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A Report of the 28th Northeast Regional Stock Assessment Workshop

28th Northeast Regional Stock Assessment Workshop (28th SAW)

Public Review Workshop

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Introduction

The Public Review Workshop of the 28th Northeast Regional Stock Assessment Workshop (SAW 28) was held in two sessions as part of meetings of the New England and Mid-Atlantic Fishery Management Council (NEFMC and MAFMC). The first session was on January 28, 1999 in Portsmouth, NH during the meeting of the NEFMC and the second session occurred on February 4, 1999 in New York city during a meeting of the MAFMC. On January 11, 1999, prior to these two Council meetings, a special presentation on the status of the Southern New England/Mid-Atlantic winter flounder stock was made to the Atlantic State Marine Fisheries Commission's Winter Flounder Board during a meeting in Alexandria, VA.

The purpose of the Workshop was to present assessment results and management advice for the stocks of Cape Cod yellowtail flounder, Gulf of Maine/Georges Bank white hake, Georges Bank winter flounder, Gulf of Maine/Georges Bank American plaice and Southern New England/Mid-Atlantic winter flounder. The five stocks were peer reviewed by the 28th Stock Assessment Review Committee (SARC) at its November 30 - December 4, 1998 meeting in Woods Hole, MA. Copies of the SAW 28 draft *Advisory Report on Stock Status* and SAW 28 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, summarized the assessment results and management advice for each stock using information contained in this report and supporting information from the *Report of the 28th Northeast Regional Stock Assessment Workshop (28th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.* Each presentation was followed by a question-and-answer session.

Status Summaries

<u>Cape Cod Yellowtail Flounder</u>

The Cape Cod yellowtail flounder stock was at a medium level of biomass and was over-exploited in 1997. Total biomass since the early 1990s has remained below the level that can produce MSY (1997 biomass was 2,700 mt, 44% of B_{msy}). Fishing mortality (F) generally decreased in the mid 1990s; fully-recruited F in 1997 was 0.64. Recruitment from 1988-1995 averaged 7 million fish, near the long term recruitment mean, but the 1996 year class size is about half the long term average. For 1998 the estimated level of biomass is 2,900 mt and full-recruited F is estimated to increase to 1.01. Relative to the Amendment 9 overfishing definition and associated control rules, the stock is overfished and overfishing is occurring. Applying the Amendment 9 control rule to the 1998 total stock biomass implies a fishing mortality target rate of 0 in 1999.

Gulf of Maine/Georges Bank White Hake
The Gulf of Maine/Georges Bank white hake stock was at a low biomass level and was over-exploited in 1997. Total biomass has remained below the level that can produce MSY since 1985 (1997 biomass was 5,300 mt, 24% of B_{msy}). Biomass in 1997 is the lowest in the time series and recent fishing mortality has been very high (fully-recruited F in excess of 0.64 between 1985 and 1997). Recruitment declined substantially from 1989 through 1995. The 1996 year class appears to comparable in size to long-term average recruitment. The 1998 estimated total stock biomass is 3,300 mt and fully-recruited F is projected to increase to 1.4. Relative to the current overfishing definition the stock is overfished. Relative to the Amendment 9 overfishing definition and associated control rules, the stock is overfished and overfishing is occurring. Applying the Amendment 9 control rule to the 1998 total stock biomass implies a fishing mortality rate target of 0 in 1999.

Georges Bank Winter Flounder
The Georges Bank winter flounder stock was at low level of biomass and was fully exploited in 1997. Fishing mortality rates were very high in the early 1990s but have declined since 1994. Spawning stock biomass levels and age composition have improved since 1993 but incoming recruitment, particularly the 1995 and 1996 year classes, is poor. Biomass in 1997 is 3,500 mt, 60% of the biomass proxy specified in the Amendment 9 overfishing definition. The 1998 spawning stock biomass is estimated to be 3,300 mt and fully recruited F 0.34. Relative to the Amendment 9 overfishing definition and associated control rules, the stock is overfished and overfishing is occurring. Applying the Amendment 9 control rule to the 1995-1997 NEFSC survey biomass index average implies a fully-recruited fishing mortality rate target of 0.03 in 1999.

Gulf of Maine/Georges Bank American Plaice
The Gulf of Maine/Georges Bank American plaice stock was at a low level of biomass and was over-exploited in 1997. Fully-recruited fishing mortality rates declined from a time series high of 0.75 in 1995 to 0.47 in 1997. Spawning stock biomass has increased from a time series low of 7,700 mt in 1989 to 13,500 mt in 1997 but remains below the long term average. Despite the appearance of two relative large year classes in the late 1980s and early 1990s, SSB did not increase appreciably, likely due to increased mortality from discarding. Year class size continues to decline with the most recent year classes (1994, 1995, 1996) being the lowest since 1985 and the 1997 year class size the lowest in the time series. The 1998 spawning stock biomass is projected to decline to 10,800 mt and the fully-recruited F to increase slightly to 0.48. Relative to the current overfishing definition the stock is overfished. Relative to the Amendment 9 overfishing definition and associated control rules, the stock is overfished and overfishing is occurring. Applying the Amendment 9 control rule to the 1998 spawning stock biomass implies a fishing mortality target rate of 0 in 1999.

Southern New England/Mid-Atlantic Winter Flounder
The southern New England/Mid-Atlantic winter flounder stock complex was at a medium level of biomass and was fully exploited in 1997. Fully recruited fishing mortality in 1997 was 0.31, about equal to

the ASMFC target for 1997. Total biomass in 1997 was 17,900 mt, 64% of B_{msy}. Reductions in fishing mortality and improvements in recent recruitment have contributed to rebuilding of the stock. The 1998 total stock biomass is estimated to increase to 20,200 mt (73% of B_{msy}) and fully-recruited F to increase to 0.39. Relative to the current overfishing definition the stock is not overfished. Relative to the Amendment 9 overfishing definition and associated control rules, the stock is not overfished and overfishing is not occurring. Applying the Amendment 9 control rule to the 1998 total stock biomass implies a fully-recruited fishing mortality rate target of 0.28 in 1999.

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 overfished 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, in this report, stocks under review are classified with respect to Council approved[1] 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. In the Northeast Multispecies FMP, individual species or stocks are managed under specific control rules. These control rules are discussed in each Advisory 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.

[1] Amendment #9 to the Northeast Multispecies Fishery Management Plan, submitted by the NEFMC, not yet approved.

		BIOMASS		
		B <$B_{THRESHOLD}$	$B_{THRESHOLD}$ < **B** < B_{MSY}	**B** > B_{MSY}
EXPLOITATION RATE	$F_{THRESHOLD}$	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}
	F_{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}

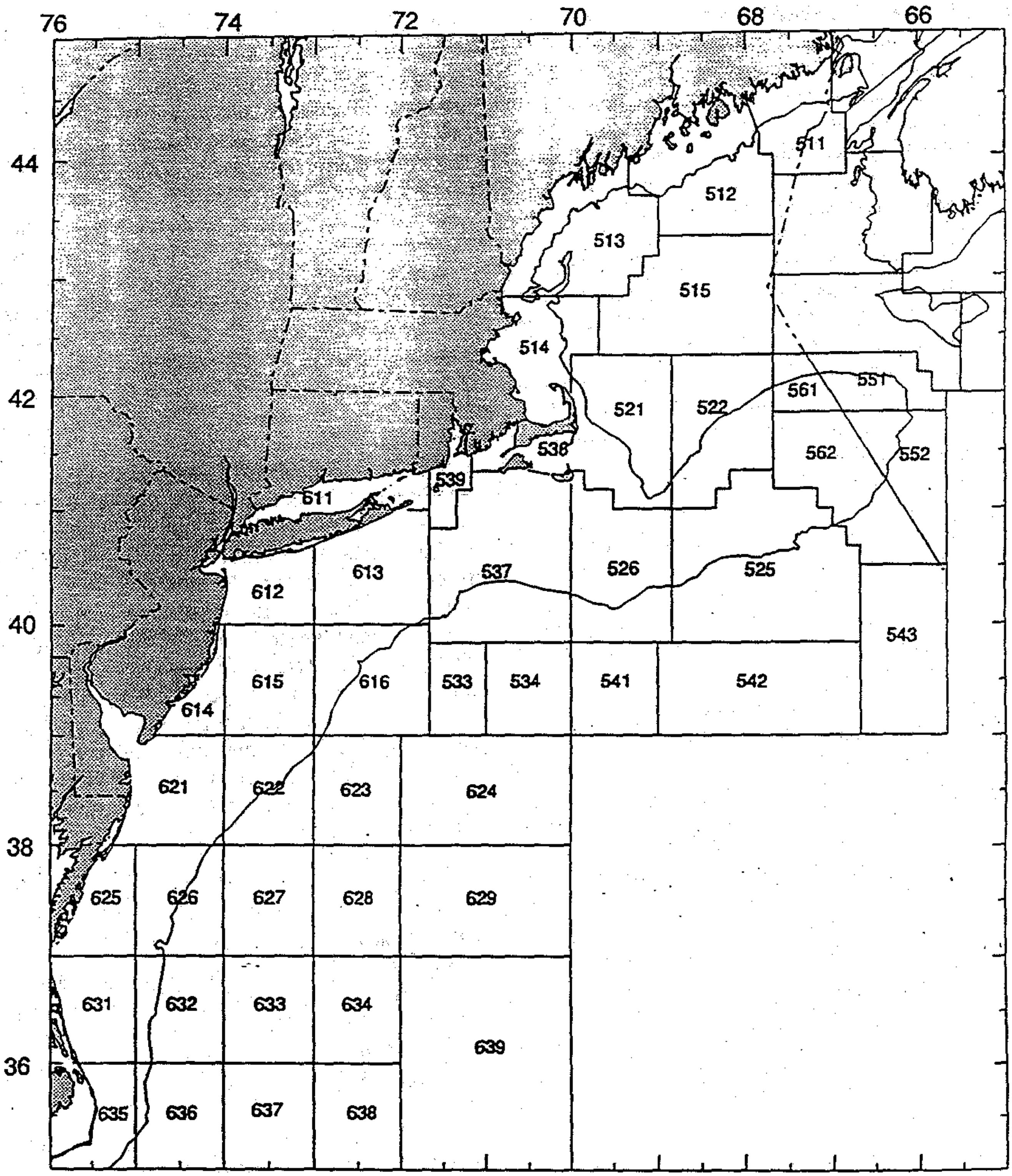


Figure 1. Statistical areas used for catch monitoring in offshore fisheries in the Northeast United States.

Biological reference points: These are specific values for the variables that describe the state of a fishery system and 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.

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 which 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, $F_{x\%}$, 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 which produces the maximum sustainable yield.

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.

Maximum Spawning Potential (MSP) reference points: 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 are derived from stock-recruitment data which can be used to estimate the level of %MSP necessary to sustain a stock, or they are chosen by analogy using available information on the level required to sustain related.

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

Overfished: Under the Sustainable Fisheries Act, the Magnuson-Stevens Fishery Conservation Act, National Standard I and its implementing guidelines, a stock is overfished when stock biomass falls below the biomass threshold ($B_{THRESHOLD}$).

Overfishing: Under the Sustainable Fisheries Act, the Magnuson-Stevens Fishery Conservation Act, National Standard I and its implementing guidelines, overfishing is occurring when current fishery removal (rates CF) exceed fishing mortality rate threshold ($F_{THRESHOLD}$).

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 which 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.

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 which are also assumed to be constant.

Status of exploitation: An appraisal of exploitation for each stock is given as under-exploited, fully-exploited, and over-exploited. These terms describe the effect of current fishing mortality on each stock, and are equivalent to the Councils' terms of under-fished, fully-fished, or over-fished. Status of exploitation is based on current data and the knowledge of the stocks over time.

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

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.

Table 1. Percentage of stock (in numbers) caught annually (the exploitation rate) under different fishing (F) mortality rates and a natural (M) mortality rate of 0.20. An M of 0.20 is appropriate for all the stocks assessed in SAW 28.

F	Exploitation Rate, %	F	Exploitation Rate,%
0.1	9	1.1	62
0.2	16	1.2	65
0.3	24	1.3	67
0.4	30	1.4	70
0.5	36	1.5	72
0.6	41	1.6	74
0.7	46	1.7	76
0.8	51	1.8	78
0.9	55	1.9	79
1.0	58	2.0	81

The 28th Northeast Regional Stock Assessment Review Committee met in Woods Hole, MA during November 30 - December 4, 1998 to review assessments of five northeast stocks: Cape Cod yellowtail flounder, Georges Bank winter flounder, Southern New England/Mid-Atlantic winter flounder, American plaice and white hake. All five stocks are managed by the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan. The inshore (state waters) winter flounder fisheries are also managed by the Atlantic States Marine Fisheries Commission Winter Flounder Fishery Management Plan.

Information for each assessment includes the current and future status of the stock and advice on managing the stock according to the current overfishing definitions and the Amendment 9 (Northeast Multispecies FMP) overfishing definitions.

The new Amendment 9 overfishing definitions include two determinations: whether *overfishing* is occurring (fishing mortality is too high), and whether the stock is *overfished* (biomass is too low).

Because most of the existing overfishing definitions in the Multispecies FMP are based on exploitation rates independent of stock biomass and the exploitation pattern, another dimension must be added to the stock status determination - a biomass dimension. It is useful, therefore, to discuss the relationship between age-based rates, the customary currency (and the rates derived from the age-based analytical assessments used for all five assessed stocks in the 28th Stock Assessment Workshop), and the related, but different, biomass-based fishing mortality rates that are necessary for interpreting the new control rules.

Incorporation of Age Structure Information in Overfishing Definitions and Control Rules

Revised overfishing definitions and harvest control rules, proposed in Amendment 9, were based on surplus production models. The surplus production model is among the simplest used in stock assessment, with modest data requirements. This form of model does not reflect any information on the age structure of the population, however, and the dynamics of natural mortality, growth, and recruitment are aggregated into a single intrinsic rate of population biomass increase and carrying capacity. The 28th SARC had an opportunity to review the proxies used to establish Amendment 9 definitions and control rules and, in some cases, using information from the age-structured assessments, offers revisions to the Amendment 9 specifications for B_{MSY} and F_{MSY}. These revisions fall within the terms of reference provided to the SARC by the SAW Steering Committee and do not revise the fundamental definitions or control rules specified in the Amendment.

Given the old and new overfishing definitions, two different measures of fishing mortality must be considered. Fishing mortality has customarily been reported as the average fishing mortality rate for fully-recruited ages within the stock, typically estimated by virtual population analysis. Because the surplus production model reflects the entire stock biomass (including partially-recruited ages), F_{MSY} also reflects an age-aggregated reference point. The biomass-based rates are therefore not directly comparable to the fishing mortality rates for full-recruited ages as customarily reported for the old overfishing definitions. Thus, translation of the fishing mortality rate (from the VPA) is needed to calculate a rate comparable to the F_{MSY} in the overfishing definitions and control rules. This 'biomass-weighted' F is averaged over all age classes in the population irrespective of vulnerability to the fishery.

As an example, consider Cape Cod yellowtail flounder assessed at this SAW, where:

Age	F (at age), 1996	Mean Biomass (mt), 1996
1	0.00	248
2	0.13	802
3	0.52	1087
4	**1.07**	418
5	**1.10**	146
6+	1.09	17

The fully-recruited F typically reported is based on the average F for fully-recruited ages 4 and 5 and is 1.09 in this example. The biomass-weighted F, on the other hand, is based on all ages, with the contribution to overall F of each age proportional to its biomass. For Cape Cod yellowtail flounder, the biomass-weighted F for ages 1+ is 0.48[1]. This includes the effects of mortality at ages 1 (F=0.0) through 5 (F=1.10) and is therefore less than the fully-recruited F. In this example the biomass-weighted F is similar to F on age 3 because the biomass of age 3 fish is a relatively large proportion of total stock biomass. Thus, it is important to distinguish which form of F is being reported for a stock. In this report, both forms of fishing mortality rates are estimated and identified.

Implications for Reference Points

The influence of changes in the exploitation pattern on the reference points illustrates the difference between the MSY-based reference points, estimated by surplus production models, and YPR-based reference points (the basis for Amendment 4 overfishing definitions). If the vulnerability of age 3 fish declines, as indicated by the current assessment of Cape Cod yellowtail flounder, fully-recruited F is unaffected because age 3 is not included in the fully-recruited estimate of F. Instead, yield per recruit reference points (e.g. F_{MAX}, $F_{0.1}$) tend to increase (or F_{MAX} becomes undefined). Yield per recruit improves because of the improved survival of young, fast-growing fish.

[1]((248*0.0 + 802*0.13 + 1087*0.52 + 418*1.07 + 146*1.10 + 17*1.09)/(248 + 802 + 1087 + 418 + 146 + 17)) = 0.48

On the other hand, age 3 fishing mortality is included in biomass-weighted fishing mortality estimates, so the effect of a decrease in vulnerability to the fishing gear (e.g., from an increase in the minimum mesh size) translates into a lower current biomass-weighted fishing mortality rate. Biomass weighted F tends to diverge from fully-recruited F as a greater proportion of total stock biomass becomes less vulnerable to fishing.

The estimate of F_{MSY}, however, is relatively insensitive to new data within the observed dynamic range of the stock. F_{MSY}, estimated by a surplus production model, will be insensitive to changes in the exploitation pattern, because the estimate is representative of a long time series and an average exploitation pattern over the entire period.

In summary, a change in the exploitation pattern will generally be seen in the yield per recruit reference points but will not be observed in the fully-recruited fishing mortality estimate. Conversely, F_{MSY} is estimated over all age groups and must therefore be compared with biomass-weighted (1+) F. In this case, a change in the exploitation pattern will influence the estimate of biomass-weighted F.

Amendment 9 Control Rules

The Amendment 9 control rules differ from stock to stock but, in general, specify F targets and F thresholds. The $F_{THRESHOLD}$ rate is the fishing mortality that should not be exceeded; the F_{TARGET} is that rate which (with some specified probability) will prevent the $F_{THRESHOLD}$ from being exceeded. The control rules also have time specific rebuilding horizons such as a 10-year or 5-year rebuilding period, or two-step horizons (e.g., a 10 year rebuilding rule between F_{MSY} and ½ B_{MSY} and a 5 year rebuilding horizon for biomass ranges between ½ and ¼ B_{MSY}). However specified, the Amendment 9 control rules provide specific prescriptions for F_{TARGET} and $F_{THRESHOLD}$ given current biomass estimates. That is, once current biomass is determined, F_{TARGET} is specified. As discussed above, the relevant F_{TARGET} is a biomass-weighted F.

In the following advisories, fully-recruited and biomass-weighted fishing mortality rates are presented. Application of the Amendment 9 control rules, however, require the use of biomass-weighted F to determine stock status. For the purposes of comparison to the status quo, where possible, projections using current overfishing definition reference points are also provided. Again, note that, in most cases, the old reference points do not depend on the current biomass level of the stock.

It is possible that current estimates of F (fully-recruited) may be less than the current F-based reference points while, at the same time, current F exceeds the new fishing mortality threshold. It is also possible that current estimates of biomass-weighted F are less than either the old reference points (appropriately converted to biomass-weighted terms) or the new reference points. Nevertheless, if current biomass estimates are less than the minimum biomass threshold (usually ¼ or ½ B_{MSY}), the Amendment 9 control rules imply that the Council should reduce fishing mortality to as close to zero as practicable. This action is needed to rebuild depressed stocks as quickly as possible, reducing the risk of stock collapse.

A. CAPE COD YELLOWTAIL FLOUNDER ADVISORY REPORT

State of Stock: The Cape Cod yellowtail flounder stock was at a medium level of biomass and was over-exploited in 1997. Total biomass since the early 1990s remained below the level that can produce MSY (1997 biomass was 2,700 mt, which is 44% of B_{MSY}, 6,100 mt). Fishing mortality generally decreased in the mid 1990s; fully-recruited F in 1997 was 0.64 (43% exploitation rate), and F on total biomass was 0.41 (31% exploitation rate) (Figure A1). Recruitment (age-1) averaged 7 million fish from 1988-1995, but the 1996 year class is about half the long term average (Figure A2).

The estimated level of biomass in 1998 is 2,900 mt and fully-recruited F is projected to increase to 1.01 (Figure A1). Relative to the Amendment 9 overfishing definition and associated control rules (Figure A7), the stock is overfished, and overfishing is occurring.

Management Advice: There is no current overfishing definition for this stock. Amendment 9 to the Northeast Multispecies FMP suggests MSY-based reference points for Cape Cod yellowtail flounder. Applying the Amendment 9 control rule to the 1998 total stock biomass implies a fishing mortality target rate of 0 in 1999 (Figure A7).

Forecasts for 1999-2000: Projections suggest that catch and biomass will decline in 1999 as the apparently poor 1996 year class recruits to the fishery. Projected 2000 biomass remains below $B_{THRESHOLD}$ (½ B_{MSY}) at status quo harvest rates, but can substantially increase at low exploitation rates (Figure A4).

Forecast Table: Basis: F_{1998} derived from preliminary 1998 catch, average 1994-1997 partial recruitment and estimated January 1 mean weights at age; age-1 recruitment in 1999-2000 estimated from the distribution of observed age-1 stock sizes from 1985-1997. The preliminary estimate of 1998 landings was based on catches from January to August and the relative proportion of monthly landings in 1997. Landings and January 1 biomass are in thousands of mt. Target F is taken from the Amendment 9 control rule. F values assumed in projections are for fully-recruited ages; their equivalents in total biomass terms are provided in parentheses.

1998			1999				2000	Consequences/Implications
Landings	Biomass	Discard	F_{1999}	Landings	Biomass	Discard	Biomass	
1.3	2.9	0.3	0.00 (F_{target} = 0.00 on biomass)	0.0	2.7	0.0	4.2	No landings. Biomass increases to 69% of B_{MSY}.
			1.01 ($F_{status\ quo}$ = 0.56 on biomass)	1.1	2.7	0.2	2.9	Landings decrease. Biomass decreases to 48% of B_{MSY}.

Catch and Status Table (weights in '000 mt, recruitment in millions): Cape Cod Yellowtail Flounder

Year	1991	1992	1993	1994	1995	1996	1997	1998[1]	Max[2]	Min[2]	Mean[2]
Landings	1.5	0.8	0.6	1.0	1.2	1.1	1.0	1.3	5.1	0.4	1.6
Discards	0.4	0.6	0.1	0.2	0.2	0.2	0.3	0.2	3.1	0.0	0.4
Total catch	1.9	1.5	0.7	1.2	1.4	1.2	1.3	1.6	5.7	0.5	2.0
Total Biomass	3.7	2.4	1.9	2.8	3.2	2.8	2.7	2.9	5.7	1.9	3.1
SSB	1.0	0.9	1.0	1.3	1.4	1.6	1.7	1.7	2.1	0.5	1.1
Recruitment (age-1)	9.2	7.3	7.5	6.8	6.6	6.8	3.4	----	21.2	3.4	8.0
Fully-recruited F[3]	2.12	1.41	0.92	1.23	0.96	1.09	0.64	1.01	3.04	0.64	1.35
Exploitation rate	82%	70%	55%	65%	57%	61%	43%	62%	90%	43%	64%
F on biomass[4]	0.66	0.86	0.34	0.40	0.53	0.48	0.41	0.56	1.09	0.24	0.55
Exploitation rate	44%	53%	26%	30%	37%	35%	31%	39%	61%	20%	38%

[1]Preliminary estimates based on expanding January-August landings to entire year.
[2]Over the period 1935-1997 for catch, and 1985-1997 for biomass, recruitment, F and exploitation rates.
[3]ages-4+, un-weighted.
[4]ages-1+, weighted by biomass.

Stock Distribution and Identification: Yellowtail flounder range from Labrador to Chesapeake Bay. Geographic patterns of landings and survey data, larval distribution, tagging observations, and life history information indicate a relatively discrete stock off Cape Cod (statistical areas 514, southwest Gulf of Maine, and 521, east of Cape Cod). Movements of yellowtail to adjacent stock areas in the northern Gulf of Maine, Georges Bank and southern New England are rare.

Catches: Landings of Cape Cod yellowtail rapidly increased in the late 1930s to an annual average of 1,300 mt from 1940 to 1962, increased sharply in 1963 to 3,600 mt, decreased to an annual average of 1,500 mt from 1964 to 1973, increased after 1973 to a peak of 5,100 mt in 1980, declined to an annual average of 1,000 from 1984 to 1989, increased in 1990, then returned to an annual average of 1,000 mt since 1991. Most landings from 1995 to 1997 (72%) were from statistical area 514, almost entirely in the first, second, and fourth quarters of the year. A large portion of area 521 landings during 1995 to 1997 (41%) were taken in the fourth quarter. Discards of Cape Cod yellowtail averaged 26% of total catch by weight from 1935 to 1997. Recent discard estimates remain substantial (20% of total catch during 1994-1997), with 40% of the discard (by weight) coming from the large mesh fishery, 30% from the exempted whiting fishery, and 30% from the scallop fishery. A large portion of total catch is immature (30% for the VPA time series, by weight, 57% by number).

Data and Assessment: The assessment is based on a virtual population analysis (VPA) of 1985-1997 total catch at age. Sampling intensity of commercial landings was inadequate for age-based stock assessment prior to 1985. Landings were prorated to stock area using interview data (1985-1993) and vessel logbooks (1994-1997). Discards were estimated using survey size distributions and selectivity estimates (1985-1988) and observer data by gear type (1989-1997). The VPA was calibrated using NEFSC and MADMF survey indices.

Biological Reference Points: The surplus production analysis used to define overfishing in Amendment 9 was revised and updated. Surplus production of Cape Cod yellowtail was modeled using total catch from 1963-1997, historical catch per unit effort, and NEFSC and Massachusetts survey indices. MSY was estimated directly from the production model as 2,400 mt, and MSY reference points were derived from 1985-1994 production model biomass ratios calibrated to VPA biomass levels: $F_{MSY} = 0.40$ (on biomass, approximately 0.54 on fully-recruited ages) and $B_{MSY} = 6{,}100$ mt ($B_{THRESHOLD} = \frac{1}{2} B_{MSY} = 3{,}050$ mt). Yield per recruit analysis indicates that $F_{max} = 0.47$ and $F_{0.1} = 0.21$ (Figure A3).

There is no current overfishing definition for this stock. The Amendment 9 control rule was developed to define overfishing thresholds and targets. When the stock biomass exceeds B_{MSY}, the overfishing threshold is F_{MSY}, and target F is based on a 10% risk of exceeding the threshold. When the stock biomass is less than B_{MSY} but more than $B_{THRESHOLD}$, the overfishing threshold is based on maximum F that would allow rebuilding to B_{MSY} in five years, and target F is based on a 10% risk of exceeding the threshold. When total biomass is less than $B_{THRESHOLD}$, F_{TARGET}, and $F_{THRESHOLD}$ are 0.0

Fishing Mortality: Fishing mortality on fully recruited ages (age-4+) has been extremely high and variable, peaked in 1988, and generally decreased to 0.64 (43% exploitation rate) in 1997. The 80% bootstrap confidence interval of 1997 F is 0.47(34% exploitation) to 0.92 (55% exploitation) (Figure A6). The temporal pattern and approximate magnitude of F estimates from VPA are confirmed from survey estimates of F, which peaked at approximately 2.0 (81% exploitation) in the late 1980s and gradually declined to approximately 1.0 (58% exploitation) in the late 1990s. Fishing mortality on young fish decreased from an annual average of 0.55 (38% exploitation) from 1985 to 1992 to 0.13 (11% exploitation) from 1993 to 1997.

Recruitment: Maximum age-1 recruitment was 21.2 million fish in 1988. Recruitment was relatively constant from 1989 to 1996 (averaging 7 million fish), but decreased to 3.4 million fish in 1997 (Figure A2).

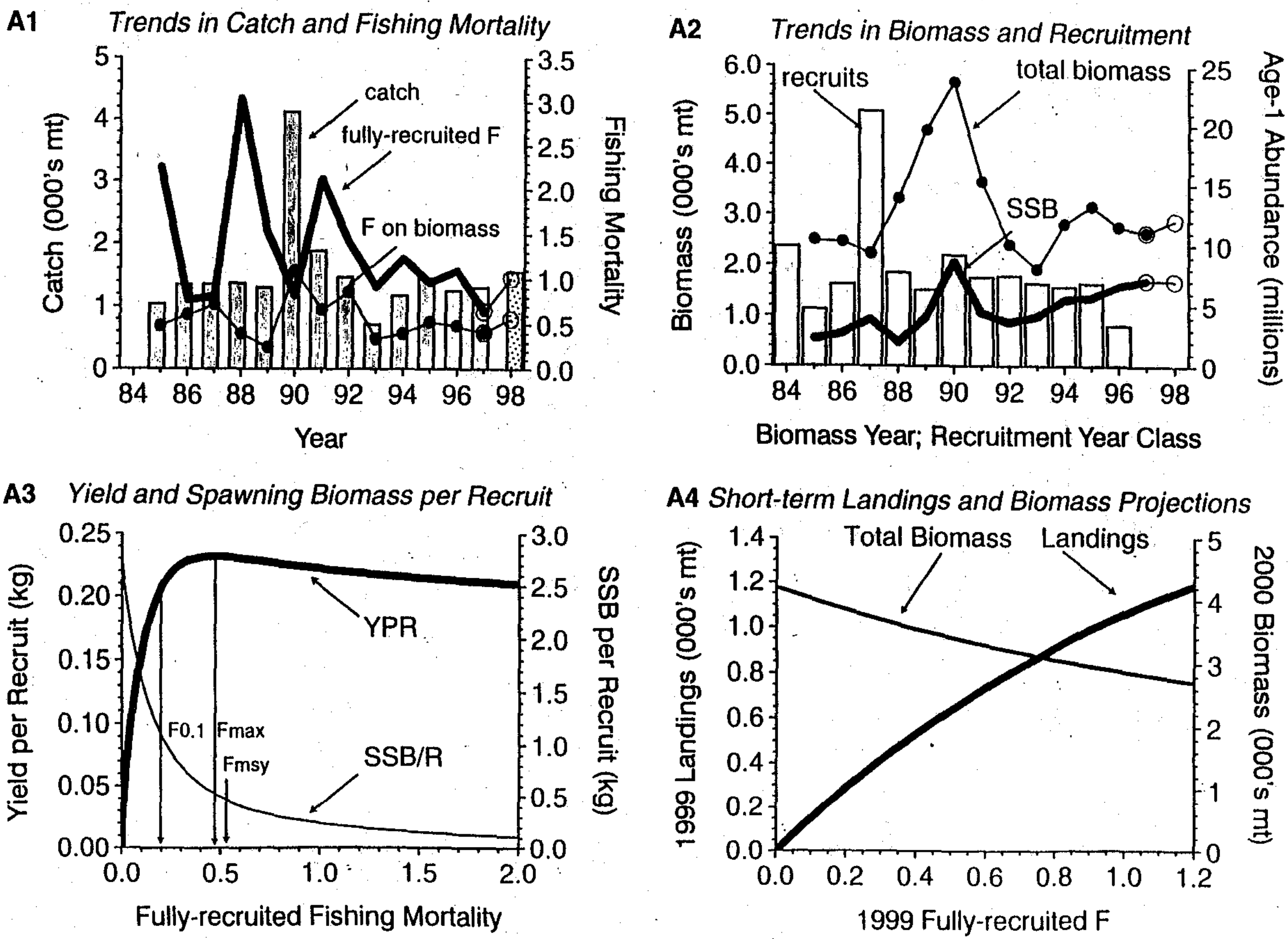
Spawning Stock Biomass: Commercial indices of abundance suggest a declining trend from the 1960s to the late 1980s. Indices from the MADMF survey have fluctuated in recent years but are now at a relatively low level (Figure A8). In terms of the VPA, spawning stock biomass peaked in 1990 at 2,100 mt when most of the 1987 cohort matured, decreased in 1991 and 1992, then generally increased to 1,700 mt in 1997 (Figure A2). The 80% bootstrap confidence interval of 1997 SSB is 1,390 mt to 2,120 mt (Figure A5). The age distribution of SSB indicates that most of the current mature biomass is composed of first-time spawners.

Special Comments: Production model results were calibrated to VPA estimates of biomass, because production models generally don't provide reliable estimates of absolute biomass. Furthermore, the historical catch rates used in the production model may not accurately reflect trends in stock biomass, because they were based on a small portion of the fleet landings of Cape Cod yellowtail.

The Amendment 9 control rule was based on a production model that estimates F_{MSY} and related targets and thresholds in terms of F on total biomass (Figure A7). In order to project VPA results to the year 2000, F on total biomass must be converted to fully-recruited biomass (Forecast Table).

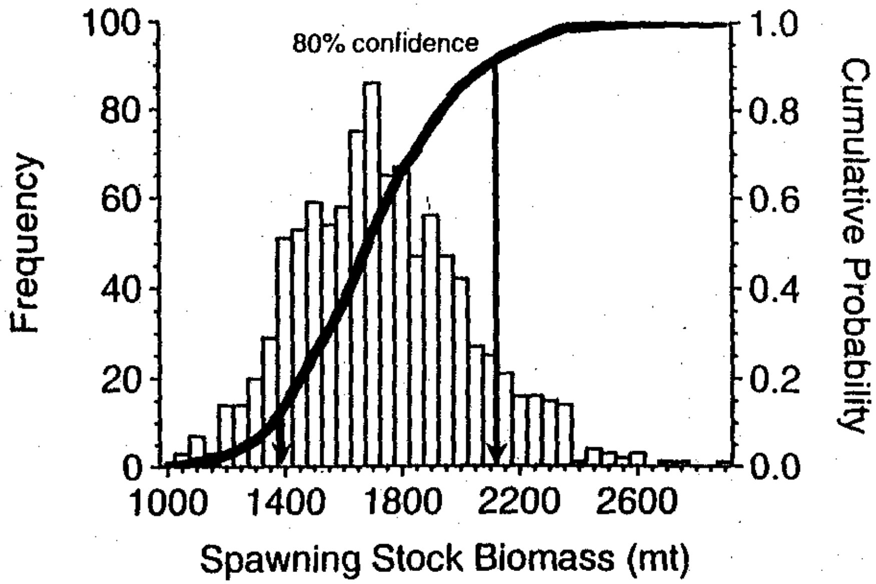
Source of Information: S. Cadrin, J. King, and L. Suslowicz. 1999. Status of Cape Cod yellowtail flounder. NEFSC Ref. Doc. 99-04.

Cape Cod Yellowtail Flounder

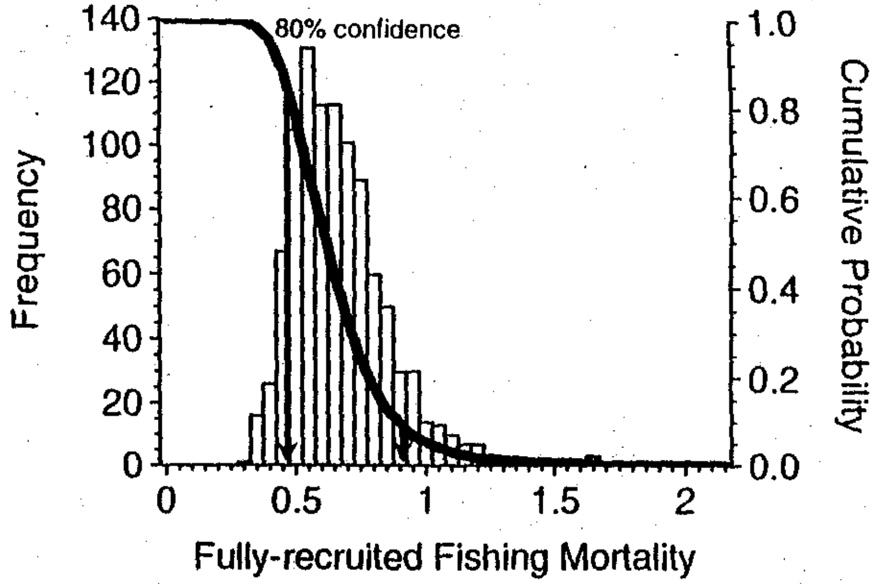


Cape Cod Yellowtail Flounder

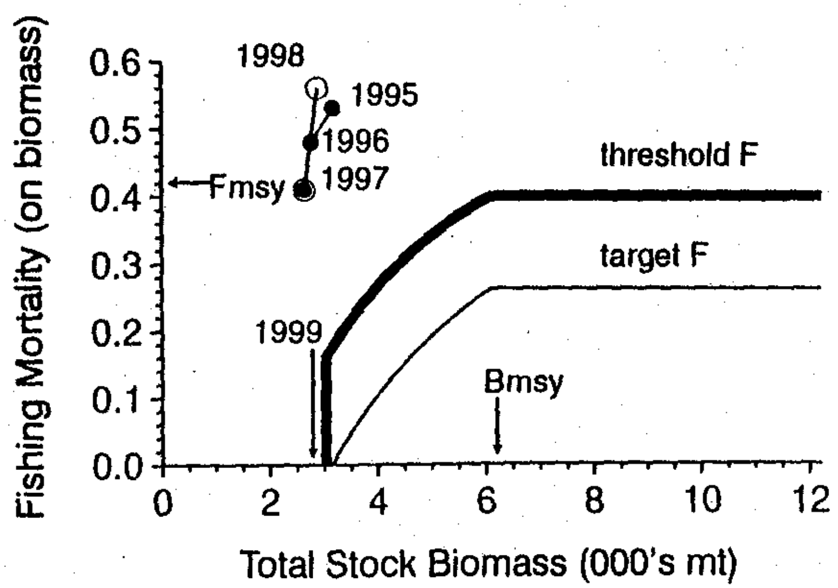
A5 *Precision of 1997 SSB Estimate*



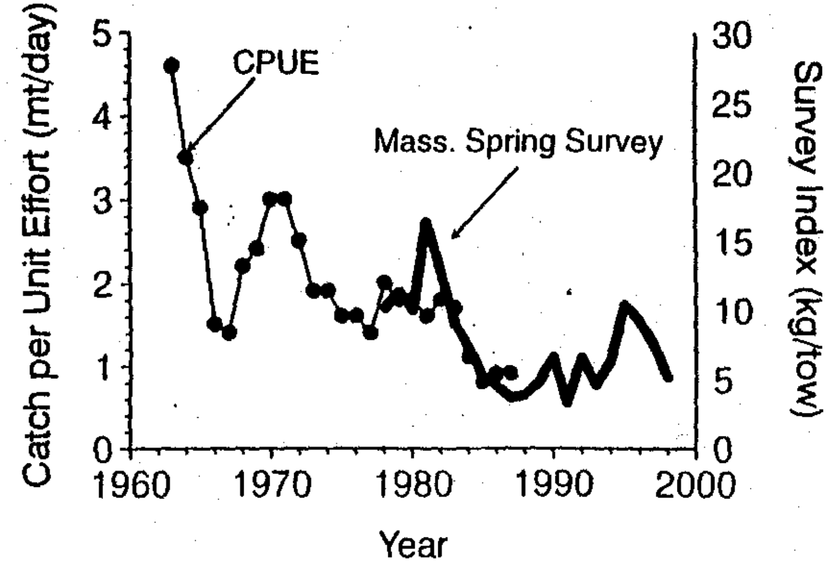
A6 *Precision of 1997 F Estimate*



A7 *Harvest Control Rule and Recent Stock Status*



A8 *Long-term Biomass Indices*



B. GULF OF MAINE-GEORGES BANK WHITE HAKE ADVISORY REPORT

State of Stock: The Gulf of Maine-Georges Bank white hake stock was at a low biomass level and was over-exploited in 1997. Total biomass has remained below the level that can produce MSY since 1985 (1997 biomass was 5,300 mt which is 24% of B_{MSY}, 22,300 mt). Biomass in 1997 is the lowest in the time series. Fishing mortality has been very high (fully-recruited F in excess of 0.64 or 43% exploitation between 1985 and 1997, Figure B1). Recruitment declined substantially from 1989 through 1995. The 1996 year class appears to be comparable to long-term average recruitment (Figure B2).

The estimated total stock biomass in 1998 is 3,300 and fully-recruited F is projected to increase to 1.4 (Figure B1). Relative to the current overfishing definition the stock is overfished. Relative to the Amendment 9 overfishing definition and associated control rule (Figure B7), the stock is overfished, and overfishing is occurring (threshold F = 0.24 on biomass, 0.27 on fully-recruited ages).

Management Advice: Applying the Amendment 9 control rule to the 1998 total stock biomass implies a fishing mortality target rate of 0 in 1999.

Forecast for 1999-2000: Forecasts assume that the US predicted catch in 1998 of 2,700 mt will be caught.

Forecast Table: F_{98} = 1.43; Basis: 1998 landings of 2,700 mt. Recruitment (age 1) of the 1997 and 1998 year classes derived by resampling the distribution of empirical recruitment of the 1991-1996 year classes (median = 2.3 million fish). Weights are in 1000s of mt.

1998			1999			2000	
F	Landings	Biomass	$F_{1999-2000}$	Landings	Biomass	Biomass	Consequences/Implications
		--	0.00 (FTARGET = 0.00 on biomass)	0.0	5.0	8.3	No landings. Biomass increases to 37% of BMSY in 2000
1.4	2.7	3.3					
			1.43 (Fstatus quo = 0.74 on biomass)	3.3	3.5	3.4	Landings increase in 1999. Biomass stabilizes at 15% of BMSY in 2000.

Catch and Status Table (weights in 1,000s of mt, recruitment in millions): Gulf of Maine-Georges Bank White Hake

Year	1991	1992	1993	1994	1995	1996	1997	1998[1]	Max[2]	Min[2]	Mea
USA commercial landings	5.6	8.4	7.5	4.7	4.3	3.3	2.2	2.4	8.4	2.2	5.
Otter trawl	3.6	5.2	4.6	2.5	2.4	2.0	1.3	-	5.5	1.3	3.
Sink gillnet	1.6	2.3	1.6	1.1	1.1	0.9	0.5	-	2.3	0.5	1.
Handline/line trawl	0.2	0.9	1.2	1.2	0.8	0.3	0.4	-	1.2	<0.1	0.
Other gear	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.2	<0.1	0.
Canada commercial landings	0.6	1.1	1.7	1.0	0.5	0.4	0.3	0.3	1.7	0.3	0.
Total commercial landings	6.2	9.6	9.1	5.7	4.8	3.6	2.5	2.7	9.6	2.5	6.
Discards[2]	1.3	0.8	0.7	0.2	0.1	0.4	0.2	-	[3]3.6	[3]0.1	[3]1.
US recreational landings[2]	<.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.
Catch used in assessment	6.2	9.6	9.1	5.7	4.8	3.6	2.5	2.7	9.6	2.5	6.
Total biomass	15.4	15.8	11.6	8.2	7.4	5.6	5.3	3.3	15.9	5.3	11.
Spawning stock biomass[4]	8.8	9.6	8.4	5.6	4.8	4.0	2.9	1.6	13.1	2.9	7.
Recruitment (age 1)	5.7	4.5	4.8	2.3	1.5	1.9	5.7	-	10.4	1.5	[5]4.
F (ages 4-8,u)	0.69	1.36	0.98	1.21	0.68	1.00	1.15	1.43	1.36	0.64	0.9
Exploitation rate	46%	69%	57%	65%	45%	58%	63%	71%	69%	43%	56%
F on biomass	0.40	0.62	0.80	0.71	0.66	0.67	0.49	0.74	0.80	0.39	0.5
Exploitation rate	30%	42%	51%	47%	44%	45%	35%	48%	51%	29%	39%

[1]Projected values. [2]Over period 1985-1997. [3]Not used in assessment. [4]Over period 1989-1997. [5]At beginning of the spawning season. [6]Geometric mean.

Stock Distribution and Identification: All white hake landed in NAFO Subareas 5 and 6 were treated as a unit stock for the purposes of this assessment. Two spawning groups of white hake are found in the Scotian Shelf-Gulf of Maine to Georges Bank region. One group spawns in winter-spring in deep waters from the Scotian Shelf through Southern New England. Growth patterns suggest that winter-spring spawning fish account for the majority of the white hake taken in NEFSC bottom trawl surveys. A summer spawning group also exists in shallow areas on the Scotian Shelf. Recruits from the two groups mix extensively in certain areas of the Gulf of Maine and are not readily distinguished in commercial landings.

Catches: Commercial landings increased in the mid 1970s and early 1980s, reaching 8,300 mt in 1985. Landings declined through 1990, increased to record highs in 1992 and 1993, but have since declined sharply (Figure B1). Total commercial landings in 1997 were 2,515 mt and are expected to increase to 2,700 mt in 1998. Preliminary estimates of discards in the commercial fishery have ranged from an estimated 122 mt to 3,600 mt per year since 1989, but are not included in the assessment.

Data and Assessment: This assessment is based on a Virtual Population Analysis (VPA) of 1985-1997 commercial landings-at-age data tuned with the ADAPT method using standardized NEFSC spring and autumn survey catch-per-tow-at-age data and standardized US commercial LPUE indices.

Biological Reference Points: Yield and SSB per recruit analyses performed with an assumed M of 0.20 indicate that $F_{0.1} = 0.14$ (12% exploitation), $F_{max} = 0.24$ (19% exploitation), and $F_{20\%} = 0.30$ (24% exploitation) (Figure B3).

The white hake stock is overfished when the total stock biomass (TSB) is less than $B_{threshold}$ (estimated to be 6,900 mt). Overfishing occurs when F exceeds F_{MSY} (estimated to be F=0.24). When TSB is between B_{MSY} and ½ B_{MSY} (11,150 mt), F will be set to allow the stock to rebuild to B_{MSY} in a period no greater than 10 years. When TSB is between ½ B_{MSY} and $B_{threshold}$ (estimated to be $0.30B_{MSY}$ or 6,900 mt), F will be set to rebuild the stock to B_{MSY} in 5 years. When TSB is less than $B_{threshold}$, no fishing mortality is permitted (F=0). MSY is estimated to be 5,400 mt.

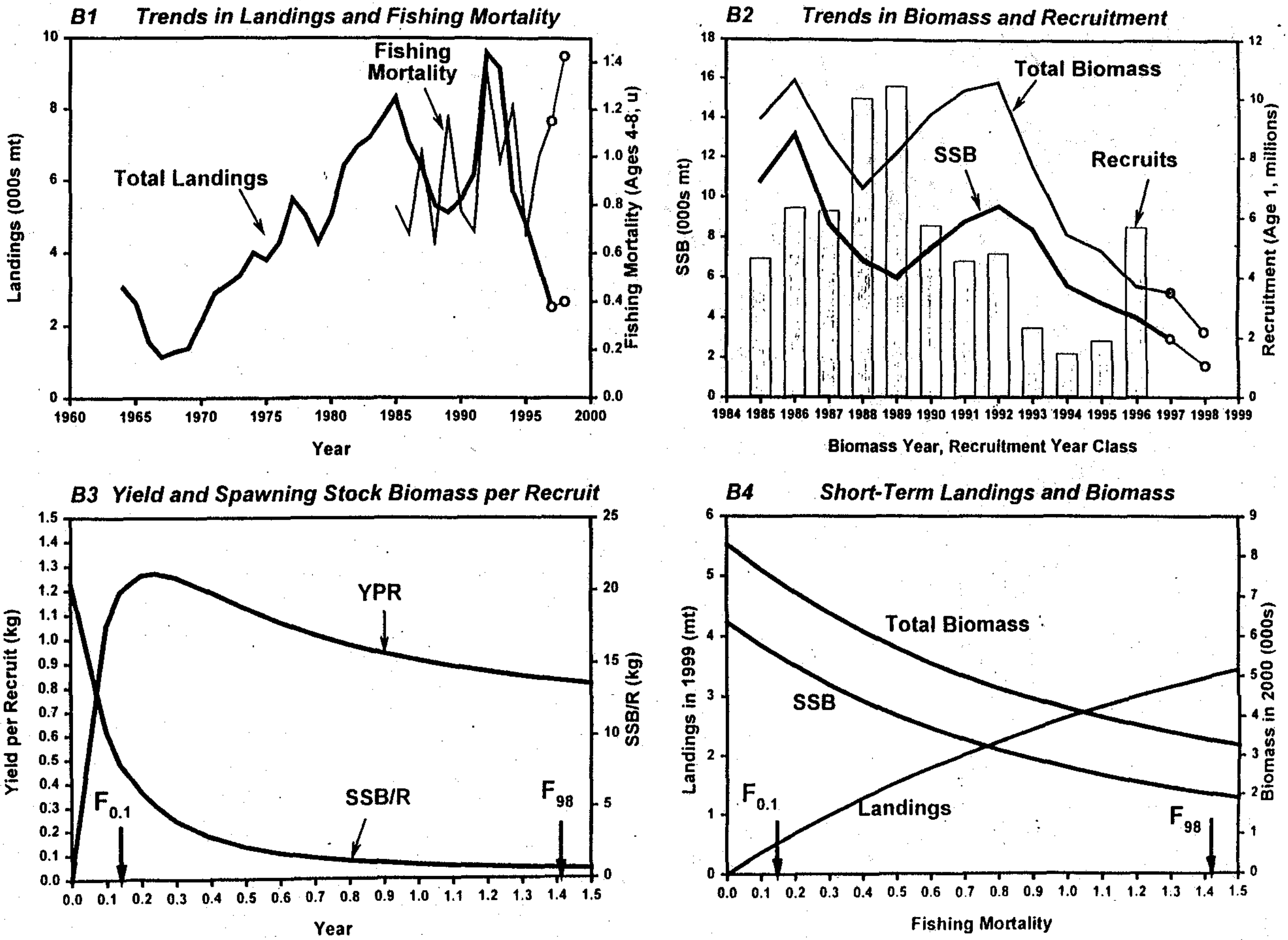
Fishing Mortality: Fishing mortality remained high (generally greater than 0.7, 46% exploitation) between 1985 and 1997 (Figure B1). Fishing mortality peaked at 1.36 (69% exploitation) in 1992 and has remained at or slightly above 1.0 (58% exploitation) since 1996. Accounting for the uncertainty of the 1997 estimate, there is an 80% probability that 1997 fully-recruited F was between 0.92 and 1.35 (Figure B6).

Recruitment: The 1988 and 1989 year classes were the strongest during the assessment period. Most recently, the 1996 year class was about average and the 1993-1995 year classes well below average (Figure B2).

Spawning Stock Biomass: After declining by over 50% between 1986 and 1989 (from 13,100 mt to 6,000 mt), SSB increased to 9,600 mt in 1992 as the 1988 and 1989 year classes recruited to the spawning stock. SSB has since declined to less than 3,000 mt in 1997, a record-low (Figure B2). Accounting for the uncertainty of the 1997 estimate, there is an 80% probability that 1997 SSB was between 2,600 and 3,500 mt (Figure B5).

Source of Information: Report of the 28th Northeast Regional Stock Assessment Workshop (28th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, 1998, in preparation, to be released in a NEFSC Ref. Doc. series; K. A. Sosebee, G. Begg, S. X. Cadrin and P. Rago, Stock Assessment for White Hake in the Gulf of Maine-Georges Bank Region, 1998, SAW Working Paper.

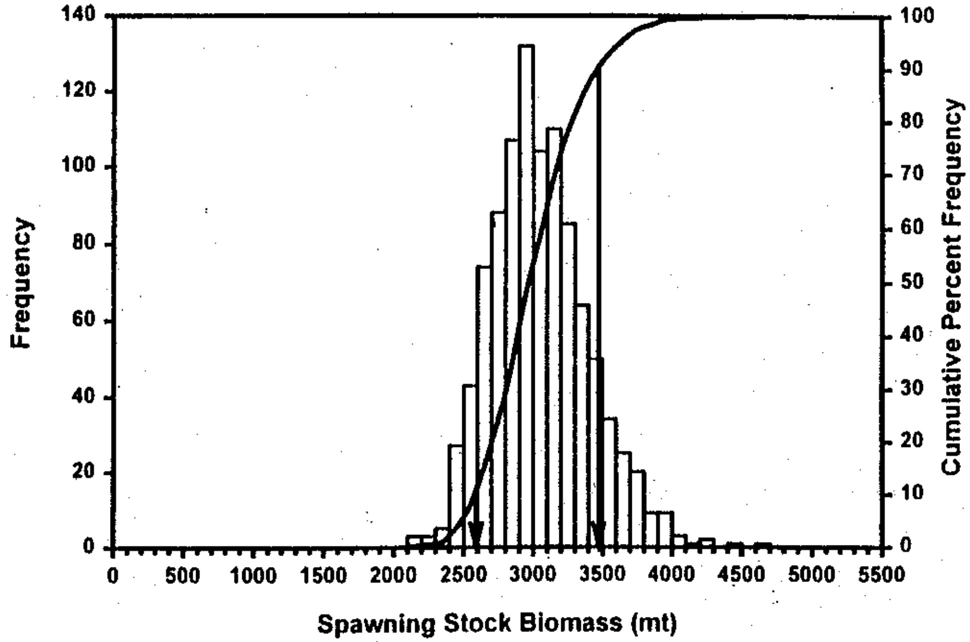
White Hake



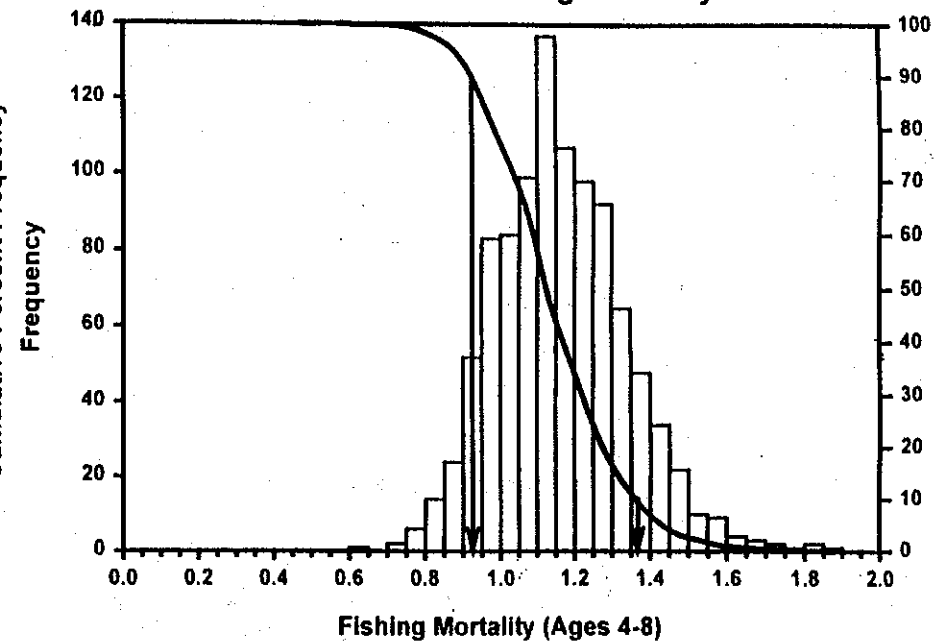
B1 Trends in Landings and Fishing Mortality
Fishing Mortality
Total Landings
Landings (000s mt)
Fishing Mortality (Ages 4-8, u)
Year
B2 Trends in Biomass and Recruitment
Total Biomass
SSB
Recruits
SSB (000s mt)
Recruitment (Age 1, millions)
Biomass Year, Recruitment Year Class
B3 Yield and Spawning Stock Biomass per Recruit
YPR
SSB/R
$F_{0.1}$
F_{98}
Yield per Recruit (kg)
SSB/R (kg)
Year
B4 Short-Term Landings and Biomass
Total Biomass
SSB
Landings
$F_{0.1}$
F_{98}
Landings in 1999 (mt)
Biomass in 2000 (000s)
Fishing Mortality

White Hake

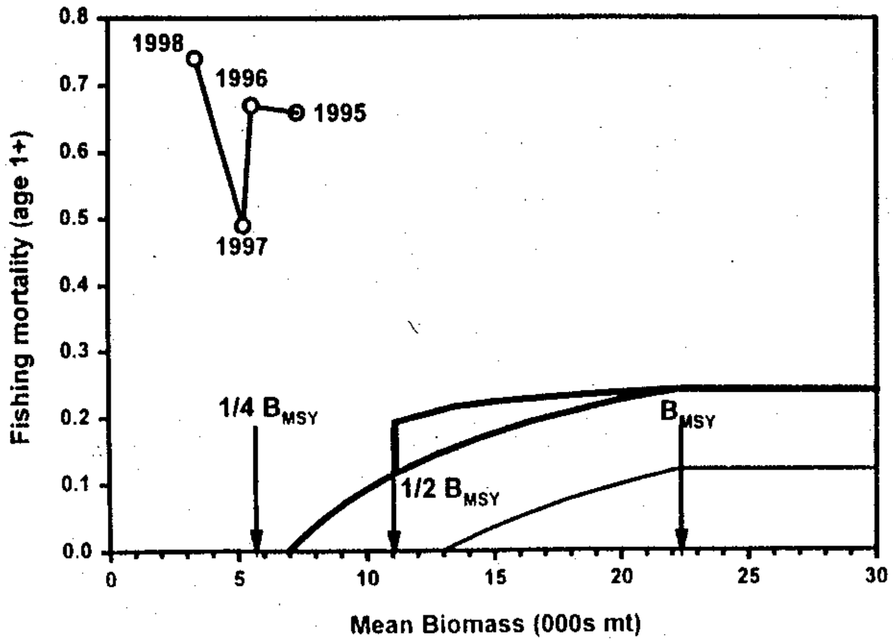
B5 Precision of 1997 SSB Estimate



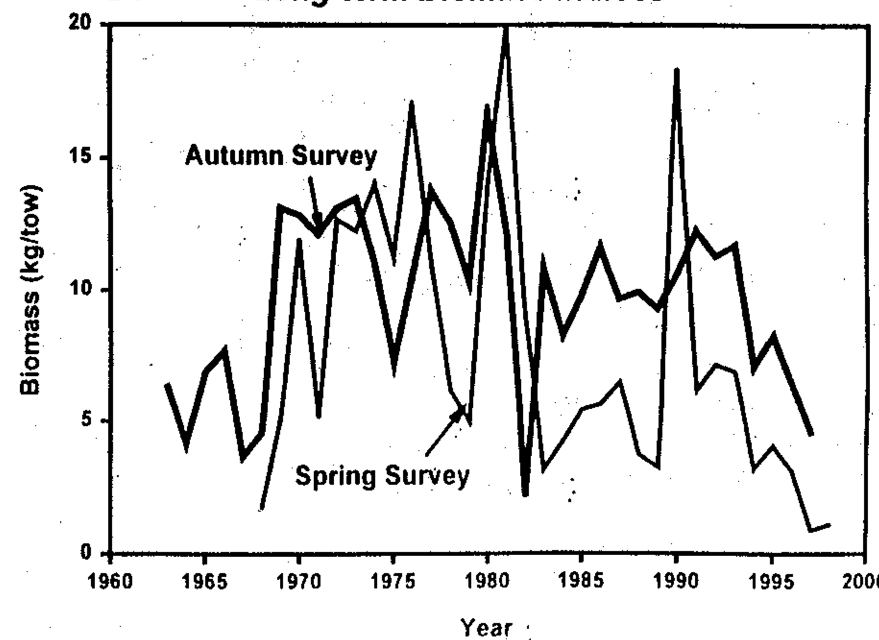
B6 Precision of 1997 Fishing Mortality Estimate



B7 Harvest Control Rule and Recent Stock Status



B8 Long-term Biomass Indices



C. GEORGES BANK WINTER FLOUNDER ADVISORY REPORT

State of Stock: The Georges Bank winter flounder stock was at a low level of biomass and fully exploited in 1997. Fishing mortality rates were very high in the early 1990s (1990-1993 F=0.74). but have declined since 1994. Spawning stock biomass levels and age composition have improved since 1993, but incoming recruitment, particularly the 1995 and 1996 year classes, is poor.

Stock biomass in 1997 (3,500 mt) was 60% of the biomass proxy specified in the Amendment 9 control rule. Assuming a catch of 1,100 mt in 1998, SSB in 1998 is 3,300 mt and fully recruited F is 0.34. Relative to the Amendment 9 overfishing definition, the stock is overfished and overfishing is occurring.

Management Advice: The 1998 estimate of fully recruited F (0.34) is less than the current overfishing definition reference point ($F_{20\%}$ = 0.47). Under the revised overfishing definition and associated control rule of Amendment 9 (Figure C7), however, the fully recruited fishing mortality rate target in 1999 is 0.03.

Forecast for 1999-2000: Forecasts for 1999-2000 (Figure C4) were based on the VPA-calibrated 1998 stock sizes. Projections were performed using the Amendment 9 control rule and assuming fishing mortality rates in 1999 and 2000 of F_{TARGET} = 0.03 (3% exploitation), and $F_{THRESHOLD}$ = 0.04 (4% exploitation). Short-term forecasts are also provided for 1999-2000 using the status quo F (0.34, 26% exploitation) and $F_{20\%}$ (0.47, 34% exploitation)

Forecast Table: Basis: 1998 landings = 964 mt based on Multispecies Monitoring Committee projections and Canadian landings of 143 mt resulting in a realized fully recruited F of 0.34 (26% exploitation). Average 1994-1997 partial recruitment, mean weights at age, and 1982-1998 maturation schedule. Age 2 recruitment in 1999 and 2000 was estimated from the distribution of observed age 2 stock sizes from 1982 - 1997. Fishing mortality rates are for fully recruited ages. Weights are in 1,000s of mt.

1998			1999-2000	1999			2000		Consequences/Implications
Landings	Biomass	SSB	Fishing Mortality	Landings	Biomass	SSB	Biomass	SSB	
			F_{target} = 0.03	0.1	5.6	3.7	7.3	5.2	Landings decline by 87%. Biomass increases by 31%. SSB increases by 41%.
1.11	4.5	3.3	**$F_{threshold}$ = 0.04**	0.2	5.6	3.7	7.3	5.2	Landings decline by 86%. Biomass increases by 30% SSB increases by 40%.
			F_{1998} = 0.34	1.2	5.1	3.5	5.6	4.0	Landings increase by 6% Biomass increases by 11%. SSB increases by 13%.
			$F_{20\%}$ = 0.47	1.6	4.8	3.4	5.0	3.6	Landings increase by 39%. Biomass increases by 4%. SSB increases by 3%.

Catch and Status Table (weights in 1,000s of mt, recruitment in millions): Georges Bank Winter Flounder

Year	1991	1992	1993	1994	1995	1996	1997	1998[1]	Max[2]	Min[2]	Mean
US commercial landings	1.8	1.8	1.7	0.9	0.7	1.3	1.3	*1.1*	4.0	0.2	2.3[2]
Otter trawl	1.7	1.7	1.5	0.9	0.7	1.2	1.3	*N/A*	3.9	0.7	2.3[2]
Other gear	0.1	0.1	0.2	<0.1	<0.1	0.1	<0.1	*N/A*	0.2	<0.1	<0.1[2]
Canada commercial landings	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	*0.1*	0.2	<0.1	<0.1[2]
Other commercial landings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*0.0*	1.7	0.0	0.4[3]
Total commercial landings	1.8	1.8	1.7	1.0	0.8	1.3	1.4	*1.2*	4.5	0.8	2.1[2]
Catch used in assessment	1.8	1.8	1.7	1.0	0.8	1.3	1.4	*1.2*	3.9	0.8	2.1[4]
Spawning stock biomass[5]	3.2	2.8	2.2	2.0	2.1	3.7	3.5	*3.3*	8.3	2.0	3.7
Total Stock Biomass[4]	4.3	3.6	3.0	3.2	4.6	5.6	3.9	*N/A*	9.7	3.0	5.1
Recruitment (age 2)	2.7	3.7	2.0	2.3	3.9	5.4	2.4	*N/A*	8.2	0.8	3.7[6]
F (ages 4-6, unweighted)[4]	0.64	0.85	1.10	0.46	0.32	0.53	0.41	*0.34*	1.10	0.32	0.76
Exploitation rate	43%	53%	62%	34%	25%	38%	31%	*26%*	62%	25%	49%
Exploitation index[7]	6.96	7.97	6.32	3.01	1.60	1.00	0.75	*N/A*	7.97	0.68	2.12

[1] Based on NEFMC Multispecies Monitoring Committee projections of 1998 U.S. landings = 964 mt and assumed Canadian landings of 143 mt. [2] Over period 1964-1997. [3] Over period 1965-1977. [4] Over period 1982-1997. [5] 1982-1997, at beginning of the spawning season. [6] Geometric mean, 1982-1998. [7] Exploitation index (landings (000's mt) / 3 year running average of autumn survey index) as defined in the Amendment 9 Harvest Control Rule.

Stock Identification and Distribution: Winter flounder is distributed in the Northwest Atlantic from Labrador to Georgia. Although primarily found in shallow inshore waters where estuarine habitat serves as important spawning and nursery areas, they are also distributed on some offshore banks including 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 NAFO statistical areas 5Zh,j,m,n. Evidence from tagging data, differences in life history characteristics, and meristic studies all provide evidence for a discrete stock of winter flounder residing in the shallower waters of Georges Bank.

Catches: U.S. landings have dominated fishery removals from this stock, although reported landings by the former Soviet Union were significant in the early 1970s. 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 declined to below 2,000 mt in 1989. During the early 1990s, landings remained below 2,000 mt and declined to below 1,000 mt in 1994 with implementation of U.S. fishery regulations designed to rebuild groundfish stocks. Total commercial landings have increased for the past two years and were estimated to be 1,400 mt in 1997 (Figure C1). Otter trawl landings account for greater than 90% of the landings from this stock; however, there is a some bycatch in the scallop dredge fishery. Recreational landings from this stock have been negligible. Commercial discards were not estimated in this assessment, but appear to be minor during the early 1990s. Beginning in 1996, there are indications that scallop dredge discards have increased and may represent an additional source of mortality for this stock.

Data and Assessment: This assessment is a Virtual Population Analysis (VPA) of 1982-1997 commercial landings-at-age data tuned using the ADAPT method with standardized U.S. NEFSC spring and autumn and the Canadian DFO survey numbers at age. The precision and uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1997 were quantitatively evaluated by bootstrapping the residuals of the VPA. Surplus production of Georges Bank winter flounder was modeled using total landings from 1963-1997, the NEFSC Spring and Autumn research vessel biomass indices, and the Canadian research vessel biomass index.

Biological Reference Points: Re-estimated yield per recruit and spawning stock biomass per recruit relationships using an assumed natural mortality of 0.20 indicate that $F_{0.1} = 0.21$ (17% exploitation) and $F_{max} = 0.42$ (31% exploitation) (Figure C3).

The Amendment 9 Overfishing Control Rule was re-estimated based on a revised surplus production model and a modified survey strata set from the U.S. Autumn survey index (Figure C7). The F_{msy} threshold proxy is 1.12 (in exploitation index units: landings (1,000's mt)/NEFSC Autumn survey index), the F_{msy} target proxy (75% of the F_{msy} threshold proxy) is 0.843 (in exploitation units), the B_{msy} proxy is 2.730 (in NEFSC Autumn survey biomass units: stratified weight (kg) per tow), and the minimum biomass threshold (50% of the B_{msy} proxy) is 1.365 (in NEFSC Autumn survey biomass units);

Fishing Mortality: Fishing mortality was moderate (approximately 0.5, 36% exploitation) during the early 1980's, but increased to a range of 0.6 (41% exploitation) to 1.4 (70% exploitation) between 1984 and 1993. Fishing mortality declined in 1994 and has ranged between 0.3 (24% exploitation) and 0.5 (36% exploitation) from 1994 to 1997 (Figure C1). Accounting for the uncertainty associated with the 1997 fishing mortality estimates, there is an 80% probability that fishing mortality in 1997 lies between 0.33 (26% exploitation) and 0.51 (37% exploitation) (Figure C6).

Recruitment: Recruitment since 1982 has been variable, generally ranging between 2 and 8 million fish. The 1980 (8.2 million), 1985 (6.6 million), 1987 (7.4 million), and 1994 (5.4 million) year classes are estimated to be above average. The 1996 estimated year class strength (0.8 million) is the lowest in the assessment time series (Figure C2).

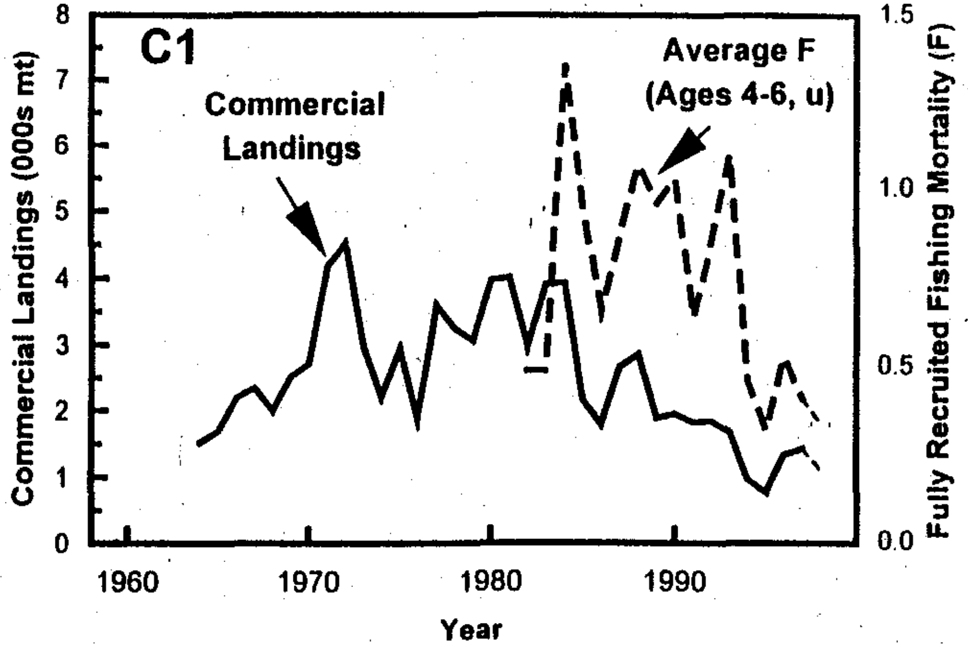
Spawning Stock Biomass: Spawning Stock Biomass declined sharply from 8,300 mt in 1982 to less than 3,000 in 1985. Between 1985 and 1994, SSB declined further, reaching 2,000 mt in 1994. SSB increased, reaching 3,700 mt in 1996, but declined slightly to 3,500 mt in 1997 (Figure B2). Accounting for the uncertainty associated with the 1997 SSB estimates, there is an 80% probability that the 1997 SSB was between 3,100 mt and 4,200 mt (Figure C5).

Special Comments: Approximately half of the spawning stock biomass is composed of age 2 and 3 fish, the majority of which are first time spawners. Reductions in fishing mortality should promote further broadening of the age composition of this stock and substantial increases in spawning stock biomass.

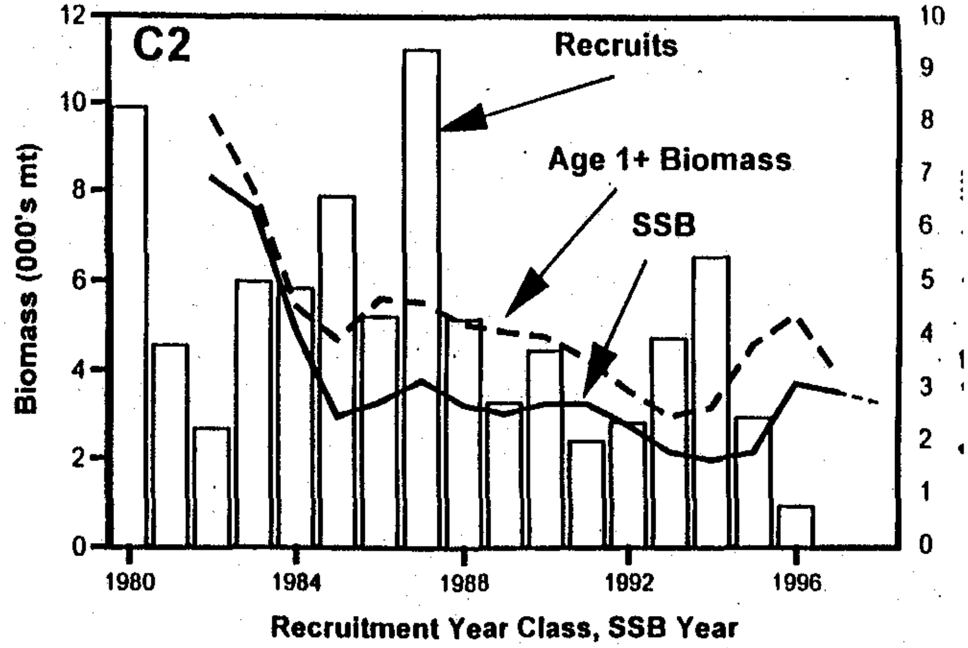
Sources of Information: Report of the 28th Northeast Regional Stock Assessment Workshop (28th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments in preparation, to be released in a NEFSC Ref. Doc. series; R. Brown and G. Begg, 1998 Assessment of the Georges Bank Winter Flounder Stock, in preparation to be released in a NEFSC Ref. Doc. series;

Georges Bank Winter Flounder

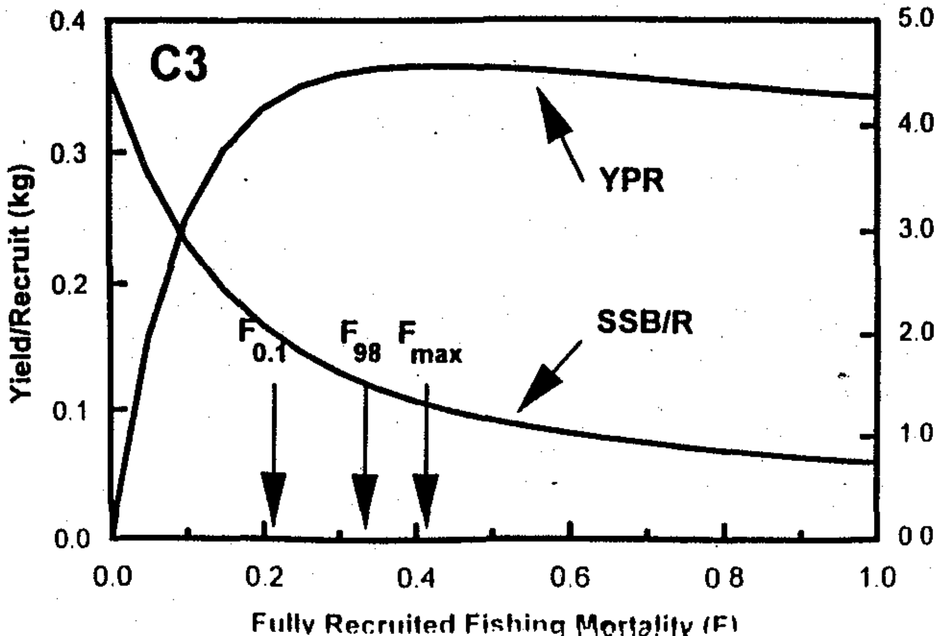
Trends in Commercial Landings and Fishing Mortality



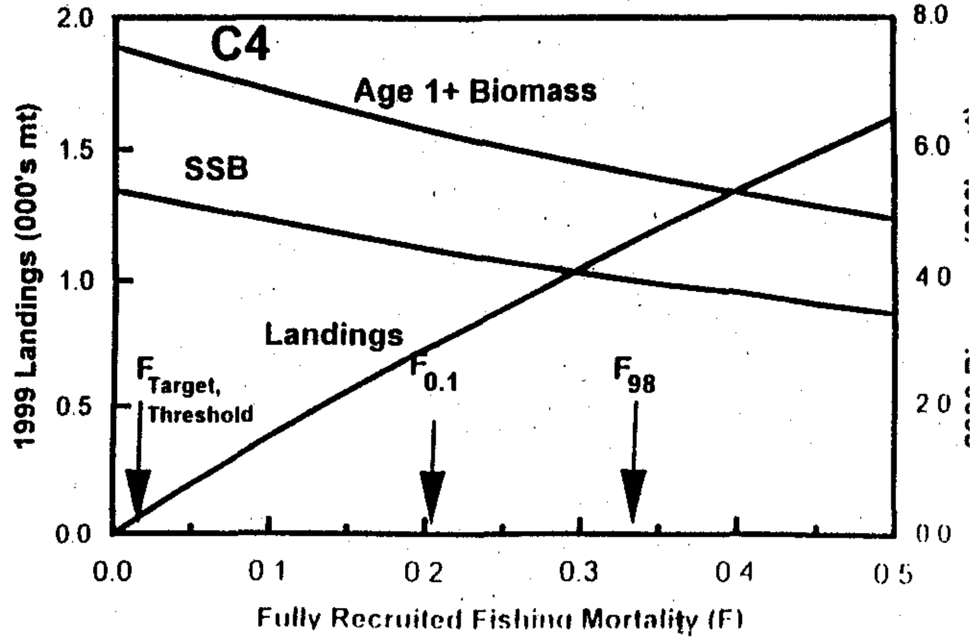
Trends in Spawning Stock Biomass and Recruitment



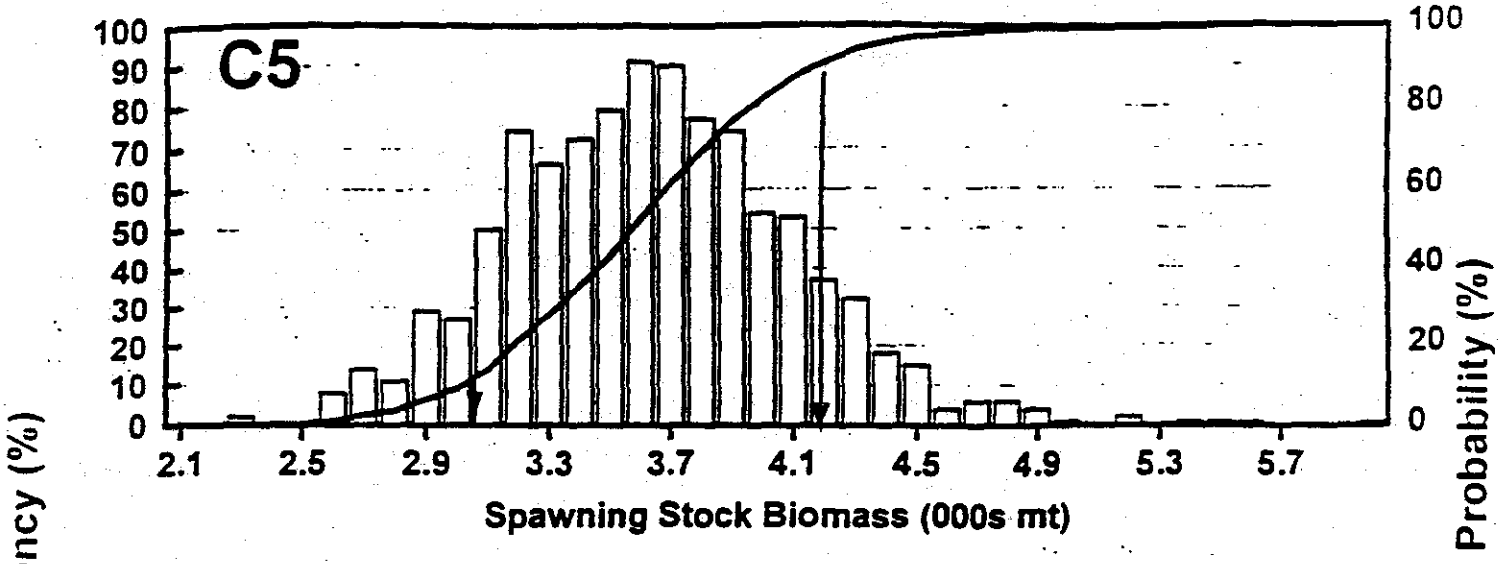
Yield and Spawning Stock Biomass per Recruit



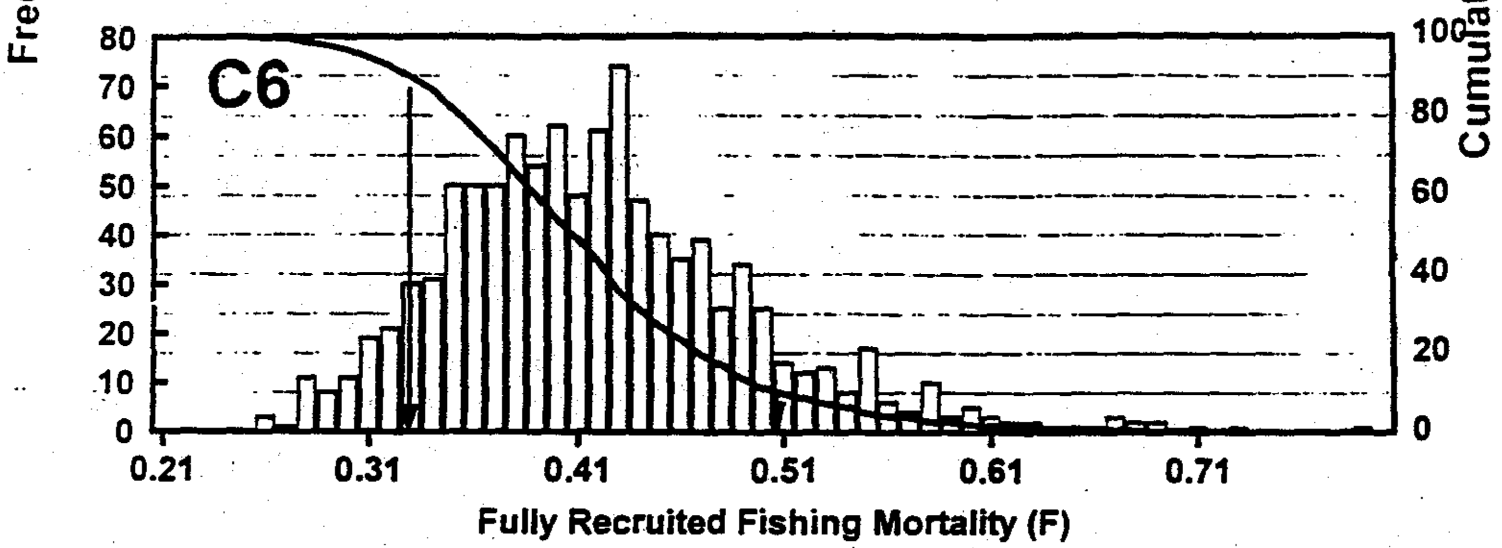
Short-Term Landings and Stock Biomass Projections



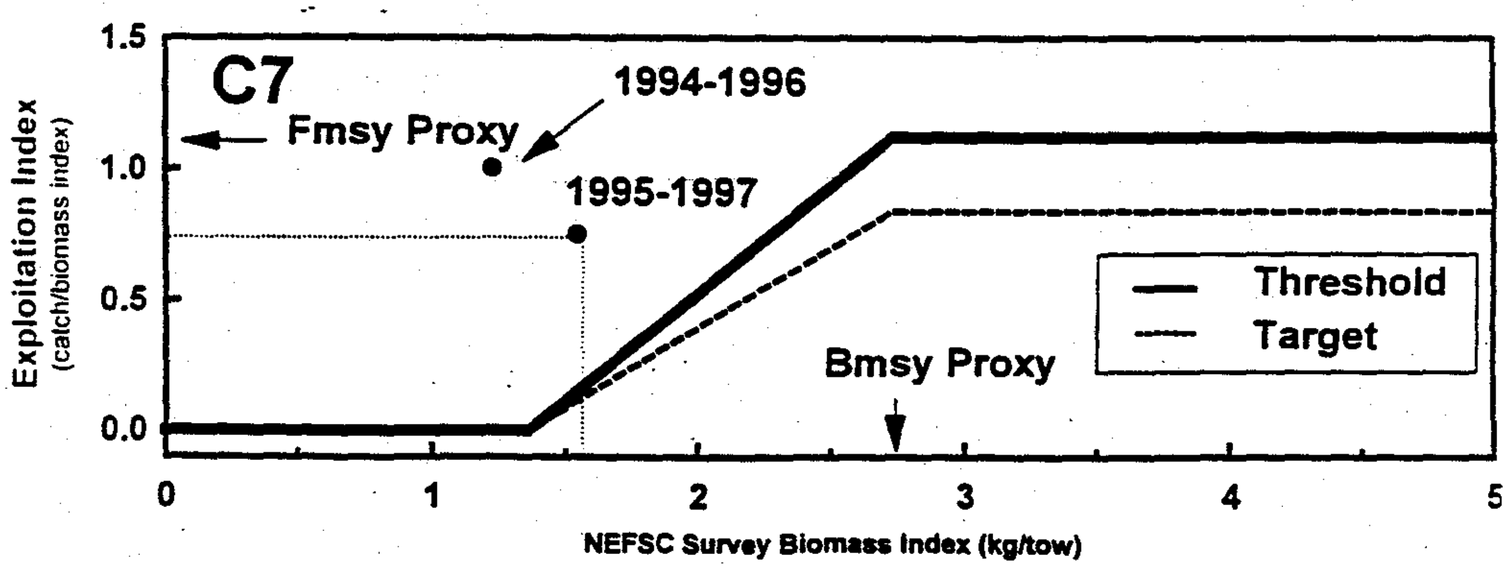
Precision of the 1997 Estimate of Spawning Stock Biomass



Precision of the 1997 Estimate of Fishing Mortality



Harvest Control Rule and Recent Stock Status



D. GULF OF MAINE-GEORGES BANK AMERICAN PLAICE ADVISORY REPORT

State of Stock: The Maine-Georges Bank American Plaice stock was at a low biomass level and was overexploited in 1997. Fully recruited fishing mortality declined from a record high of 0.75 (48% exploitation) in 1995 to 0.47 (34% exploitation) in 1997 (Figure D1). Although spawning stock biomass has increased from the time series low of 7,700 mt in 1989 to 13,500 mt in 1997, SSB remains below the long term average (Figure D2). Despite the appearance of two relatively large year classes in the late 1980s and early 1990s, SSB did not increase appreciably, likely the result of increased mortality due to discards. The size of recruiting year classes continue to decline, with the most recent year classes (1994, 1995, and 1996) being the lowest since 1985. The 1997 year class size is the lowest in the time series.

Assuming total catch in 1998 is 4,500 mt, fully recruited fishing mortality in 1998 is projected to be 0.48 (35% exploitation). Spawning stock biomass in 1998 is projected to decline to 10,800 mt. Relative to the current overfishing definition reference point ($F_{20\%}$ = 0.40) the stock is overfished. Relative to the Amendment 9 overfishing definition, the stock is overfished and overfishing is occurring.

Management Advice: According to the current overfishing definition, fishing mortality should be reduced. Applying the Amendment 9 control rule to the 1998 SSB implies a fishing mortality target rate of 0 in 1999. $F_{THRESHOLD}$ in 1999 is 0.19.

Forecast for 1999-2000: The forecasts for 1998-2000 (Figure D4) are based on VPA-calibrated 1998 stock sizes. Projections for 1999-2000 were performed assuming F=0.0, $F_{0.1}$ = 0.19 (16% exploitation), $F_{20\%}$ = 0.40 (30% exploitation) and F_{98} = 0.48 (35% exploitation). Recruitment (age 1) in 1998 was derived from the distribution of bootstrapped VPA estimates (1979-1996 year classes) and recruitment in 1999-2000 was estimated from the distribution of the final VPA estimates of the 1979-1996 year class strength.

Forecast Table: F_{98} = 0.48 Basis: F from MMC projected landings in 1998 of 3,600 mt; SSB estimated to be 13,500 mt in 1997. Average 1994-1996 partial recruitment and mean weights at age, and 1986-1990 maturation ogive. Weights are in 1,000s of mt.

1998				1999			2000	Consequences/Implications
Landings	Discards	SSB	$F_{1999-2000}$	Landings	Discards	SSB	SSB	
			0.00 F_{TARGET}	0.0	0.0	9.5	10.4	SSB decreases to 43% of SSB_{MSY}.
			0.19 $F_{0.1} = F_{THRESHOLD}$	1.4	0.3	9.1	8.6	SSB decreases to 36% of SSB_{MSY}. Landings decrease to record low level.
3.6	0.9	10.8	0.40 $F_{20\%}$	2.7	0.5	8.7	7.0	SSB decreases to 31% of SSB_{MSY}. Landings remain near record low levels.
			0.48 $F_{1998} = F_{STATUS\ QUO}$	3.0	0.6	8.5	6.5	SSB decreases to 27% of SSB_{MSY}. Landings remain near record low levels.

Catch and Status Table (weights in 1,000s of mt, recruitment in millions): Gulf of Maine-Georges Bank American plaice

Year	1991	1992	1993	1994	1995	1996	1997	1998[4]	Max[3]	Min[3]	Mean[3]
Total commercial landings	4.3	6.4	5.7	5.1	4.6	4.4	4.0	3.6	15.1	2.4	6.9
US commercial landings	4.3	6.4	5.7	5.1	4.6	4.4	3.9	3.6	15.1	2.3	6.8
Canada commercial landings	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.1	0.0	<0.1
Discards	0.9	1.3	2.0	1.6	3.0	0.8	0.9	0.9	3.0	0.1	0.8
US recreational landings[1]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Catch used in assessment	5.2	7.7	7.7	6.7	7.6	5.2	4.9	4.5	15.5	2.9	7.7
Spawning stock biomass[2]	11.7	13.0	12.6	12.1	10.3	12.1	13.5	10.8	49.2	7.8	17.8
Recruitment (age 1)	30.7	35.2	56.6	39.4	16.7	15.0	7.9	-----	56.6	7.9	26.8
F (ages 5-8)	0.44	0.66	0.66	0.70	0.75	0.52	0.47	0.48	0.75	0.31	0.49
Exploitation rate	32%	44%	44%	46%	48%	37%	34%	35%	44%	24%	35%

[1]Not used in assessment. [2]At beginning of the spawning season (April 1). [3]Over period 1980-1997. [4]Projected

Stock Identification and Distribution: The Gulf of Maine-Georges Bank American plaice stock is distributed along the continental shelf from southern Labrador to Long Island, New York. In US waters, plaice are most abundant in the deeper (>50 m) waters of the Gulf of Maine and off the northern edge of Georges Bank. Although growth varies between the Gulf of Maine and Georges Bank, all American plaice from these areas are considered to represent a unit stock.

Catches: Commercial landings increased in the mid 1970s and early 1980s, peaking at a record high 15,000 mt in 1982. During 1983-1989, landings declined but subsequently increased through 1992, but have since declined to 4,000 mt in 1997 (Figure D1). Discards in the northern shrimp fishery from 1992-1994 accounted for about 0.3% of the total catch (by weight) and increased in 1996 and 1997 to 2.5% and 2.3%, respectively. Discards in the large mesh fishery accounted for 1.6% of the total catch in 1992, increased to 3.8% in 1995, and have declined to 1.6% of the total catch in 1997.

Data and Assessment: This assessment is a Virtual Population Analysis (VPA) of commercial landings-at-age data and discards at age data from the large mesh otter trawl fleet and the northern shrimp fishery for the years 1980-1997 tuned with the ADAPT method using standardized NEFSC spring and autumn and Massachusetts Division of Marine Fisheries (MADMF) spring survey catch-per-tow-at-age data.

Biological Reference Points: Yield and SSB per recruit analyses updated with an assumed M of 0.20 indicate that $F_{0.1}$ = 0.19 (16% exploitation), F_{max} = 0.35 (27% exploitation) and $F_{20\%}$ = 0.40 (30% exploitation) (Figure D3).

The Amendment 9 control rule defines target F as 60% of the F_{MSY} proxy of $F_{0.1}$ when SSB is greater than SSB_{MSY}. For SSB less than SSB_{MSY}, F_{TARGET} decreases linearly to zero at ½ SSB_{MSY} (Figure D7). SSB_{MSY} is estimated as 24,200 mt. MSY is estimated as 4,400 mt.

Fishing Mortality: Fishing mortality increased from a low of 0.31 (24% exploitation) in 1980 to 0.53 (38% exploitation) in 1983, declined to 0.37 (28% exploitation) in 1990, but increased in 1995 to 0.75 (48% exploitation), a record high. Fishing mortality decreased in 1996 to 0.52 (37% exploitation) and again in 1997 to 0.47 (34% exploitation) (Figure D1). There is an 80% probability that fully recruited F in 1997 was between 0.41 and 0.57 (Figure D5).

Recruitment: Strong year classes were produced in 1979, 1987, and 1992. The 1993 year class was above average, but the 1994, 1995 and 1996 year classes are well below average (Figure D2).

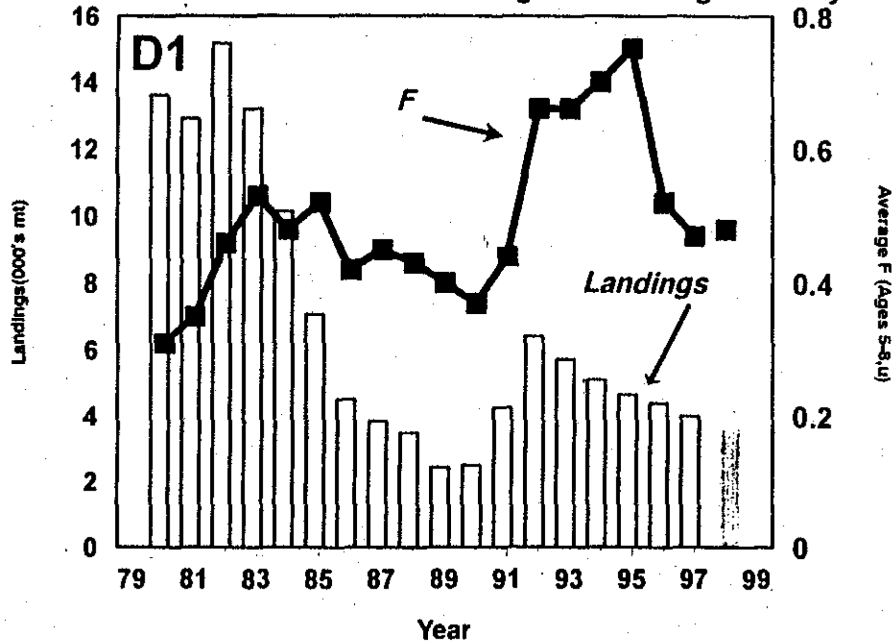
Spawning Stock Biomass: The long-term average SSB is 18,000 mt. SSB declined by about 84% between 1980 and 1989 (49,200 mt to 7,700 mt), increased to 13,000 mt in 1992, but declined to 10,300 mt in 1995 (Figure D2). SSB increased to 13,500 mt in 1997 and is projected to decrease in 1998 and 1999. There is an 80% probability that SSB in 1997 was between 12,000 and 15,000 mt (Figure D6).

Special Comments: The Amendment 9 control rule was re-estimated using the $F_{0.1}$ proxy for FMSY and current estimates of SSB_{MSY}.

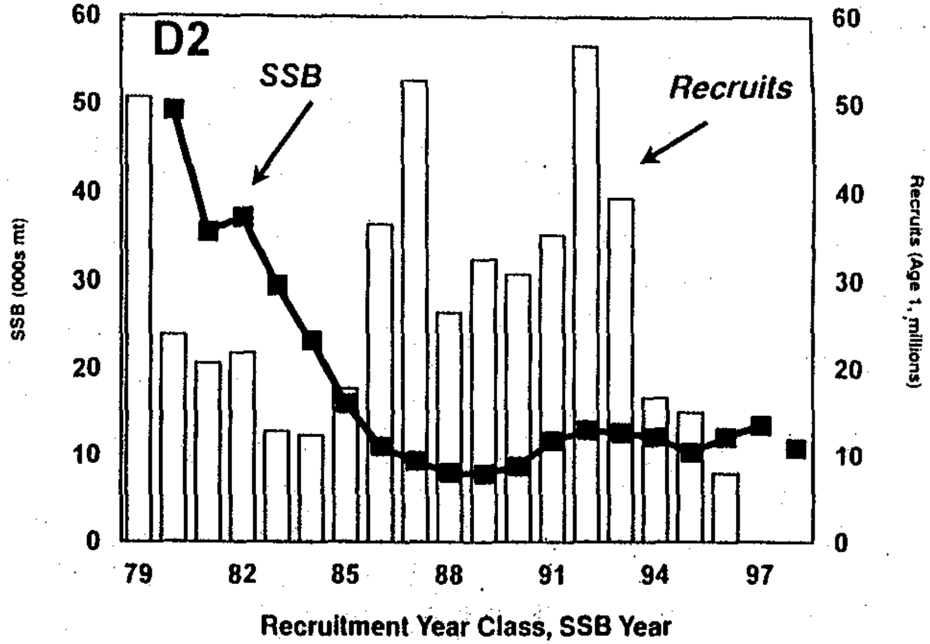
Source of Information: Report of the 28th Stock Assessment Workshop (28thSAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, in preparation, to be released in a NEFSC Ref. Doc. series.

Gulf of Maine-Georges Bank American Plaice

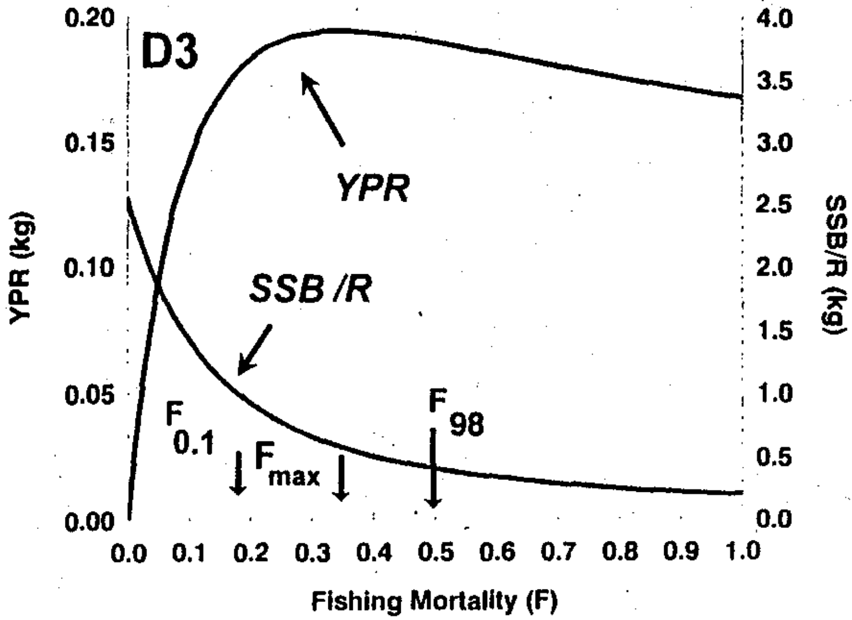
Trends in total commercial landings and fishing mortality



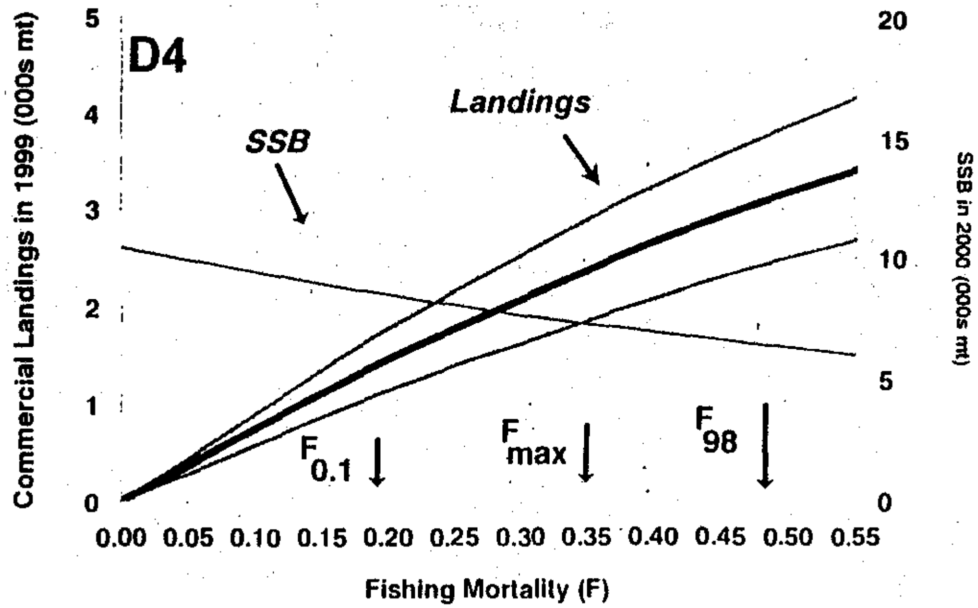
Trends in Spawning Stock Biomass and Recruitment



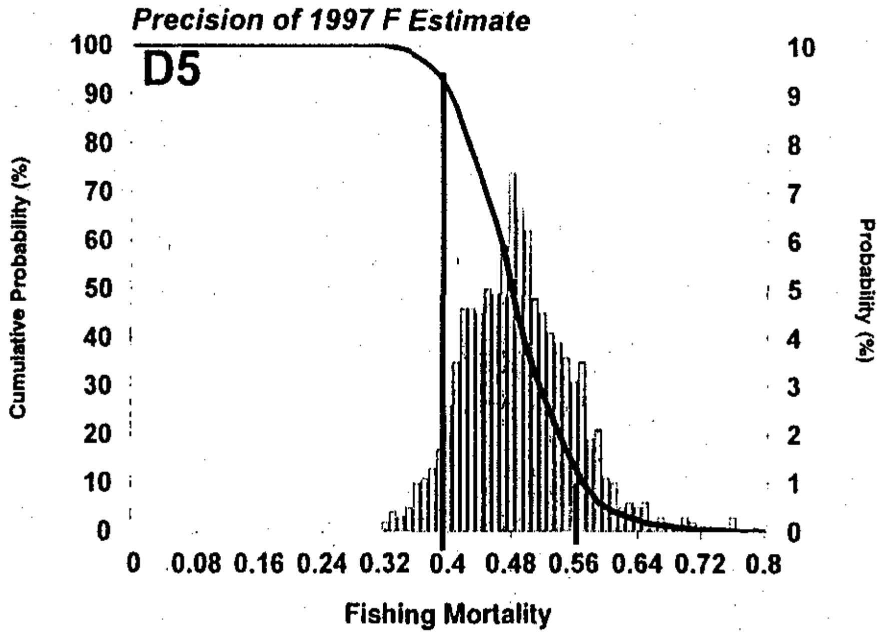
Yield and Spawning Stock Biomass per Recruit

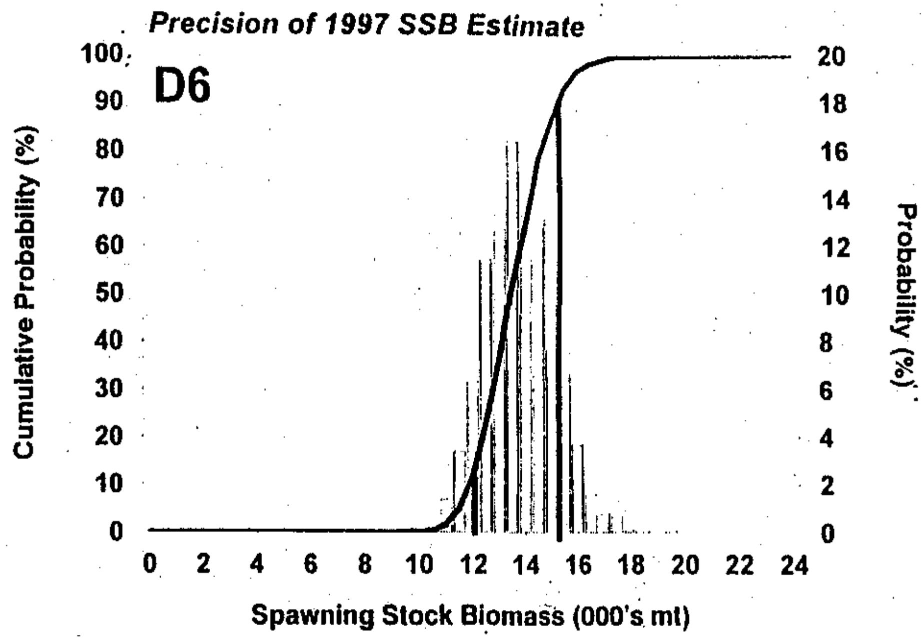


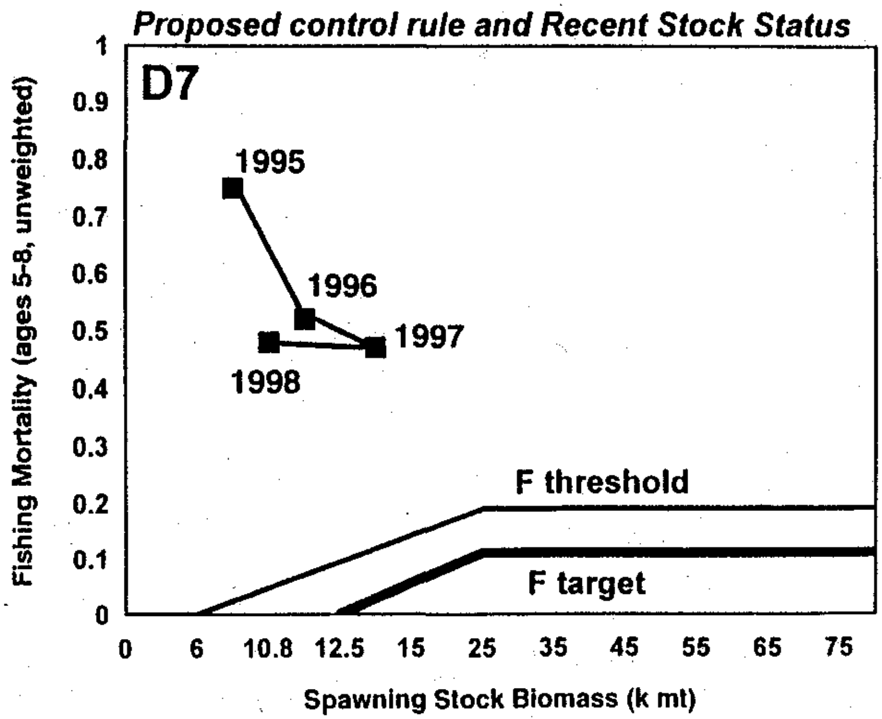
Short-Term Commercial Landings and Spawning Stock Biomass



Gulf of Maine-Georges Bank American Plaice







E. SOUTHERN NEW ENGLAND/MID-ATLANTIC WINTER FLOUNDER ADVISORY REPORT

State of Stock: The southern New England/Mid-Atlantic winter flounder stock complex was at a medium level of biomass and fully exploited in 1997. Reductions in fishing mortality, and to a lesser degree, improvement in recent recruitment, have contributed to rebuilding of the stock (Figures E1 and E2). Total biomass in 1997 was estimated to be 17,900 mt, which is 64% of BMSY (27,810 mt). Fully recruited fishing mortality in 1997 was 0.31 (24% exploitation rate), about equal to the ASMFC target for 1997 of $F_{30\%} = 0.29$. The corresponding total biomass fishing mortality in 1997 was 0.24, below $F_{MSY} = 0.37$.

Assuming a total catch of 4,800 mt in 1998, fully recruited fishing mortality in 1998 is projected to rise to 0.39 (29% exploitation rate), corresponding to a total biomass fishing mortality of 0.27 (22% exploitation). Total stock biomass is projected to increase to 20,200 mt in 1998, about 73% of B_{MSY}. The 1998 estimate of fully recruited F is slightly less than the current Northeast Multispecies FMP overfishing definition of $F_{20\%} = 0.46$. Relative to the Amendment 9 overfishing definition and associated control rules (Figure E7), and according to National Standard 1 guidelines, the stock is not overfished (biomass is above $B_{threshold}$) and overfishing is not occurring (1997 and 1998 biomass F below $F_{threshold}$). Relative to the ASMFC FMP overfishing definition of $F_{25\%} = 0.35$ overfishing is occurring (Figure E3).

Management Advice: Applying the Amendment 9 control rule to the 1998 total stock biomass implies a target total biomass fishing mortality rate of $F_{TARGET} = 0.21$ for 1999, corresponding to a fully recruited fishing mortality of F = 0.28 (22% exploitation). Meeting this target will require a 28% reduction in fully recruited fishing mortality from that observed in 1998. The ASMFC FMP fully recruited fishing mortality rate target of $F_{40\%} = 0.20$ for 1999 implies a 49% reduction in fully recruited fishing mortality.

Forecast for 1999-2000: Projections suggest that if fully recruited fishing mortality is maintained in the range of 0.20 to 0.40 during 1999-2000, then total biomass will continue to rebuild toward B_{MSY} (Figure E4).

Forecast Table: Basis: F_{1998} derived from preliminary 1998 catch, average 1996-1997 partial recruitment and mean weights at age. Age-1 recruitment in 1999-2000 is estimated from the distribution of observed age-1 recruitment from 1981-1998. Biomass, landings, and discards are in thousands of mt. $F_{40\%}$ and $F_{25\%}$ are targets from the ASMFC FMP, F_{TARGET} is from the NEFMC Amendment 9 control rule. Fully recruited F values are for ages 4-6, total biomass F values are for ages 1-7+.

1998			Scenario	1999			2000	Consequences/Implications
Biomass	Landings	Discards	F1999	Biomass	Landings	Discard	Biomass	
20.2	4.5	0.3	0.20 (F40% = 0.16 on biomass)	23.0	2.7	0.1	27.5	ASMFC target for 1999, biomass increases to near BMSY
			0.28 (FTARGET 5 = 0.21 on biomass)	22.5	3.6	0.2	26.8	Amendment 9 control rule target, 5 year rebuilding Biomass increases to 96% of BMSY
			0.33 (FTARGET 10 = 0.24 on biomass)	22.1	4.2	0.2	25.1	Amendment 9 control rule target, 10 year rebuilding biomass increases to 90% of BMSY
			0.35 (F25% = 0.25 on biomass)	22.0	4.5	0.2	24.7	ASMFC overfishing definition, biomass increases to 89% of BMSY
			0.39 (F1998 = 0.27 on biomass)	21.7	4.8	0.3	24.1	Status quo, biomass increases to 87% of BMSY

Landings and Status Table (weights in 1,000s of mt, recruitment in millions): Southern New England/Mid-Atlantic winter flounder

Year	1991	1992	1993	1994	1995	1996	1997	1998[1]	Max[2]	Min[2]	Mean[2]
Commercial landings	4.8	3.8	3.0	2.2	2.6	2.8	3.4	3.7	11.2	2.2	5.0
Commercial discards[3]	0.8	0.5	0.5	0.3	0.1	0.2	0.3	0.3	1.5	0.1	2.5
Recreational landings	1.2	0.4	0.5	0.6	0.7	0.7	0.6	0.8	5.8	0.4	2.1
Recreational discards[4]	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Catch used in assessment	6.9	4.7	4.0	3.1	3.4	3.7	4.3	4.8	15.8	3.1	9.7
Spawning stock biomass	4.6	4.1	3.8	3.4	4.1	5.2	8.6	10.2	14.8	4.0	7.6
Total stock biomass	10.3	8.0	8.1	8.9	11.9	17.3	17.9	20.2	34.1	8.0	18.0
Recruitment (Age 1)	12.4	8.8	12.0	14.6	23.3	18.8	21.0	16.8	62.9	8.8	27.6
Fully recruited F (age 4-6)	1.32	1.01	0.70	0.32	0.47	0.40	0.31	0.39	1.38	0.31	0.77
Exploitation rate	68%	59%	46%	25%	34%	30%	24%	29%	69%	24%	48%
Total biomass F (age 1-7+)	0.65	0.59	0.50	0.20	0.18	0.14	0.24	0.27	0.67	0.14	0.44
Exploitation rate	43%	41%	36%	16%	15%	12%	19%	22%	45%	12%	32%

[1]Projected; [2] Over period 1981-1998; [3]Assuming 50% discard mortality; [4] Assuming 15% release mortality.

Stock Distribution and Identification: Winter flounder are distributed from Labrador to North Carolina. Localized stocks are found in the region's estuaries. Because the fishery exploits a mixture of these stocks, for assessment purposes, a Southern New England/Mid-Atlantic stock complex has been defined as extending from the waters of outer Cape Cod to the south and west. including NEFSC statistical areas 521, 526, 533-538, and 611 to 639.

Catches: Commercial landings peaked in 1966 at 12,000 mt and then by 1976 declined to 3,300 mt. Commercial landings increased in the late 1970s and early 1980s to a peak of 11,200 mt in 1981, and then declined to a record low of 2,200 mt in 1994. Commercial landings have since increased to a projected 3,700 mt in 1998. Recreational landings peaked at 5,800 mt in 1984, and then declined to 400 mt in 1992. Recreational landings have since increased to a projected 800 mt in 1998. Total discards (commercial plus recreational, by weight) as a percentage of total catch peaked in 1989 at 21%, but have since declined to about 7%. Total catches (including discards) declined from 15,800 mt in 1984 to 3,100 mt in 1994, but have since increased to a projected 4,800 mt in 1998 (Figure E1).

Data and Assessment: The Southern New England/Mid-Atlantic winter flounder stock was last assessed at SAW 21 in 1995 and by the ASMFC winter flounder technical committee in early 1998. The current assessment includes elements of these previous assessments, including estimated and projected total catch for 1981-1998, survey indices through 1998, estimates of stock size and fishing mortality by VPA for 1981-1998, and biological reference points estimated by yield and SSB per recruit analyses and by the ASPIC surplus production model using total catch and NEFSC, MADMF, and RIDFW biomass indices for 1981-1997.

Biological Reference Points: Yield and SSB per recruit analyses, updated for this assessment with an assumed M of 0.20, indicate that $F_{40\%} = 0.20$, $F_{30\%} = 0.29$, $F_{25\%} = 0.35$, and $F_{20\%} = 0.43$ (Figure E3). Biomass based reference points estimated by the ASPIC surplus production model (with survey catchability coefficients fixed to correspond to the magnitude of VPA biomass estimates) were MSY = 10,200 mt, $F_{MSY} = 0.37$ (equivalent to fully recruited F = 0.59), and B_{MSY} = 27,810 mt.

The target fishing mortality to be used when stock biomass is greater than B_{MSY} was estimated as the 10th percentile of F_{MSY}, $F_{TARGET} = 0.24$ (equivalent to fully recruited F = 0.33). When total stock biomass is between ½ B_{MSY} and B_{MSY}, a 10-year rebuilding strategy applies. When total biomass is between $B_{THRESHOLD}$ (1/4 B_{MSY}) and ½ B_{MSY}, a 5-year rebuilding strategy applies. When rebuilding, F_{TARGET} is based on a 5-year rebuilding strategy (Figure E7).

Fishing Mortality: During 1981-1993, fishing mortality was very high, varying between 0.5 and 1.4 (33% to 69% exploitation rate). Fishing mortality has been at or below 0.5 (exploitation rate = 34%) since 1993 (Figure E1). Accounting for the uncertainty of the 1997 estimate, there is an 80% probability that F in 1997 was between 0.26 and 0.38 (21% and 29% exploitation, respectively) (Figure E6).

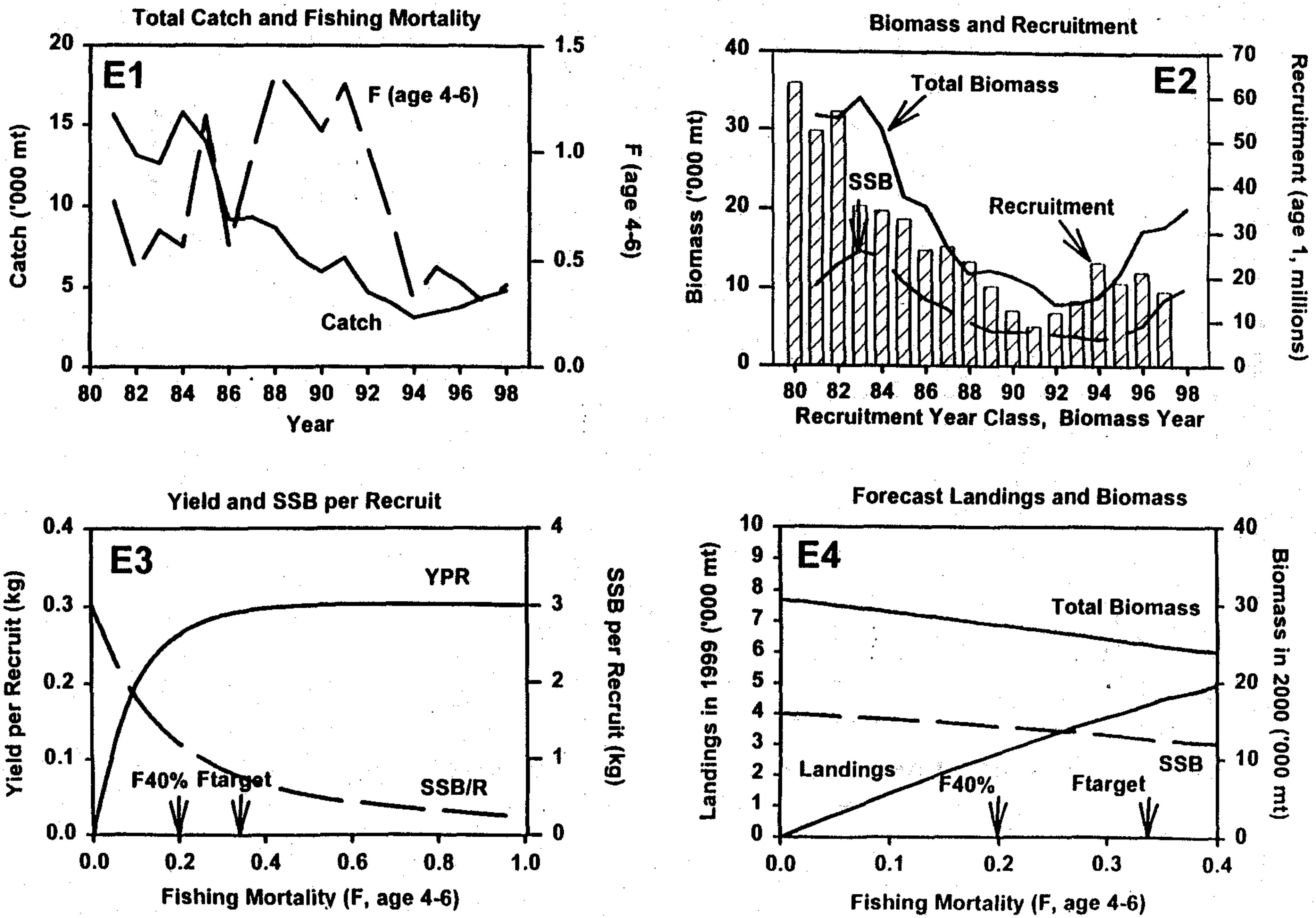
Recruitment: Recruitment declined continuously from 62.9 million age-1 fish in 1981 to a record low of 8.8 million in 1992. Recruitment has averaged 17.7 million fish during 1993-1998, below the VPA time series average of 27.6 million (Figure E2).

Spawning Stock Biomass: SSB declined from 14,800 mt in 1984 to a record low of 3,400 mt in 1994. SSB has increased since 1994 to 8,600 mt in 1997 and to a projected 10,200 mt in 1998 (Figure E2). Accounting for the uncertainty of the 1997 estimate, there is an 80% probability that SSB in 1997was between 7,500 mt and 10,000 mt (Figure E5).

Special Comments: An unusually high proportion (69%, compared to the 1989-1996 average of 43%) of the commercial landings for the stock complex was reported from NEFSC statistical area 521 in 1997. When considered along with the distribution of survey catches, this factor indicates that the commercial fishery is exploiting an increased abundance of winter flounder along the western side of the Great South Channel.

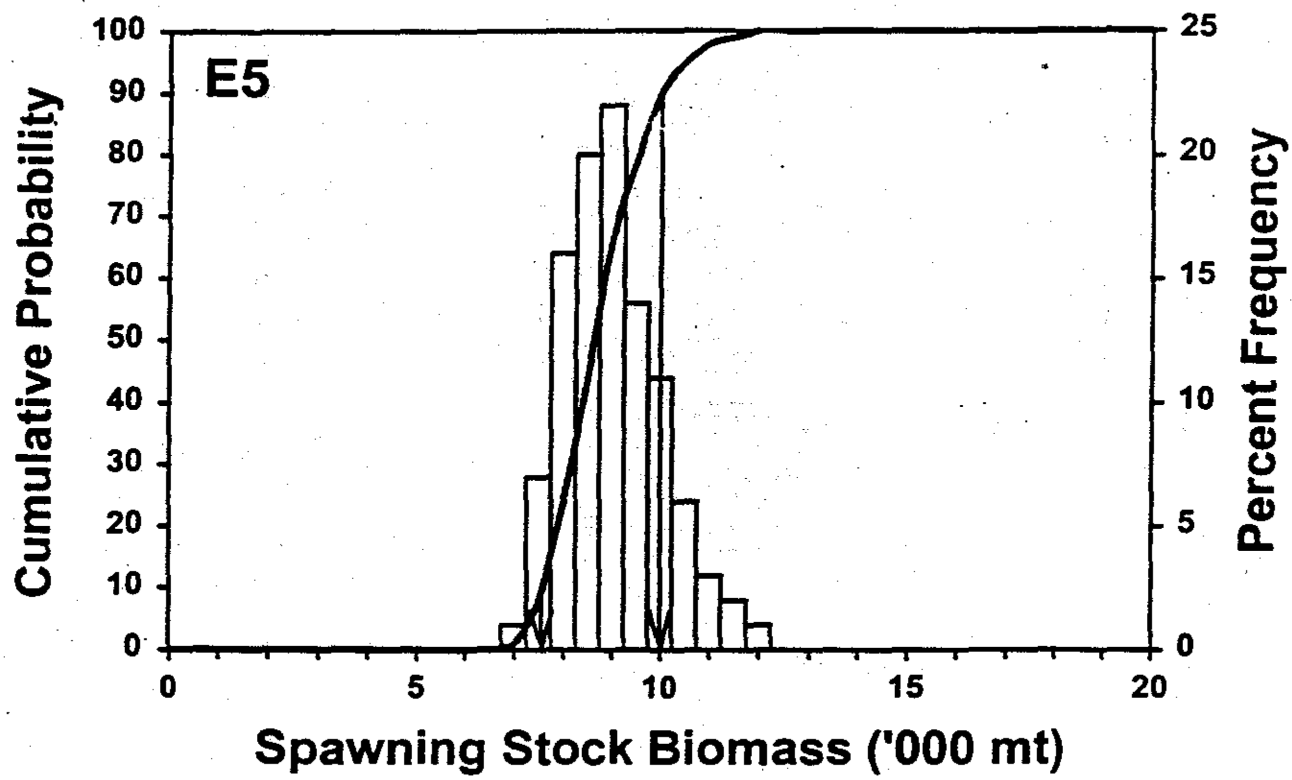
Source of Information: Report of the 28th Northeast Regional Stock Assessment Workshop (28th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, in preparation, to be released in a NEFSC Ref. Doc. series.

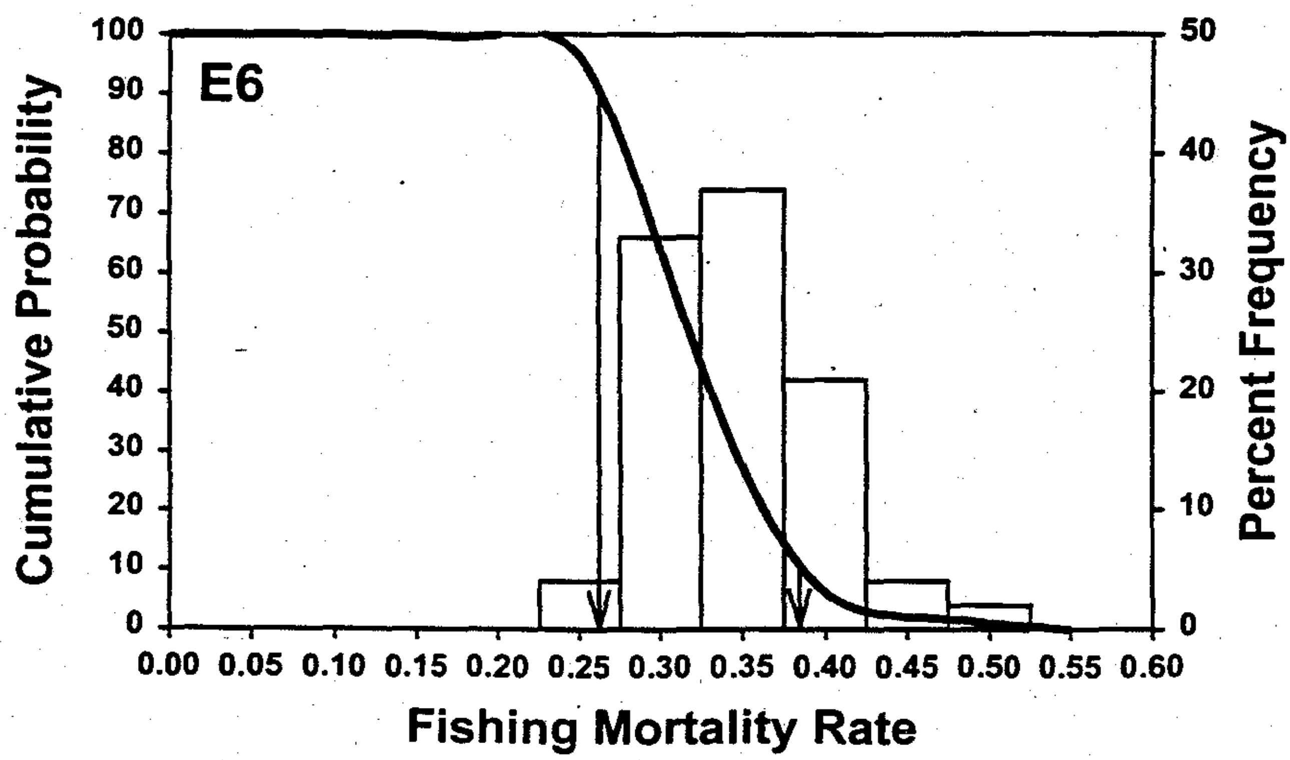
SNE/MA Winter Flounder



SNE/MA Winter Flounder

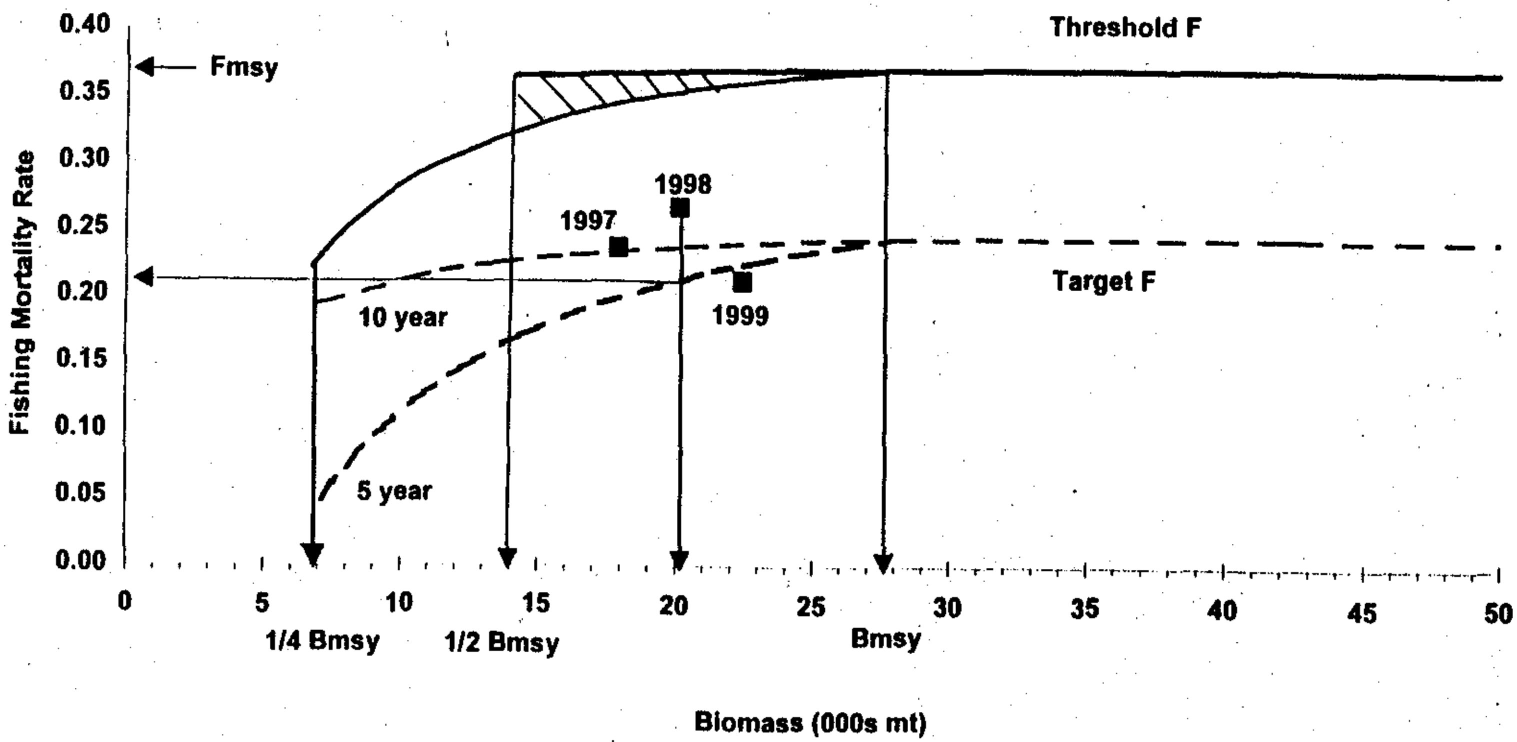
Precision of 1997 Estimates for SSB and F





E7

NEFMC Amendment 9 Control Rule for SNE/MA Winter Flounder



CONCLUSIONS OF THE SAW STEERING COMMITTEE MEETING

CONCLUSIONS OF THE SAW STEERING COMMITTEE MEETING

The Steering Committee for the Northeast Regional Stock Assessment Workshop (SAW) held two meetings during the SAW 28 cycle. The first was via a teleconference on March 12 to finalize the stocks and the Terms of Reference for assessment review at SARC 29. The second was a two-day workshop in Providence, RI on March 22-23, 1999 to re-examine the overall SAW schedule and process so as to be more responsive to SFA-mandated management needs.

Teleconference of March 12

Participating were Jack Dunnigan, Dieter Busch and Lisa Kline, ASMFC; Dan Furlong, Chris Moore, MAFMC; Paul Howard, NEFMC; and Mike Sissenwine, Steve Murawski, Terry Smith (SAW Chairman) and Pie Smith (SAW Coordinator), NEFSC.

<u>SAW Personnel</u>
Dr. Victor Restrepo of the University of Miami has accepted the temporary assignment as SARC Chairman. Dr. Restrepo will chair SARC 29 and likely provide SAW 29 presentations to the Councils and Commission. Helen Mustafa, SAW Coordinator for many years, is phasing out her SAW/SARC activities to take on additional NEFSC responsibilities. Mary Jane (Pie) Smith will serve as the new SAW Coordinator.

<u>SAW 28</u>
The 28th SARC went well, in part due to the the consistent set of assessments presented to the panel. The participation of Bob Mohn (DFO, Canada), representing the NMFS Assessment Peer Review Pilot Program, and five industry representatives nominated by the Councils (Bob Hamilton, Frank Mirachi, Maggie Raymond, Russ Sherman, Matthew Stommell) represented a valuable addition to the process and should be continued.

<u>SAW 29</u>

Stocks

Sea scallops
Long-finned squid (loligo)
Short-finned squid (illex)
Witch flounder

Meeting dates and places

<u>SARC</u>
June 21-25, 1999
NEFSC, Woods Hole, MA

Public Review Workshops

<u>ASMFC</u>
August 2-5, 1999
Alexandria, VA

<u>NEFMC</u>
July 13-15, 1999
Portland, ME

<u>MAFMC</u>
August 10-12, 1999
Philadelphia, PA

Discussion
At its last meeting, the Steering Committee suggested that stocks to be reviewed by SAW 29 should be sea scallops, short- and long-finned squid, witch flounder, Atlantic (sea) herring (MSY question only) and mackerel. It

is no longer necessary to review the herring MSY issue. The anticipated spring TRAC (joint US-Canada transboundary assessment group) review of mackerel will not take place. The Steering Committee suggested an agenda item which would review updated status reports for a number of groundfish stocks, specifically catch and index updates and whether or not, for overfished stocks, the anticipated rebuilding schedule was being met. Focus would be placed on the status determination for selected stocks (overfished/not overfished, overfishing/not overfishing). The MAFMC reiterated the need to work up an index data update for scup and black sea bass for the MAFMC meeting in August to be used in the setting year 2000 quotas.

There was the general sense that updates and/or status determination information for Gulf of Maine winter flounder, windowpane flounder, Georges Bank and Gulf of Maine cod, Georges Bank haddock, Georges Bank and Southern New England yellowtail, and redfish would be useful but questions remain on the appropriate set of updates, our ability to process new information and the role, timing and agenda for the U.S./Canadian TRAC process. The Steering Committee decided to revisit this issue at its next meeting. (See the report of the March 22-23 meeting below.)

Terms of Reference: The following Terms of Reference (TOR) for SARC 29 were adopted with the understanding that there would be an accommodation of the generic terms of reference provided by the NEFMC and that the Illex squid assessment will include Canadian and NAFO catches.

Atlantic Sea Scallop
a. Update the status of Georges Bank and Mid-Atlantic sea scallop populations through 1998, providing estimates of fishing mortality and stock biomass, and characterize variability in these estimates.

b. To the extent possible, provide estimates of scallop biomass in various closed areas, and the distribution of shell sizes and associated meat counts both inside and outside the closed areas.

c. Comment on and revise, if necessary, the overfishing definition reference points for sea scallop recommended by the Overfishing Definition Review Panel and comment on the rebuilding horizon relative to the updated stock status.

d. Evaluate methods for estimating population sizes and biological characteristics of scallop populations in closed areas, based on area-swept surveys using commercial and/or research vessels.

Witch flounder
a. Update the status of the Gulf of Maine - Georges Bank witch flounder stock through 1998 and characterize the variability of estimates of stock size and fishing mortality rates.

b. Provide projected estimates of catch for 1999 and spawning stock biomass for 1999-2000 at various levels of F.

c. Comment on and revise, if necessary, the overfishing definition reference points for witch flounder recommended by the Overfishing Definition Review Panel.

Loligo Squid

a. Update the status of the long-fin squid fishery through 1998 and characterize the uncertainty in stock size and fishing mortality rate estimates.

b. Update estimates of biological reference points based on new data, if possible.

c. Determine, relative to the current overfishing definition, the status of long-fin squid.

d. Relative to the SFA-related new overfishing definitions and reference points and current management measures, determine if long-fin squid is overfished or likely to be overfished during the next two years and whether overfishing is occurring or is likely to occur during the next two years.

e. If stock biomass is less than B_{target}, determine likely rebuilding scenarios under current management measures.

f. Examine relationships between the winter and summer fisheries for long-fin squid.

Illex Squid

a. Update the status of the northern short-fin squid fishery and characterize uncertainty in stock size and fishing mortality rates.

b. Update estimates of biological reference points based on new data, if available.

c. Determine, relative to the current overfishing definition, the status of short-fin squid.

d. Relative to the SFA-related new overfishing definitions and reference points and current management measures, determine if short-fin squid is overfished or likely to be overfished during the next two years and whether overfishing is occurring or is likely to occur during the next two years.

e. If stock biomass is less than B_{target}, determine likely rebuilding scenarios under current management measures..

f. If practical, evaluate new management approaches and sources of information for short-fin squid including feasibility of real time management.

Meeting of March 22-23

The SAW Steering Committee met in Providence on March 22-23. Participants were Dieter Busch and Lisa Kline, ASMFC; Dan Furlong, MAFMC; Paul Howard and Lou Goodreau, NEFMC; Fred Serchuk, Mike Sissenwine, Terry Smith and Pie Smith, NEFSC; and, John Witzig, NERO. The purpose of the meeting was to develop proposals and protocols which would provide for a more disciplined approach to scheduling assessments and to provide for annual assessment updates for all regional stocks. This perspective resulted in consideration of three major issues: the scheduling of assessments to be reviewed by the SARC; procedures for annual assessments updates; and, the design of a process and protocol to be used in producing an annual Stock Assessment Fishery Evaluation Report (SAFE) for each of the Region's Federal FMPs.

<u>SARC Scheduling</u>. All regional stock assessments should be classified as analytical or index-based (Table 1). Analytical assessments will be reviewed by the SARC on a periodic basis ('benchmarked'). Given the current 26 analytical assessments in the region and the

SARC's ability to accommodate 4-6 assessment reviews at each of their two annual meetings, all analytical assessments would be benchmarked by the SARC over a three-year cycle. The Steering Committee considered, for each analytical assessment, how often it would be necessary to produce a new assessment for the thorough peer review of the SARC. The resultant analytical assessment benchmark-review schedule is reflected in Table 1 and provides for a peer review of analytical assessments every two to five years. Such a schedule offers the advantage of a multi-year or extended planning horizon for peer reviews and provides ample notice to managers, fishery participants, and assessment scientists of upcoming assessment reviews.

With respect to those assessments which currently are not analytical, two overarching principles were adopted. Insofar as practical, index-based assessments should be upgraded to an analytical basis; and, with respect to SARC consideration and review, the SARC should 'benchmark' the index assessments every five years.

Assessment Updates. The Steering Committee agreed that all assessments (analytical and index) should be updated annually. For analytical assessments, a number of significant technical and staffing issues need to be resolved relative to updating catch-at-age data versus conducting an additional year-ahead projection using the stock size from an existing catch-at-age matrix. Nevertheless, the Committee agreed to a process that would provide for annual updates. Scheduling specifics will be dictated by issues related to the production schedule for the Stock Assessment and Fishery Evaluation documents (SAFEs, discussed below), the timing of the fishing year, and the timeliness of fishery-dependent and fishery-independent data used in the assessment update.

In terms of an overall scheduling process, the Committee developed a general model keyed to the fishing year; where in the first 3 months following the end of fishing year, fishery-independent and fishery-dependent data files would be closed out and made available to assessors; the next 3 month period would be devoted to conducting the assessment and preparing the report to the appropriate Council or Councils; and the final 6 months would allow the Council to consider and decide upon management actions relevant to information in the assessment so as to have revised management measures in place prior to the start of the next fishing year. This is the most compressed schedule technically possible and implies a minimum 12-month lag between the most recent assessment and the proposed actions.

It was clear that, given this ambitious schedule, and a commitment to annual updates, that it would only be possible to update/project each stock's status once annually.

The overall 3 month/3 month/6 month assessment/review/action model, the numbers of assessments involved and the various fishing years that exist for the region's Federal FMPs led to consideration of a more simple fishing year model. The Committee agreed, in principle, to the classification of all fishing years into one of two categories: an annual cycle corresponding to a calendar year and an annual cycle corresponding to a fishing year beginning mid-year (say, July 1). The Committee understands the difficulty and complexity of re-specifying fishing years for the Region's FMPs, but was faced with the reality that the only workable approach to the above assessment scheduling commitments was to simplify the region's approach to fishing years. Clearly, this particular issue will need to be discussed extensively within and between the two Regional Councils.

Given this overall future fishing year model, an approximate cycle for benchmark and updated assessments emerged. Generally, on an annual basis, two SARC meetings would occur; one in the spring and one in the autumn. Assessments for stocks managed under a calendar fishing year would be considered by a spring SARC, and assessments for stocks managed under the mid-year convention would be reviewed by the autumn SARC. In addition, all other assessments would be updated and reported to the appropriate Council consistent with the fishing year convention — assessment updates for calendar fishing year stocks would be available in the summer and updates for stocks managed by the mid-year convention in the winter.

With respect to 1999 and the NEFMC's need for an annual update of the stocks managed under the Northeast Multispecies FMP, the Committee agreed that assessment updates for all the stocks listed in the FMP would be provided by a special SAW working group. The status report would be made available in August. Details to be decided inlcude how this report will be peer-reviewed, the constitution of a special working group and coordination with the Groundfish PDT and Multispecies Monitoring Committee. The NEFSC will, as soon as possible, provide the Steering Committee with a prognosis on its ability to update these assessments.

<u>The Stock Assessment and Fishery Evaluation Document</u>. The timing of the production of a SAFE was made consistent with the assessment timing model outlined above. In general, the assessment update information, other fishery-dependent information, and ancillary performance information would be made available in a standard report about 6 months after the end of the fishing year. The report would be based in part on information in the NEFSC's Status of Stocks Report (SOS) which will be available on the World Wide Web and updated continually. The format and content of the report will generally follow the outline provided by the NEFMC (Table 2) where Section A (Biological Factors) would be derived from the assessment updates and the SOS; and Sections B (Economic Factors) and C (Social Factors) from the SOS and additional reports from the Region's Fisheries Statistics Office. Details on the contents of Section D (Ecological Factors) await consideration by the Council's Habitat Committee. Parts 2 through 6 (Table 2) will be developed by groups outside the scope of the stock assessment process.

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	1997	2	1999
LOBSTER	Analytical	1996	3	1999
COD, Georges Bank	Analytical	1998	2	2000
COD, Gulf of Maine	Analytical	1998	2	2000
FLDR, WINTER, GB	Analytical	1998	2	2000
FLDR, Yellowtail, GB	Analytical	1998	2	2000
FLDR, Yellowtail, SNE	Analytical	1998	2	2000
HADDOCK-Georges Bank	Analytical	1998	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	1999
WHITE HAKE	Analytical	1998	3	2001
FLDR, WITCH	Analytical	1999	3	1999
POLLOCK	Analytical	1999	5	2004
SPINY DOGFISH	Analytical	1997	5	2002
SQUID, ILLEX	Analytical	1999	5	1999
SQUID, LOLIGO	Analytical	1999	5	1999
SURFCLAM	Analytical	1999	3	1999
MACKEREL, ATLANTIC	Analytical	1999	3	2002
WEAKFISH	Analytical	1999	5	1999
CUSK	Index	1995	5	2000
SCUP	Index	1998	5	1999
TILEFISH	Index	1999	5	2004
WOLFFISH	Index	1995	5	2000
BLACK SEA BASS	Index	1998	5	1999
RIV. HERRING/SHAD	Index	1988	5	TBD
BUTTERFISH	Index	1993	5	1999
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	TBD
RED HAKE, Southern	Index	1990	5	TBD
REDFISH	Index	1992	5	TBD
SILVER HAKE, Northern	Index	1995	5	2000
SILVER HAKE, Southern	Index	1995	5	2000
SKATES	Index	1985	5	1999
TAUTOG	Index	1995	5	1999

<u>SAW 30</u>. SAW 30 will include analytical assessments of surfclams, weakfish (if the ASMFC technical committee has completed an assessment) and mackerel. Additionally, the SARC should formally review indexed assessments of scup, black sea bass, butterfish, and possibly tautog (which may have to be postponed until SAW 31, again depending on the status of the assessment). The SARC will also review the status of the skate complex and, as a special topic, consider methodology developed to update index assessments and provide management advice consistent with the new SFA requirements for such assessments. Issues include how a generic index assessment methodology addresses the quality of a biomass index; how to use size composition information; how to address fishing mortality; how to evaluate rebuilding scenarios/options; and, what criteria are necessary to upgrade an indexed stock to analytical status.

Table 2. Stock Assessment and Fishery Evaluation (SAFE) Report

1. Most recent biological and social sciences information (NMFS)

A. Biological factors

What is 1998 fishing year F
What is 1998 fishing year B (survey index, or biomass)
What are 1998 fishing year commercial LANDINGS
What are 1998 fishing year discards
What is 1998 fishing year recreational catch
What is 1998 fishing year DAS utilization
Estimate the potential of the stocks to rebuild to target B within 1 to 10 years

B. Economic factors

How many vessel permits (by type)
How many vessels participated
How many vessels bought-out
All trip information in the fishery (from dealer logs, and VTRs)
What are 1998 fishing year revenues (by fleet, and per boat)
Costs affected by management measures, for Cost/Benefit analysis
Include all data from the ACCSP annual fixed cost survey
Include all data from the ACCSP trip cost survey
Crew sizes
What are 1998 fishing year crew shares
How many dealer (processor) permits
How many dealers processed

C. Social factors

Number of boat owners (include party/charter) in 1998 fishing year
Total number of fishermen in fishery
number of dealers/processors in 1998 fishing year
Total employment, in processing this fishery
How many operator permits
How many operators fished
Include all data from the ACCSP annual owner/captain/crew survey
Other

D. Ecological factors (awaits first Habitat report in April 1999 fishing year)

- Marine mammal takes

2. Multispecies Monitoring Committee/Plan Development Team recommendations for management measures (Council) :

Recommend allowable biological catch and/or TAC [ ] for 1999 fishing year
Recommended total DAS for 1999 fishing year
Recommended DAS per vessel category
Recommended areas to close/open
Recommend changes to supplemental measures (mesh sizes, trip limits, crew sizes, etc.)
Quantify effect of each management measure to achieve target F in 1999 fishing year
Economic Impact Analyses of new TAC/measures
Social Impact Analyses of new TAC/measures
Community Impact Analysis

3. Enforcement (from NMFS & USCG)

Effort monitoring (number of call-ins and VTS trips) in this fishery
How many intercepts, at-sea and on-the-dock, in this fishery
How many NOVAs issued in this fishery, by measure
How many prosecutions
Total fines collected from this fishery
Number of gear conflicts in this fishery in 1998 fishing year
Measures affecting Safety at sea

4. Habitat (from annual April report) (Council)

Habitat Area of Particular Concern: NE Georges Bank cod
Other

5. Fishermen's Observations and Recommendations (Council)

- from annual Call for Industry Proposals

6. Data and Research needs (Council)

Data and research shortfalls