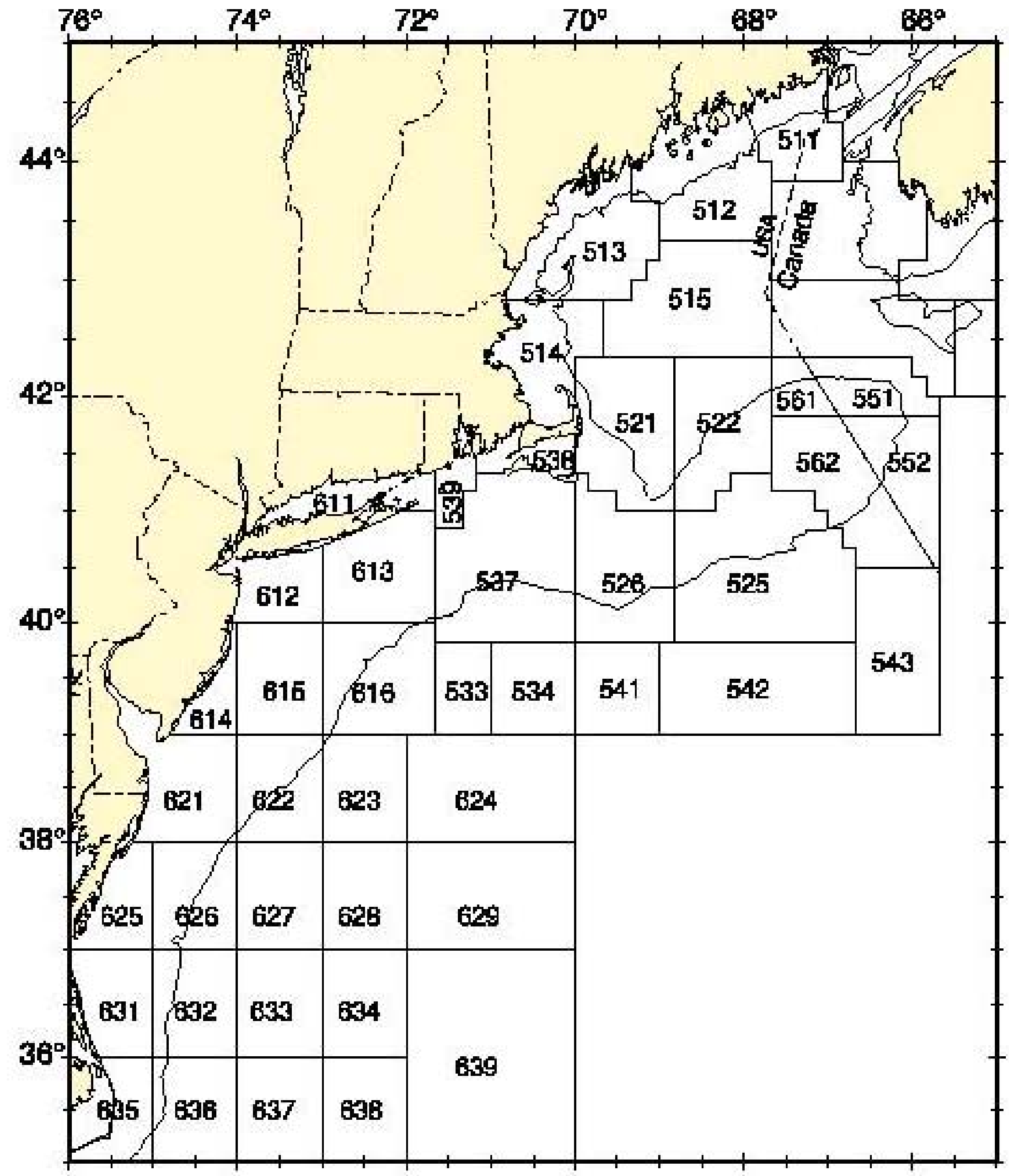


Figure 1. Statistical areas used for catch monitoring in offshore fisheries in the Northeast United States.

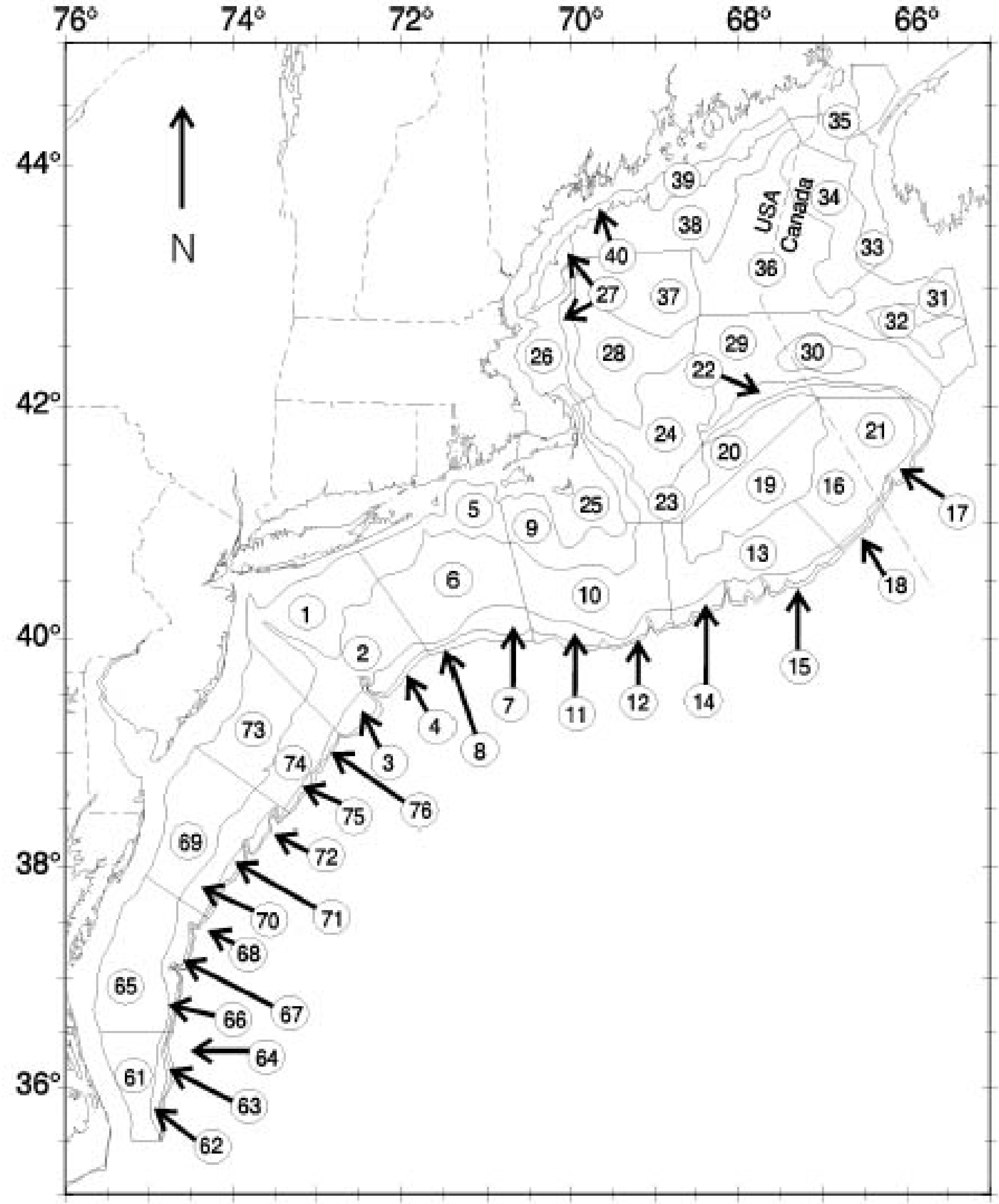


Figure 2. Offshore sampling strata used in NEFSC bottom trawl surveys.

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 current overfishing definitions. 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 noted below depicts a generic control rule of this nature.

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

GLOSSARY OF TERMS

ADAPT. A commonly used form of computer program 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 only 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 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 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 CPUE 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, $\mathbf{F_{threshold}}$). 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 $\mathbf{F_{threshold}}$ overfishing is occurring.

Minimum Stock Size Threshold (MSST, $\mathbf{B_{threshold}}$). Another of the Status Determination Criteria. The greater of (a) ½B_{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 $\mathbf{B_{threshold}}$, 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 a stock is being overfished or 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.

S**urvival 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. LONGFIN SQUID ADVISORY REPORT

State of Stock: New analyses of survey data indicate that stock biomass since 1967 has fluctuated without trend and has supported annual catches around 20,000 mt. A new surplus production model suggests that biomass has fluctuated between 14,000 and 27,000 mt since 1987. During this period quarterly F has fluctuated between 0.06 and 0.6 with a mean of 0.24. A proxy $F_{THRESHOLD}$ of 0.31 is proposed and relative to this limit reference point, overfishing is not occurring. Although estimates of biomass are presented, there is no satisfactory reference point for comparison.

Management Advice: The SARC recommends continuing the current catch of 20,000 mt (to include both landings and discards) which, on average, implies a quarterly F close to a proposed Ftarget of 0.24.

Forecasts: No forecasts were performed.

Catch and Status Table (catch and biomass in thousands of mt): Inshore Longfin Squid (Loligo pealeii)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	Min[1]	Max[1]	Mean[1]
Landings:												
Jan-Mar	11.4	4.8	5.8	5.2	3.3	10.7	4.9	6.4	na[2]	2.5	11.4	5.9
Apr-Jun	4.7	2.3	3.8	4.6	3.0	2.1	3.2	3.3	na	2.1	7.6	4.3
July-Sep	1.7	6.6	3.9	1.0	2.8	1.1	5.0	3.9	na	1.0	6.6	2.9
Nov-Dec	5.1	9.8	5.3	1.2	7.2	5.2	6.3	3.4	na	1.2	9.8	5.2
Summer fishery[3]	6.5	8.9	7.8	5.7	5.7	3.3	8.2	7.2	na	3.3	11.0	7.2
Winter fishery[4]	9.9	15.6	10.5	4.5	17.9	10.1	12.7	na	na	4.5	17.9	11.6
Annual Total	22.9	23.5	18.8	12.0	16.3	19.1	19.4	17.0	na	10.4	23.7	18.3
Annual discards[5]	1.4	1.4	1.1	0.7	1.0	1.1	1.2	1.0	---	0.6	1.4	1.1
Annual total catch	24.4	24.9	20.0	12.7	17.3	20.3	20.6	18.1	---	11.0	25.2	19.4
Quota	44.0	44.0	36.0	30.0	21.0	21.0	21.0	15.0	17.0	15.0	44.0	34.2
Biomass[6]	22	25	19	16	22	21	23	24	---	16	25	22
F[6]	0.29	0.28	0.28	0.21	0.20	0.26	0.23	0.20	---	0.16	0.32	0.24
Recruitment[7]	0.3	1.2	0.9	0.4	0.7	0.5	2.0	1.6	3.0	0.15	3.0	1.0

[1]During 1987-2000 except winter fishery landings during 1987-1999, quotas during 1987-2001, and recruitment during 1967-2001.
[2]Not available or preliminary and incomplete.
[3]"Summer" fishery during second and third quarters, e.g. "1994" means April –September 1994.
[4]"Winter" fishery during fourth and first quarters, e.g. in this assessment, the 1994 winter fishery was October 1994-March 1995.
[5]Discard assumed 6% of landings, based on discard rates from sea sampling data.
[6]Annual averages of quarterly estimates from the PDQ surplus production model.
[7]Rescaled numbers per fall survey tow for squid smaller than targeted by the fishery (< 8.9 cm dorsal mantle length).

Stock Distribution and Identification: *Loligo pealeii*, the inshore longfin squid, is distributed from the Caribbean to Newfoundland. The geographic distribution depends on season and environmental conditions. *Loligo pealeii* are most abundant from Cape Hatteras north, but are infrequently taken in survey tows north of Georges Bank and overlap in the south with a related species *L. plei*. For stock assessment and management purposes, the stock consists of inshore longfin squid within the range of commercial exploitation from Georges Bank to Cape Hatteras. Because of seasonal migrations, a portion of the stock may be found south of the range of commercial exploitation, particularly during winter.

Catches: Catches increased rapidly in the 1960s and early 1970s to a peak of 38 thousand mt during 1973, with nearly all catch by foreign fleets (Figure A1). Since 1987, when foreign fishing was eliminated, catches ranged from 10-24 thousand mt and averaged 18 thousand mt. Landings by the traditional inshore summer fishery decreased by about 25% after 1991. During the same period, landings in the domestic offshore winter fishery varied without trend. Discards appear to have been relatively low in recent years (about 6% of landings).

Data and Assessment: The stock assessment for inshore longfin squid is based on four bottom trawl survey indices, catch data, standardized commercial landings per unit effort data, scaled catch-survey biomass and *F* estimates, length-based virtual population analysis and a new surplus production model (PDQ). A statistical model (GAM) of the survey biomass data was also reviewed which evaluated changes in catch rate due to variation in time of day, depth and location.

Biological Reference Points: Per recruit quarterly F reference points were revised for this assessment (Figures A7 and A8) using updated information on natural mortality, exploitation pattern, growth and maturity rates. For the winter fishery, which is assumed to catch summer-hatched squid, biomass weighted F_{max} = 0.77, $F_{0.1}$ = 0.58 and $F_{50\%}$ = 0.45 per quarter. Corresponding fully recruited values are F_{max} = 1.4, 0. $F_{0.1}$ = 0.94 and $F_{50\%}$ = 0.69 per quarter. For the summer fishery, which is assumed to catch winter-hatched squid, biomass weighted F_{max} = 1.1, $F_{0.1}$ = 0.82 and $F_{50\%}$ = 0.64 per quarter. Corresponding fully recruited values are F_{max} = 1.6, $F_{0.1}$ = 1.1 and $F_{50\%}$ = 0.82 per quarter. Neither the original nor the recalculated F limits are considered appropriate for status determination. B_{MSY} for Loligo could not be estimated (in this assessment) and the current proxy (80,000 mt) is inappropriate. Given the apparent resilience of biomass for the last two decades, two proxies are proposed for quarterly fishing mortality: an $F_{THRESHOLD}$ (0.31) set at the 75th percentile of the observed Fs and an F_{TARGET} (0.24) set at the mean. These Fs are quarterly values.

Fishing Mortality: Mean biomass weighted *F* estimates from the PDQ production model for 1987-2000 ranged from 0.06 to 0.6 per quarter (Figure A3). The instantaneous quarterly rate of surplus production during the same period was 0.24. For 2000 average F was estimated as 0.20 with a 95% confidence interval of 0.14 to 0.28 per quarter (Figure A5).

Recruitment: Survey recruitment indices (squid < 8.9 cm dorsal mantle length) have generally increased since 1998 (Figure A4). However, because of the extremely short life span and continuous recruitment of Loligo, these indices have limited utility as predictors of trends of productivity.

Stock Biomass: Estimated stock biomass (Figure A2) fluctuated during 1987-2000 around a mean of 22 thousand mt. The estimate of average biomass during 2000 was 24 thousand mt (95% confidence interval 17-34 thousand mt, Figure A6). Similar estimates were produced from minimum swept area estimates from the fall survey and similar patterns were seen in the GAM analysis. In the longer term, biomass, estimated from survey indices, has fluctuated without trend

Special Comments: The perception of this stock has changed markedly since the last assessment (SARC 29). There are two reasons for this change. First, new and more sophisticated analyses of survey indices indicate greater long-term stock stability than reflected by the indices alone. Second, more recent survey indices have recovered to the long term average.

Considerable parameter uncertainties exist, in part due to fluctuation in predator- and temperature-mediated growth. This may affect the stability of reference points that maximize yield.

Sources of Information: Cadrin, S. and E. Hatfield. 1999. Stock Assessment of inshore longfin squid *Loligo pealeii*. NEFSC Ref. Doc. 99-12; Macy, W.K., III, and J.K.T. Brodziak. 2001. Seasonal maturity and size at age of *Loligo pealeii* in waters of southern New England. ICES J. Mar. Sci. 58; Maxwell, M.R., and R.T. Hanlon. 2000. Female reproductive output in the squid *Loligo pealeii*: multiple egg clutches and implications for a spawning strategy. Mar. Ecol. Prog. Ser. 199: 159-170; Hatfield, E.M.C, and S.X. Cadrin. In press. Geographic and temporal patterns in *Loligo pealii* size and maturity off the northeastern United States. Fish. Bull.

Figure A1. *Loligo* squid landings.

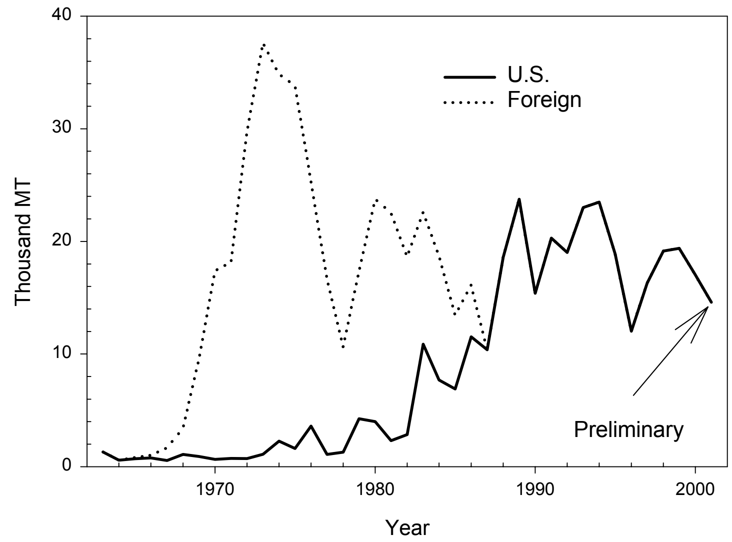


Figure A2. *Loligo* squid biomass.

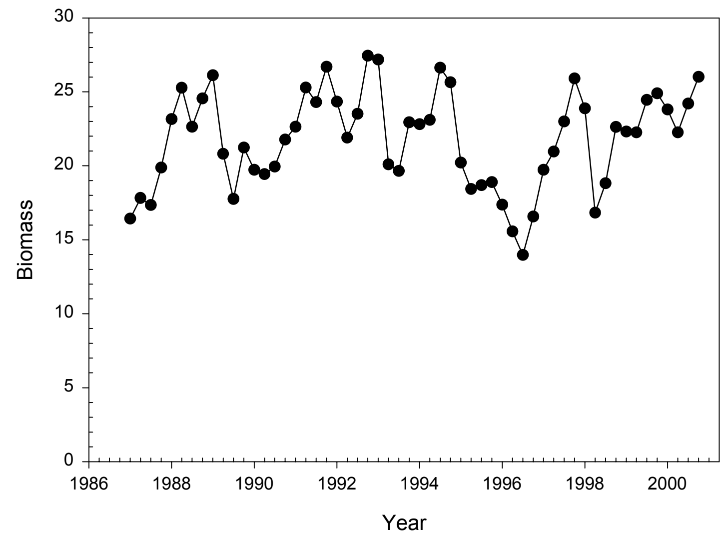


Figure A3. Quarterly fishing mortality rates (*F*) for *Loligo* squid.

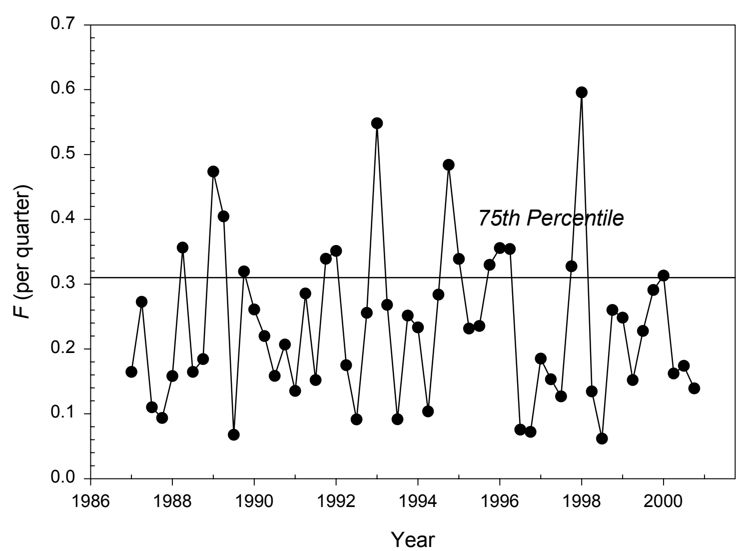


Figure A4. Bottom trawl survey recruitment indices for *Loligo* squid (number <= 8 cm DML per standard tow, rescaled to same average).

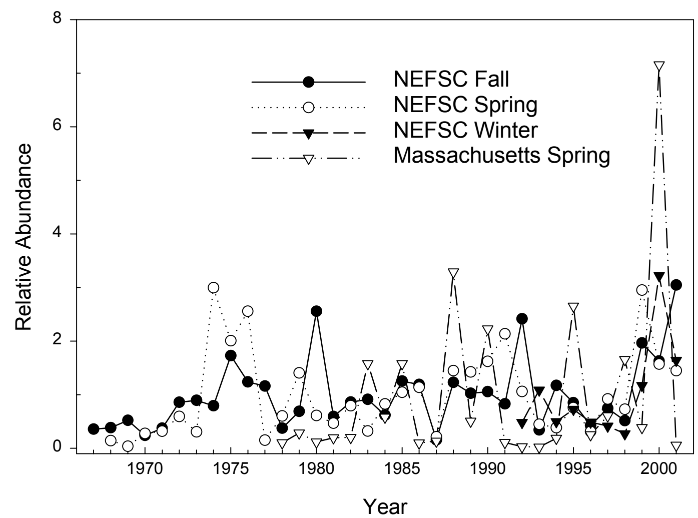


Figure A5. Uncertainty in mean *F* during 2000 for *Loligo*.

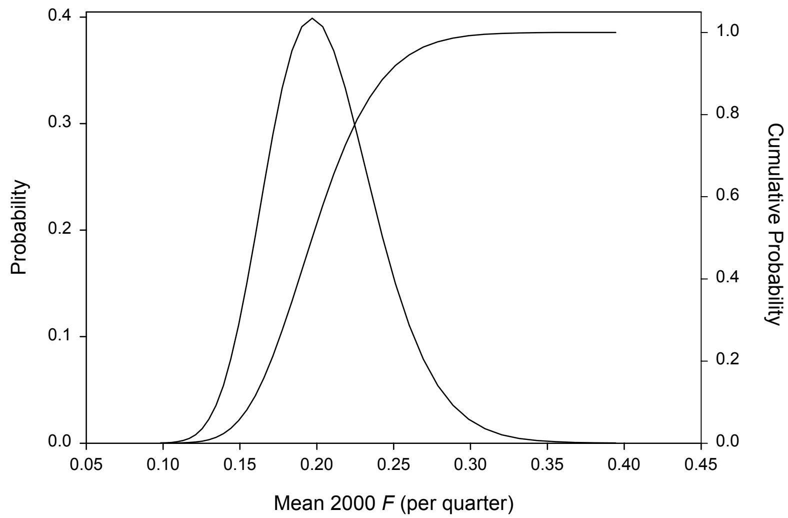


Figure A6. Uncertainty in mean biomass during 2000 for *Loligo*.

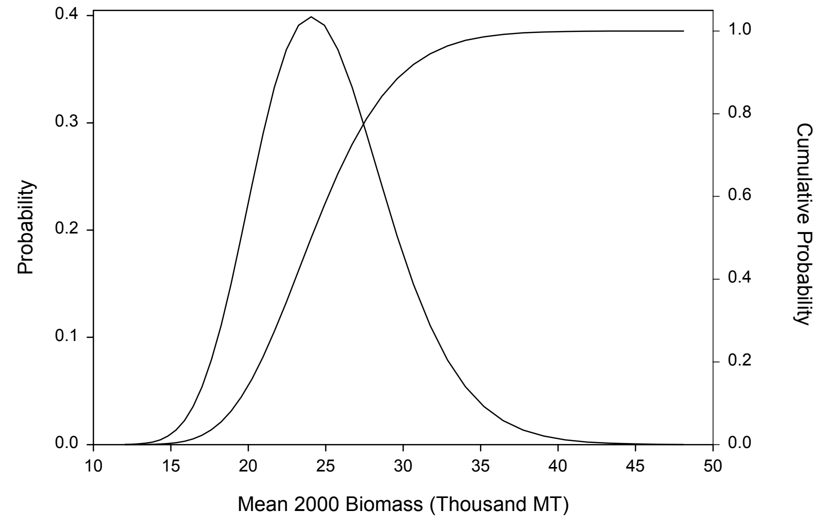


Figure A7. Yield and spawning biomass per recruit for fully recruited fishing mortality rates in *Loligo* squid.

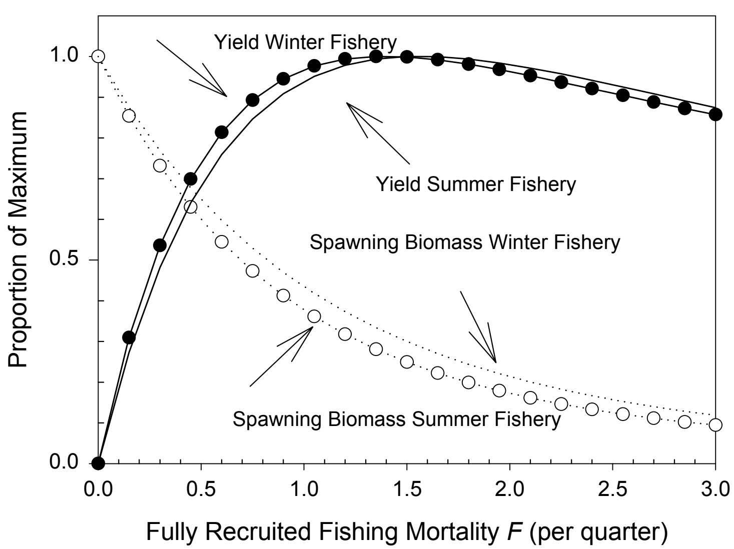
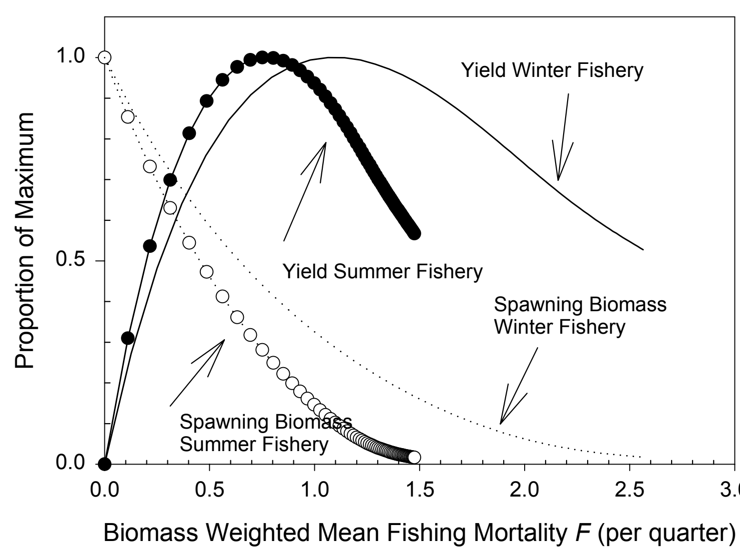


Figure A8. Yield and spawning biomass per recruit for biomass weighted mean fishing mortality rates in *Loligo* squid.



B. GEORGES BANK WINTER FLOUNDER ADVISORY REPORT

State of Stock: The Georges Bank winter flounder stock was not overfished and overfishing was not occurring in 2000. Stock biomass in 2000 was 92% of the re-estimated B_{MSY} target and fishing mortality in 2000 was 71% of the re-estimated fishing mortality rate target. Fishing mortality rates were very high during 1984-1993, but have been declining since 1994. Stock biomass has been increasing steadily since 1994. US and Canadian resea`rch surveys indicate recruitment has been below average since 1994. Research survey indices indicate that the age structure became truncated in the early 1990s but is beginning to broaden.

Management Advice: Fishing mortality rates should not exceed target levels to provide for increasing fishery harvests, while allowing for continued stock rebuilding and broadening of the age structure.

Forecasts: No medium term forecasts were made because of the inability to explicitly model recruitment.

Catch and Status Table (weights in '000 mt): Georges Bank Winter Flounder

Year	1993	1994	1995	1996	1997	1998	1999	2000	Max[1]	Min[2]	Mean
U.S. commercial landings	1.7	0.9	0.7	1.3	1.3	1.2	0.9	1.6	3.9	0.7	2.2[2]
Canada commercial landings	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.2	0.2	<0.1	<0.1[2]
Total commercial landings	1.7	1.0	0.8	1.3	1.4	1.3	1.0	1.8	4.5	0.8	2.4[2]
Commercial Discards	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Catch used in assessment[3]	1.7	1.0	0.8	1.3	1.4	1.3	1.0	1.8	3.9	0.8	2.0
Total Stock Biomass	2.4	2.5	3.2	4.0	4.7	5.8	7.3	8.8	10.8	2.4	6.7[4]
F (biomass-based, age1+)	0.69	0.39	0.24	0.34	0.30	0.23	0.14	0.21	0.77	0.14	0.40[4]
Relative Biomass Index	0.66	0.58	1.34	1.76	1.53	1.57	2.64	2.66	6.49	0.14	2.05[5]
Exploitation Index	2.54	1.68	0.57	0.76	0.93	0.85	0.40	0.69	13.44	0.40	1.94[6]

[1,2] During 1964-2000. [3] During 1982-2000. [5] During 1982-1997. [4] During 1964-2000, average biomass from ASPIC model results. [5] During 1964-2000, U.S. Autumn survey indices (kg/tow) for offshore strata 13-22. [6] Exploitation index = (landings (in 000's mt) / 3-year average of autumn survey biomass index (in kg/tow)) as defined in Overfishing Control Rule.

Stock Identification and Distribution: Winter flounder is distributed in the Northwest Atlantic from Labrador to Georgia. Although primarily distributed in shallow inshore waters where estuarine habitat serves as important spawning and nursery areas, the species is also distributed on offshore banks such as Nantucket Shoals and Georges Bank. The winter flounder resource in the U.S. waters of the Northwest Atlantic is currently assessed as three stock complexes: Gulf of Maine, Georges Bank, and Southern New England/Mid-Atlantic. The Georges Bank stock area includes U.S. statistical areas 522, 525, 551,552, 561, and 562, which correspond approximately to Canadian unit areas 5Zh, j, m, and n. Evidence from tagging data, differences in life history characteristics, and meristic studies provide evidence for a discrete stock of winter flounder residing in the shallower waters of Georges Bank.

Catches: Otter trawl landings, primarily bycatch, account for the majority of landings (92-100%) from this stock with the balance primarily from the sea scallop dredge fishery. Discarding occurs in the otter trawl and sea scallop dredge fisheries. However, data were insufficient to estimate discard numbers at age for inclusion in this assessment.

Recreational landings from this stock are insignificant. U.S. commercial landings have dominated fishery removals from this stock, although landings reported by the former Soviet Union were significant in the early 1970s (Figure B1). Total commercial landings increased sharply in the late 1960s and early 1970s with reported landings by distant water fleets. Landings exceeded 4,000 mt in the early 1970s, but declined to less than 2,000 mt by 1976. Landings increased again, reaching 4,000 mt in 1981, but were less than 2,000 mt during 1989-2000. Due to the implementation of U.S. fishery regulations designed to rebuild groundfish stocks, total landings declined to their lowest levels since 1964, in 1995 (760 mt), then increased to 1,800 mt in 2000.

Data and Assessment: A biomass dynamics model (ASPIC) that incorporated U.S. spring (1968-2001, lagged back one year) and autumn survey (1964-2000) biomass indices and total landings (1964-2000) provided estimates of biomass (age 1+), surplus production, and fishing mortality rates. Stock status was determined based on the results of the ASPIC model. The virtual population analysis approach used as a basis for the SARC 28 assessment was updated (1982-2000) and evaluated, but not adopted. An alternate age-based model with forward projection of the landings at age data (WIN model) was also conducted to derive estimates of biomass and fishing mortality rates.

Biological Reference Points: Amendment 9 biological reference points were re-estimated based on a surplus production model (Figure B7). The Amendment 9 overfishing definition specifies survey-based biological reference points. The re-estimated fishing mortality rate reference points (expressed in exploitation units) are F_{msy} threshold proxy = 1.21, F_{msy} target proxy (75% of F_{msy} threshold proxy) = 0.91 total landings/U.S. autumn survey index), B_{MSY} target proxy = 2.49, and a biomass threshold (50% of B_{MSY} proxy) = 1.24 (all in U.S. autumn survey biomass units: stratified weight (kg) per tow). ASPIC-based absolute values of F_{MSY} and B_{MSY} are recommended for future determinations of stock status (see Special Comments).

Fishing Mortality: Trends in biomass-based fishing mortality rate estimates from the ASPIC model (average biomass for age 1+) were similar to those from the VPA age-based model. Fishing mortality rates were highest during 1984-1993, but have declined since then (Figure B3). ASPIC-based fishing mortality rates ranged between 0.77 and 0.39 during 1984-1993 and were much lower during 1994-1999, ranging between 0.14 and 0.39. The fishing mortality rate in 2000 was 0.21.

Average exploitation indices (3-year average catch/3-year average autumn survey biomass index) were above the threshold F during 1981-1995, but have since declined to 71% of the fishing mortality target. The average exploitation index for 1998-2000 was 0.65 (Figure B2). Absolute values of fishing mortality are recommended for future determinations of stock status, but exploitation indices are used here to be consistent with the method used to calculate reference points for the stock (see Special Comments).

Recruitment: Stratified mean numbers per tow at age indicated that the 1981, 1983,1984 and 1994 year classes were above average. U.S. and Canadian research surveys indicate recruitment has been below average since 1994 (Figure B6).

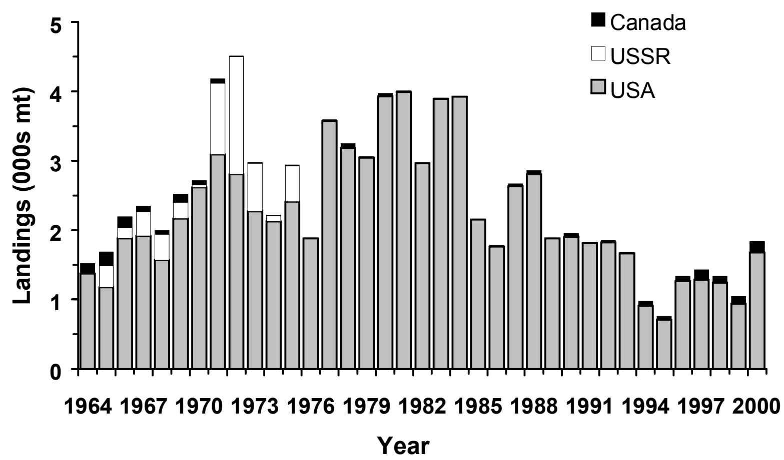
Stock Biomass: The ASPIC model indicates that average biomass (age 1+) declined during 1977-1994, then increased from 2,500 in 1994 to 8,800 mt in 2000 (Figure B4).
Spring and autumn research surveys indicate a general increase in relative biomass indices since1994 (Figure B5). The biomass index for 1998-2000 was 2.29 kg/tow. Absolute values of biomass are recommended for future determinations of stock status, but survey biomass indices are used here to be consistent with the method used to calculate reference points for the stock (see Special Comments).

Special Comments: The SARC recommends that the biological reference points be revised to incorporate absolute values of Fmsy and Bmsy, as estimated by the ASPIC biomass dynamics model, to resolve some of the difficulties in interpretation of stock status with regard to reference points. The status of this stock and current reference points were defined using a production model (ASPIC) which produces estimates in traditional units of fishing mortality and biomass. However, these units are converted into survey-based units for evaluation purposes.

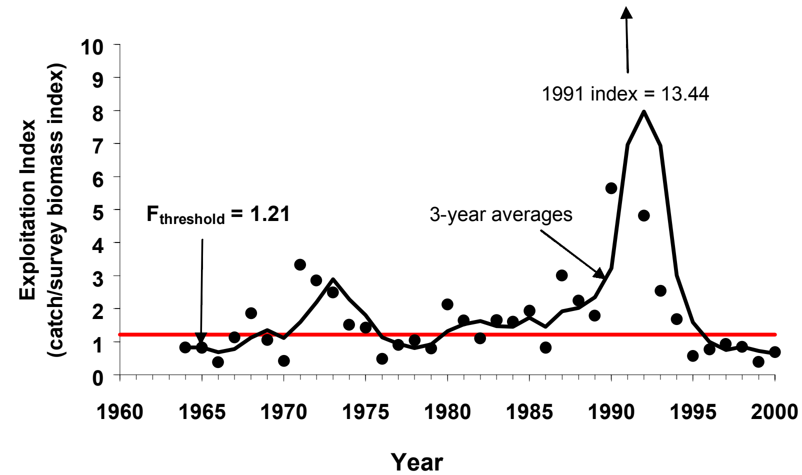
If sampling of the landings for characterization of age and size distribution is improved, it would preferable to conduct an age-based assessment.

Fishing mortality rates are near the long-term targets for the stock. Given the substantial distribution of winter flounder within the Georges Bank closed areas, managers should carefully consider the impacts on this stock if any portion of these areas is reopened to fishing.

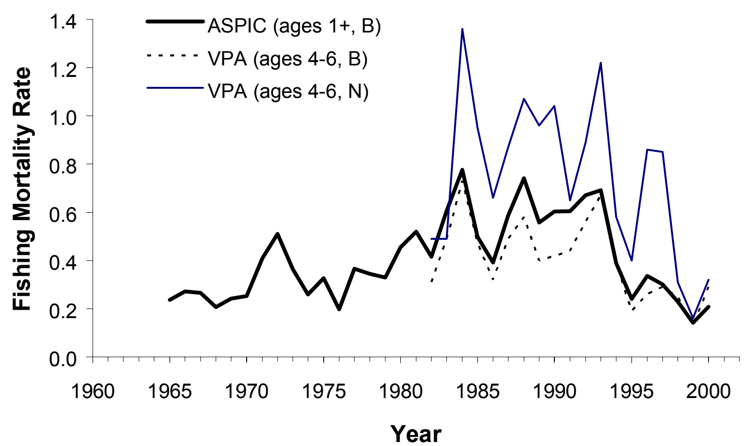
Source of Information: Report of the 34th Northeast Regional Stock Assessment Workshop (34th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC Ref. Doc. 01-06; Hendrickson *et al*. 2001, Assessment of the Georges Bank Winter Flounder Stock, 1982-2000, in prep.; Report of the 28th Northeast Regional Stock Assessment Workshop (28th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC Ref. Doc. 99-08; Brown *et al*. 2000, Assessment of the Georges Bank Winter Flounder Stock, 1982-1997, NEFSC Ref. Doc. 00-16. Amendment 9 to the Northeast Multispecies Fishery Management Plan, NEFMC, 1998.



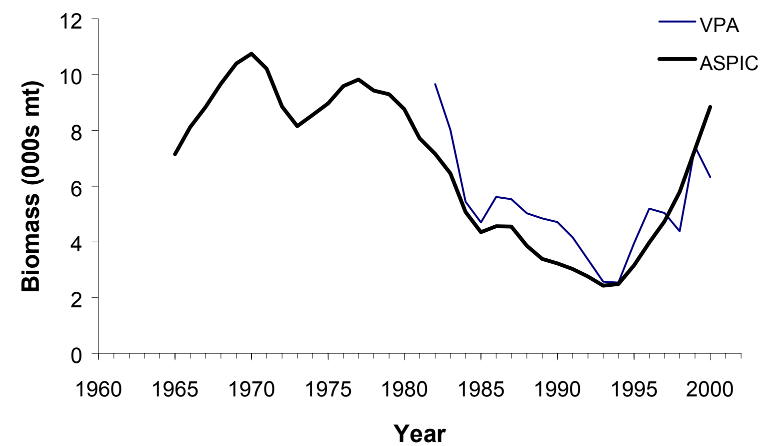
B1 Trends in commercial landings



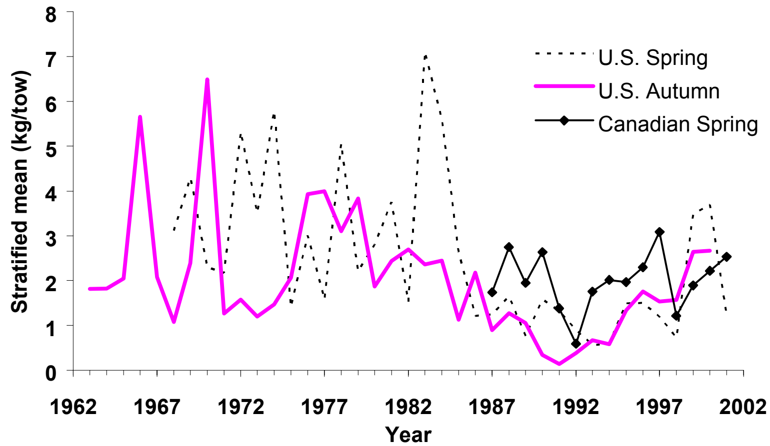
B2 Trends in annual and average relative exploitation indices



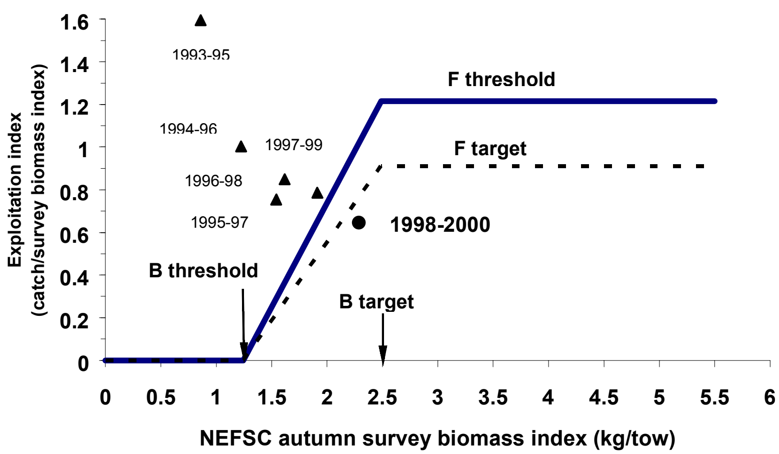
B3 Trends in fishing mortality rates



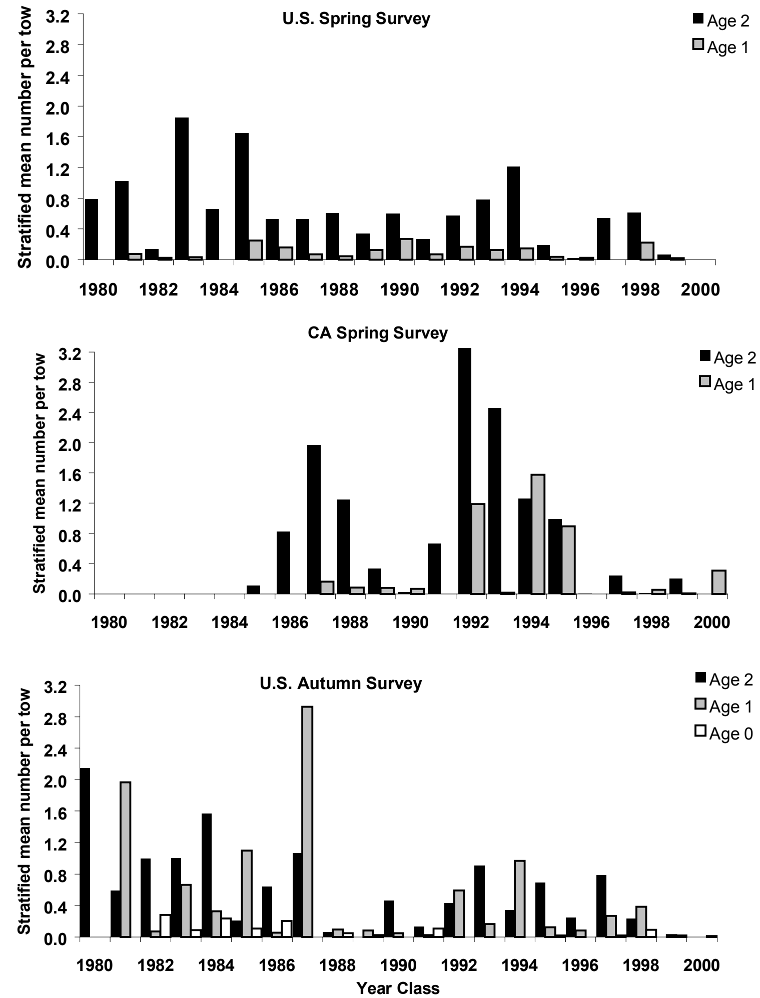
B4 Trends in average stock biomass



B5 Trends relative biomass indices from research vessel surveys



B7 Overfishing Control Rule and three-year average exploitation and survey biomass indices



B6 Trends in recruitment

C. GOOSEFISH (Monkfish) ADVISORY REPORT

State of Stock: Based on existing reference points, the goosefish (also known as monkfish) resource is overfished and overfishing is occurring in both stock management areas (north and south). Reported landings (converted to live weight) have steadily increased from an annual average of 2,500 mt in the 1970s to 8,700 mt in the 1980s and 23,000 mt in the 1990s. Biomass in the northern area has been below $B_{THRESHOLD}$ since 1989 but is estimated to be close to $B_{THRESHOLD}$ in 2000 (Figure C7). Biomass in the southern area has been below $B_{THRESHOLD}$ since 1987 (Figure C8). Size distributions in fishery-independent surveys have become truncated over time. Indices of egg production have declined by around 80% since the 1970s and the proportion of spawners below the age of full maturity has increased; however, recruitment in the northern area has recently increased. Estimates of fishing mortality from research vessel surveys and the 2001 industry cooperative survey indicate that the current F exceeds F_{MAX} (Figure C4).

Management Advice: Indicators of stock status for this resource consistently indicate a need for reducing fishing mortality and rebuilding biomass. Based on results from the cooperative survey, fishing mortality rates need to be reduced 20-40% to reach the proposed fishing mortality rate threshold. Efforts should be made to reduce discards.

Forecasts for 2001-2003: No forecasts were made

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

Year	1994	1995	1996	1997	1998	1999	2000	Max[1]	Min[1]	Mean[1]
USA Commercial landings										
Northern area	11.0	12.0	10.8	9.8	7.4	9.3	10.7	12.0	0.2	5.2
Southern area	12.1	14.6	16.0	18.5	19.3	16.0	10.2	19.3	0.0	6.8
Total	23.1	26.7	26.8	28.3	26.7	25.2	20.9	28.3	0.2	12.0
USA Commercial discards										
Northern area	not available		1.9	1.3	0.7	0.7	0.9	1.9	0.7	1.1
Southern area	not available		2.2	2.2	1.3	1.9	2.8	2.8	1.3	2.1
Total	not available		4.1	3.4	2.0	2.6	3.6	4.1	2.0	3.1
Foreign landings[2]	0.5	0.4	0.2	0.2	0.2	0.2	0.2	6.8	0.2	1.0
Total Catch	23.5	26.8	30.7	31.8	28.7	27.8	24.5	31.8	0.2	13.0
Northern area										
Biomass index	0.97	1.71	1.07	0.67	0.97	0.83	2.50	5.57	0.67	2.11
Z index ($\geq$ 30 cm, 11.8")	0.55	0.59	0.55	0.59	0.42	0.69	0.55	0.69	0.11	0.30
Annual mortality index (%)	42.3	44.6	42.3	44.6	34.3	49.8	42.3	49.8	10.4	25.6
Egg production index[3]	0.41	0.47	0.46	0.41	0.40	0.38	0.44	2.19	0.38	1.05
Southern area										
Biomass index	0.61	0.39	0.39	0.59	0.50	0.30	0.48	4.92	0.27	1.13
Z index ($\geq$ 30 cm, 11.8")	0.65	0.84	0.61	0.46	0.39	1.14	0.65	1.14	0.20	0.52
Annual mortality index (%)	47.8	56.8	45.7	36.9	32.3	68.0	47.8	68.0	18.1	40.4
Egg production index[3]	0.13	0.13	0.11	0.14	0.17	0.15	0.17	1.11	0.11	0.47

[1] 1970-2000. Commercial fishery discards not available before 1996.
[2] Foreign landings are for NAFO Areas 5 and 6.
[3] Egg production index is a function of mean number per tow at length, proportion mature at length and fecundity at length.

Stock Distribution and Identification: The monkfish resource in US waters is distributed from the Gulf of Maine through Cape Hatteras. Data to definitively distinguish separate stock units of monkfish are currently unavailable. Differing recruitment patterns combined with low mixing suggest the existence of two stock units. However, similar growth and maturity patterns along with genetic testing argue for a single stock unit. Assessment units as described in previous SARCs (north and south, separated along the middle axis of Georges Bank) are continued in this assessment. In addition a combined unit is considered. The management consequences of the choice of stock units are discussed in Special Comments below.

Catches: Total reported landings (live weight) increased from several hundred mt in the early 1970s to 28,500 mt in 1997 and have since remained high (Figures C1, C2, C3). Landings in 2000 declined substantially in the south but increased moderately in the north (Figures C2, C3). These patterns of landings are likely due to changes in management. Landings in the early part of the time series are thought to be under-reported. The accuracy of landings data has improved with mandatory reporting beginning in 1994. During 1998-2000, trawls caught 54% of USA landings, scallop dredges 17%, and gill nets 29% (Figure C1). Estimates of discard rates are 7-15% of the catch in the north and 6-22% in the south.

Data and Assessment: Monkfish were last assessed at SAW 31 in 2000. Data used in the current assessment included NEFSC research survey catch per tow indices (mean numbers and weights), an industry cooperative survey, research survey length distributions, and commercial fishery data from vessel trip reports, dealer records and on-board fishery observers. Mortality estimates were calculated from catch-per-tow-at-length and catch-per-tow-at-age indices from bottom trawl surveys as well as catch-biomass ratios, yield per recruit analyses, surplus production modeling and a swept-area estimate of current biomass. Most reliance was put on age-based methods and the catch-biomass ratios from the cooperative survey.

Biological Reference Points: Biological reference points for monkfish calculated during SARC 23 were: for the northern stock component, $F_{threshold}$ (average F during 1970-1979) = 0.05, $B_{THRESHOLD}$ (33^{rd} percentile of the 1963-1994 NEFSC autumn trawl survey catch (kg) per tow) = 1.46 kg/tow, F_{target} is undefined, B_{target} (the median of the 3-year moving average of the 1965-1981 NEFSC autumn trawl survey catch (kg) per tow) = 2.50 kg/tow; for the southern stock component, $F_{threshold}$

= 0.21, $B_{THRESHOLD}$ (33[rd] percentile of the 1967-1994 NEFSC autumn trawl survey) = 0.70 kg/tow, F_{target} ($F_{0.1}$) = 0.10, B_{target} =1.85 kg/tow.

Based on the conclusions of the 31[st] SARC that the above F proxies are unreliable, the SARC recommends changing these biological reference points for fishing mortality rates. Possible approaches are either yield per recruit analyses (e.g., $F_{threshold}=F_{max}$, $F_{target}=F_{0.1}$) to take advantage of increased information on age in surveys or surplus production modeling (e.g., $F_{threshold}=F_{MSY}$, $F_{target}=F_{MSY}*0.8$) to take advantage of a comprehensive modeling approach. Of these two approaches the yield per recruit appears the more promising. For the purposes of this assessment, the SARC is providing advice based on the old reference points and a provisional YPR analysis ($F_{MAX} = F_{THRESHOLD} = 0.2$).

Fishing Mortality: Most methods to estimate current fishing mortality rates for both the north and south stock units resulted in values higher than the current or alternative proposed fishing mortality reference points such as F_{MAX} (Figure C4). The two methods that could produce a long time series of mortality estimates (length-based Z and surplus production models) showed a large increase in fishing mortality rate in recent years compared to the 1970's.

Recruitment: There is evidence of increased recruitment in the northern area during the 1990s (10-20 cm animals, Figure C5). In the southern area recruitment appears to have fluctuated without trend (Figure C6).

Total Stock Biomass: The current biomass index for the northern component is 1.43 kg/tow relative to a $B_{THRESHOLD}$ of 1.46 (Figure C7); and the southern component index is 0.48 kg/tow relative to a $B_{THRESHOLD}$ of 0.70 (Figure C8). Swept area estimates of current biomass from the cooperative research survey ranged from 97,600 to 134,900 mt (assuming high to intermediate net efficiency).

Spawning Stock Biomass: Egg production indices for the northern area are at 29% of their 1970-1979 average and 20% of the maximum observed (Figure C9). For the southern area, egg production indices are at 21% of the 1970-1979 average and 8% of the maximum observed (Figure C9). The proportion of egg production generated by females smaller than the size at full maturity increased rapidly from the early 1980s through the mid-1990s and has since declined but remains high. Estimates of absolute egg production derived from the cooperative survey in 2001 range from 4,200 to 5,800 billion eggs (spawning biomass 47,500 – 65,200 mt).

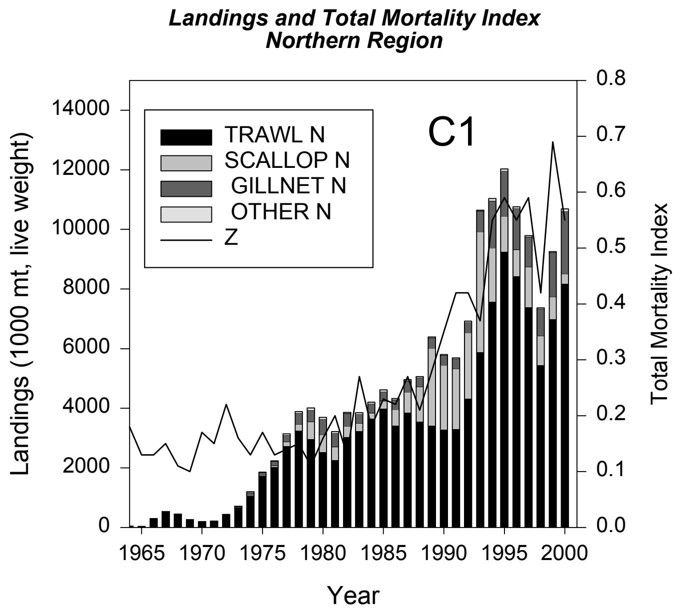
Special Comments: The SARC notes that the choice of management units need not be dependent on the choice of biological units. Differences in landings by gear type, both in terms of magnitude and directedness, in the two current units provide a basis for the use of two management units. The use of a single management unit provides consistent regulations for all areas, reducing the complexity of management, but could potentially allow overfishing of one stock if in fact multiple stocks are contained in the management unit. Assuming two stocks when in fact there is one could lead to erroneous interpretation of data and, consequently, inappropriate management advice.

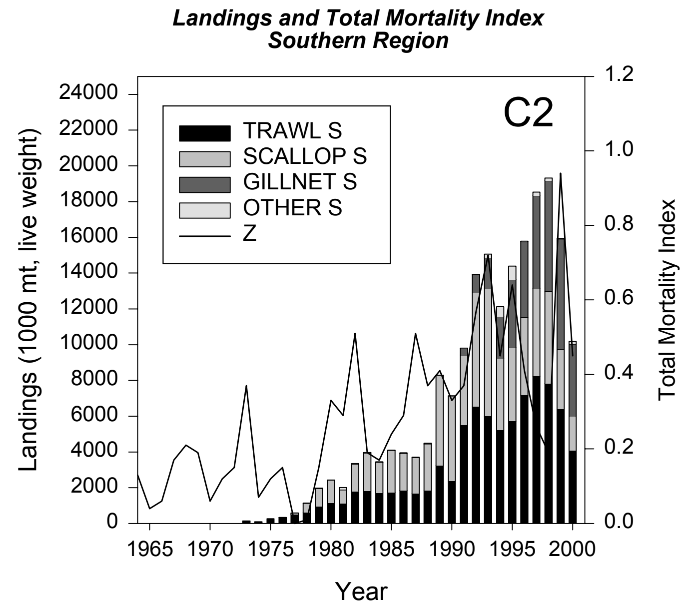
A cooperative industry survey conducted from February-April 2001 over the range of distribution collected substantial new data appropriate to the assessment of this stock. Some of the important findings from the cooperative survey are

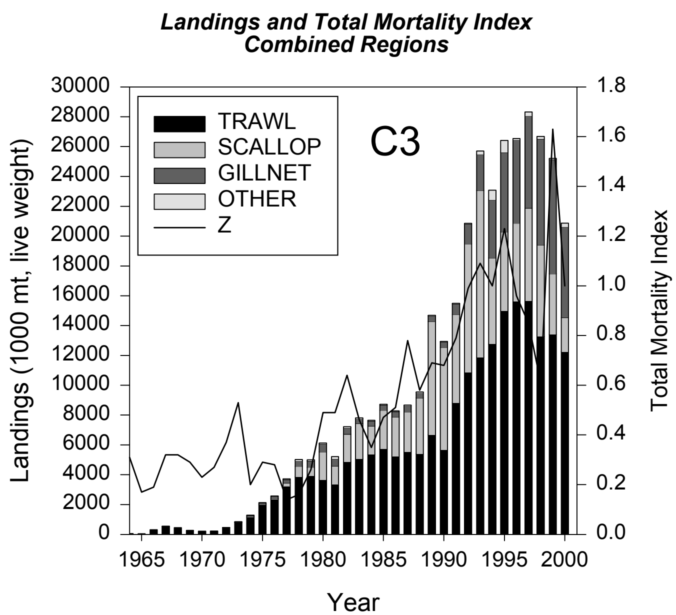
- the size distribution of fish captured in the southern area was very similar to that observed in the NEFSC Winter survey for 2001,
- growth rates were similar in northern and southern areas,
- catchability of NEFSC winter survey gear was approximately half that of the gear used to conduct the cooperative industry survey,
- Blackfin goosefish were not prevalent in catches, comprising less than 0.01% (8 of over 9000 monkfish examined),
- 9 incidences of cannibalism were detected among 2160 stomachs examined (0.42%),
- monkfish larger than about 70 cm were all females. The maximum age for males caught was age 8 and for females age 10.

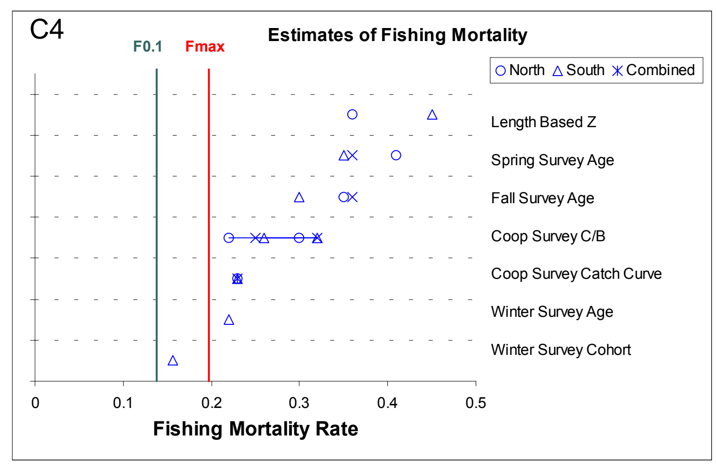
Sources of Information: Chikarmane, H.M. , Kuzirian, A.M, Kozlowksi, R, Kuzirian, M. and Lee, T. 2000. Population genetic structure of the goosefish, Lophius americanus. Biol. Bull. 199: 227-228. NEFSC 1997. Report of the 23[rd]

Northeast Regional Stock Assessment Workshop (23rd SAW). NEFSC Reference Document 97-05. NEFSC 2000. Report of the 31st Northeast Regional Stock Assessment Workshop (31st SAW). NEFSC Reference Document 00-15. NEFSC 2001. Report of the 33rd Northeast Regional Stock Assessment Workshop (33rd SAW): SARC Consensus Summary of Assessments. NEFSC Reference Document 01-18.

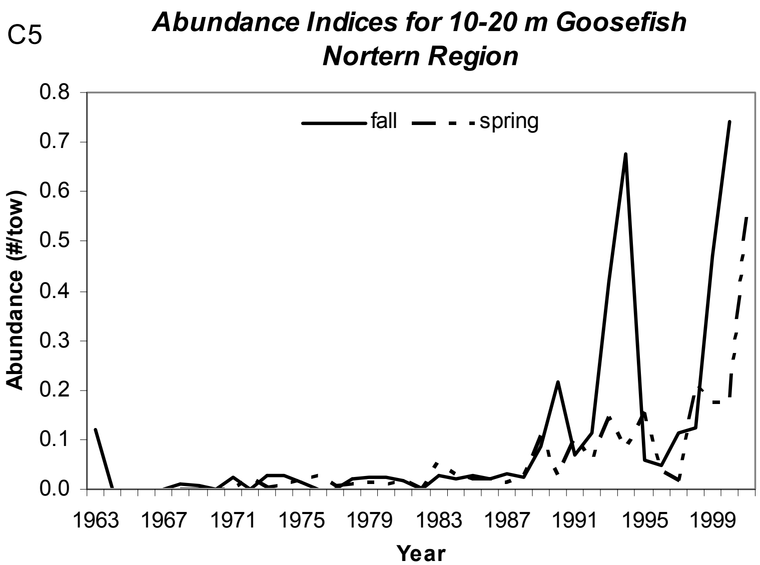

Landings and Total Mortality Index
Northern Region
C1
TRAWL N
SCALLOP N
GILLNET N
OTHER N
Z
Landings (1000 mt, live weight)
Total Mortality Index
Year


Landings and Total Mortality Index
Southern Region
C2
TRAWL S
SCALLOP S
GILLNET S
OTHER S
Z
Landings (1000 mt, live weight)
Total Mortality Index
Year

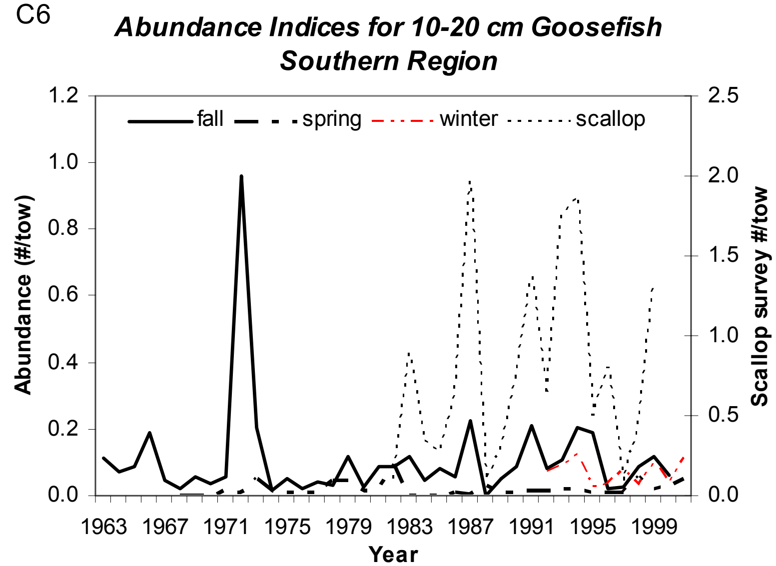

Landings and Total Mortality Index
Combined Regions
C3
TRAWL
SCALLOP
GILLNET
OTHER
Z
Landings (1000 mt, live weight)
Total Mortality Index
Year


C4
Estimates of Fishing Mortality
F0.1
Fmax
North
South
Combined
Length Based Z
Spring Survey Age
Fall Survey Age
Coop Survey C/B
Coop Survey Catch Curve
Winter Survey Age
Winter Survey Cohort
Fishing Mortality Rate

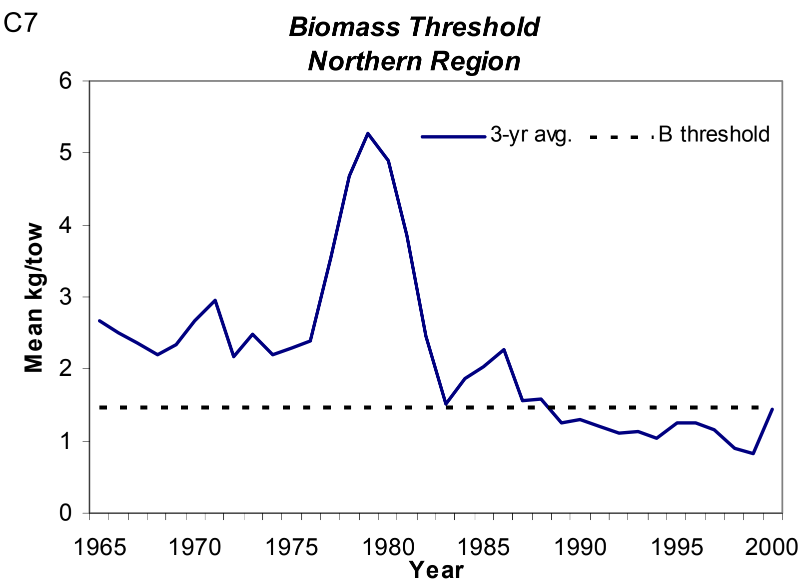
C5


Abundance Indices for 10-20 m Goosefish
Nortern Region
fall
spring
Abundance (#/tow)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1963
1967
1971
1975
1979
1983
1987
1991
1995
1999
Year

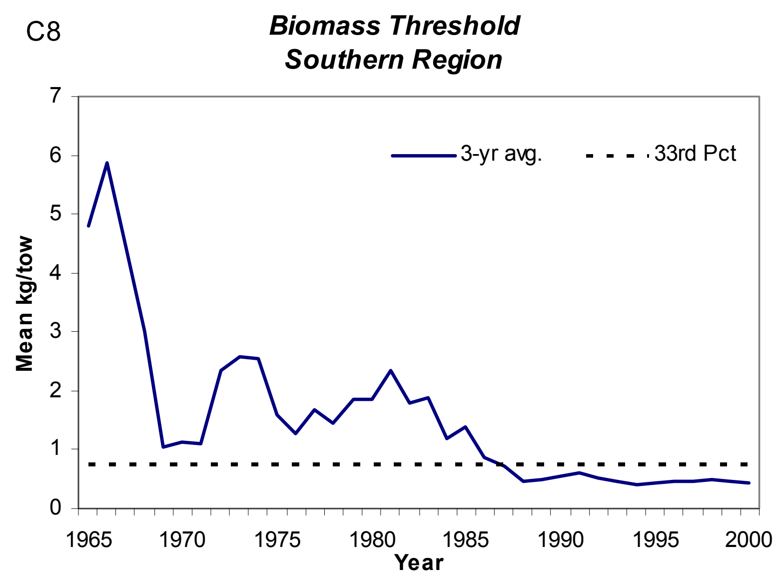
C6


Abundance Indices for 10-20 cm Goosefish
Southern Region
fall
spring
winter
scallop
Abundance (#/tow)
Scallop survey #/tow
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2.5
2.0
1.5
1.0
0.5
0.0
1963
1967
1971
1975
1979
1983
1987
1991
1995
1999
Year

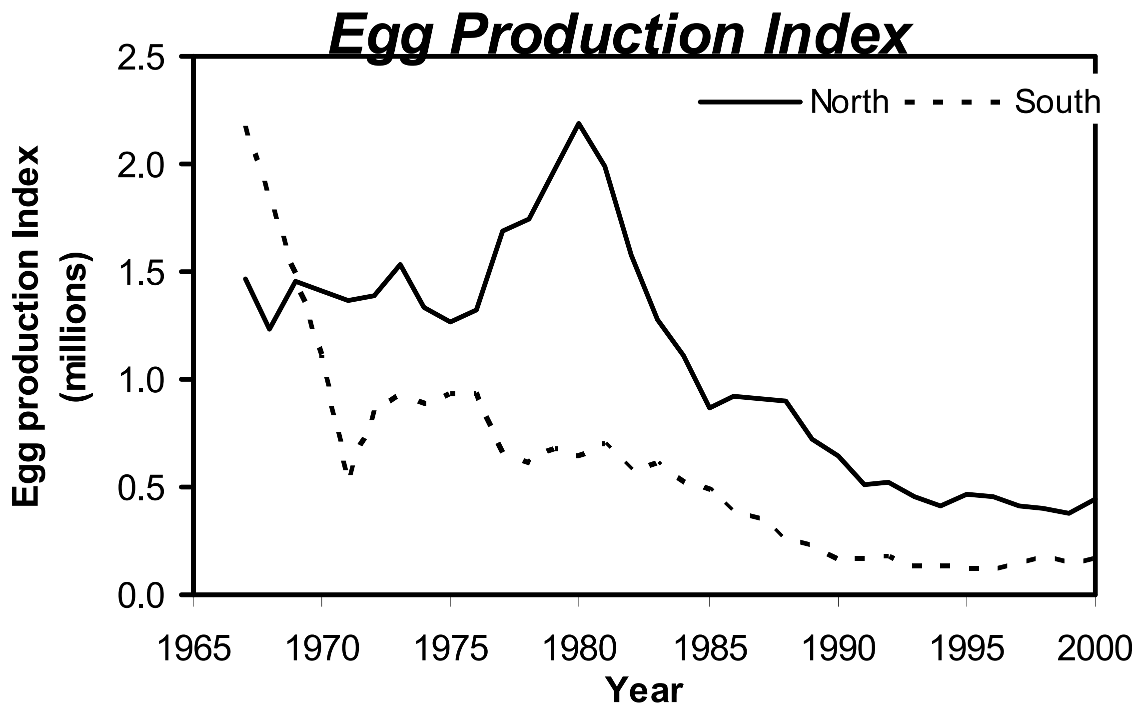
C7


Biomass Threshold
Northern Region
3-yr avg.
B threshold
Mean kg/tow
6
5
4
3
2
1
0
1965
1970
1975
1980
1985
1990
1995
2000
Year

C8


Biomass Threshold
Southern Region
3-yr avg.
33rd Pct
Mean kg/tow
7
6
5
4
3
2
1
0
1965
1970
1975
1980
1985
1990
1995
2000
Year

C9


Egg Production Index
North
South
Egg production Index (millions)
2.5
2.0
1.5
1.0
0.5
0.0
1965
1970
1975
1980
1985
1990
1995
2000
Year

CONCLUSIONS OF THE SAW STEERING COMMITTEE MEETING

The Steering Committee for the Northeast Regional Coordinating Council (NRCC) Stock Assessment Workshop (SAW) held a meeting in Washington, DC on 23-25 October, 2001 to discuss a number of regional coordinating/planning issues among the NMFS, New England and Mid-Atlantic Councils and Atlantic States Marine Fisheries Commission.

Participating in the meeting were: Jack Dunnigan, Robert Beal, and Lisa Kline of the Atlantic States Marine Fisheries Commission, Tom Hill, Paul Howard, Christopher Kellogg of the New England Fishery Management Council, Patricia Kurkul and Dan Morrris of the Northeast Regional office, Robert Smith and Dan Furlong of the Mid-Atlantic Fishery Management Council, Michael Sissenwine, Frank Almeida, John Boreman, Fredrick Serchuk, and Terry Smith of the Northeast Fisheries Science Center, and Laurie Allen of NMFS Headquarters.

Part of the agenda was devoted to the Northeast Regional Stock Assessment Workshop (SAW) process. The following report deals only with that part of the meeting.

SAW 33
(SARC, June 2001; Gulf of Maine cod, white hake, Acadian redfish)

The Coordinating Council briefly reviewed the just completed SAW 33 cycle. Among the topics discussed were the various drafts of the Advisory Report that were provided in both paper form to the Councils at two Public Review Workshops and concurrently on the NEFSC website. Given that the Advisory Report was revised several times to correct computational errors and that multiple drafts with potentially conflicting information could contribute to confusion and detract from the credibility of the SAW Process, the Coordinating Council suggested that, in the future, the draft versions of the Advisory Report and Consensus Summary would be produced only in paper form. These documents would be distributed to the Councils and Commission as soon as available, hopefully prior to the Public Review Workshops.

Draft documents would not appear on the web; final versions (the SAW Public Review Workshop Report and the final Consensus Summary Report), however, would be primarily distributed via the web using the NEFSC's Laboratory Reference Document publication protocol.

SAW 34
(SARC, November 2001; goosefish (monkfish), loligo squid, Georges Bank winter flounder)

The Coordinating Council reviewed and discussed the Terms of Reference for the upcoming SARC (November 26-30, 2001; NEFSC, Woods Hole) and suggested some minor editorial changes (revised TORs attached as Enclosure 2).

More substantive was the issue of stock identification/separation for the northern and southern monkfish stock components. With respect to the upcoming SARC, it is not possible, at this point in time, to specify a new TOR which would thoroughly explore the stock identification issue. It was noted that this topic was discussed at the last assessment, that the past SARCs research recommendations include further research and examination of the issue, and that it was likely that the upcoming SARC would review the basis for identification of separate stock components. It was also noted that it is possible to manage a fishery as separate geographical units, irrespective of the judgement on stock separation and identification.

The rest of the meeting was devoted to a discussion of stocks to be scheduled for assessment review at upcoming SARCs. The NRCC discussion is summarized as an annotated schedule file with the revised SARC schedule included.

OTHER BUSINESS

The NEFMC and MAFMC offered generic terms of reference for consideration by the Coordinating Committee. It was agreed that the generic TOR would be circulated among staff in the next couple of weeks so as to finalize the draft. It is the understanding of the NRCC that these generic TOR would serve as a starting point or template for specific TORs offered for any particular SARC (draft attached).

The NRCC also discussed a number of other SAW related issues. These include the need to spend a full day at the next meeting of the NRCC to discuss SAW process issues. Topics include revisions to the overall process, documentation, presentation to the Councils, and education/outreach on the SAW process. With respect to the latter issue, the NRCC asked that recent discussion papers on the SAW process by Emory Anderson and Terry Smith be distributed to the Council. It was also agreed that prior to the next meeting of the NRCC and the discussion of SAW process, the Regional Council Executive Directors would offer any comments/questions/criticisms of the current process to facilitate a directed discussion.

With respect to a review of the process, Mike Sissenwine noted that he had recently completed a discussion paper for ICES which identified the necessary components of an assessment peer review process. Drs. Sissenwine and Smith will revise that document to make it relevant to the Northeast SAW and distribute to the NRCC.

The NRCC agreed to meet again in April 2002 and that, in the interim and outside of the formal multi-day meetings of the NRCC, brief teleconferences dealing with SAW business could be scheduled as necessary.

The following table represents the current schedule for the upcoming SARC, in summary form, along with recommendations on treatment. A more detailed rationale for the recommendations is provided immediately below the table.

SAW 35 Candidate Stocks, Assessment Responsibility and Status Recommendation

Stock	Lead	Basis	Recommendation
Summer flounder	S. Demersal WG	NECC, Oct	Benchmark
Scup	ASMFC	NECC, Oct.	Benchmark
Silver hake (whiting)	N. Demersal WG	NECC, Oct.	Postpone (see notes)
Black Sea Bass	S. Demersal WG	NECC, Oct	Index update, not in SARC
Gulf of Maine Winter Flounder	ASMFC	NECC, Oct.	Postpone (SAW 36)
Southern New England/Mid-Atlantic Winter Flounder	ASMFC	NECC, Oct.	Postpone (SAW 36)
Striped Bass	ASMFC	NECC, Oct	Postpone (SAW 36)
Northern Shrimp	ASMFC	NECC, Oct	Postpone (SAW 36)
Pollock	N. Demersal WG	NECC, Aug.	Send to TRAC
Atlantic Herring	Pelagic WG	Deferred	Send to TRAC

Rationale

Summer flounder - benchmark assessment. Special concerns: Terms of Reference should reflect most recent advice of MAFMC's SSC with respect to biological reference points.

Scup - planning meetings have been held, work is underway.

Whiting - The principal assessment issue is stock identification (one stock, two stocks, etc.). As you know, this is a scientific issue and one often difficult to resolve. Some genetic research is underway, but it is not clear that definitive information will be available in the near term. Although it is relatively straightforward to run assessment models for one stock, two stocks or "n" stocks, given our current state of knowledge, it will not be informative to do so. Probably the most pressing management issue is *stock management by units*. This is related but different than stock identification and can be discussed productively outside the SARC.

With respect to resolving the stock identification issue, it may be preferable to design a research program and to appoint a special technical group to advise the Council on that single issue. One would anticipate that the work would take a year or more and would need external funding.

Black sea bass - Recall that we had attached a high priority to a benchmark assessment of this stock. Development of such an assessment, however, awaits better information on fishery dependent mortality. The ASMFC, the MAFMC and the NMFS are exploring options for funding such research, most notably, a tagging study. When such a study is completed the SAW will provide a benchmark review. In the interim, a simple index update should suffice. This need not go through the SARC.

Gulf of Maine winter flounder, Southern New England winter flounder - Recall that we were awaiting the advice of the ASMFC's technical committee with respect to the availability of aging data. We're informed that such data will not be available in time for preparation of an assessment for the June SARC and the ASMFC recommends postponement to SAW 36 (fall 2002).

Striped bass, northern shrimp - Similarly, the ASMFC indicates that work on developing assessments for these two stocks is not yet complete and that a fall 2002 assessment review would be more appropriate.

Pollock - We have been trying to schedule an assessment review of this stock for some time. Pollock is a transboundary stock (with the preponderance of the biomass in Canadian waters). We agreed, some time ago, that this would be best handled by the TRAC. As you know, the timing and protocol for the TRAC itself is somewhat indeterminate at this point in time. More importantly, we have not yet been able to sit down with our Canadian colleagues and develop a joint assessment model. Technically, this stock was dropped from our list at the August 2001 conference and does not appear in the October 2001 accounting. In any case, it would seem best to run this through the TRAC. It is not clear, however, when that can happen (see discussion on herring).

Atlantic herring - More than two years ago, in discussions with Canada, we agreed to pass this through the TRAC, specifically a TRAC occurring in the spring of this year. Additionally, we commenced work on new assessment methodology based on hydroacoustic surveys. This fall a peer review panel met to review that methodology and to advise the SAW Working Group how to best conduct such a survey. The report of that peer review is not yet available.

The TRAC meeting in the spring has been postponed (although there will be a benchmark review of cod assessment methodology next week). Our current understanding is that the US and Canada have agreed to schedule an assessment review for herring via a TRAC in the spring of 2003.

It is not clear what the NEFMC's management needs are with respect to herring, but it's possible that they may be dealt with outside the assessment peer review process.

SAW SCHEDULING STATUS SUMMARY

SAW 36 (SARC, November-December 2002)
Southern New England-Mid-Atlantic yellowtail flounder, black sea bass - if tagging work available; red crab - to be confirmed; surfclam - if surfclam/ocean quahog survey takes place in 2002.

SAW 37 (SARC, June 2003)
Ocean quahog - if surfclam/ocean quahog survey takes place in 2002; bluefish - to be confirmed.

SAW 38 (SARC, November-December 2003)
Tilefish.

Draft General Terms of Reference for Stock Assessments

NEFMC & MAFMC Staffs 10/22/01

Terms of reference

The following list is intended to provide guidance to the Stock Assessment Workshop for assisting the Mid-Atlantic and New England Fishery Management Councils in meeting the requirements of the Sustainable Fisheries Act and the Atlantic States Marine Fisheries Commission in meeting the requirements of the Atlantic Coastal Fisheries Management Act.

1. Characterize the commercial and recreational catch including both landings and discards.

2. Estimate fishing mortality and stock biomass for the current year. Age-structured assessments should be provided for all stocks managed under fishery management plans (FMPs). In cases where age-structured data or other needed data are not available, a plan to collect the information with target deadlines should be developed.

3. For stocks with MSY reference points that define overfishing, estimate biomass-weighted fishing mortality and total stock biomass for the current year. For stocks with proxy reference points that define overfishing, estimate fully-recruited fishing mortality and spawning stock biomass. Characterize the uncertainty (via bootstrap re-sampling, sensitivity analysis, etc.) for these estimates and document all assumptions or estimates of natural mortality, weights at age, maturation, and other factors.

4. Provide updated estimates of biological reference points. Evaluate and re-estimate biological reference points if appropriate.

- For stocks where the MSY estimate was conditioned on the VPA biomass estimates, re-estimate F_{MSY} and B_{MSY} whenever there is an update to the VPA.

- For stocks for which MSY was estimated from an unconditioned surplus production model or for stocks with proxy reference points, re-estimate FMSY and BMSY (or their proxies) whenever new information would significantly change their values.

5. Estimate a TAC and/or TAL based on stock status and target mortality rate for the year [*suggested change*: three year period] following the terminal assessment year.

6. When stock biomass is less than B_{target} (B_{MSY} or proxy), estimate the potential of the stock to rebuild to B_{target} within 1 to 10 years at various fishing mortality rates and exploitation patterns.

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Northeast Fisheries Science Center
National Marine Fisheries Service, NOAA
166 Water St.
Woods Hole, MA 02543-1026

STANDARD
MAIL A

Publications and Reports of the Northeast Fisheries Science Center

The mission of NOAA's National Marine Fisheries Service (NMFS) is "stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and promotion of the health of their environment." As the research arm of the NMFS's Northeast Region, the Northeast Fisheries Science Center (NEFSC) supports the NMFS mission by "planning, developing, and managing multidisciplinary programs of basic and applied research to: 1) better understand the living marine resources (including marine mammals) of the Northwest Atlantic, and the environmental quality essential for their existence and continued productivity; and 2) describe and provide to management, industry, and the public, options for the utilization and conservation of living marine resources and maintenance of environmental quality which are consistent with national and regional goals and needs, and with international commitments." Results of NEFSC research are largely reported in primary scientific media (*e.g.*, anonymously-peer-reviewed scientific journals). However, to assist itself in providing data, information, and advice to its constituents, the NEFSC occasionally releases its results in its own media. Those media are in four categories:

NOAA Technical Memorandum NMFS-NE -- This series is issued irregularly. The series typically includes: data reports of long-term or large area studies; synthesis reports for major resources or habitats; annual reports of assessment or monitoring programs; documentary reports of oceanographic conditions or phenomena; manuals describing field and lab techniques; literature surveys of major resource or habitat topics; findings of task forces or working groups; summary reports of scientific or technical workshops; and indexed and/or annotated bibliographies. All issues receive internal scientific review and most issues receive technical and copy editing.

Northeast Fisheries Science Center Reference Document -- This series is issued irregularly. The series typically includes: data reports on field and lab observations or experiments; progress reports on continuing experiments, monitoring, and assessments; background papers for scientific or technical workshops; and simple bibliographies. Issues receive internal scientific review, but no technical or copy editing.

Fishermen's Report -- This information report is a quick-turnaround report on the distribution and relative abundance of commercial fisheries resources as derived from each of the NEFSC's periodic research vessel surveys of the Northeast's continental shelf. There is no scientific review, nor any technical or copy editing, of this report.

The Shark Tagger -- This newsletter is an annual summary of tagging and recapture data on large pelagic sharks as derived from the NMFS's Cooperative Shark Tagging Program; it also presents information on the biology (movement, growth, reproduction, etc.) of these sharks as subsequently derived from the tagging and recapture data. There is internal scientific review, but no technical or copy editing, of this newsletter.

OBTAINING A COPY: To obtain a copy of a *NOAA Technical Memorandum NMFS-NE* or a *Northeast Fisheries Science Center Reference Document*, or to subscribe to the *Fishermen's Report* or the *The Shark Tagger*, either contact the NEFSC Editorial Office (166 Water St., Woods Hole, MA 02543-1026; 508-495-2228) or consult the NEFSC webpage on "Reports and Publications" (*http://www.nefsc.nmfs.gov/nefsc/publications/*).