Northeast Fisheries Science Center Reference Document 94-07

Report of the 17th Northeast Regional Stock Assessment Workshop

The Plenary

NOAA/National Marine Fisheries Service
Northeast Fisheries Science Center
Environmental Processes Division
Woods Hole, MA 02543-1097

March 1994

The 17th Northeast Regional Stock Assessment Workshop is documented in seven separate reports, listed below. The Northeast Fisheries Science Center Reference Documents are a series of informal reports produced by the Center for timely transmission of results obtained through work at NEFSC labs. The documents are reviewed internally before publication, but are not considered formal literature. The National Marine Fisheries Service does not endorse any proprietary material, process, or product mentioned in these reports. To obtain additional copies of this report or other Center Reference Documents contact, Information Services Unit, Northeast Fisheries Science Center, Woods Hole, MA 02543 (508-548-5123, ext. 260 or 378).

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Reports of the 17th Stock Assessment Workshop (17th SAW)

CRD 94-01 Estimation of Discards in the Silver Hake Fisheries and its Implications on the Long-Term Yield of the Stocks
by T. Helser and R. Mayo

CRD 94-02 Assessment of Yellowtail Flounder *Pleuronectes ferrugineus*, 1993
by P. Rago, W. Gabriel, and M. Lambert

CRD 94-03 Stock Assessment of Atlantic Butterfish, *Peprilus triacanthus*, in the Northwest Atlantic During 1992
by J. Brodziak

CRD 94-04 Stock Assessment of Long-Finned Squid, *Loligo pealei*, in the Northwest Atlantic During 1992
by J. Brodziak

CRD 94-05 Stock Assessment of Short-Finned Squid, *Illex illecebrosus*, in the Northwest Atlantic During 1992
J. Brodziak and L. Hendrickson

CRD 94-06 Report of the 17th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee Consensus Summary of Assessments

CRD 94-07 Report of the 17th Northeast Regional Stock Assessment Workshop, The Plenary

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SUMMARY

The **Plenary Meeting of the 17th Northeast Regional Stock Assessment Workshop (17th SAW)** was held at Dunes Manor Hotel, Ocean City, Maryland on 24 - 25 January 1994, in conjunction with a meeting of Mid-Atlantic Fishery Management Council. About 35 persons attended the meeting, including almost all Council members and some individuals from the states and industry in the Mid-Atlantic region (Table 1). The meeting agenda is presented in Table 2.

Opening

David Keifer, Executive Director of the Mid-Atlantic Fishery Management Council welcomed the meeting participants. He noted that this was the first SAW meeting held south of the Hudson.

Introduction

Dr. Vaughn Anthony, SAW Chairman, indicated that the science part of the 17th SAW has been completed and that only scientific advice for management will be presented at this meeting. He noted that one day, the social and economic issues will also be addressed within the SAW process.

Dr. Anthony reviewed the SAW Process (Figure 1). Most of the assessment activities occur at the SARC Subcommittee level. Subcommittee participants include scientists from NMFS, Councils, and the states within the region, as well as some experts from outside the region. Although at this point all Subcommittee chairs are from NEFSC Investigations, experts from other organizations may serve as chairs in the future. Currently, a chair is needed for the Pelagic/Coastal Subcommittee.

The assessments submitted by the Subcommittees are peer reviewed by a Stock Assessment Review Committee (SARC), a diverse group of individuals from NMFS/Northeast Fisheries Science Center and Northeast Region, Regional Fishery Management Councils, the Atlantic States Marine Fisheries Commission and the states, academia, and outside the region, including Canada. The SARC prepares the "Consensus Summary of Assessments" (SARC Report), determines which papers should be published in the NEFSC Reference Document series, and drafts the "Advisory Report On Stock Status" (Advisory Report).

The SAW Plenary is a forum for vetting scientific advice to managers. Plenary meetings are usually of one day duration, held in conjunction with the meetings of the Regional

Fishery Management Councils or the Atlantic States Marine Fisheries Commission. Members of the SAW Steering Committee, Council staffs, ASMFC Commissioners, and SARC Subcommittee chairs are expected to attend these meetings.

SAW Steering Committee meetings represent the end of one SAW process and the beginning of the next. This Committee guides the SAW process and sets priorities for the SAW agenda based on management needs. The next Steering Committee meeting will take place on 15 February 1994 in Danvers, MA. At that time, highlights and the recommendations from this Plenary meeting, as well as the just completed SARC meeting, will be discussed and the agenda for SAW-18 set.

SARC Meeting and Reports

Species Assessments

The SARC (Table 3) met at the Northeast Fisheries Science Center in Woods Hole, MA during 29 November - 4 December 1994. Reviewed were seven, first priority, species/stocks: two stocks of silver hake, Southern New England yellowtail flounder, bluefish, butterfish, and long- and short-finned squid. The Committee determined that five papers would be published in the NEFSC Reference Documents series (Table 4).

The SARC Report (distributed at this meeting) is a summary of all the science reviewed at the December meeting, based on the work done in Subcommittees (Table 5). The terms of reference for the species are presented at the beginning of each section and research recommendations at the end of each section, although the general format of this report (length and details) is not rigid because species differ in data available and type of assessment.

The SARC also drafted an Advisory Report. The format for this report was set by the SAW Steering Committee and is quite rigid with standard tables and figures. In addition to figures with information on each species, the report includes figures with information on the precision of estimates, developed with the use of the so called "bootstrap" method. Once the Advisory Report has been reviewed at this meeting and discussed at the upcoming Steering Committee meeting, it will become part of the Plenary Report.

As it is now apparent that only five species can be comfortably peer reviewed at a one week long SARC meeting, more than two SARC meetings per year may have to be scheduled in the future to meet management needs.

Assessment Methods Subcommittee and ADAPT Tutorial

Dr. Anthony reviewed the role and terms of reference of the Assessment Methods Subcommittee (Tables 6a and 6b). The SARC recommended that the Methods

Subcommittee meet five days in April to address the first and second priority terms of reference (potential biases in SARC assessment results, and methods for medium-term stochastic projections) and software design for the ADAPT framework. The ADAPT framework is adaptive to a variety of data on particular species and has a central role in age-based assessments performed in the region. Specification of what should be included in a standard, user friendly, version of software is a "high priority."

The NEFSC will convene an ADAPT tutorial two days this spring to explain the method and use of the framework so as to provide access for people outside the Center. It would be beneficial that members of state fisheries organization, in particular, participate. Terms of reference for the tutorial include, background and history, data requirements for use, description of methods and assumptions, use of model diagnostics, and interpretation of output. A follow up tutorial for the use of the new software will be recommended to the Steering Committee.

Presentation of the Advisory Report

Introduction

The scientific advice for management that Dr. Vaughn Anthony presented at the Plenary meeting appears in the "Advisory Report on Stock Status" section of this report. At this time the advice only deals with the condition of the stocks based on fishing, habitat change, environmental change, and biological interactions relative to competition, predation, and cannibalism. There is, however, the need to provide information on economic and social aspects of management. The additional information, however, will be forthcoming only after a few more SAWs, when the current SAW process is firmly implanted.

Dr. Anthony discussed the introduction to the Advisory Report, providing a detailed description of the stock classification chart and the classification procedure developed within the SAW process. Each stock reviewed was described by the level of abundance (low, medium, or high) and exploitation status (over- fully- or under-exploited) (Figure 2). The objective is to move toward the fully exploited stage and to maintain a medium or high level of abundance (Figure 3). Classification of the Northeast Demersal, Pelagic, and Invertebrate Fisheries (Figures 4a, b, and c), as well as a summary classification of 34 stocks in the Northeast, as of 1992 (Figure 4d), was illustrated on the basis of the classification chart in the Advisory Report.

The format for the Advisory report is set by the SAW Steering Committee. At the beginning of each species/stock report are sections on the state of stock (where stock level and exploration rate are indicated), management advice, and a forecast for 1994 (when available). These are followed (in smaller print) by sections on catches, data and assessment, fishing mortality, recruitment stock biomass, special comments, and sources

of information. Standardized tables and figures accompany each species/stock report.

Bluefish

The Pelagic/Coastal Subcommittee met only three out of five terms of reference that were set for bluefish. No analytical assessment was submitted to the SARC. Although the Subcommittee met twice before the SARC meeting, at the SARC meeting, Subcommittee members indicated that an analytical assessment could be forthcoming given one more meeting.

The Subcommittee met, for the third time, on 5 January 1994 to review new assessment analyses for bluefish (completed after the SARC meeting in early December 1993) and to reach a consensus on best estimates of stock size and fishing mortality rates. The Subcommittee reviewed results from three different assessment models (ADAPT VPA, DeLury, and CAGEAN), evaluated fishery and research survey selectivity patterns, examined alternative yield per recruit analyses, and discussed the adequacy and appropriateness of various indices of stock abundance and fishing effort. Although a number of issues were resolved during the meeting, the Subcommittee was unable to agree upon a definitive assessment, and hence unable to provide consensus best estimates of stock abundance and fishing mortality.

The Subcommittee believes that both the DeLury and CAGEAN models offer promise in developing a definitive, quantitative assessment of bluefish. However, further Subcommittee analyses examining the assumptions and input sensitivity of these models are required before accepting any of the results.

In discussion, it was noted that this was the first time that a bluefish assessment was attempted in the context of the SAW and that consensus was sought from individuals from a number of organizations. As information from a bluefish assessment is important to the development of a bluefish management plan, bluefish analyses should remain part of the SAW process. The SAW Steering Committee should encourage the group to continue their work and come to a consensus as soon as possible.

Other Business

MAFMC Statement on Fisheries Data Precision

Dr. Anthony referred to a statement on fisheries data precision which was tabled at the December MAFMC meeting, indicating that he was pleased that the Council wants to understand statistical precision and accuracy of data. He indicated that he asked NEFSC to assemble a package on surveys which he plans to bring before the Council. The

suggested policy statement concerning the presentation of fisheries analyses is as follows:

> *(1) that all fisheries statistics be accompanied by a statement of their statistical precision or stipulation on quality of data,*
>
> *(2) that all conclusions which have been derived from the use of numerical models be accompanied by a complete list of the assumptions made in the course of running the model, and*
>
> *(3) that all fisheries data which have been derived from a survey be accompanied by a summary of the methods by which the survey was conducted and a discussion of the bias and precision of the survey.*
>
> *These recommendations shall apply to fisheries analyses presented to the Council by the Council staff. NEFSC, NMFS, ASMFC, or any other official source. If, for some reason, the required information is not available, this must be stated and explained.*

Next SAW

The agenda for the next SAW will be set at a SAW Steering Committee Meeting on 15 February. At that time, the items from this Plenary and the SARC meetings will be reviewed. The Steering Committee will set the species/stocks and meeting dates for SAW-18, and discuss species/stocks and meeting dates for SAW-19.

The MAFMC will prepare a list of species for Steering Committee's consideration.

Other

Dr. Anthony indicated that he would appreciate any comments from participants, particularly on the Advisory Report.

It was suggested that a glossary of terms be included into each Advisory Report.

It was noted that the SARC Subcommittee structure seems to be working well, in spite of the bluefish problem. The SARC is, however, limited in the number of assessments that it can review and there must be additional ways to access assessment information. Currently a SARC of one week duration can review assessments for only five stocks with adequate data.

Table 1. List of Participants

National Marine Fisheries Service

Northeast Fisheries Science Center

Vaughn Anthony
Steve Clark
Ralph Mayo
Helen Mustafa
Fred Serchuk
Terry Smith

Northeast Regional Office

Dick Roe

Mid-Atlantic Fishery Management Council

Lee Anderson
Tony DiLernia
James Gilford
Al Goetze (retired)
Tom Hoff
John Horn
Dave Keifer
Roger Locandro
Tom McVey
Gil Radonski
Carl Safina
Rich Seagraves
Alan Weiss
Bill Wells

New England Fishery Management Council

Thomas Hill

Atlantic States Marine Fishery Commission

Jack Dunnigan
Paul Perra

Delaware Division of Fish and Wildlife

Rick Cole
Desmond Kahn
Stewart Michaels

New York Division of Marine Resources

John Mason

U.S. Coast Guard

Vince O'Shea

Cape May County Party & Charter Boat Assn.

Don Basmajian

Axelsson and Johnson

Charlie Bergman

F/V Darana R.

Jim Ruhle

F/V Flicka, F/V Dyrsten

Lars Axelsson

East Coast Fish. Association

Erling Berg

Chincoteague, VA

Bennie Rubin

National Fisheries Institute

Rick Marks

Table 2. Agenda

17th Northeast Regional Stock Assessment Workshop
(17th SAW)
Plenary Meeting

Genesar Ballroom
Dunes Manor Hotel
28th Street and the Ocean
Ocean City, MD
Telephone: 410-2891100 or 800-523-2888

24 - 25 January 1994

AGENDA

Monday, January 24

1:00	Opening	MAFMC Executive Director, D. Keifer
1:15	Introductory Remarks	SAW Chairman, V. Anthony
1:45	Stock Assessment Review Committee (SARC*) Meeting Report	V. Anthony
2:15	**Advisory Report on Stock Status** Presentation and Discussion Introduction Long-finned Squid Short-finned Squid Butterfish	V. Anthony

Tuesday, January 25

8:00	Continue Advisory Report Presentation and Discussion Yellowtail Flounder (SNE) Silver Hake (2 stocks) Bluefish	
11:30	Other Business	

*V. Anthony (Chair), F. Almeida, K. Friedland, S. Murawski, F. Serchuk (NEFSC); P. Colosi (NERO); A. Applegate (NEFMC); T. Hoff (MAFMC); L. Kline (ASMFC); S Correia (MA DMF); D. Simpson (CT DEP); C. Annand (DFO, Canada); J. Boreman (UMA/NOAA CMER); G. Thompson (AKFSC).

Table 3. **SAW-17 SARC COMPOSITION**

Chair NEFSC Chief Scientific Advisor

Vaughn Anthony

Ad hoc assessment members

Frank Almeida
Kevin Friedland
Steve Murawski
Fred Serchuk

NMFS Northeast Regional Office

Pete Colosi

Regional Fishery Management Councils

Andy Applegate, NEFMC
Tom Hoff, MAFMC

Atlantic States Marine Fisheries Commission/State

Lisa Kline, ASMFC
Steve Correia, MA
David Simpson, CT

Canada

M. Christina Annand, DFO

Academia

John Boreman, UMA/NOAA CMER

Other Region

Grant Thompson, AKFSC

Table 4. NEFSC Reference Documents associated with the 17th Northeast Regional Stock Assessment Workshop (17th SAW)

Number	Title/Author(s)
CRD 94-01	Estimation of Discards in the Silver Hake Fisheries and its Implications on the Long-Term Yield of the Stocks by T. Helser and R. Mayo
CRD 94-02	Assessment of Yellowtail Flounder Pleuronectes ferrugineus, 1993 by P. Rago, W. Gabriel, and M. Lambert
CRD 94-03	Stock Assessment of Atlantic Butterfish, Peprilus triacanthus, in the Northwest Atlantic During 1992 by J. Brodziak
CRD 94-04	Stock Assessment of Long-Finned Squid, Loligo pealei, in the Northwest Atlantic During 1992 by J. Brodziak
CRD 94-05	Stock Assessment of Short-Finned Squid, Illex illecebrosus, in the Northwest Atlantic During 1992 by J. Brodziak
CRD 94-06	Report of the 17th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee Consensus Summary of Assessments
CRD 94-07	Report of the 17th Northeast Regional Stock Assessment Workshop, The Plenary

Table 5. Subcommittee Meetings, participants, and analyses prepared

Subcommittee/Participants	Meeting Date(s) and Place(s)	Analyses Prepared
Northern Demersal	8 - 12 November 1993	Silver hake
A. Applegate, NEFMC	Woods Hole, MA	(2 stocks)
D. Hayes, NEFSC		GB Cod
T. Helser, NEFSC		
T. Hoff, MAFMC		
J. Mason, NY DEC		
R. Mayo, NEFSC (Chair)		
L. O'Brien, NEFSC		
F. Serchuk, NEFSC		
K. Sosebee, NEFSC		
S. Wigley, NEFSC		
Southern Demersal	2 - 5 November 1993	Yellowtail Flounder
A. Applegate, NEFMC	Woods Hole, MA	(2 stocks)
R. Conser		
W. Gabriel (Chair)		
M. Lambert		
P. Rago		
Pelagic/Coastal	25 - 26 October 1993	Bluefish
J. Buckler, SUNY	Old Lyme, CT	
V. Crecco, CT DEP		
M. Gibson, RI DFW	16 November 1993	
D. Hayes, NEFSC	Old Lyme, CT	
C. Moore, MAFMC		
S. Murawski, NEFSC (Chair)		
W. Overholtz, NEFSC		
J. Ross, NC DMF		
L. Rugolo, MD DNR		
M. Terceiro, NEFSC		
Special Meeting	5 January 1994	
V. Crecco, DT DEP	Woods Hole, MA	
M. Gibson, RI DFW		
C. Moore, MAFMC		
W. Overholtz, NEFSC		
F. Serchuk, NEFSC (Act. Chair)		
T. P. Smith, NEFSC		
M. Terceiro, NEFSC		
Invertebrate	27 - 29 October 1993	Long-finned squid
J. Brodziak, NEFSC	Dover, DE	Short-finned squid
T. Hoff, MAFMC		Butterfish
A. Lange, MD DNR		
R. Seagraves, MAFMC		
F. Serchuk, NEFSC (Chair)		
J. Weinberg, NEFSC		

Table 6a. Role of the Stock Assessment Methods Subcommittee.

1.	Address the practical methodological and statistical problems encountered by the species oriented subcommittees in the course of carrying out their respective assessments;
2.	Suggest alternative procedures or methods to address these problems;
3.	Evaluate new assessment methods (e.g. methods development elsewhere) and make recommendations regarding their usage in SAW/SARC assessments; and
4.	Develop new assessment methods, as needed, to address recurring problems or to improve the quality and precision of SAW/SARC assessments.

These terms of reference for the Stock Assessment Methods Subcommittee will be closely tied to the ongoing work within the species oriented subcommittees. Members of the methods Subcommittee will also serve as members of one of the species oriented subcommittees, and will participate fully in the ongoing assessment work. Outside experts will be invited to participate in the Methods Subcommittee meetings.

Table 6b. Stock Assessment Methods Subcommittee terms of reference.

1.	Potential biases in SARC assessment results
2.	Methods for medium-term stochastic projections
3.	Multiple indices of abundance within the DeLury model
4.	CPUE-based indices of abundance for VPA tuning
5.	Calibration of recruitment indices
6.	Effects of outliers in survey data
7.	Sensitivity of ADAPT results
8.	Extending the time series of stock-recruitment data
9.	Design ADAPT software specifications

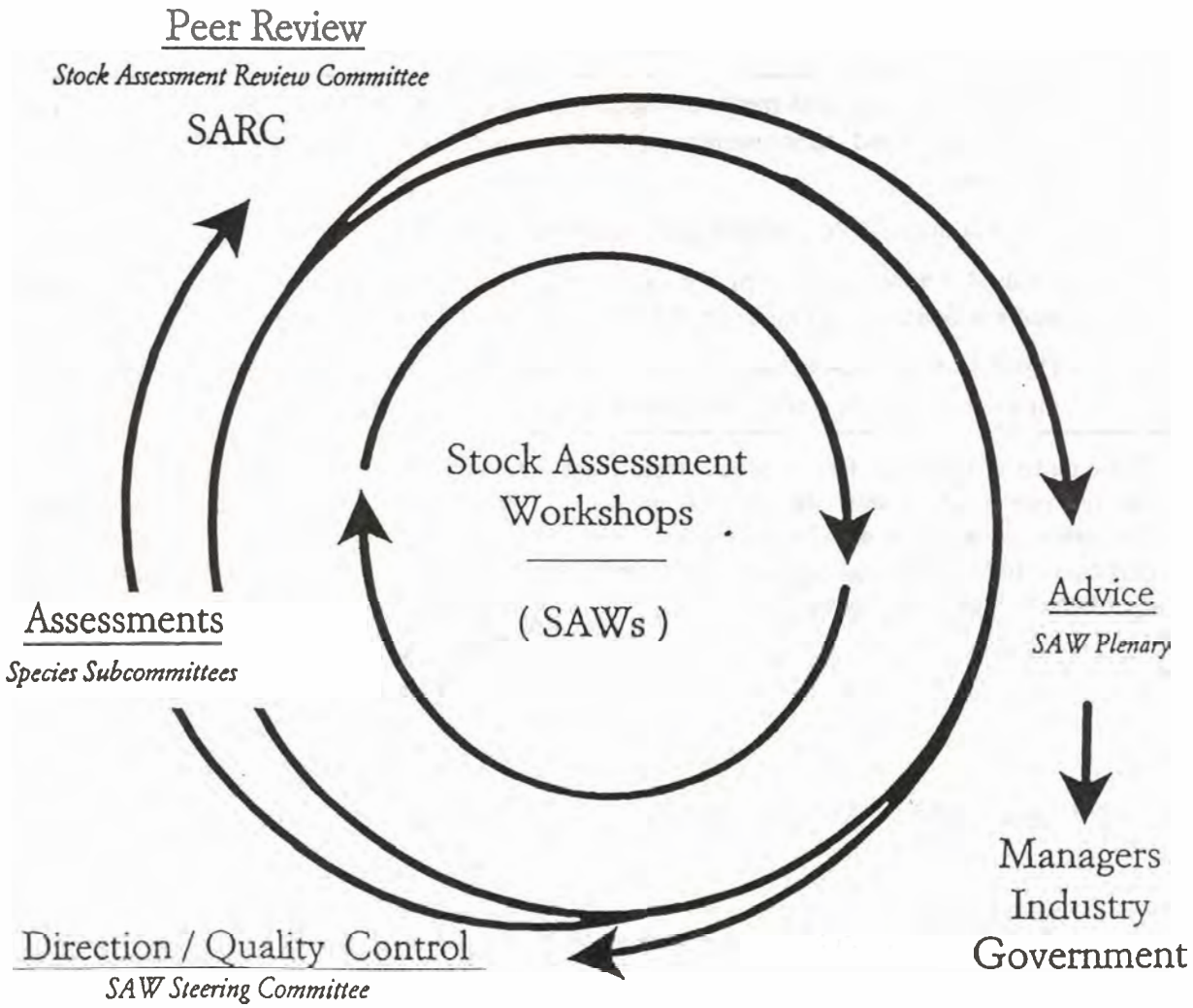


Figure 1. SAW structure.

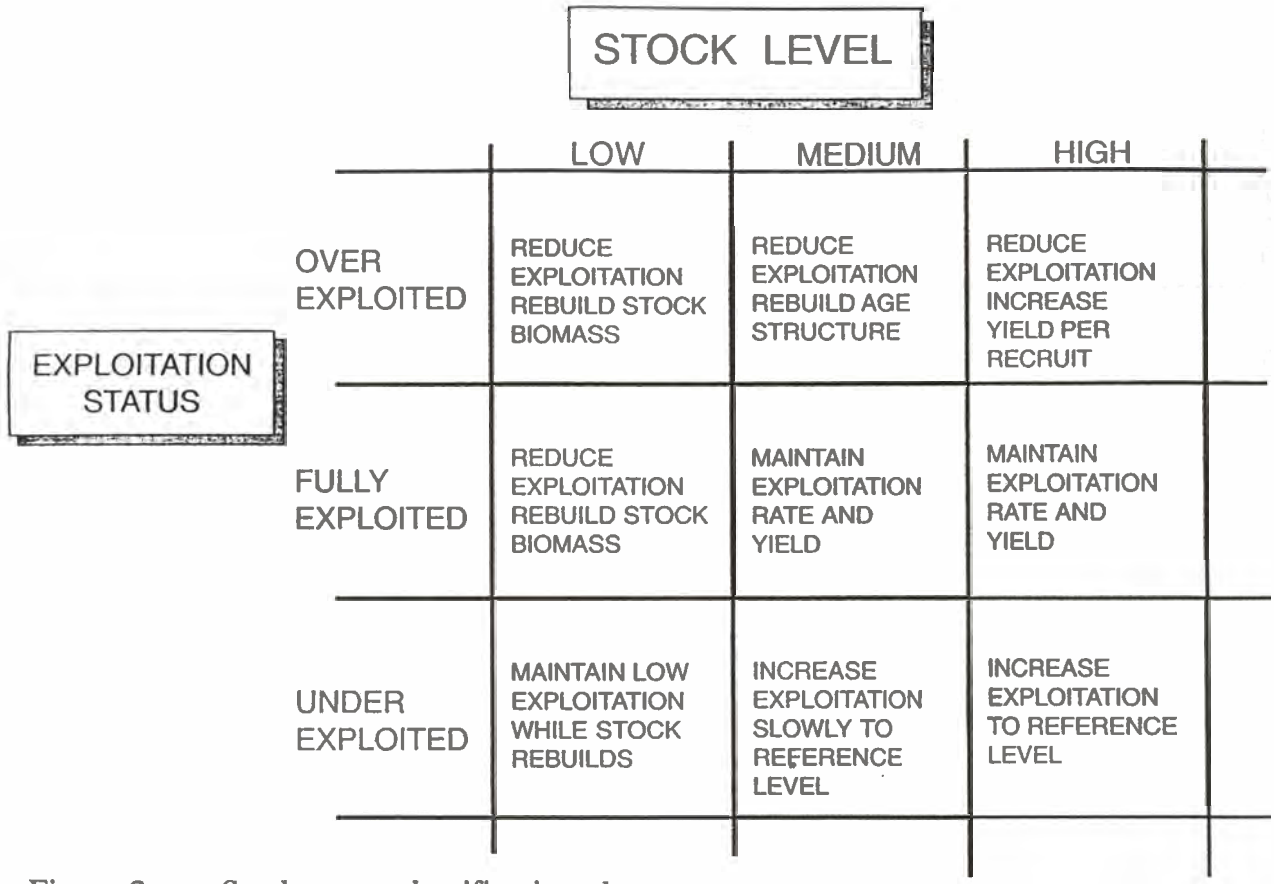


Figure 2. Stock status classification chart.

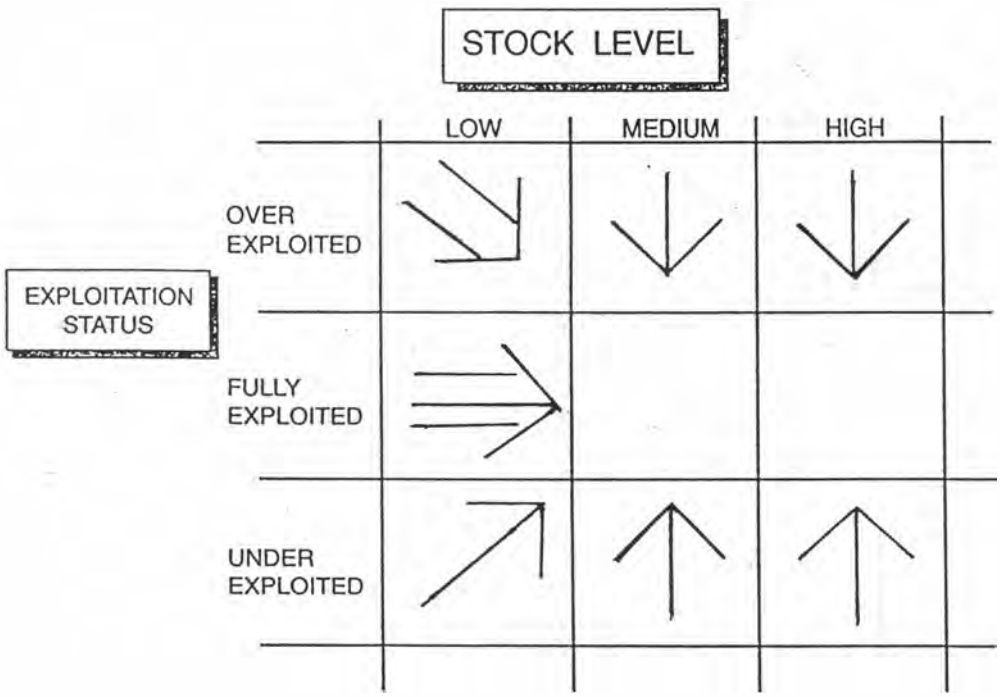


Figure 3. The objective is to move toward the fully exploited stage and to maintain a medium or high level of abundance.

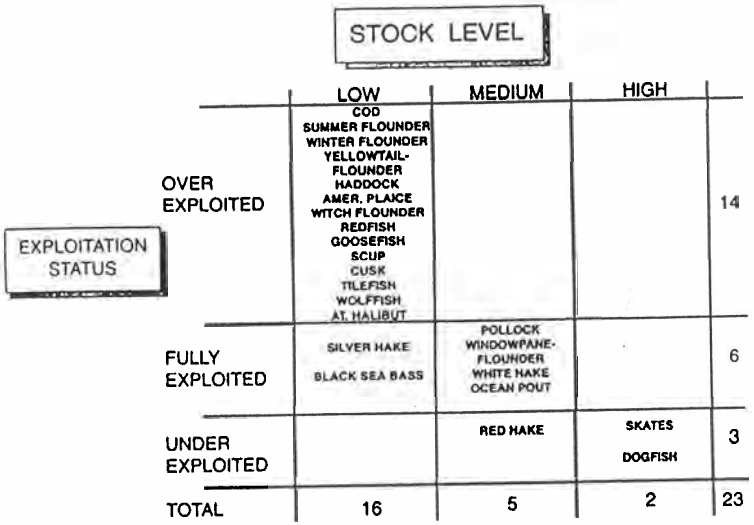


Figure 4a. Northeast demersal fisheries, as of 1992.

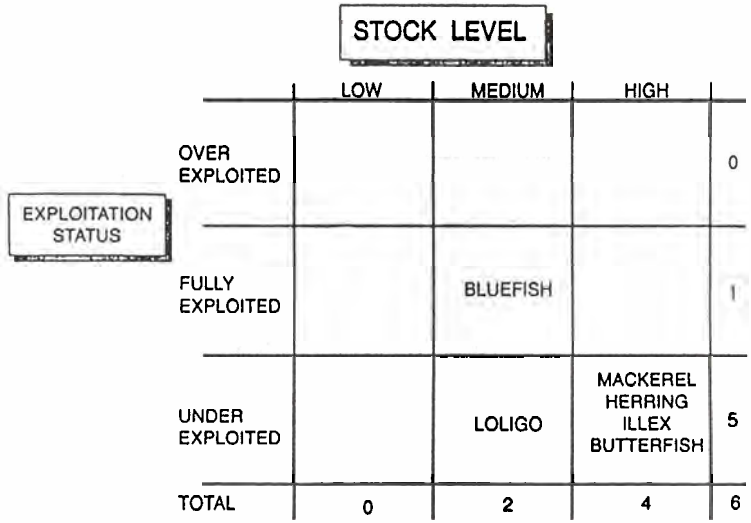


Figure 4b. Northeast pelagic fisheries, as of 1992.

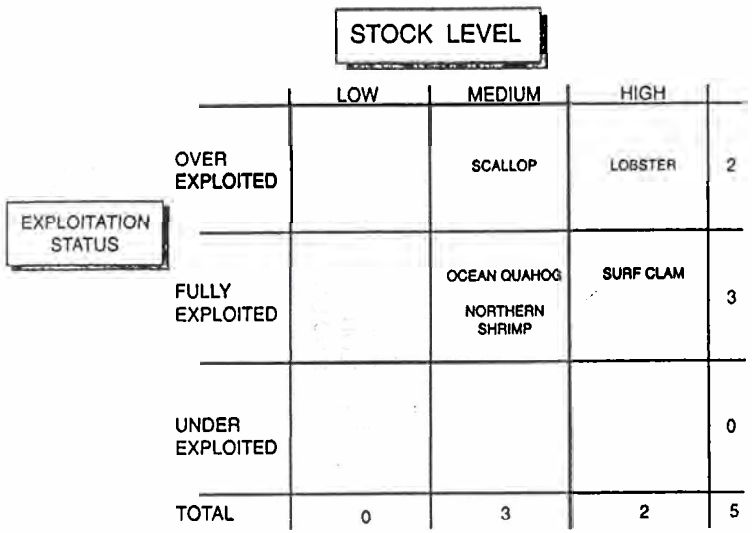


Figure 4c. Northeast invertebrate fisheries, as of 1992.

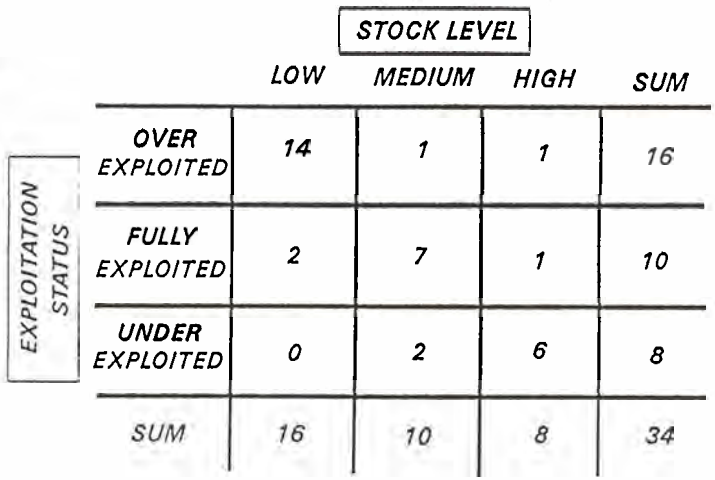


Figure 4d. Summary classification of 34 Northeast stocks, as of 1992.

ADVISORY REPORT ON STOCK STATUS

SAW 17 PLENARY

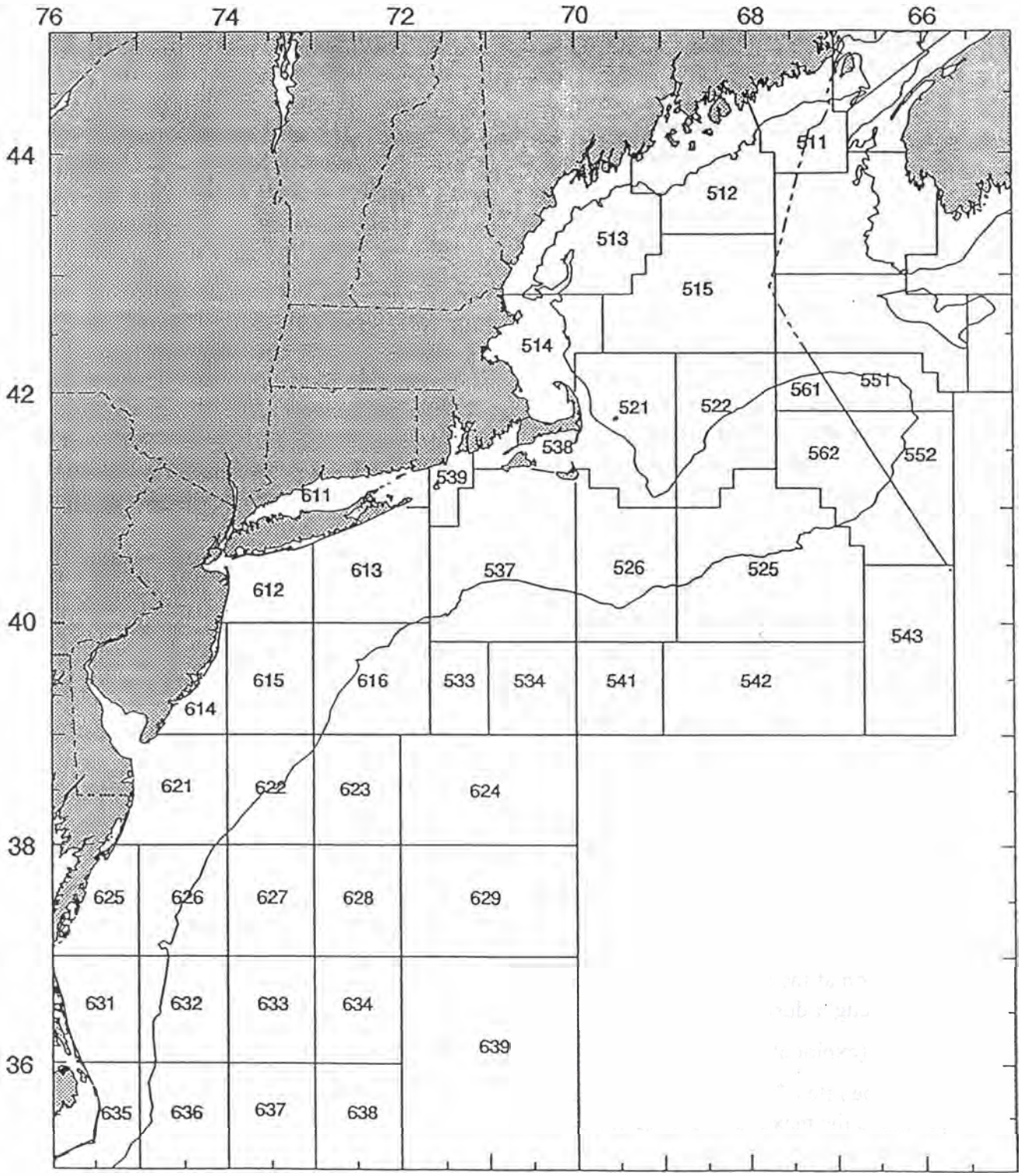
INTRODUCTION

The **Advisory Report on Stock Status** is a major product of the Northeast Regional Stock Assessment Workshop. It 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 whether a stock is currently over-, fully-, or under-exploited. As these categories specially refer to the act of fishing, they are best thought of in terms of exploitation rates relative to the Councils' overfishing and maximum sustainable yield (MSY) definitions. 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 defined by the Councils' overfishing definition, it is considered to be over-exploited. When the stock is at such a level that the MSY can be taken but the fishery is only removing a small portion of the stock, then it is considered to be under-exploited.

Another important factor for classifying the status of a resource is the current stock level, e.g., spawning biomass (SSB). It is possible that a stock that is not currently overfished in terms of present exploitation rates, is still at a low biomass level due to heavy exploitation in the past. In this case, future recruitment to the stock is very important and the probability of improvement is increased greatly by increasing the SSB. Conversely, a stock currently at a high level may be exploited at a rate greater than the overfishing definition level until such time as it is fished down to a stock size judged appropriate for maximum productivity or desirable from an ecological standpoint. Therefore, where possible, stocks under review were classified as high, medium, or low biomass compared to historic levels. The figure below describes this classification.

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



GLOSSARY OF TERMS

Biological reference points: Fishing mortality rates that may provide acceptable protection against growth overfishing and/or recruitment overfishing for a particular stock. Rates are usually calculated from equilibrium yield-per-recruit curves, spawning stock biomass-per-recruit curves and stock recruitment data. Examples are $F_{0.1}$, F_{max} and F_{med}.

Exploitation pattern: The distribution of fishing mortality over ages. This 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. The decline is defined by survival curves such as

$N_{t+1} = N_t e^{-z}$ to the base e (2.718 28) when the number of deaths is proportional to the number present.

Z is the total instantaneous mortality rate which can be separated into deaths due to fishing (F) and deaths due to all other causes (M).

Exploitation rate: The proportion of a population at the beginning of the year that is caught during the year.

C = No (exploitation rate).

F_{max}: The rate of fishing mortality that produces the maximum level of yield-per-recruit. This is the point where 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 percent 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).

Growth overfishing: The points on the equilibrium yield-per-recruit curve, where high fishing mortality produces losses in weight rather than gains in weight because of an imbalance of growth and natural mortality. These yield per-recruit values are those that occur at values of F greater than F_{max}.

Long-term potential catch: The largest annual harvest in weight that could be removed from a fish stock year after year, under existing environmental conditions.

Recruitment: The number of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term is also used in referring to the number of fish from a year class reaching a certain age. For example, all fish reaching their second year would be age 2 recruits.

Recruitment overfishing: The rate of fishing above which the recruitment to the exploitable stock becomes significantly reduced. 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.

Spawning stock biomass: The total weight of all sexually mature fish in the population.

Spawning stock biomass-per-recruit (SSB/R): The expected lifetime contribution to the spawning stock biomass for each recruit. An equilibrium value of SSB/R is calculated for each level of F for a given exploitation pattern, rate of growth, and natural mortality. This means that under constant conditions of growth, natural mortality, and exploitation patterns over the life span of the species, an expected average SSB/R would result from each constant rate of fishing.

Status of exploitation: An appraisal of exploitation is given by the scientists for each stock using the terms under-exploited, fully-exploited, and over-exploited. These terms describe the effect of current fishing effort on each stock, and are equivalent to the Councils' terms of under-fished, fully-fished, or over-fished.

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

Virtual population analysis (or cohort analysis): A retrospective analysis of the catches from a given year class over its life in the fishery. This technique is used extensively in fishery assessments since it requires only information on catches in number by age each year.

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

Yield-per-recruit (Y/R): The average expected yield in weight from a single recruit. For a given exploitation pattern, rate of growth, and natural mortality, an equilibrium value of Y/R is calculated for each level of F.

Silver Hake Overview

Assessment of the status of silver hake stocks and the provision of management advice is hampered by several problems. First, there remains considerable uncertainty about the current definition of stock boundaries. Possible mixture of silver hake from the presently defined southern stock with those from the northern stock in the region of Cultivator Shoals may be introducing considerable variability into the landings at age matrices for both stocks. Second, discarding of juvenile silver hake appears to be substantial for both stocks and lack of discard estimates in the catch at age renders any virtual population analysis (VPA) results suspect. The emerging juvenile fishery has not yet been adequately monitored. Finally, biological sampling in the ports and aboard commercial vessels has been insufficient in recent years to adequately estimate the length and age composition of the catch

The SARC can provide basic advice on these stocks based on indices of relative abundance and total mortality estimates derived from bottom trawl survey data. The SARC can also provide advice on the long-term consequences to both stocks of continued exploitation of both juvenile and adult components of the stock, but the impact of recent increases in landings of juvenile silver hake from both stocks cannot be quantified at present because of insufficient information on the extent of landings and discards.

These stocks were last assessed in 1990 at the 11th SAW. At that time biological reference points were derived from stock and recruitment data computed from a VPA using landings data. For the northern stock, F_{REP} was estimated at 0.51 corresponding to 31% of the maximum spawning potential (MSP), and for the southern stock, at 0.39, corresponding to 42% of the MSP. New information in this assessment estimated an exploitation pattern which allowed for discards, and produced an F of 0.36 for the northern stock and 0.34 for the southern stock.

A. GULF OF MAINE - NORTHERN GEORGES BANK SILVER HAKE

State of Stock: Stock abundance appears to be increasing while landings remain relatively low and the stock is at least fully-exploited. The age structure is still severely truncated as few fish older than age 4 have been detected in the population. Although uncertain, fishing mortality (F) is estimated as 0.4 during 1988-1992, and is near the revised overfishing level of 0.36.

Management Advice: The exploitation pattern in this fishery is problematic and could become of greater concern if increased effort is directed towards juvenile hake. Information on increased landings of juvenile silver hake is insufficient at present to document any quantitative impacts on the stock. If the increased landings are derived from catches that would otherwise have been discarded, then there would be no further impact on the stock and overall yield would increase by the newly retained catches. If, on the other hand, the increase in landings of juveniles is the result of increased exploitation on younger ages, spawning stock biomass and catches of large silver hake will decline and the stock will become over-exploited. Furthermore, under any exploitation pattern, increases in effort on this stock are not warranted. Under the current fishing mortality rate and exploitation pattern, strong recruiting year classes are not likely to contribute to any significant rebuilding of the stock biomass.

Persistent discarding or landing of small hake results in a substantial loss of yield from the adult component of the stock and a reduction in spawning stock biomass per recruit (Figure A3). Most of the discard of silver hake consists of juveniles in the range of 15-25 cm (6-10 inches) at age 1 and, to a lesser extent, at age 2. The SARC notes that the size at 50% maturation is 22-23 cm (9 inches) and the age at 50% maturation is 1.7 year for males and females. To better assess the impact of the emerging juvenile fishery it will be necessary to collect additional information on juvenile catch and discard.

Forecast for 1994: No forecasts were performed.

Landings and Status Table (weights in '000 mt): Northern Silver Hake

Year	1986	1987	1988	1989	1990	1991	1992	Max (1955-1992)	Min (1955-1992)	Mean (1955-1992)
Total Comm Landings	8.5	5.7	6.8	4.6	6.4	6.1	5.3	94.5	3.4	28.6
USA Comm Landings	8.5	5.7	6.8	4.6	6.4	6.1	5.3	62.8	3.4	20.6
Discards	N/A	N/A	N/A	7.2	1.8	1.7	2.9	N/A	N/A	N/A
USA Rec Landings	-	-	-	-	-	-	-			
Catch used in Assessment	8.5	5.7	6.8	11.8	8.2	7.8	8.2	94.5	3.4	28.9
Survey F's, Age 3+	— 0.51 —			——	0.40		——			

Catches: Total annual commercial landings declined from over 90,000 mt in 1963 to less than 10,000 mt since 1979 (Figure A1). The 1992 landings of 5,300 mt is among the lowest on record. Discard estimates for 1989-1992 represent a substantial fraction of the total catch.

Data and Assessment: Data are seriously lacking for this species (see overview). This stock was last assessed in December 1990 at the 11th SAW. Indices of abundance are available from NEFSC bottom trawl surveys. Estimates of total mortality are also available from spring and autumn surveys. Yield and SSB per recruit analyses are based on an exploitation pattern derived from analysis of catch-at-age including discards from 1989 through 1992. Discards were estimated from data derived from the NEFSC Sea Sampling Program.

Fishing Mortality: Based on a VPA analysis on landings data from the 11th SAW, F decreased from values in excess of 1.0 during the late 1970's to half that by the early 1980's (Figure A1). Average F derived from bottom trawl survey indices was 0.47 in 1974-1977; 0.58 in 1979-1982; 0.51 in 1984-1987 and 0.40 in 1989-1992 (Figure A1). The estimates of F are uncertain due to insufficient information on the levels of natural mortality and this most recent estimate of F is also uncertain due to recent variability in the survey indices.

In 1990, biological reference points were derived from stock and recruitment data computed from a VPA using landings data. For this stock, F_{REP} (F_{MED}) was estimated at 0.51 corresponding to 31% MSP (Figure A3). The current assessment estimated an exploitation pattern which allowed for discards (the "Ref" line in Fig. A3), and produced an F of 0.36, corresponding to 31% MSP. If increased mortality on ages 1 and 2 is from a new fishery on juveniles (e.g., the "+100%" line in Fig. A3), then F at 31% MSP would be 0.29.

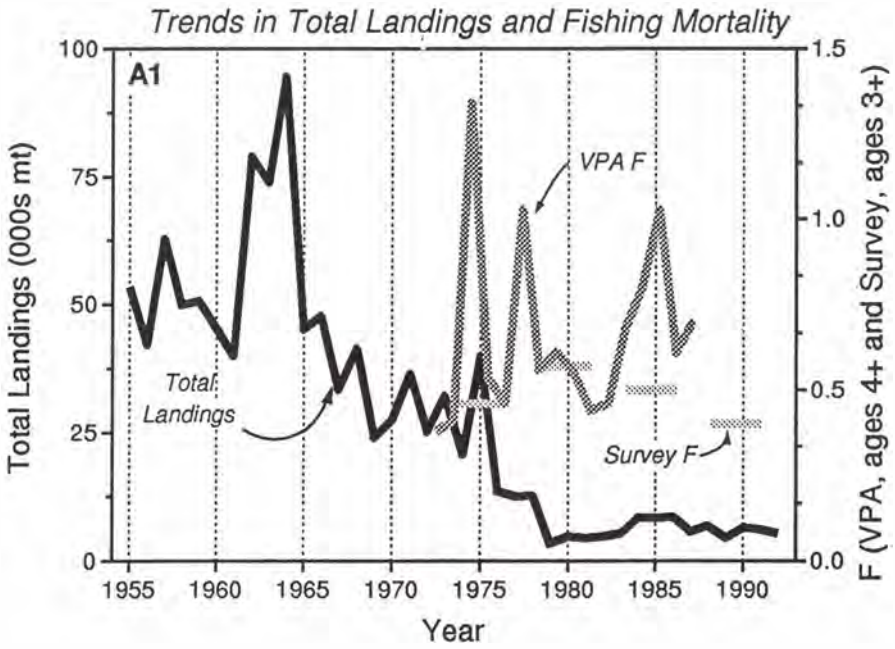
Recruitment: The 1985, 1988 and 1991 year classes appear to be particularly strong as indicated by research vessel surveys (Figure A2).

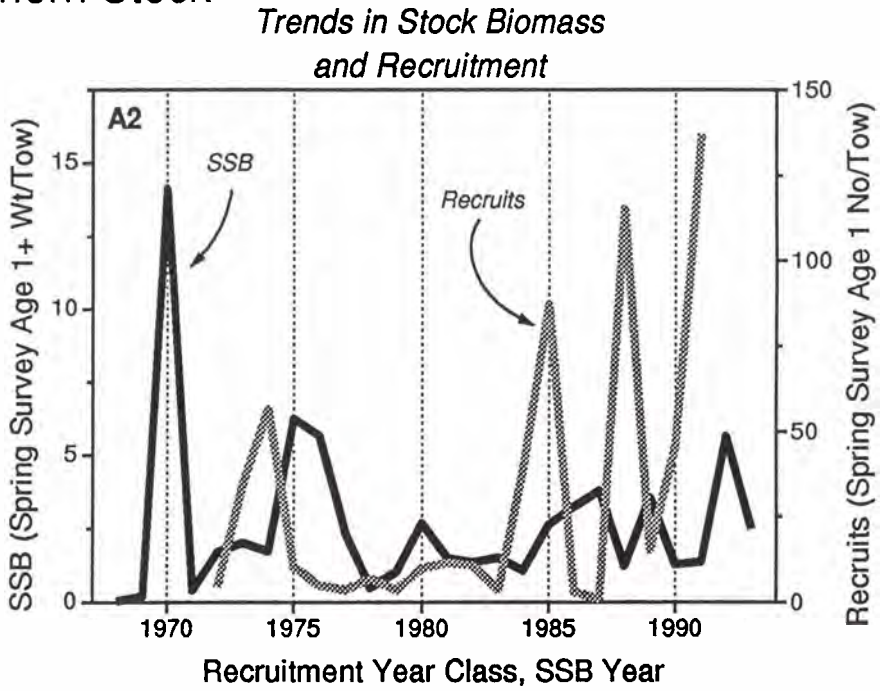
Stock Biomass: Total biomass is increasing due to the contribution of pre-recruit biomass from recent year classes, however, there is no corresponding increase in adult biomass (Figure A2).

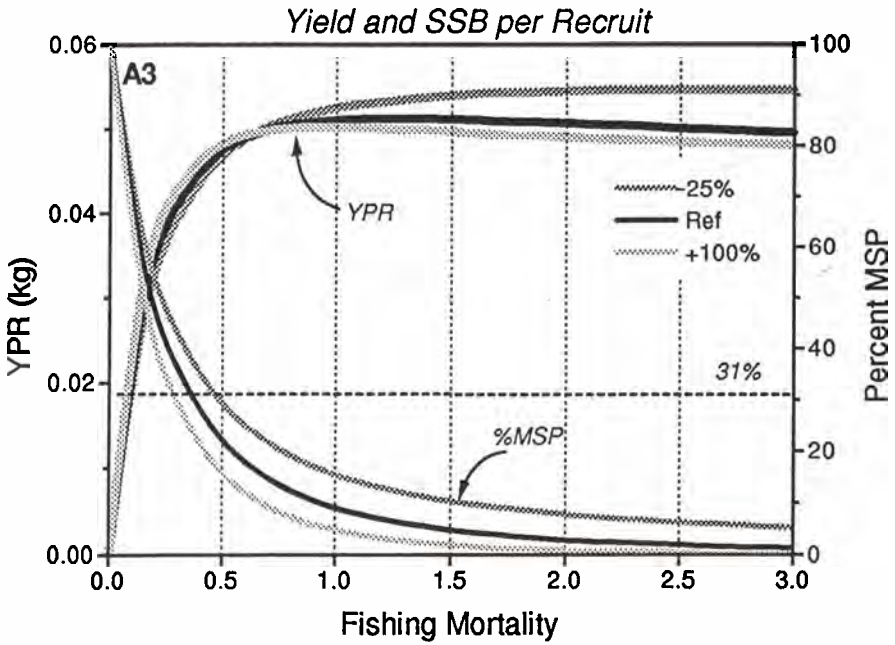
Special Comments: Despite continued low levels of landings since 1979, the age structure of the stock remains severely truncated as few fish older than 4 years appear in the population. Considering that recruitment has been relatively good in recent years, this suggests that total mortality has remained high either from predation on juvenile hake or because of unaccounted fishing mortality due to discarding.

Source of Information: Report of the 17th SAW; Report of the 11th SAW; Helser, T. E., NEFSC Lab Ref 94-01.

Silver Hake-Northern Stock







B. SOUTHERN GEORGES BANK - MIDDLE ATLANTIC SILVER HAKE

State of Stock: Stock abundance continues to decline and is at a low level (Figure B2). Landings remain relatively low and the stock is considered to be over-exploited. The age structure is still severely truncated as few fish older than age 4 have been detected in the population. Although the actual level of fishing mortality (F) is uncertain because natural mortality is not well known, F appears to have been close to 1.2 during 1988-1992. For the purpose of comparison, F_{REP} (F_{MED}) is 0.39.

Management Advice: Fishing effort on this stock needs to be reduced. The exploitation pattern in this fishery is problematic and is expected to become of greater concern if increased effort is directed towards juvenile hake. Recent reports of increased landings of juvenile silver hake are insufficient at present to document any quantitative impacts on the stock. If the increased landings are derived from catches that would otherwise have been discarded, then there would be no further impact on the stock and yield would increase by the newly retained catches. If, on the other hand, the increase in landings of juveniles is the result of increased exploitation on younger ages, spawning stock biomass and catches of large silver hake will decline and the stock will become increasingly over-exploited. Furthermore, under any exploitation pattern, increases in effort on this stock are not warranted. Under the current fishing mortality rate and exploitation pattern, strong recruiting year classes are not likely to contribute to any significant rebuilding of the stock biomass.

Persistent discarding or landing of small hake results in a substantial loss of yield from the adult component of the stock and a reduction in spawning stock biomass per recruit (Figure B3). Most of the discard of silver hake consists of juveniles in the range of 15-25 cm (6-10 inches) at age 1 and, to a lesser extent, at age 2. The SARC notes that the size at 50% maturation is 22-23 cm (9 inches) and the age at 50% maturation is 1.7 year for males and females. To better assess the impact of the emerging juvenile fishery it will be necessary to collect additional information on juvenile catch and discard.

Forecast for 1994: No forecasts were performed.

Landings and Status Table (weights in '000 mt): Southern Silver Hake

Year	1986	1987	1988	1989	1990	1991	1992	Max (1955-1992)	Min	Mean
Total Comm Landings	10.0	10.0	9.2	13.2	13.6	10.1	10.3	305.7	9.2	49.9
USA Comm Landings	9.5	10.0	9.2	13.2	13.6	10.1	10.3	25.0	5.2	11.4
Other Comm Landings[1]	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	283.4	<0.1	56.3
Discards	N/A	N/A	N/A	10.0	4.5	1.2	3.8	N/A	N/A	N/A
USA Rec Landings	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.0	<0.1	0.7
Catch used in Assessment	10.1	10.1	9.2	23.2	18.1	11.3	14.1	305.7	9.2	52.4
Survey F's, Age 3+	— 0.71 ——			——	1.16	——				

[1] 1962-1987

Catches: Total annual commercial landings declined from over 300,000 mt in 1965 to less than 15,000 mt since 1980 (Figure B1). Total landings have been stable since 1986 between 9,000 and 14,000 mt. The 1992 total of 10,300 mt is among the lowest on record. Discard estimates for 1989-1992 represent a substantial fraction of the total catch.

Data and Assessment: This stock was last assessed in December, 1991 at the 11th SAW. Data are seriously lacking for this species (see overview). Indices of abundance are available from NEFSC bottom trawl surveys. Estimates of total mortality are also available from spring and autumn surveys. Yield and SSB per recruit analyses are based on an exploitation pattern derived from analysis of catch at age including discards from 1989 through 1992.

Fishing Mortality: Based on a VPA analysis on landings data from the 11th SAW, F decreased from a mean of 1.0 during 1974-1977 to 0.5 during 1978-1980 and increased to over 1.0 during 1983-1987 (Figure B1). The average F derived from bottom trawl survey indices was 0.37 in 1974-1977, 0.27 in 1979-1982, 0.71 in 1984-1987 and 1.16 in 1989-1992 (Figure B1). The estimates are uncertain due to insufficient information on the level of natural mortality and, for the most recent estimates, because of survey variability as well.

At SAW11 in 1990, biological reference points were derived from stock and recruitment data computed from a VPA using landings data. For this stock, F_{REP} (F_{MED}) was estimated at 0.39 corresponding to 42% MSP (Figure B3). The current assessment estimated an exploitation pattern which allowed for existing discards (the "Ref" line in Fig. B3), and produced an F of 0.34, corresponding to 42% MSP. If increased mortality on ages 1 and 2 is from a new fishery on juveniles (e.g., the "+100%" line in Fig. B3), then F at 42% MSP would be 0.25.

Recruitment: The 1984, 1988 and 1991 year classes appear to be above average as indicated by research vessel surveys (Figure B2).

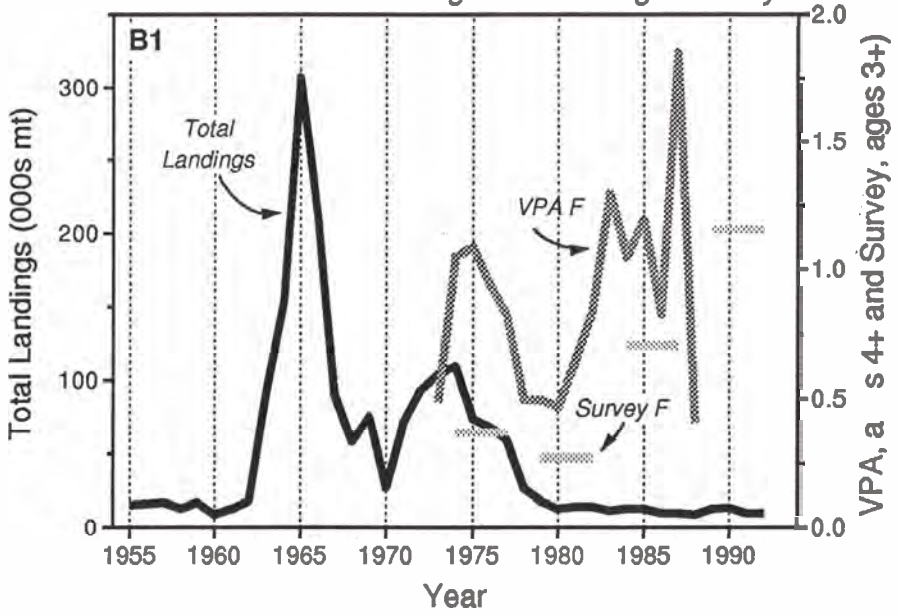
Stock Biomass: Despite some recent above average recruitment, total weight per tow indices have declined from the late 1980s (Figure B2).

Special Comments: Despite continued low levels of landings since 1980, the age structure of the stock remains severely restricted as few fish older than 4 years appear in the population. Considering that recruitment has been at least average in recent years, this suggests that total mortality has remained high either from predation on juvenile hake or because of unaccounted fishing mortality due to discarding.

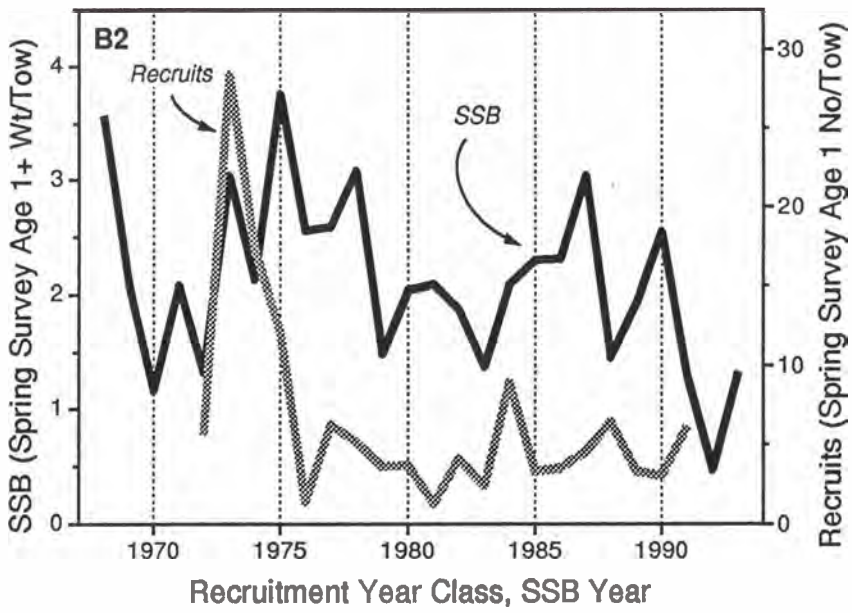
Source of Information: Report of the 17th SAW; Report of the 11th SAW; Helser, T. E., NEFSC Lab Ref 94-01.

Silver Hake-Southern Stock

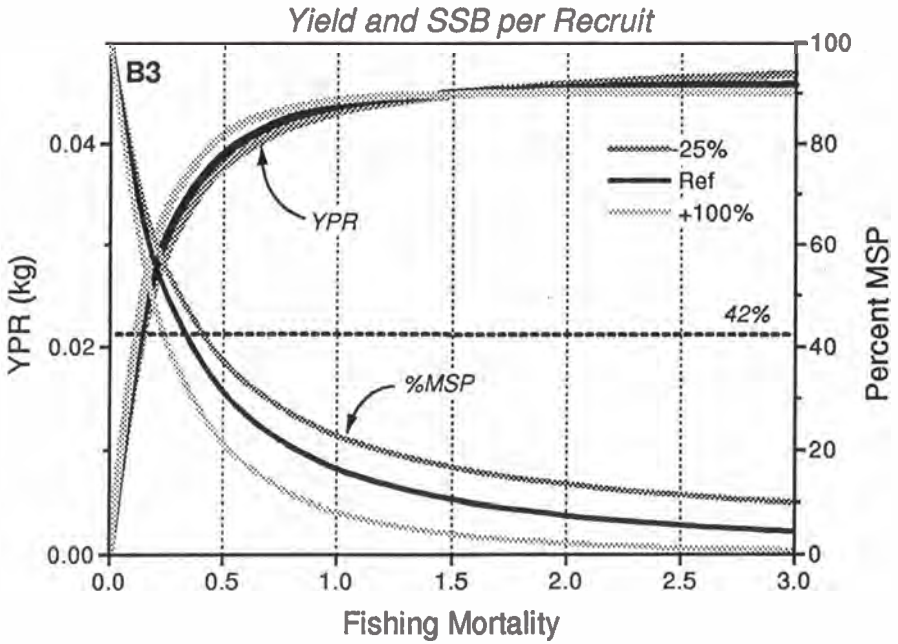
Trends in Total Landings and Fishing Mortality



Trends in Stock Biomass and Recruitment



Yield and SSB per Recruit



C. SOUTHERN NEW ENGLAND YELLOWTAIL FLOUNDER

State of stock: The stock is at low biomass levels and is over-exploited. The fishing mortality rate has been extremely high, reaching exploitation rates greater than 80% in recent years (Figure C1). The current exploitation rate is 84%, well above the 35% exploitation rate associated with $F_{20\%}$. This means that currently for every 100 fish alive at the beginning of the year, only 8 survive to the beginning of the next year. Spawning stock biomass in 1992 was at a record low level (1,300 mt). Recruitment in the last three years has been the poorest on record. The stock has collapsed!

Management Advice: Fishing mortality on this stock should be reduced to levels approaching zero. This includes discard mortality in other small mesh fisheries.

Forecast for 1994: Because of uncertainty in 1993 stock size estimates, a stochastic forecast for 1994 was used to estimate stock sizes in 1993-1994. An exploitation rate of 84% was assumed in 1993. Even under optimistic assumptions concerning recruitment in 1993-1994, mean landings in 1994 will probably be well below 1,000 mt, and spawning stock biomass (SSB) will be less than 2,500 mt; both well below average. If poor recruitment occurs in 1993-1994, landings and spawning stock biomass will remain very low, probably at less than 600 mt and 1,100 mt, respectively. Under any projection scenario, discards will exceed landings.

By 1995, with three consecutive years of high recruitment and restrictions on fishing mortality in 1994-1995 to exploitation rates of < 35%, spawning stock biomass could return to 1990 levels (approximately 14,000 mt). Otherwise, with three consecutive years of medium recruitment, SSB would increase to about 4,000 mt, if exploitation rates dropped below 60% in 1994-1995.

Forecast for 1993-1995: (Assumes F in 1993 was 2.3.)

		1993			1994			1995		
F(1994-95)	Recruitment	Landings	Discards	SSB	Landings	Discards	SSB	Landings	Discards	SSB
2.3	High	564	744	1052	603	1197	2262	2686	6999	9860
Status quo)	Medium				550	900	1315	1011	2209	3034
	Low				535	819	1053	548	894	1157
2.1	High				572	1112	2312	2554	6539	10231
(90% SQ)	Medium				524	843	1363	989	2091	3177
	Low				510	769	1101	557	864	1237
1.14	High				403	714	2548	1850	4338	11983
(50% SQ)	Medium				377	563	1592	835	1468	3930
	Low				369	522	1327	550	675	1714
0.49	High				213	349	2758	1032	2164	13636
($F_{20\%}$)	Medium				202	284	1797	542	781	4775
	Low				198	265	1531	406	399	2336

Landings and Status Table (weights in '000 mt, recruitment in millions): Southern New England Yellowtail Flounder

Year	1986	1987	1988	1989	1990	1991	1992	1993	Max	Min	Mean
									(1973-1992)		
Commercial Landings (000 mt)	3.3	1.6	0.9	2.5	8.0	3.9	1.4	0.6	6.4	0.9	5.0
Commercial Discards (000 mt)	1.3	0.9	1.3	5.1	9.1	2.5	1.1	0.7	9.1	1.1	3.1
Catch used in assessment (000 mt)	4.6	2.5	2.2	7.6	17.1	6.4	2.5		20.8	2.2	8.0
Spawning stock biomass[1]	2.9	1.7	6.1	21.9	14.2	3.7	1.3	1.0	21.9	1.3	8.8
Recruitment (Age 1)	7.0	14.0	121.9	16.4	6.0	3.7	5.5	2.5	126.9	3.7	33.5
Mean F (Ages 3-6, unweighted)	1.4	1.7	1.4	1.2	2.3	1.9	2.3		2.5	0.6	1.3
Exploitation Rate	70%	76%	70%	65%	86%	79%	84%		86%	41%	67%

[1]On 1 June, the peak of the spawning season, age 1 (13% mature), age 2 (74% mature).

Catches: Estimated landings from the stock peaked at 33,200 mt in 1969, but declined to 1,600 mt by 1976 (Figure C1). Although landings briefly averaged 13,500 mt in 1982-1983, they quickly declined to a new record low level of 900 mt in 1988. In 1992, commercial landings were 1,400 mt (Figure C1), 500 mt above the 1988 record-low level, but the second-lowest level in the landings history of the stock (since 1935). Landings through September in 1993 were less than 400 mt; projected total landings for 1993 are less than 600 mt. Based on recent sea sampling data, discard rates of age 1 through 5 fish are 91%, 76%, 49%, 23% and 10%, respectively.

Data and Assessment: Yellowtail flounder was last assessed at the 12th SAW in 1990. The current assessment is based on virtual population analysis of commercial landings-at-age and estimated discard-at-age data. Natural mortality (M) was assumed to be 0.2. Information on recruitment and stock abundance was used from NEFSC spring and autumn bottom trawl surveys and NEFSC scallop surveys. The uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1993 was evaluated (Figures C5 and C6). Precision of assessment results is declining with declining stock status, and traditional techniques are compromised by the truncated age structure of the stock and changing fishery targeting patterns as year class strength and regulations change over time.

Fishing Mortality: Fishing mortality rates have been very high over the last several years (Figure C1, C3), with exploitation rates generally between 65% and 85% during 1982-1992. Exploitation rates this high are far in excess of the overfishing definition, which is 0.49 ($F_{20\%}$), implying a 35% exploitation rate. In spite of low stock abundances in the mid-1980s, exploitation rates still remained above 60%. Exploitation rates in 1992 may be as high as 85%.

Recruitment: The last relatively strong year class was in 1987 — 122 million age 1 fish (Figure C2). The 1989-1991 year classes were the smallest of the 1973-1992 series. The abundance of the 1992 year class in 1993 was estimated using 1993 spring survey data to be about 2.5 million fish, but the precision of the estimate is low.

Spawning Stock Biomass: Spawning stock biomass declined 94% between 1989-1992; from 22,000 mt to 1,300 mt as the 1987 year class was removed from the spawning stock (Figure C2). A similar pattern occurred in 1982-1987, when spawning stock biomass declined from 22,000 mt to 1,700 mt as the 1980 year class was removed from the spawning stock. Spawning stock biomass will continue to decline in 1993, to about 1,100 mt, because year classes following the 1987 year class are weak. Although the 1987 year class was produced from a low spawning stock biomass, only one strong year class has been produced when spawning stock biomass is in the lower third of the time series.

Special Comments: This stock has collapsed. Although assessment results have become imprecise at such low stock sizes, it is clear that recent year classes have been weak, while fishery mortality rates remain high. If any strong year classes appear in the future, the fishery has the potential to rapidly remove them. For example, the 1987 year class of 122 million fish was removed in three years (9% survived to reach age 4 and < 1% survived to reach age 5). Discarding in this fishery is substantial: significant numbers are discarded even as old as age 4. The compensatory responses of the population to this extreme level of exploitation (especially changes in growth, maturation and sex ration) should be investigated.

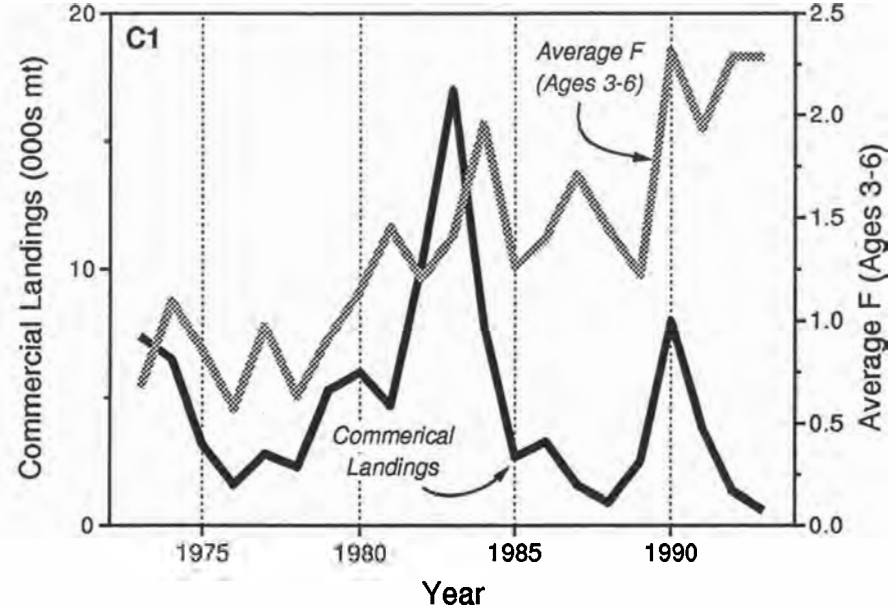
Minimum fish size for yellowtail and other fisheries should not exceed the L25 level (11" for 5 1/2" square mesh). Discarding in this fishery is substantial, but although reducing minimum size to below 13" would reduce discards, it would not change the high rate of fishing mortality currently experienced by the stock.

In the past the stock has rebuilt quickly from one outstanding year class, thus the stock should be closely monitored.

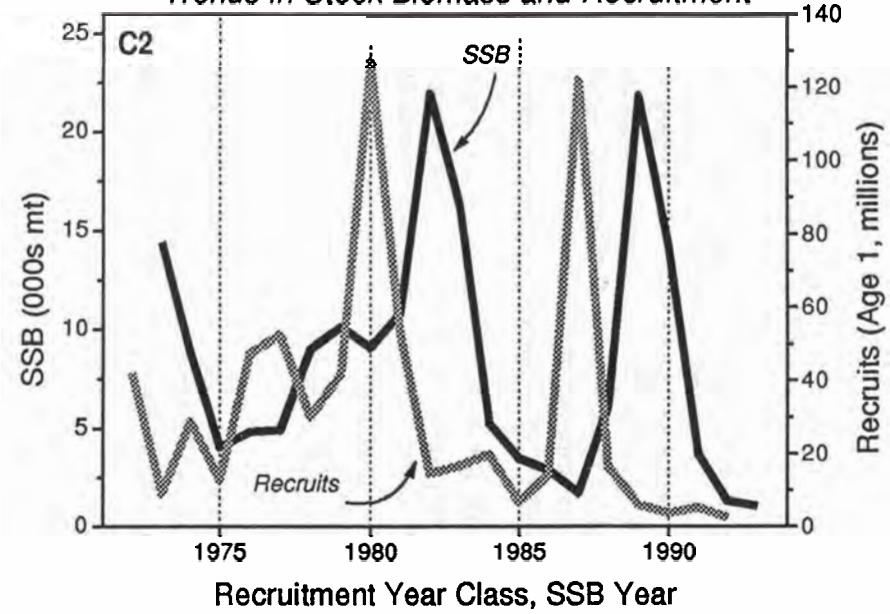
Source of Information: Report of the 17th Northeast Regional Stock Assessment Workshop (17th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 93-06) Rago, P., W. Gabriel, and M. Lambert, 1993, Assessment of Yellowtail Flounder *Plueronectecs ferrugineus*, (NEFSC Ref. Doc. 94-02).

Southern New England Yellowtail Flounder

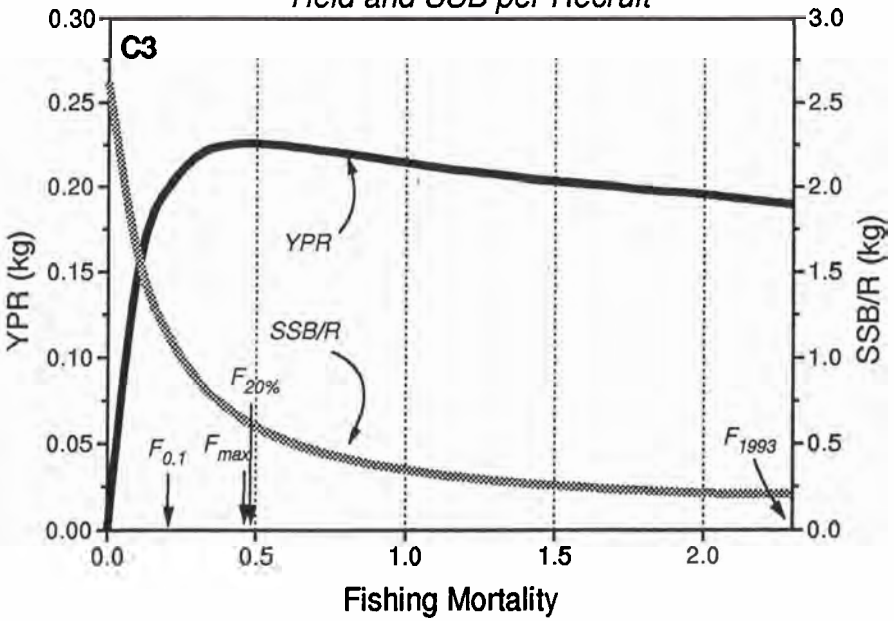
Trends in Commercial Landings and Fishing Mortality



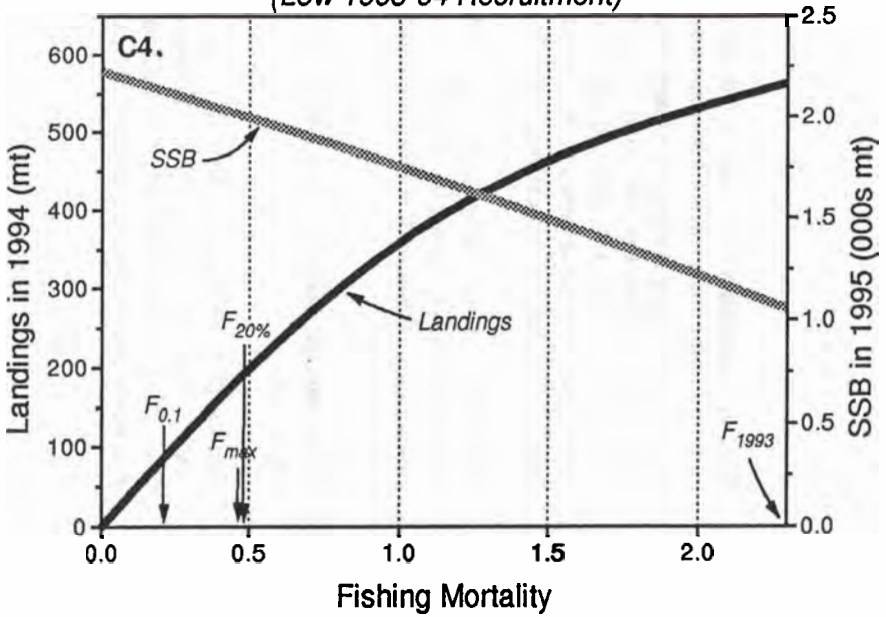
Trends in Stock Biomass and Recruitment



Yield and SSB per Recruit

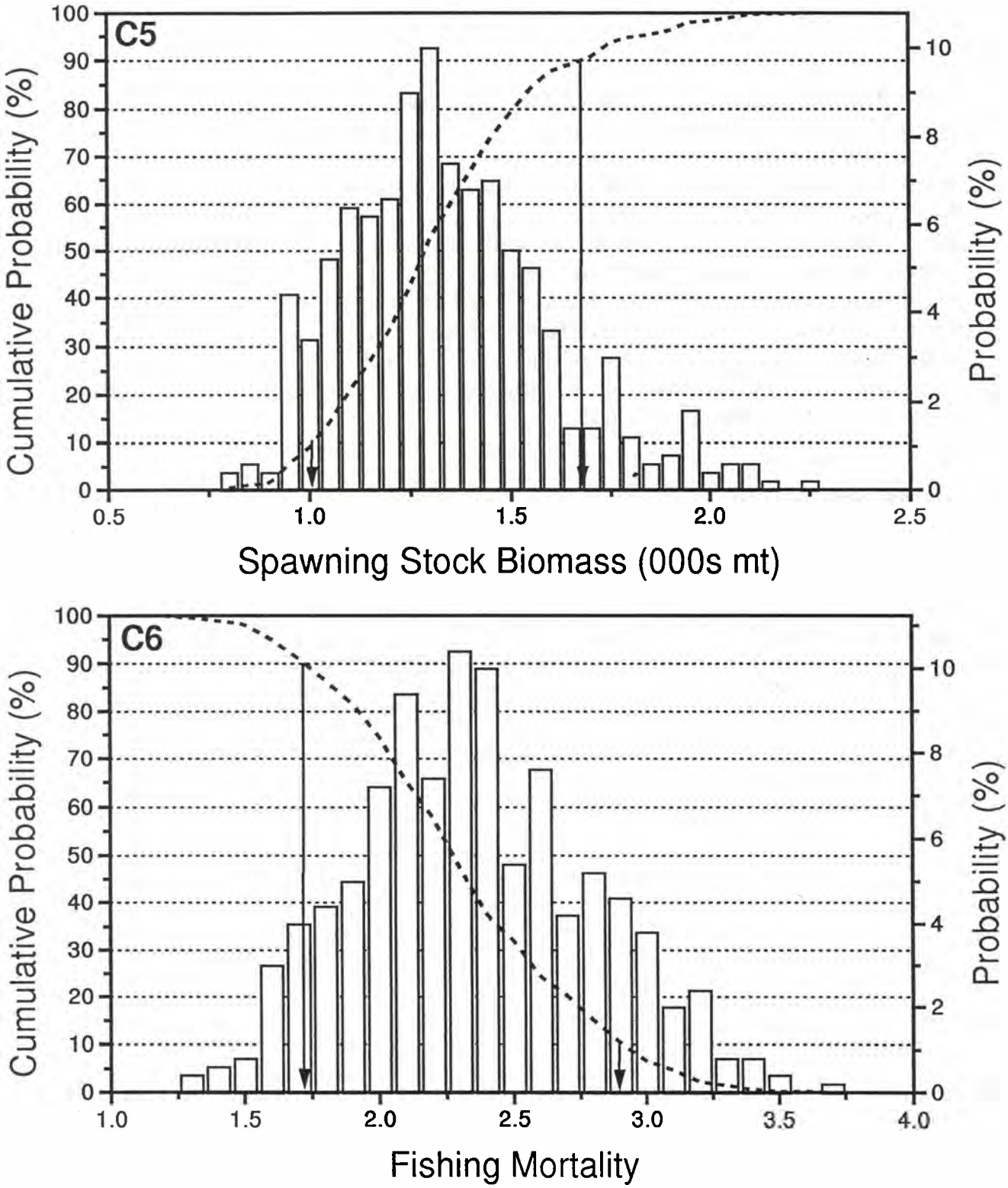


Short-Term Landings and Spawning Stock Biomass
(Low 1993-94 Recruitment)



Southern New England Yellowtail Flounder

Precision Estimates for SSB and Fishing Mortality



Precision of the estimates of spawning stock biomass, SSB, (top panel) and fishing mortality, F, (lower panel) for Southern New England yellowtail flounder. The bar height indicates the probability of values within that range. The dashed line gives the probability that SSB is less than or F is greater than the corresponding value on the x-axis. The arrows indicate the approximate 90% and 10% confidence levels for SSB and F.

D. BLUEFISH

State of Stock: The stock is considered to be at a medium level of historical abundance (1960-1993) and is probably fully exploited. Indices of abundance from commercial and recreational fisheries as well as research surveys indicate a decline in abundance from the record high levels in the early 1980's. Current levels of abundance are probably similar to levels prior to the late 1970's, when the stock increased dramatically. Catch per unit of effort has declined at higher rates in more northern areas, implying that the availability of bluefish in New England waters has declined relative to the southern region. Low recruitment indices after 1989 will result in lower recreational catches in 1994 if effort remains at current levels. Commercial landings have remained relatively stable in recent years. Reasons for the differential trends in commercial and recreational fisheries are not well understood, but probably reflect changes in availability and targeting of local concentrations as well as changes in abundance.

Management Advice: The decline in abundance should be halted. Most of the mortality is generated in the recreational fishery and reductions in mortality on early ages should be considered.

Forecast for 1994: No forecasts were performed.

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

Year	1986	1987	1988	1989	1990	1991	1992	1993	1979-1992 Max	1979-1992 Min	1979-1992 Mean
USA Comm Landings	6.7	6.6	7.2	4.7	6.2	6.2	5.0	-	7.5	4.7	6.3
Discards, commercial	Discards occur but reliable estimates are not available										
USA Rec Landings[1]	51.1	36.0	28.6	18.2	18.2	15.3	12.2		64.6	12.2	38.2
USA Rec Catch[2]	59.4	43.5	35.7	23.0	23.7	21.1	17.0	-	69.6	17.0	44.3
Catch used in assessment[3]	57.8	42.5	35.7	23.0	24.5	21.4	17.3	-	71.4	17.3	44.5

1 Includes recreational landings plus 25% of released fish (i.e., discard mortality rate is 25%).
2 Includes all recreational catch, landed or released, dead or alive.
3 Total fishing mortality - commercial and recreational landings (1986 and 1987 include foreign commercial landings of 28 and 2 mt, respectively).

Catches: After peaking at 76,500 mt in 1980, total catch has declined to 22,000 mt in 1992 (Figure D1). Most of the decline has been due to a steady drop in the recreational catch, from 69,600 mt in 1980 to 17,000 mt in 1992. Recreational fishing effort for bluefish, defined as those trips catching or targeting bluefish, declined from a peak of about 14 million trips in 1980 to about 9.0 million trips in 1987 and has remained stable through 1992. Commercial landings have remained stable at 5,000-7,000 mt since 1980. Recreational landings include a mortality component from bluefish released alive (assumed 25% mortality).

Data and Assessment: Bluefish were last assessed in December 1990 at the 11th SAW . The current assessment is an interim step in the development of an age-structured assessment for bluefish. Biological sampling has been inadequate for the recreational fishery and, since 1989, for the commercial fishery. No ages are collected in the recreational fishery. Biological sampling, however, has been good in the NC commercial fishery . A standard length-to-age conversion method for bluefish has been adopted, and consistent series of catch-at-age data from the recreational and commercial fisheries and from research surveys have been compiled. No consensus, however, has been reached on estimates of stock size and fishing mortality rates derived from age-structured analyses. Natural mortality rates are now assumed to be in the range of 0.20-0.25.

Fishing Mortality: No estimates of fishing mortality (F) were made. Trends in commercial and recreational effort indicate F has been relatively stable since 1988.

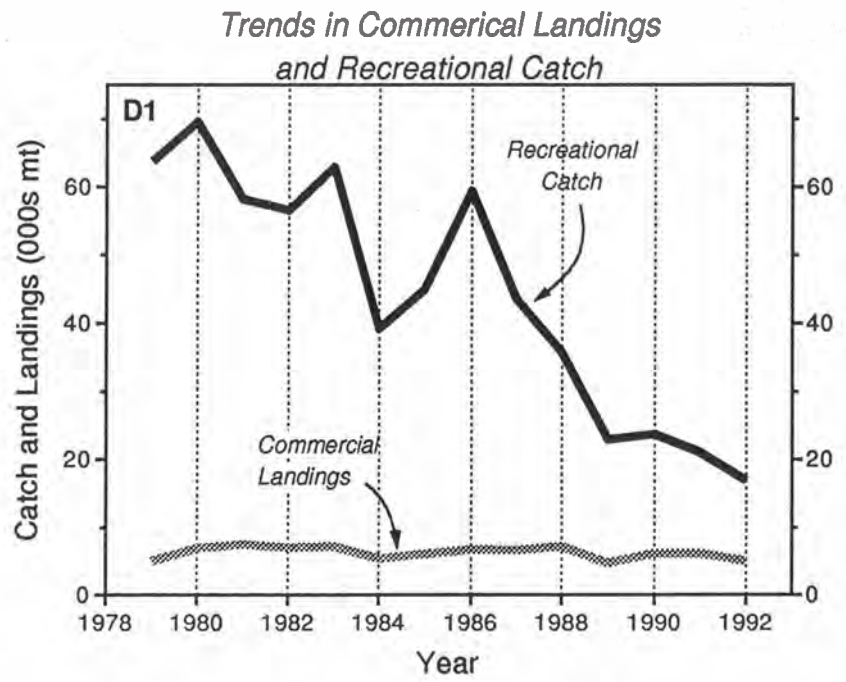
Recruitment: Indices of recruitment are available from research survey data collected by the states of Rhode Island, Connecticut, Delaware, Virginia, and North Carolina, as well as from NEFSC surveys (Figure D2). Most of these surveys indicate that the strongest recent year classes recruited to the bluefish stock in 1984 and 1989, with poor recruitment in 1992 and 1993.

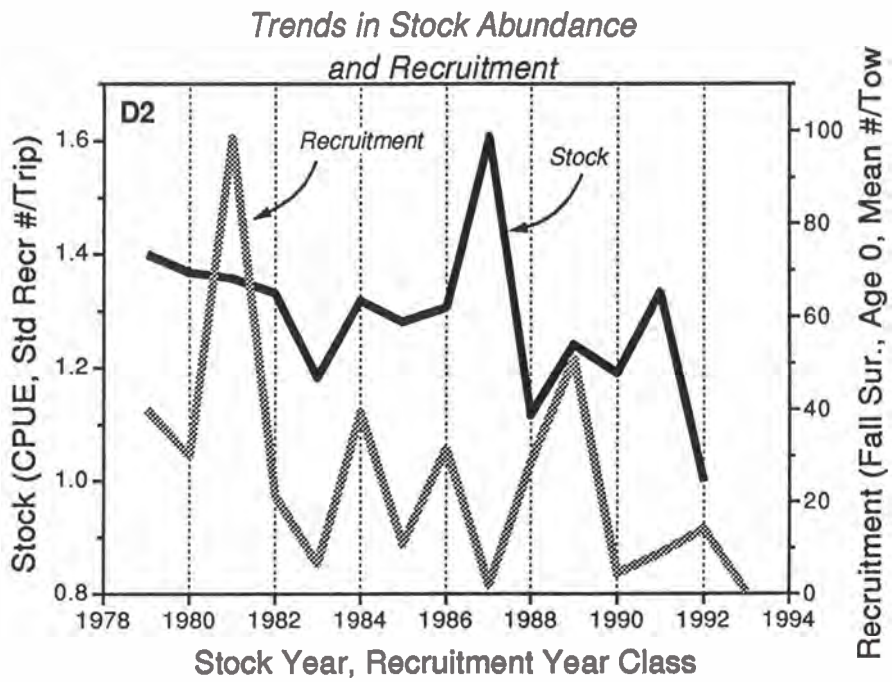
Stock Biomass: Indices of abundance available from fisheries data suggests a steady decline in bluefish abundance since 1979 (Figure D2). Current levels of abundance are probably similar to levels that occurred prior to the build up of the stock in the 1970's.

Special Comments: Work on age-structured analyses to estimate stock size and fishing mortality rates is ongoing. Revised analytical assessments will be attempted as soon as possible.

Source of Information: Report of the 17th Northeast Regional Stock Assessment Workshop (17th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 93-06).

Bluefish


Trends in Commerical Landings
and Recreational Catch
D1
Recreational
Catch
Commercial
Landings
Catch and Landings (000s mt)
Year
0
20
40
60
1978
1980
1982
1984
1986
1988
1990
1992


Trends in Stock Abundance
and Recruitment
D2
Recruitment
Stock
Stock (CPUE, Std Recr #/Trip)
Recruitment (Fall Sur., Age 0, Mean #/Tow
Stock Year, Recruitment Year Class
0.8
1.0
1.2
1.4
1.6
0
20
40
60
80
100
1978
1980
1982
1984
1986
1988
1990
1992
1994

E. ATLANTIC BUTTERFISH

State of Stock: The stock is at a low to medium biomass level and current catch levels are below the MSY of 16,000, however, exploitation rate is unknown. Although recruitment of butterfish has remained high in recent years, the stock size of adults has declined since 1990 and is currently well below average. Since 1988, annual butterfish landings have averaged 2,500 mt, or only 25% of the domestic allowable harvest (DAH) of 10,000 mt. Landings in 1993 are projected to be 3,000 mt. Survey biomass indices in autumn 1992 and spring 1993 were among the lowest in the survey time series. Fishing effort increased in 1992 but, overall, has been relatively stable since 1984. Commercial landings per unit of effort (LPUE) in 1992 remained at the low levels observed since 1988.

Management Advice: Butterfish landings in recent years have been well below historical average yields. Japanese demand for butterfish has waned and this has had a negative impact on harvest levels. Butterfish landings are thus unlikely to increase unless market demand improves. If demand does improve, however, the stock in its current condition may not be able to sustain landings in excess of the long term historical average (1965-1992) of 7,200 mt because of recent declines in abundance as indicated by survey indices.

Historical information suggests that discarding of butterfish may be an important source of fishing-induced mortality. The SARC recommends that data be collected that would allow discard levels to be reliably estimated.

Given that butterfish is a short-lived species, new approaches to the assessment and management of the stock are required. A more adaptive, real-time assessment/management system will be needed to maintain full exploitation of the stock while simultaneously ensuring that adequate spawning stock levels are achieved. This would involve both real-time evaluation of stock status and in-season catch level adjustments.

Forecast for 1994: No forecasts were performed.

Landings and Status Table (weights in '000 mt): Butterfish

Year	1986	1987	1988	1989	1990	1991	1992	Pred 1993	(1968 - 1992) Max	Min	Mean
USA Comm Landings	4.4	4.5	2.0	3.2	2.3	2.2	2.7	2.7	12.0	0.8	3.4
Foreign Comm Landings	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8	0.0	4.0
Total Comm Landings	4.6	4.5	2.0	3.2	2.3	2.2	2.7	4.2	19.5	2.0	7.4
Discards	Discards occur but reliable estimates not available										
Catch used in Assessment	4.6	4.5	2.0	3.2	2.3	2.2	2.7	-	19.5	2.0	7.4
Fall Svy Age 0 Index	140.2	78.6	282.3	332.3	328.3	168.4	230.3	-	358.8	26.3	166.5
Fall Svy Age 1+ Index	44.3	39.0	35.1	66.0	38.3	24.4	14.1	-	100.4	8.7	44.2
Fall Svy Wt/Tow Index	6.8	4.7	7.3	12.2	8.9	5.3	4.5	-	15.2	2.3	7.1
USA Otter Trawl Effort[1]	1830	1361	1532	1560	1405	1143	1676	-	1830	990	1405
USA Otter Trawl LPUE[2]	1.8	2.6	0.9	1.3	1.0	1.2	1.1	-	6.7	0.9	2.5

[1] Standard days fished [2] MT per standard day fished

Catches: From 1920 to 1962, US commercial landings averaged 3,500 mt per year. Foreign landings began in the mid-1960s and averaged 8,000 mt during 1965-1976. Total annual landings peaked in 1973 at 19,500 mt, but since 1977, have ranged between 2,000 and 12,400 mt (Figure E1). Since 1988, annual landings have averaged 2,500 mt. Butterfish landings in 1992 were 2,700 mt, and are projected to be about 4,200 mt in 1993. Discard levels could not be determined therefore total catch (landings + discards) is unknown.

Data and Assessment: Atlantic butterfish were last assessed in August 1991 (SAW 12). The current assessment relies on indices of stock size and recruitment from NEFSC research vessel survey data, and newly developed standardized commercial effort and landings-per-unit-effort data.

Fishing Mortality: No estimates of current fishing mortality are available. Estimates of total mortality derived from NEFSC autumn survey data indicate that age-0 total mortality rates have been at record-high levels since 1989 and that age-2 total mortality has been relatively high since 1987. Age 1 mortality remains high following a peak in 1990 (Figure E1). Overall, survival to older ages has decreased in recent years, and this decreased survival may reflect an increase in the natural mortality rate, an increase in discard mortality, or a reduced availability of older age groups. For these reasons estimates of F from survey data are unreliable.

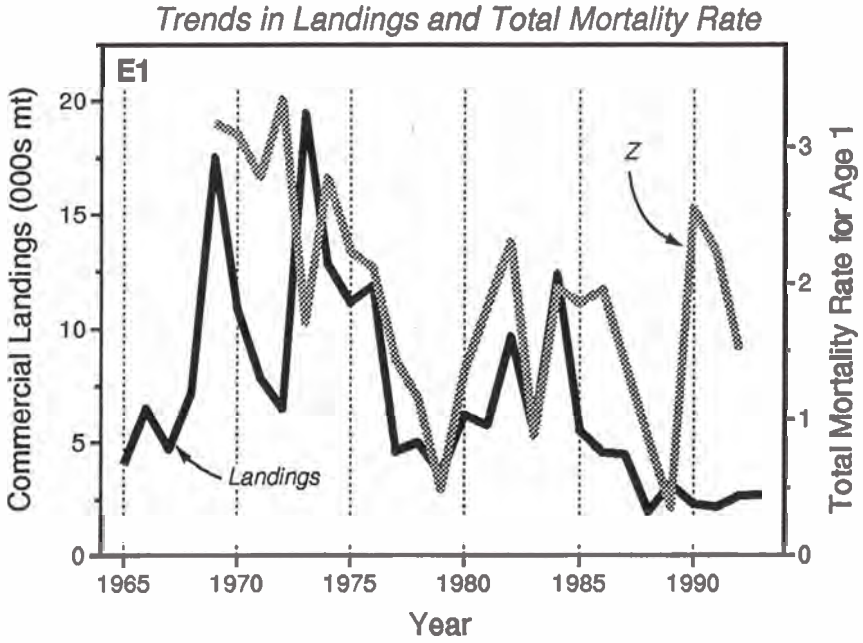
Recruitment: The NEFSC autumn 1992 survey pre-recruit (age 0) index increased from the 1991 level and was 40% above the long-term average (Figure E2). Despite declines in the adult stock, the abundance of pre-recruits has remained high since 1987. In fact, the estimates of pre-recruit abundance for 1988-1990 were twice the long term average.

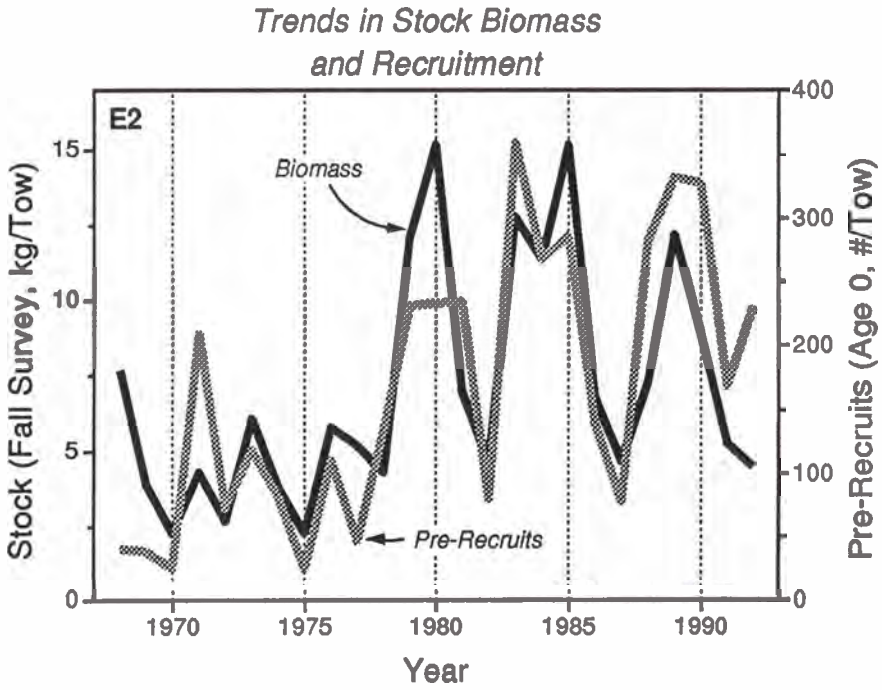
Spawning Stock Biomass: NEFSC survey indices of the adult component of the butterfish stock have declined since 1989 (Figure E2). The autumn 1991 survey index (5.3 kg/tow) was about three fourths the long term average (7.1 kg/tow) and the 1992 index (4.5 kg/tow) was the lowest since 1978. The landings per days absent (LPUE) for the USA otter trawl fishery for 1992 were the second lowest in the 10 year time series from 1982 to the present. Overall, the survey results and recent commercial LPUE indices (1988-1992) indicate that the spawning stock biomass is currently below average and lower than during the 1982-1987 period.

Special Comments: Further evaluation of the precision and design of the NEFSC Sea Sampling Program is needed in order to evaluate butterfish discards by fishery. Sea sampling trips need to be conducted on vessels targeting butterfish since no discard data are available from these vessels. $F_{0.1}$ was last calculated in 1983 by Waring and Anderson (1983) as 1.60, and should be reexamined.

Sources of Information: Report of the 17th Northeast Regional Stock Assessment Workshop (17th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 94-06); Brodziak, J., 1993, Stock assessment for Atlantic butterfish, *Peprilus tricanthus*, in the Northwest Atlantic during 1992 (NEFSC Lab Ref. Doc. 94-03); Waring, G. T. and E. D. Anderson, 1983, Status of the northwestern Atlantic butterfish stock - 1983, NEFSC Lab. Ref. Doc. 81-41; and ICES, 1993, Report of the working group on methods of fish stock assessment, Copenhagen, February, ICES CM 1993/Assess:12.

Butterfish


Trends in Landings and Total Mortality Rate
E1
Commercial Landings (000s mt)
Total Mortality Rate for Age 1
Landings
Z
0
5
10
15
20
0
1
2
3
1965
1970
1975
1980
1985
1990
Year


Trends in Stock Biomass
and Recruitment
E2
Stock (Fall Survey, kg/Tow)
Pre-Recruits (Age 0, #/Tow)
Biomass
Pre-Recruits
0
5
10
15
0
100
200
300
400
1970
1975
1980
1985
1990
Year

F. LONG-FINNED SQUID

State of Stock: The stock is at a medium biomass level, and is probably fully-exploited. The current MSY of 44,000 mt is based on a 3-year life span and may too high if *Loligo* is an annual species. The most recent estimate of MSY based on an annual cycle is 36,000 mt. Annual catches above 30,000 mt may only be attainable in years of very high abundance. Projected landings in 1993 are 21,500 mt and do not include discards. If discards are significant, the stock in 1993 must be considered as fully exploited. Survey biomass indices in autumn 1992 and spring 1993 were 35-50% below average. Although a strong year class recruited to the winter 1992-1993 fishery (generating large increases in landings), spring 1993 survey abundance indices were sharply lower - rather than higher - than in 1992. Fishing effort in the offshore fishery has doubled since 1985 and was the second-highest on record in 1992 (Figure F4).

Management Advice: In order to maintain the current yield, exploitation rate should not be increased. Irrespective of the actual MSY level, the potential for recruitment overfishing of *Loligo* may be substantial since only a single cohort exists at any one time and this cohort recruits to the fishery and the spawning stock within the same year. Failure to ensure an adequate annual level of spawning escapement can jeopardize both the stock and the fishery.

Given that *Loligo* is a short-lived species, new approaches to the assessment and management of the stock are required. A more adaptive, real-time assessment/management system will be needed to maintain full exploitation of the stock while simultaneously ensuring that adequate spawning stock levels are achieved. This would involve both real-time evaluation of stock status and in-season catch level adjustments.

Forecast for 1994: No forecasts were performed.

Landings and Status Table (weights in '000 mt): Long-finned squid

Year	1986	1987	1988	1989	1990	1991	1992	Pred 1993	(1967 - 1992) Max	Min	Mean
USA Comm Landings	13.3	11.5	19.1	23.7	15.0	19.4	18.2	21.5	23.7	0.7	7.3
Foreign Comm Landings	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.5	0.0	12.5
Total Comm Landings	17.9	11.5	19.1	23.7	15.0	19.4	18.2	21.5	37.6	1.2	17.8
Discards	Discards occur but reliable estimates not presently available										
Catch used in Assessment	17.9	11.5	19.1	23.7	15.0	19.4	18.2	21.5	37.6	1.2	17.8
Fall Svy Prerec Index[1] (Recruits)	364.6	33.9	316.0	291.3	286.6	194.7	755.8	-	755.8	33.9	225.7
Fall Svy Wt/Tow Index[2] (SSB)	8.9	2.2	7.7	11.9	9.2	11.0	5.3	-	13.1	2.2	8.2
Small-Vessel Effort[3]	113	139	196	184	150	152	86	-	210	76	139
Small-Vessel LPUE[4]	5.3	3.0	4.7	4.3	3.0	3.3	1.8	-	7.8	1.8	4.0
Large-Vessel Effort[3]	2206	1578	1571	1693	1517	1946	2109	-	2206	373	1421
Large-Vessel LPUE[4]	3.7	4.7	6.8	8.7	6.8	7.2	7.4	-	8.7	3.7	5.8

[1] NEFSC Fall Survey Mean Number Per Tow Index (< 8 cm) [2] NEFSC Fall Survey Mean Weight (kg) Per Tow Index
[3] Standard days fished [4] MT per standard day fished

Catches: Prior to 1967, US commercial landings of squid (*Loligo* and *Illex* combined) averaged about 2,000 mt per year. A directed foreign fishery developed in 1967 and subsequently landings markedly increased (Figure F1). During 1967-1986, total landings averaged 20,400 mt (4,100 mt US; 16,300 mt foreign) and peaked at 37,600 mt in 1973 (Figure F1). Foreign fishing ceased in 1987 and annual landings (solely US) averaged 17,800 mt during 1987-1992. Landings in 1993 are projected to be 21,500 mt, 18% higher than in 1992. Beginning in the early 1980s, the domestic fishery began to shift from a primarily inshore, small-vessel fishery to an offshore, large-vessel fishery. Since 1985, offshore fishery landings have accounted for 92-99% of the total annual landings.

Data and Assessment: *Loligo* were last assessed in July 1992 (SAW 14). The current assessment relies on indices of stock size and recruitment from NEFSC and Massachusetts research vessel survey data, and newly developed standardized commercial effort and landings-per-unit-effort data (Figure F4). Provisional surplus production analyses, yield per recruit analyses (YPR) and spawning stock biomass per recruit analyses (SSB/R) were also conducted (Figure F3). For the YPR and SSB/R analyses, new life history parameters, based on an annual life span, were used.

Fishing Mortality: No estimates of current fishing mortality are available. Provisional YPR results indicate, in terms of monthly fishing rates, that $F_{0.1} = 0.16$ and $F_{max} = 0.26$ (Figure F3). These translate to annual rates of 1.92 and 3.12. These reference points are 47% and 76% of the assumed monthly natural mortality rate ($M_m = 0.34$; $M_{ANNUAL} = 4.08$), suggesting that fishing mortality should be kept below natural mortality for this stock.

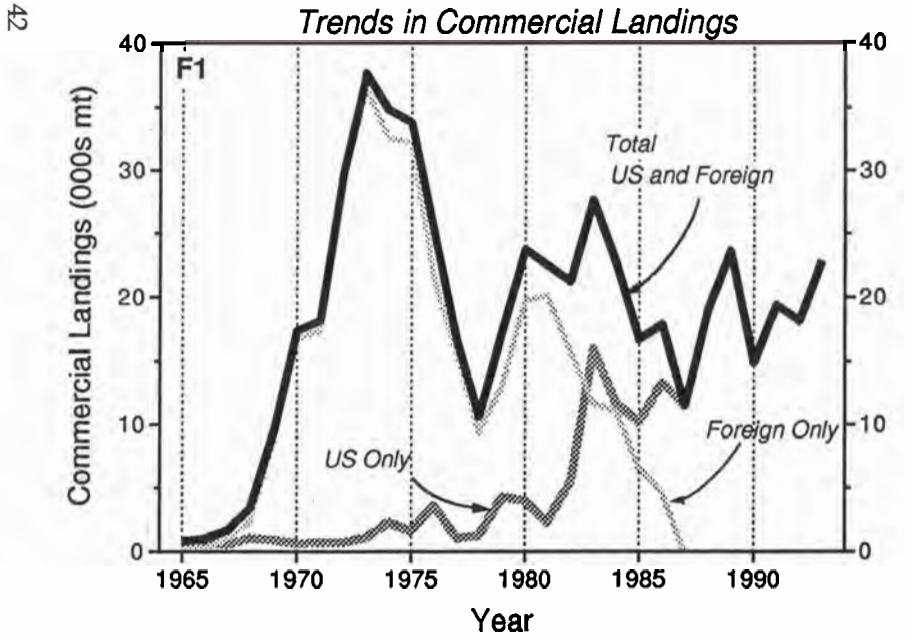
Recruitment: The NEFSC autumn 1992 survey pre-recruit index was the highest on record and suggested that a very large cohort would be available to the offshore fishery in winter 1992-1993. Landings during the first four months of 1993 were 67% higher than in 1992, indicative of the rapid growth and recruitment of *Loligo* to the offshore fishery. The 1993 fall index is among the lowest on record and one half the long term average (Figure F2). Assuming average recruitment, estimated annual potential yield from the stock (based on the provisional YPR results) is about 36,000 mt, with a 95% confidence interval of 22,000 - 49,000 mt.

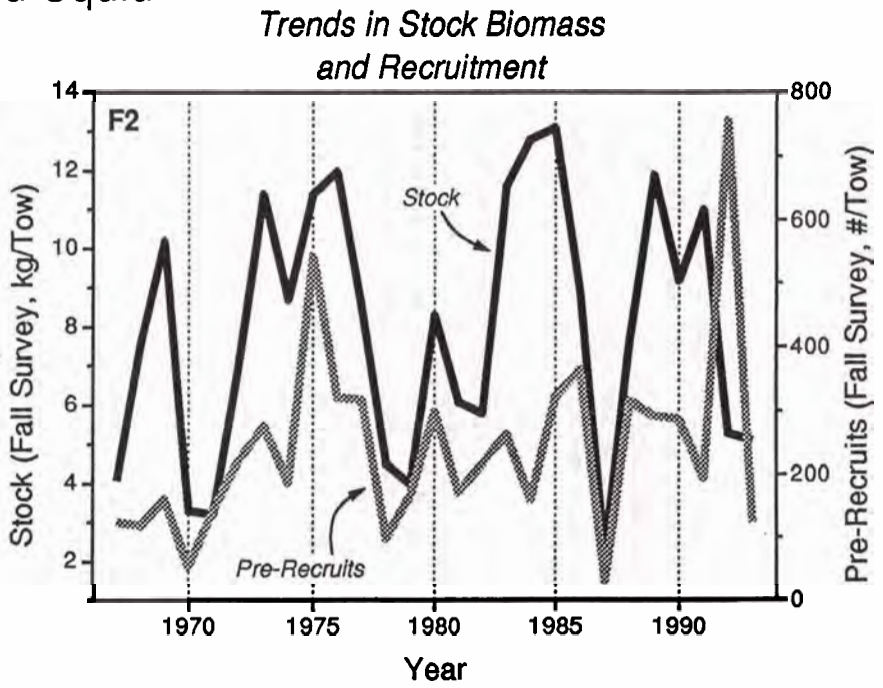
Spawning Stock Biomass: NEFSC survey indices of the adult component of the stock declined in autumn 1992 and spring and autumn 1993 and were below the long term average (Figure F2). In both surveys, the total weight-per-tow indices were also below average and lower than in the preceding year. The 1993 NEFSC spring survey indices did not reflect a high abundance of *Loligo* which might have been expected given the record-high autumn 1992 pre-recruit index.

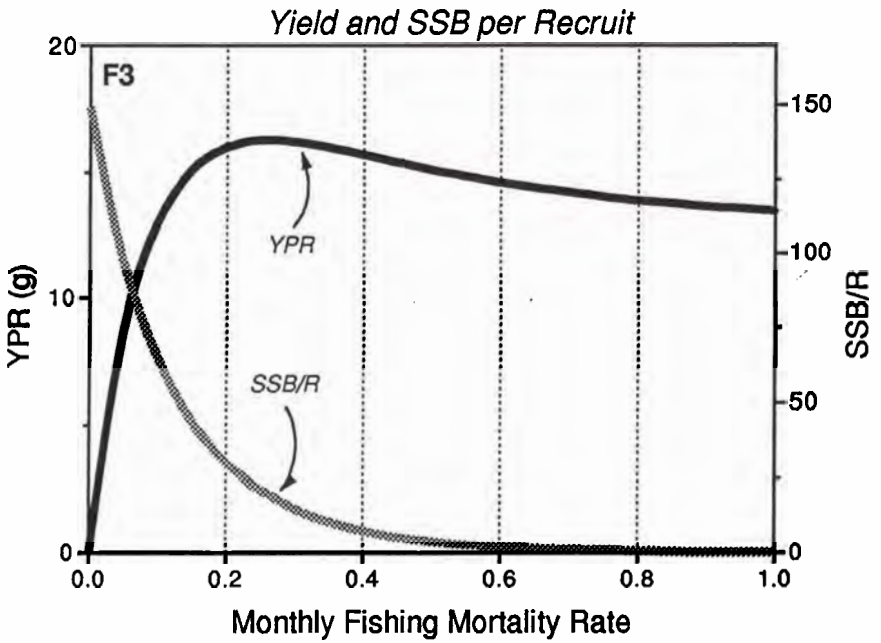
Special Comments: Recent research on the age and growth of *Loligo* indicate a lifespan of less than one year. Previous assessments assumed a lifespan of as much as three years based on modal analysis of survey length-frequency data. Given that *Loligo* is an annual species, new estimates of MSY are required and new approaches to the assessment and management of the stock should be developed. As well, a new overfishing definition needs to be prepared which recognizes that only a single cohort supports both the fishery and the spawning stock.

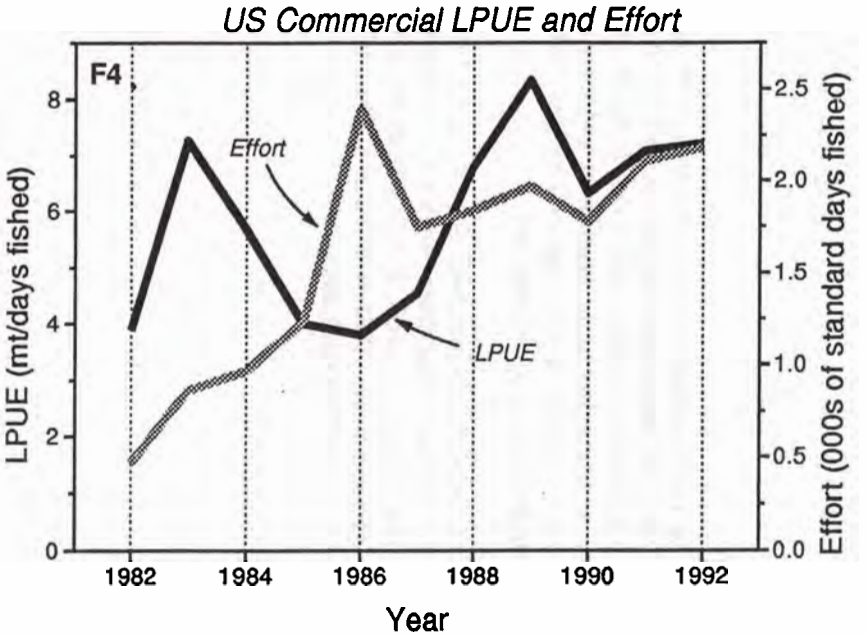
Sources of Information: Report of the 17th Northeast Regional Stock Assessment Workshop (17th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 94-06); Brodziak, J., 1993, Stock assessment for long-finned squid, *Loligo pealei*, in the Northwest Atlantic during 1992 (NEFSC Ref. Doc. 94-04); and ICES, 1993, Report of the working group on methods of fish stock assessment, Copenhagen, February, ICES CM 1993/Assess:12.

Long-Finned Squid









G. SHORT-FINNED SQUID

State of Stock: The stock is at a medium biomass level, and is under-exploited (based on the current MSY level of 30,000 mt). However, a large fraction of this stock is distributed outside U.S. waters. Also, this MSY level may no longer be appropriate; as the current estimate was based on a 2-year life span for *Illex* which is now recognized as an annual species. During 1990-1992, US annual landings of *Illex* averaged 13,700 mt, about twice as high as during 1983-1989 (7,000 mt). US landings in 1992 were a record-high 17,800 mt and are projected to be 15,000 mt in 1993, the second-highest domestic harvest on record. Fishing effort in 1992 increased to a record-high level, but commercial LPUE declined (Figure G4). As such, annual domestic landings above the 1990-1992 average (14,000 mt) may not be realized in 1994 and 1995. The most recent NEFSC survey indices (spring 1992-1993; autumn 1991-1992) indicate that *Illex* is presently at an intermediate level of abundance.

Management Advice: *Illex* is now documented to be an annual species. Re-evaluation of MSY is required based on new life history parameters. The potential for recruitment overfishing of *Illex* may be substantial since only a single cohort exists at any one time and this cohort recruits to the fishery and the spawning stock within the same year. Failure to ensure an adequate annual level of spawning escapement can jeopardize both the stock and the fishery.

Since *Illex* is a transboundary stock between the US and Canada, a joint assessment approach involving US and Canadian scientists would be beneficial.

Given that *Illex* is a short-lived species, new approaches to the assessment and management of the stock are required. A more adaptive, real-time assessment/management system will be needed to maintain full exploitation of the stock while simultaneously ensuring that adequate spawning stock levels are achieved. This would involve both real-time evaluation of stock status and in-season catch level adjustments.

Forecast for 1994: No forecasts were performed.

Landings and Status Table (weights in '000 mt): Short-finned squid

Year	1986	1987	1988	1989	1990	1991	1992	Pred 1993	(1967 - 1992) Max	Min	Mean
USA Comm Landings	5.2	10.3	2.0	6.8	11.3	11.9	17.8	15.2	17.8	0.1	4.0
Foreign Comm Landings	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	8.1
Total Comm Landings	5.4	10.3	2.0	6.8	11.3	11.9	17.8	15.2	24.9	0.6	12.2
Discards	Discards occur but reliable estimates are not available										
Catch used in Assessment	5.4	10.3	2.0	6.8	11.3	11.9	17.8	15.2	24.9	0.6	12.2
Fall Svy Prerecruit Index[1] (Recruits)	0.5	1.3	0.7	1.9	1.2	0.4	3.3	-	6.2	0.1	1.3
Fall Svy Wt/Tow Index[2] (SSB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	20.0	0.1	2.7
USA Otter Trawl Effort[3]	116	119	37	113	385	272	526	-	526	37	260
USA Otter Trawl LPUE[4]	37.0	54.3	52.9	60.4	29.4	43.7	33.9	-	60.4	20.0	38.2

[1] NEFSC Fall Survey Mean Number Per Tow Index (< 10 cm) [2] NEFSC Fall Survey Mean Weight (kg) Per Tow Index
[3] Standard days fished [4] MT per standard day fished

Catches: Prior to 1967 US commercial landings of squid (*Illex* and *Loligo* combined) averaged about 2,000 mt per year (Figure G1). A directed foreign fishery for *Illex* developed in 1967 in US EEZ waters and continued through 1982 (Figure G1). During this period, total landings averaged 19,250 mt, with the foreign fishery accounting for 95% of the harvests. Since 1983, annual landings from the US EEZ (solely US) have ranged between 2,000 and 17,800 mt, and have averaged 9,400 mt per year. Landings in 1992 attained a record-high level (17,800 mt) and are projected to be about 15,000 mt in 1993.

Data and Assessment: *Illex* were last assessed in July 1992 (SAW 14). The current assessment relies on indices of stock size and recruitment from NEFSC research vessel survey data, and newly developed standardized commercial effort and landings-per-unit-effort data. No new information is available on yield per recruit or spawning stock biomass per recruit, but previous analyses were based on a two-year, rather than a one-year, life cycle. New analyses need to be conducted using life history parameters consistent with an annual lifespan.

Fishing Mortality: No estimates of current fishing mortality are available. Domestic fishing effort for *Illex* increased sharply in 1992 to a record high level. Although large inter-annual changes in *Illex* fishing effort are not uncommon, effort has trended upward since 1988. Commercial LPUE indices were highest during 1987-1989 (Figure G4). LPUE values in 1991 and 1992 were about 30% lower than the peak values, but near the 1982-1992 average.

Recruitment: The NEFSC autumn 1992 survey pre-recruit index was the third highest on record (Figure G2). However, no clear relationship exists between survey pre-recruit indices and the abundance of recruits.

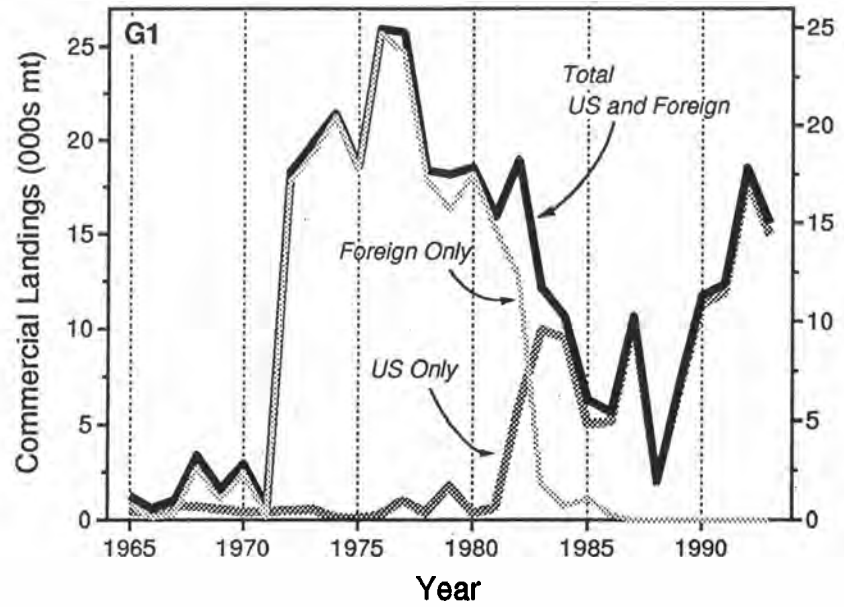
Spawning Stock Biomass: NEFSC survey indices of the adult (recruited) component of the stock indicate a cyclical pattern in *Illex* stock abundance over the past 25 years. Periods of low indices (1967-1974 and 1982-1986) have been followed by periods of very high abundance indices (1975-1981 and 1988-1990) (Figure G2). The most recent recruit indices (spring 1992-1993; autumn 1991-1992), however, are neither high nor low - but near the long-term average. Such periods of intermediate *Illex* abundance have not been previously observed.

Special Comments: Recent research on the age and growth of *Illex* indicate a lifespan of no more than one year. Previous assessments and advice were based on a two-year, crossover life cycle. Given that *Illex* is an annual species, new estimates of MSY are required and new approaches to the assessment and management of the stock should be developed. As well, a new overfishing definition needs to be prepared which recognizes that only a single cohort supports both the fishery and the spawning stock.

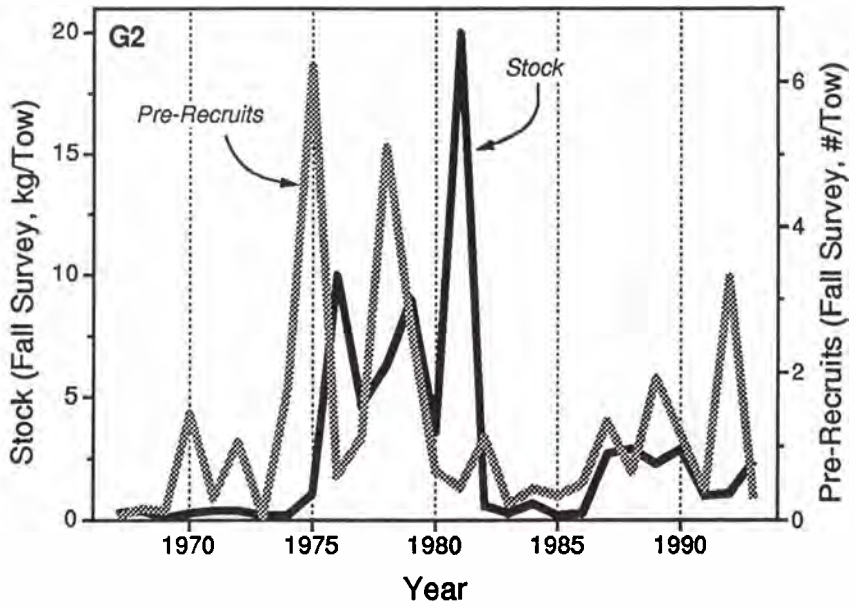
Sources of Information: Report of the 17th Northeast Regional Stock Assessment Workshop (17th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 94-06); Brodziak, J., 1993, Stock assessment for short-finned squid, *Illex illecebrosus*, in the Northwest Atlantic during 1992 (NEFSC Ref. Doc. 94-05); and ICES, 1993, Report of the working group on methods of fish stock assessment, Copenhagen, February, ICES CM 1993/Assess:12.

Short-Finned Squid

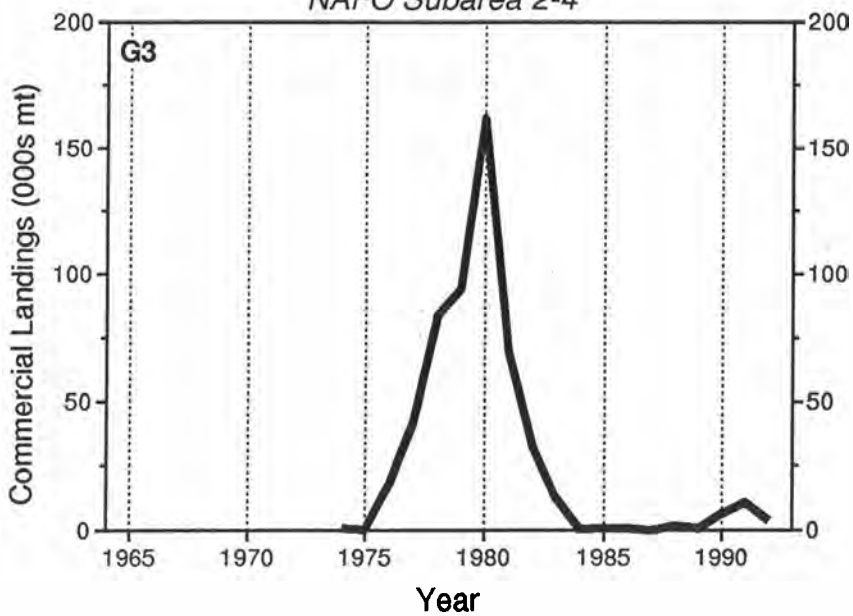
Trends in Commercial Landings
NAFO Subarea 5-6



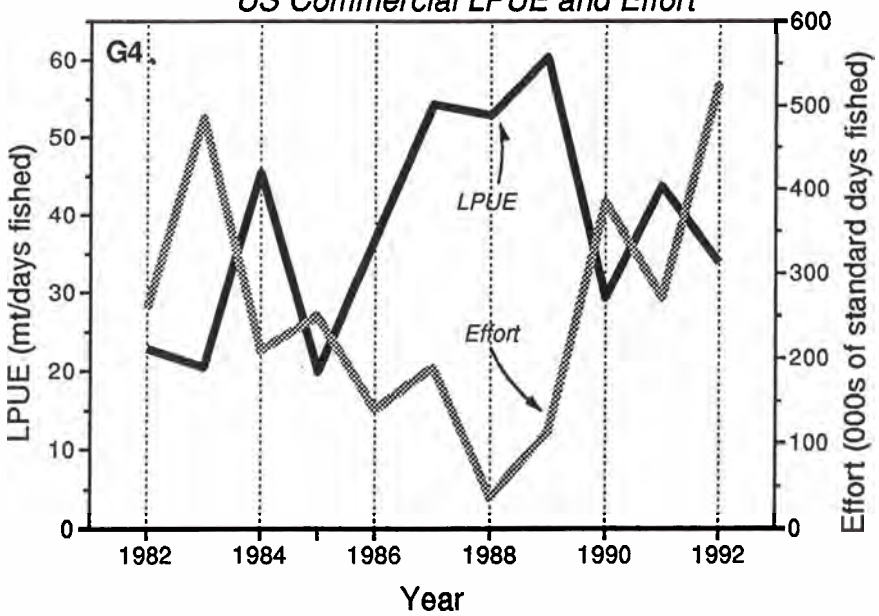
Trends in Stock Biomass
and Recruitment



Trends in Commercial Landings
NAFO Subarea 2-4



US Commercial LPUE and Effort



CONCLUSIONS OF THE SAW STEERING COMMITTEE

(Committee Members: *J. Dunnigan, ASMFC; D. Keifer, MAFMC; D. Marshall, NEFMC; A. Peterson, NMFS/NEFSC; R. Roe, NMFS/NER.*)

The SAW-17/18 Steering Committee Meeting was held on 15 February 1994 in East Boston, Massachusetts. C. Moore represented the Mid-Atlantic Fishery Management Council and D. Keifer. In addition to the Steering Committee members, participants included: C. Kellogg (NEFMC); and V. Anthony, T. P. Smith, and H. Mustafa (NEFSC/NMFS).

Dr. Vaughn Anthony, SAW Chairman, led the discussions outlined in the agenda (Table 7). Steering Committee functions were reviewed and Advisory Report, items form the SAW-17 SARC and Plenary meetings, research recommendations, and the SAW process were thoroughly discussed. The Steering Committee then set the species/stocks to be assessed and reviewed along with their terms of reference and the dates for the SAW-18 meetings; and, suggested species and meeting dates for SAW-19.

1. Advisory Document

The Steering Committee recommended that a glossary of terms be included in the Advisory Report along with additional sections on biological reference points and stock identification. It was agreed to add a preliminary glossary this time and the additional sections in the future. Possible addition of species distribution charts and a classification chart incorporating the species reviewed was suggested.

The content of the glossary was discussed at length. It was agreed that a glossary of terms should be as simple as possible so that it can be understood by persons outside the technical field, but noted that some technical language is unavoidable. Readers do not necessarily have to understand the technical aspects of the prepared advice and should have a certain amount of trust in the technical experts. The glossary, however, should serve as a reference for other experts and/or as a set of standard definitions of the terms used. The glossary should be improved for next year. Mortality rates, in particular, were considered to be difficult to understand and will require a simpler definition.

Possible addition of species distribution charts and an exploitation/abundance matrix chart with each species reviewed, in addition to the chart in the Introduction to the Advisory Report was suggested.

Editorial changes recommended by the Steering Committee have been incorporated into the Advisory Report section of this document.

2. SAW-17 SARC and Plenary Meetings

2a. The SARC Meeting

The SARC agenda was discussed (Table 8). The Chairman indicated that at the last meeting there was insufficient time to review more than the first priority species. It appears that only one species/stock can be properly reviewed per meeting day (5 in a one week meeting) if the assessments are more than routine updates.

The SARC prepared a "Consensus Summary of Assessments" (SARC Report), developed advice on each species reviewed, and determined which working papers would be published in the NEFSC Reference Document series.

For the first time, "SARC Leaders" were designated to assure that the advice and recommendations developed reflect the consensus of the SARC. The leaders were also useful as spokesmen of small groups in the resolution of special problems.

The SARC reviewed the terms of reference for the Assessment Methods Subcommittee. The Subcommittee will meet five days in April 1994 to address two first priority terms of reference : 1) potential biases in SARC assessment results, including uncertainty in catch-at-age, construction of CPUE indices, and retrospective analyses of assessment performance; and 2) methods for medium-term stochastic projections, including recruitment time trends and variability, and trends in effort and catchability; and to design "user friendly" ADAPT software. A full time programmer with a background in population dynamics and assessments will be needed for the development and documentation of the software. Software development is of particular relevance to the state/federal role in regional assessments, as the ADAPT framework is currently not accessible to experts outside the NEFSC. It may take as long as one year to develop a user friendly software package.

2c. ADAPT Tutorial

To facilitate accessibility to the ADAPT framework, the NEFSC will set up a tutorial this spring. The terms of reference for the tutorial include: background and history, data requirements, description of methods and assumptions, use of model diagnostics, and interpretation of output. An additional, one week follow-up tutorial will be held once a modular software package has been developed.

The utility of the ADAPT framework relative to other packages was discussed. Although the ADAPT framework is considered to be most adaptive to NEFSC assessment needs, the choice of a framework actually depends on the type of data that are available for analyses. The question of holding tutorials on other modeling systems used in the Northeast was thus explored, including CAGEAN and DeLury.

2d. Plenary Meeting

Attendance at the Plenary Meeting was discussed (see Table 1). Attendance by members of the MAFMC as well as the efforts by Dave Keifer and Lee Anderson, the MAFMC Chairman, to make the meeting a success was noted.

The status of the stocks "matrix chart," which appears in the Introduction of the Advisory Report and referred to in each assessment, was reviewed. This matrix lists the stock status according to its level of exploitation and abundance. The explanation was appreciated by many who attended the Plenary Meeting (see Figures 3 and 4).

Presentation of background material and technical information in addition to that in the Advisory Report was discouraged by the Steering Committee and will be omitted in the future!

The statement on fisheries data precision drawn up by the MAFMC at an earlier Council meeting was addressed by the Chairman. The Steering Committee noted that this advice on precision has been referred to the Scientific and Statistical Committee (SSC). It was, therefore, decided that since the interest leading to the formation of the statement was in getting a general idea of how good the scientists' answers are rather than knowing the actual precision, an audit of data would probably be more appropriate. If necessary, it could be arranged to make presentations to the Councils on the credibility of data.

The SAW recommendation to implement a real-time assessment/management program for short lived species was in response to new life-history findings on butterfish and long- and short-finned squid. Such a program would be expensive and demanding. The value of the program in light of priorities and other needs, as well as management strategies for the species concerned, was discussed. As the recommendation was considered to be only one management option which would be better addressed by the Councils, it was concluded that it would be inappropriate to carry it in the Advisory Report. An information statement under management advice would be sufficient.

3. Research Recommendations

The SARC's research recommendations were summarized and discussed. The type and amount of research recommended for each species is presented in Table 9. The recommendations are useful for planning and are a reflection of what is needed before the Councils' requests can be fulfilled. On silver hake, for example, seven levels of science need to be completed to answer the requests of the Councils.

It was noted that although the recommendation under bluefish which relates the difficulties in the assessment to the unavailability of a user friendly version of the ADAPT VPA

software may have been appropriate at the time of the SARC meeting, it is not accurate at this time, as it has been since determined that the ADAPT VPA may not be the best tool to use in the case of bluefish.

4. SAW Process

The current SAW process, Subcommittee species assignments, and responsibilities of the SARC, Subcommittee chairs, rapporteurs, editor of the Advisory Report, and SARC leaders were reviewed. As requested by the MAFMC, the responsibility for dogfish was moved from the Pelagic/Coastal Subcommittee to the Southern Demersal Subcommittee. During SAW-17 only, the butterfish analysis was developed in the Invertebrate Subcommittee, as it is in the same FMP with squid and requires the participation of the same experts.

4a. SARC Discussion of Procedure

The list of comments from the discussion of the SAW process at the SAW-17 SARC meeting was discussed (See SARC Report, CRD 94-06, pages 123 - 124). A number of comments on the list were thought to be inappropriate. Comments which would improve the efficiency of the process and could be reasonably addressed were encouraged to be implemented, however. Reducing debate time and limiting SARC meeting attendance was discussed in the light of streamlining the process. To further save meeting time, it was suggested reduce report editing functions during the meeting. Once consensus is reached and drafted, reports could be edited after the meeting. To assure that consensus reached by the SARC prevails, edited report sections of the SARC and Advisory Reports, on specific species, could then be provided to SARC leaders for review before the reports are presented at the Plenary Meeting.

4b. Special Bluefish Meeting

The Special Bluefish Meeting and problems concerning the bluefish assessment were discussed, as well as the MAFMC request to handle the bluefish assessment as soon as possible. The Pelagic/Coastal Subcommittee Chairman has already scheduled a Subcommittee meeting for 5 -7 April 1994 to deal with the remaining issues regarding the bluefish assessment. It is possible to provide the Subcommittee's product from the upcoming April meeting to the MAFMC Scientific and Statistical Committee (SSC) who could review it for the Council. It was concluded, however, that the work of the Subcommittee will be reviewed at the next regularly scheduled SARC meeting instead of trying to provide immediate advice to the MAFMC, as it would set a bad precedent to

"short circuit" the SAW process. The SAW/SARC integrity must be maintained.

As the Bluefish Plan calls for a catch quota, it was discussed how the MAFMC could develop the necessary information without a full assessment. It was agreed that the management procedure could proceed while the final advice was being drawn up.

4c. How to Proceed Given Limited Resources

A discussion was held on ways to facilitate state participation at SARC meetings. On the Subcommittee level, the responsibility for dogfish has been moved from the Pelagic/Coastal Subcommittee to the Southern Demersal Subcommittee so that the same experts would not have to travel to two Subcommittee meetings. To further facilitate the participation, during SAW-17 only, butterfish was assessed at a meeting of the Invertebrate Subcommittee as the same experts who would assess butterfish would also assess the squids. In addition, while a variety of options for scheduling SARC meetings was discussed, it was suggested to begin the next SARC meeting at noon on Monday to allow people to travel that morning and to make up for the lost time at the end of the day.

4d. SARC Membership

The difficulty of obtaining SARC members, particularly from state organizations and academia was discussed. It was concluded that there needs to be a formal arrangement with the states concerned to provide appropriate state personnel to serve on the SARC. One way to accomplish this would be for the chief scientific officer from each state to take the responsibility to serve on the SARC, or designate someone in his/her place. Individuals may then be selected from this pool of state experts on a rotating basis. The ASMFC will continue to support the travel of the state personnel associated with the organization's technical committees.

4e. The Plenary

Holding Plenary meetings during two one half day sessions was thought to be working well. Holding them in conjunction with Council meetings was also deemed to be appropriate.

Because of the extensive amount of material that must be presented, in the future, the SAW Chairman will be permitted to share the presentation of the Advisory Report with one or two experts at his discretion. The presentation of advice should be fully related to prepared documentation, however.

5. SAW-18

SAW-18 Stock Assessment Review Committee (SARC) Meeting
Woods Hole
20 - 24 June 1994
(On the first day the meeting will begin at noon and end at 7:30)

SAW-18 Plenary Meeting
Two half days in conjunction with NEFMC meeting
Danvers
9 - 10 August 1994

SAW18/19 Steering Committee Meeting
In conjunction with the MAFMC meeting
Philadelphia
18 August 1994

5a. Species/Stocks for SAW-18

SPECIES	SUBCOMMITTEE	CHAIR
Bluefish	Pelagic/Coastal	Anderson/Murawski
Summer Flounder	Southern Demersal	W. Gabriel
Witch Flounder	Northern Demersal	R. Mayo
Dogfish	Southern Demersal	W. Gabriel
Georges Bank Cod	Northern Demersal	R. Mayo
Georges Bank Yellowtail	Southern Demersal	W. Gabriel

The possibility of looking at Gulf of Maine yellowtail flounder, as well as those from Cape Cod, in addition to the Georges Bank stock was discussed. As the Southern New England stock, reviewed at SAW-17, was in such a poor state, the status of that stock may have management implications throughout the range of the species in the Northeast. In the past, information on yellowtail flounder has been divided into four regions. This needs to be simplified, if possible.

As there will be no new information on mackerel, and the species is not "management sensitive" at this time, it was concluded to delete mackerel from the SAW-18 species list the Committee developed earlier. Information on mackerel will be sent from NEFSC as

required directly to the MAFMC.

Lobster, also earlier slated to be reviewed at SAW-18, will be reviewed at a future SAW, as there will be insufficient new information to warrant a review this time.

5b. Species/Stock Terms of Reference

BLUEFISH (complete work started for SAW-17)

a. Assess the status of bluefish through 1993 and characterize the variability of stock abundance and fishing mortality rates. Review and update biological reference points for bluefish, as necessary.

b Provide 1994 projections of catch and 1995 SSB options at various levels of F.

WITCH FLOUNDER (new assessment)

a. Assess the status of the witch flounder stock, providing historical data on abundance, catch and, if possible, fishing mortality rates.

b. If possible, provide 1994 projections of catch and 1995 SSB options at various levels of F.

SUMMER FLOUNDER (update for quotas)

a. Provide updated assessment for the coastwide stock of summer flounder and provide catch and SSB options at various levels of F.

b. Provide catch and SSB forecasts incorporating uncertainty in recruitment and F estimates (e.g., in a Risk format).

SPINY DOGFISH (a beginning analysis)

a Summarize historical patterns of landings, CPUE and size composition for the coastwide stock of spiny dogfish.

b. Provide time-series fishery independent abundance data, disaggregated by sex, size, and sub-area.

c. Explore calculations of biological reference points for management, specifically addressing sustainable harvest rates for the stock.

GEORGES BANK COD (important vis a vis haddock management)

a. Assess the status of Georges Bank cod through 1993 and provide estimates of historical stock size and F.

b. Provide 1994 catch projections and 1995 SSB options at various levels of F.

GEORGES BANK YELLOWTAIL FLOUNDER (Southern New England stock reviewed at SAW-16)

a. Assess the status of Georges Bank yellowtail flounder through 1993 and characterize the variability of stock abundance and fishing mortality rates.

b. Provide 1994 projections of catch and 1995 SSB options at various levels of F.

5c. Other

The SARC should also consider the report of the Assessment Methods Subcommittee which is scheduled to meet in 5 days in April 1994 to address two first priority terms of reference and ADAPT software design:

a. Potential biases in SARC assessment results (including, among other things, investigation of implication of uncertainty in the catch-at-age matrix).

b. Methods for medium-term stochastic projection.

c. Considerations for ADAPT software design.

The Assessment Methods report will be presented for information only. Although no peer review will be conducted, the SARC may provide guidance for the Subcommittee.

6. Future SAWs

6a. SAW-19 SARC Meeting

Woods Hole
28 November - 2 December 1994

Species suggested for evaluation at this meeting include: Gulf of Maine cod, scallop, white hake, scup, and black sea bass.

Because the Council is currently constrained by the permitting process and information on scallop may be required before analyses are reviewed in a SARC, the possibility of the SSC evaluating the species for the Council was discussed. The MAFMC representative will further discuss the issue at the Council office.

6b. SAW-19 Plenary Meeting

30 - 31 January 1995

The meeting will be held in conjunction with the MAFMC meeting, in two one half day sessions.

6c. Future SARC and Plenary Meetings

Shad and river herring were suggested to be evaluated at a future SARC. As there will be no NEFSC assessments for these species, analyses for peer review will have to come from other organizations.

The following questions were raised to think about:

- Should weakfish, for which the NMFS Southeast Fisheries Science Center has the lead, be peer reviewed in the SAW process?
- How should species which would have less than full scale assessments be handled?

Table 7. **SAW-17/18 Steering Committee Meeting**

Ramada Hotel
225 McClellan Highway
Boston, Massachusetts
15 February 1994

(Beginning at 1:00 PM)

AGENDA

Steering Committee Functions
Advisory Document
- Recommended changes to advice
add glossary
add sections: Biological Reference Points
Stock Identification

2. SAW-17 SARC and Plenary Meetings
   a. SARC Meeting
   b. Assessment Methods Subcommittee
      - Priority terms of reference
      - ADAPT software
   c. ADAPT Tutorial
      - Follow up tutorial
   d. Plenary Meeting
      - MAFMC statement on fisheries data precision
      - real time assessment/management program
3. Research Recommendations
4. SAW Process
   a. SARC discussion of procedure
   b. Special Bluefish Meeting
   c. How to proceed given limited resources
   d. SARC membership
      - U.S.- Canada SARC
   e. Plenary
5. SAW-18 SARC - Woods Hole, 20 - 24 June 1994
   SAW-18 Plenary - Danvers, MA, 9 August 1994
   a. Species
      - List from last meeting
      - SARC discussion
   b. Terms of Reference
   c. Other
6. Future SARC and Plenary Meetings
   a. SAW-19 SARC - Woods Hole, 28 November - 2 December 1994
   b. SAW-19 Plenary - In conjunction with MAFMC or ASMFC?

Table 8. 17th Northeast Regional Stock Assessment Workshop (SAW-17)

Stock Assessment Review Committee (SARC) Meeting
Woods Hole, Massachusetts
November 29 - 4 December 1993

AGENDA

Monday, November 29 (9:00 AM - 6:00 PM)

Opening — Chairman, V. Anthony
- Welcome
- Agenda
- Conduct of meeting

Assessment Methods Subcommittee — R. Conser
- Review Terms of Reference from SAW-16

SPECIES/STOCK	SUBCOMMITTEE & PRESENTER	RAPPORTEUR	SARC LEADER
First Priority			
Silver Hake	No. Demersal		
GoM-NGB (A)	R. Mayo	J. Idoine	G. Thompson
SGB-Mid-Atl (B)		J. Idoine	G. Thompson
Tuesday, November 30 (9:00 AM - 6:00 PM)			
Yellowtail Flounder	So. Demersal		
So. New England (C)	W. Gabriel	P. Rago	K. Friedland
Bluefish (D)	Pelagic/Coastal		
	M. Terceiro	J. Kocik	L. Kline
Review available report sections (SARC and Advisory Reports)			
Wednesday, December 1 (9:00 AM - 6:00 PM)			
Butterfish (E)	Invertebrate		
	J. Brodziak	J. Weinberg	T. Hoff
Squid	Invertebrate		
Long-finned (F)	J. Brodziak	A. Richards	J. Boreman
Short-finned (G)		A. Richards	C. Annand
Review available report sections (SARC and Advisory Reports)			
Thursday, December 2 (9:00 AM - 6:00 PM)			
Review all sections of the SARC and Advisory Reports (1st priority)			
Complete SARC Report sections			
Complete Advisory Report sections			Editor, T. P. Smith

Table 8. (continued)

Friday, December 3 (9:00 AM - 6:00 PM)

SPECIES/STOCK	SUBCOMMITTEE & PRESENTER	RAPPORTEUR	SARC LEADER
Second Priority			
Cod	No. Demersal		
Georges Bank (H)	R. Mayo	G. Shepherd	P. Colosi
Yellowtail Flounder	So. Demersal		
Georges Bank (I)	W. Gabriel	P. Rago	A. Applegate
Review 2nd priority sections (SARC and Advisory Reports)			
Assessment Methods Subcommittee			R. Conser
Terms of Reference (J)			
Complete SARC Report sections			
Complete Advisory Report sections			Editor, T. P. Smith

Saturday, December 4 (9:00 AM - 6:00 PM) IF NECESSARY

Finalize sections of SARC and Advisory Reports
Complete any other unfinished business

Table 9. Research recommendations from the 17th SAW SARC by type and species. The species are identified as A,B (silver hake), C (yellowtail flounder), D (bluefish), E (butterfish), F (*Loligo* squid) and G (*Illex* squid).

Research Type	**A,B**	**C**	**D**	**E**	**F**	**G**	**TOTAL**
Stock identification	X						1
Biological sampling							
- length/age	X		X		X	X	4
- weights			X				1
- growth					X	X	2
- maturity					X	X	2
General biology					X	X	2
Distribution/environment					X	X	2
Discards							
- sea sampling design	X	X		X			3
- more trips	X	X		X			3
More assessments	X	X	X		X		4
Better monitoring of landings	X						1
Scientific programming	X	X	X				3
Strategy for real time management				X	X	X	3
Cannibalism					X	X	2
Joint assessments						X	1
TOTAL	7	4	4	3	8	8	34