Northeast Fisheries Science Center Reference Document 93-07

Report of the 15th Northeast Regional Stock Assessment Workshop (15th SAW)

The Plenary

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

March 1993

The 15th Regional Stock Assessment Workshop (15th SAW) is documented in seven separate reports. For copies of these documents, contact the NMFS/NEFSC, Information Services Unit, 166 Water Street, Woods Hole, MA 02543-1096, (508)548-5123.

Reports of the 15th Regional Stock Assessment Workshop (15th SAW)

CRD 93-01 Surfclam populations of the Middle Atlantic, Southern New England, and Georges Bank for 1992 by J. Weinberg

CRD 93-02 Ocean quahog populations of the Middle Atlantic, Southern New England, and Georges Bank, and Gulf of Maine for 1992 by J. Weinberg

CRD 93-03 Historic and recent trends in the population dynamics of the redfish, *Sebastes fasciatus* Storer, in the Gulf of Maine - Georges Bank region by R. Mayo

CRD 93-04 Assessment of the Gulf of Maine cod stock for 1992 by R. Mayo, L. O'Brien, F. Serchuk

CRD 93-05 Assessment of the Georges Bank cod stock for 1992 by F. Serchuk, R. Mayo, L. O'Brien, and S. Wigley

CRD 93-06 Report of the 15th Northeast Regional Stock Assessment Workshop (15th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments

CRD 93-07 Report of the 15th Northeast Regional Stock Assessment Workshop (15th SAW), the Plenary

TABLE OF CONTENTS

SUMMARY

SAW Chairman: Vaughn Anthony | Rapporteur: Helen Mustafa

The **Plenary Meeting of the Fifteenth Northeast Regional Stock Assessment Workshop (15th SAW)** was held in Woods Hole, Massachusetts, 26 - 27 January 1993. About 60 individuals from a number of organizations in the New England and Mid-Atlantic regions, including members of the SAW Steering Committee, attended this meeting (Table 1). The Plenary Meeting Agenda is presented in Table 2.

Opening

In his opening remarks, Chairman Vaughn Anthony (NEFSC) indicated that the SAW is currently being restructured. As more and more fishery management is instituted, it is critical to provide the assessment advice on the 48 stocks in the most efficient and timely manner. Although restructuring the SAW is an agenda topic at this meeting, some steps toward restructuring have already taken place. For example, in addition to the **Consensus Summary of Assessments** (NEFSC Reference Document 93-06), the Stock Assessment Review Committee (SARC), which met 7 - 11 December 1992, also drafted the **Advisory Report on Stock Status**. SARC working papers will no longer be saved and the SAW Research Document series will now be replaced by NEFSC Reference Documents. The list of eight working papers at this SARC was, therefore, reduced to five NEFSC Reference Documents (Table 3). The **SARC Consensus Summary of Assessments**, previously a part of the overall SAW report, will henceforth be a separate document.

Advisory Report

The Plenary reviewed and discussed the draft **Advisory Report on Stock Status** (containing an introduction, and sections on surf clam, ocean quahog, Gulf of Maine-Georges Bank redfish, Gulf of Maine and Georges Bank cod, and gear research) and the Recommendations/Research Needs sections of the **Consensus Summary of Assessments.** The final version of the Advisory Report, contained in this report, reflects the changes recommended at the Plenary Meeting.

During discussion of the SARC reports, three assessment procedures were presented by experts in the NEFSC Population Dynamics Branch: ADAPT, an age-structured framework for estimating historical stock sizes of an exploited population (R. Conser); a bootstrap estimation procedure, applied to ADAPT, which describes the accuracy of a sample or statistic (W. Gabriel); and a procedure for developing catch and stock size projections that serves as a bridge of continuity between the end of a virtual population analysis (VPA) and the beginning of projections (R. Mayo).

As a result of discussion the Plenary made the following generic recommendations:

- Studies should be undertaken to understand the possible changing relationship between fishing effort and fishing mortality.

- The fishing effort standardization analyses in many of the groundfish assessments use catch per effort from interviewed otter trawl trips to standardize effort for all commercial gears. This standardization procedure may not be effective in capturing changes in effort patterns for other gears. If at all possible, standardization of effort by individual fishing gear and by age groups should be conducted to derive the most representative commercial catch per effort for VPA tuning. A better understanding of meaningful units of fixed gear fishing effort is also needed, e.g. sink gill nets.

- For many stocks, discards and recreational catches may be significant. Inclusion of these catches in the stock assessment analyses is highly desirable, if meaningful estimates of the magnitude and age composition of these removals are available or can be derived.

- Present catch and stock projection methods do not include all sources of uncertainty within the assessment. To address this shortcoming, projection methods should be developed that use a Monte Carlo approach for all input parameters, including current fishing mortality, natural mortality, starting stock conditions, and recruitment.

- Survey surf clam and ocean quahog populations again in 1995.

- Investigate the usefulness of reducing the sampling density on next clam survey of Georges Bank, Southern New England, and Long Island and expand the number of stations to the south to improve precision in the New Jersey-Delmarva area.

- Update the catch at age matrix for redfish preparatory to updating the VPA.

- Investigate better procedures (surveys) for estimating cod recruitment for both stocks.

In addition, it was recommended to establish a Working Group to:

- Examine methods of increasing precision of recruitment prediction for Atlantic cod and to recommend appropriate adjustments to the research vessel sampling program.

- Evaluate the impacts of neglecting discards in the catch-at-age matrix on estimates of recruitment.

- Determine how much apparent variability in the available indices is induced by not estimating or poorly estimating discard of young fish.

Special Topics

Presentations under special topics included future mesh selection research, the NEFSC 1993 sea sampling plan, reports of the Recreational Statistics Working Group and the Biological Reference Points Working Group, and an overview of the Second Annual National Stock Assessment Workshop held in La Jolla in March/April 1992, with the theme of defining overfishing/stock rebuilding. Recommended were several specific directions for future gear research as well as terms of reference for the Biological Reference Points Working Group. Summaries of these presentations and related discussion, as well as plans to restructure the SAW are featured in this report.

Although consensus was not reached on precisely how to revise the SAW process, the following points were made in discussion:

- Create five standing assessment sub-committees to develop comprehensive assessments and facilitate the participation of interested parties.

- Hold an open SARC for an intensive review of the assessments prepared by the sub-committees. Membership would continue to be ad hoc, based on technical expertise.

- Prepare the Advisory Report at the SARC meeting and modify the structure of the report by expanding the discussion under the sections.

- Hold the Plenary as an open meeting. A Plenary committee of three (SARC Chair, Council Liaison, and NEFSC Population Dynamics Branch Chief) would finalize the Advisory Report.

- Hold additional meetings with managers and other interested parties to present results of the SAW.

It was suggested to continue discussion on restructuring the SAW at the next Plenary meeting.

Other Business

Under other business, the Plenary identified nine species/stocks as possible candidates for review at the next SARC meeting and suggested dates for both the 16th SAW SARC and Plenary sessions (see page 47).

Conclusions of the SAW Steering Committee

The discussions and recommendations of the Plenary, were considered at a meeting of the SAW Steering Committee held on March 25, 1993. The conclusions of the Steering Committee are summarized at the end of this report.

Table 1. List of Participants

National Marine Fisheries Service

Northeast Fisheries Science Center

Vaughn Anthony
Jon Brodziak
Darryl Christensen
Ray Conser
David Dow
Brenda Figuerido
Wendy Gabriel
Patricia Gerrior
George Grice
Marv Grosslein
Ruth Haas
Dan Hayes
Tom Helser
Josef Idoine
Marjorie Lambert
Ralph Mayo
Bill Michaels
Tom Morrissey
Steve Murawski
Helen Mustafa
Loretta O'Brien
John Pearce
Al Peterson
Greg Power
Paul Rago
Fred Serchuk
Terry Smith
Tim Smith
Kathy Sosebee
Mark Terceiro
James Weinberg
Alan White
Susan Wigley

Northeast Regional Office

Peter Colosi
Hannah Goodale
Kathi Rodrigues
Richard Roe

Office of Research and Environmental Information

Andrew Rosenberg

Atlantic States Marine Fishery Commission

John Dunnigan
Paul Perra

Mid-Atlantic Fishery Management Council

Tony DiLernia
Dave Keifer

New England Fishery Management Council

Andrew Applegate
Phillip Haring
Chris Kellog
Douglas Marshall

Massachusetts Division of Marine Fisheries

Steve Cadrin
Steve Correia
Tom Currier
Arnold Howe
Jeremy King
Dan McKiernan
David Pierce

Connecticut Department of Environmental Protection

Dave Simpson

Conservation Law Foundation

Eleanor Dorsey

Manomet Bird Observatory

Connie Gagnon
Tom Larsen
Fred von Krusenstiern
Jay Wennemer

Connamessett Farm

Ron Smolowitz

Table 2.
15TH NORTHEAST REGIONAL STOCK ASSESSMENT WORKSHOP
PLENARY MEETING

Carriage House, Quissett Campus
Woods Hole, Massachusetts

January 26 - 27, 1993

AGENDA

Tuesday, January 26

9:00	Opening	V. Anthony
9:15	SARC Report	V. Anthony
9:45	**Advisory Report on Stock Status** surf clam, ocean quahog, redfish	V. Anthony
10:30	Coffee	
10:45	Advisory Report (continued)	
12:00	Lunch	
1:00	Advisory Report (continued) cod	
2:45	Coffee	
3:00	Advisory Report (continued) gear research	
4:00	Future Mesh Selection Studies	P. Colosi

Wednesday, January 27

8:30	Sea Sampling Plan for 1993	D. Christensen
9:00	Recreational Statistics Working Group Report	P. Perra
9:15	Overview of National Stock Assessment Workshop	A. Rosenberg
10:00	Biological Reference Points Working Group Report	A. Rosenberg
10:30	Coffee	
10:45	Restructuring the SAW	V. Anthony
11:30	Other Business	

Table 3.

SAW-15 NEFSC REFERENCE DOCUMENTS

Document Number	Title	Author
93-01	Surf Clam Populations of the Middle Atlantic, Southern New England, and Georges Bank for 1992	J. Weinberg
93-02	Ocean Quahog Populations of the Middle Atlantic, Southern New England, Georges Bank and Gulf of Maine for 1992	J. Weinberg
93-03	Historic and Recent Trends in the Population Dynamics of the Redfish *Sebastes fasciatus* Storer, in the Gulf of Maine - Georges Bank Region	R. Mayo
93-04	Assessment of the Gulf of Maine Cod Stock for 1992	R. Mayo, L. O'Brien, F. Serchuk
93-05	Assessment of the Georges Bank Cod Stock for 1992	F. Serchuk, R. Mayo, L. O'Brien, S. Wigley
93-06	Report of the Fifteenth Northeast Regional Stock Assessment Workshop (15th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments	
93-07	Report of the Fifteenth Northeast Regional Stock Assessment Workshop (15th SAW) The Plenary	

ADVISORY REPORT ON STOCK STATUS

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 some reference value such as the replacement rate of fishing mortality, $F_{rep,}$ or the rate of fishing mortality which should give the maximum yield per recruit in the long-term, F_{max}. 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 exploitation rates, is still at a low biomass level due to heavy exploitation in the past such that future recruitment to the stock is jeopardized. 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, the SAW Plenary, where possible, classified stocks as high, medium, or low biomass compared to historic levels.

When definitions of overfishing are developed by the Fishery Management Councils they may relate to exploitation rate (e.g., threshold percentage of the maximum spawning potential of the stock, %MSP) or biomass level (e.g., threshold spawning biomass) or a combination of the two. The SAW used the council reference points wherever possible in classifying stocks. The figure below describes the contingencies identified by SAW for this classification.

EXPLOITATION RATE / STOCK LEVEL	LOW	MEDIUM	HIGH
OVER EXPLOITED	REDUCE EXPLOITATION REBUILD STOCK BIO MASS	REDUCE EXPLOITATION REBUILD AGE STRUCTURE	REDUCE EXPLOITATION INCREASE YIELD PER RECRUIT
FULLY EXPLOITED	REDUCE EXPLOITATION REBUILD STOCK BIOMASS	MAINTAIN EXPLOITATION RATE AND YIELD	MAINTAIN EXPLOITATION RATE AND YIELD
UNDER EXPLOITED	MAINTAIN LOW EXPLOITATION WHILE STOCK REBUILDS	INCREASE EXPLOITATION SLOWLY TO REFERENCE LEVEL	INCREASE EXPLOITATION TO REFERENCE LEVEL

A. SURF CLAM ADVISORY REPORT

<u>State of Stock</u>: The stock is at a medium level of abundance, and it is considered to be fully exploited (i.e., annual landings have been near the annual quotas). Populations are comprised of adults, and over 60% of the total biomass is in the Delmarva and Northern New Jersey areas (Figure A2). The survey biomass index has declined by approximately 50% from 1983 to 1992 in the Mid-Atlantic (Figure A1). In the Mid-Atlantic region, landings per unit effort (LPUE) have fallen steadily since 1986 (Figure A3), and are expected to continue to decline. Surf clams take about 6 years to grow to harvestable size (4-3/4 inches), and there are no strong year classes spawned since 1977 (Figure A4).

<u>Management Advice</u>: If surf clams continue to be harvested at the current annual rate off Northern New Jersey (where 90% of EEZ landings are currently derived), that area will be depleted in 6-7 years, based on minimum biomass estimates from surveys. The entire supply in the Mid-Atlantic could support the current Mid-Atlantic catch for 11-14 more years, but this will require a shift of the fishery to other Mid-Atlantic areas.

<u>Forecast for 1993</u>: Under current exploitation patterns there will be a continued gradual decline in abundance, and based on trends in LPUE, a moderate-strong decline in LPUE.

<u>Landings and Status Table (weight 000s mt meats):</u>

Year	1985	1986	1987	1988	1989	1990	1991	1992	Max	Min	Mean
										(1965-1992)	
Quota - EEZ TAC	24.3	24.3	24.3	24.0	23.3	24.3	22.0	22.0	-	-	-
Landings - EEZ Total	23.7	24.9	22.1	23.9	22.3	24.0	20.6	20.7	33.7	7.2	19.3
NNJ	8.5	14.3	16.9	18.8	15.9	16.6	17.1	17.7	17.7[1]	0.1[1]	10.1[1]
DMV	6.6	3.1	1.5	1.4	3.3	4.7	1.6	0.5	10.5[1]	0.5[1]	5 1[1]
Other	8.6	7.5	3.7	3.7	3.1	2.7	1.9	2.5	9.7[1]	1.9[1]	5.1[1]
State	9.2	10.8	5.4	4.9	8.1	8.5	9.4	-	24.1	1.1	7.3
Discards				not available for this assessment							
Total Comm Landings	32.9	35.7	27.5	28.8	30.4	32.6	30.0	-	43.6	15.8	26.6
Data Used in Assessment				EEZ Catch data							
Minimum biomass estimates											
Total		688[2]	-	-	591[2]	-	-	445[2]			
NNJ		147	-	-	184	-	-	141			
DMV		347	-	-	180	-	-	134			

[1] Over period 1978-1992. [2] Includes N. Carolina through Georges Bank.

__Catches__: Landings have been stable since 1984 (Figure A1), with quotas in EEZ waters. Landings from state waters are significant (average 27% of the total), but are considered separate from EEZ stocks for management purposes. Discard data are available, but were not analyzed for this assessment.

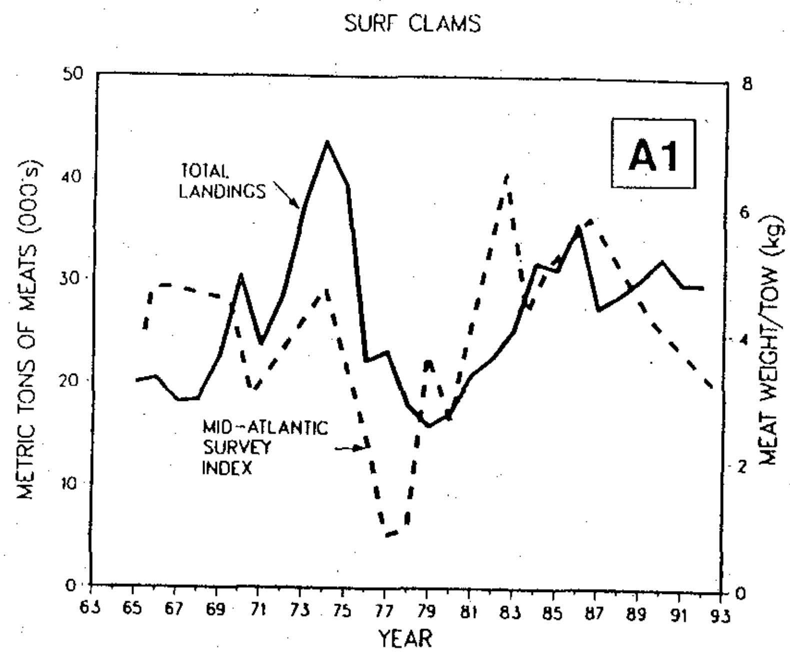
__Data and Assessment__: Commercial landings data used in assessments were for EEZ populations only. Mortality estimates are from research vessel surveys. LPUE was computed by year, region, and vessel size class. Interpretation of LPUE is confounded by changes in effort, adoption of an ITQ system and changes in discard rates. Minimum biomass estimates are based on areal expansion of survey catch-per-tow data.

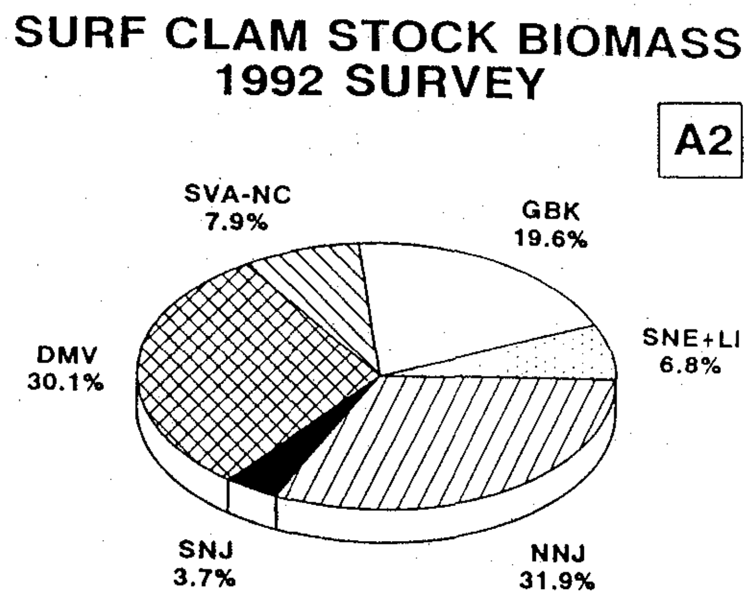
__Fishing Mortality__: For Northern New Jersey, where most harvesting currently occurs, the total mortality rate (Z) is 0.06 (annual survival rate = 0.94). For Delmarva, where most harvesting took place before 1984, Z=0.17 (annual survival rate = 0.84) between 1984-1992. Given the lower rate of survival off Delmarva, natural mortality is probably greater there than off Northern New Jersey. With constant annual catches and no significant recruitment, F will increase each year as population size declines.

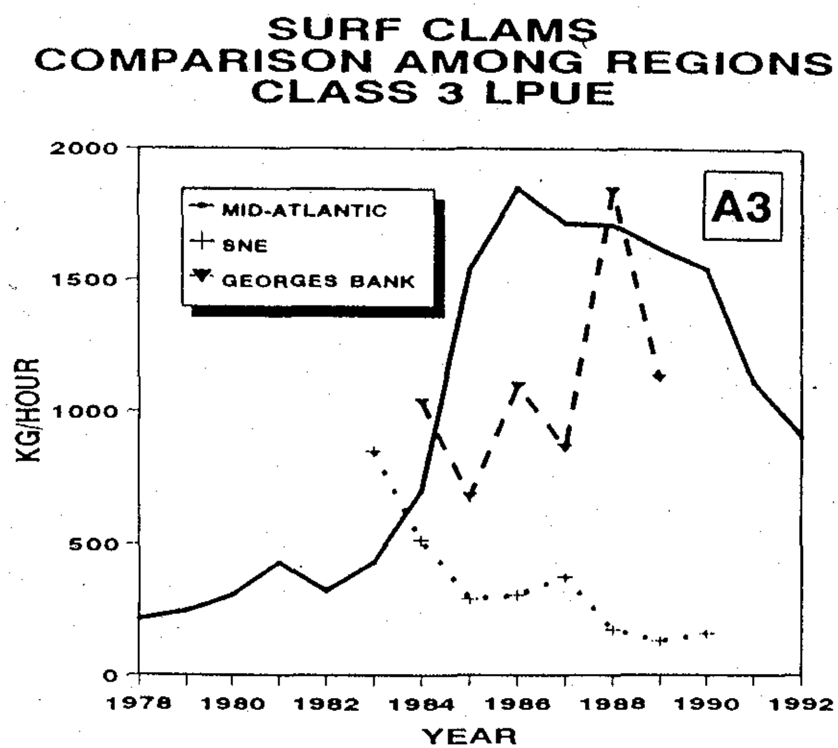
__Recruitment__: There has been low recruitment to the Middle Atlantic Region, after the strong 1976 year class in New Jersey and the strong 1977 year class in Delmarva. The other previous big year class occurred in the mid 1960's off the Chesapeake.

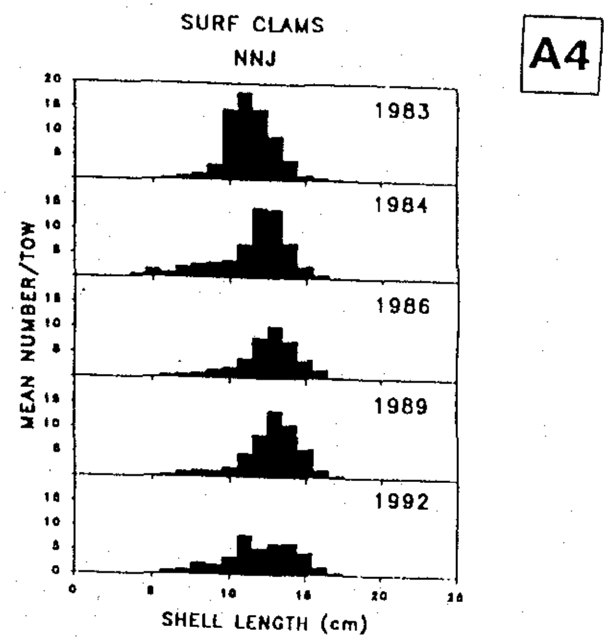
__Special Comments__: The fishery is similar to a mining operation. Calculation of years of supply assumes two rates of natural mortality, no recruitment and the efficiency of the survey dredge is 100%. The next NEFSC regionwide survey is scheduled for 1995. Because of the slow growth and low mortality rates of adults, annual surveys are not required to monitor the population. Nevertheless, additional sampling effort in areas of high exploitation might provide more precise estimates of changing stock size.

__Source of Information__: Report of the 15th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC Ref. Doc. 93-06. Surf clam populations of the Middle Atlantic, Southern New England and Georges Bank for 1992. NEFSC Ref. Doc. 93-01 by J. Weinberg.


SURF CLAMS
A1
TOTAL LANDINGS
MID-ATLANTIC SURVEY INDEX
METRIC TONS OF MEATS (000's)
MEAT WEIGHT/TOW (kg)
YEAR
0
10
20
30
40
50
0
2
4
6
8
63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93


SURF CLAM STOCK BIOMASS
1992 SURVEY
A2
SVA-NC 7.9%
GBK 19.6%
SNE+LI 6.8%
DMV 30.1%
SNJ 3.7%
NNJ 31.9%


SURF CLAMS
COMPARISON AMONG REGIONS
CLASS 3 LPUE
A3
MID-ATLANTIC
SNE
GEORGES BANK
KG/HOUR
YEAR
0
500
1000
1500
2000
1978 1980 1982 1984 1986 1988 1990 1992


SURF CLAMS
NNJ
A4
1983
1984
1986
1989
1992
MEAN NUMBER/TOW
SHELL LENGTH (cm)

B. OCEAN QUAHOG ADVISORY REPORT

State of Stock: The total stock from Georges Bank to North Carolina is at a high biomass level, and is considered to be fully exploited (i.e., annual landings have been close to the annual quotas; Figure B1). From Georges Bank south, populations are comprised almost exclusively of large 2-3/4 inch and greater (>7cm) adult clams. Small, young individuals are rare (Figure B4). The fishery has focused on the New Jersey and Delmarva areas, which contain only about 20% of the stock biomass (Figure B2), and abundance is declining slowly. Areas with highest biomass of quahogs are located off Southern New England, Long Island, and on Georges Bank (Figure B2). In the Mid-Atlantic region, CPUE has fallen steadily by 33% from 1986 to 1992 (Figure B3). Local areas off Delmarva and New Jersey have experienced heavy exploitation and substantial decreases in biomass.

Based on an exploratory survey conducted in summer 1992, eastern Maine populations are comprised of small, individuals, primarily less than 2-1/3 inches or 6cm.

Management Advice: If current harvest patterns persist, the Middle Atlantic (NC to LI) supply of quahogs in these areas will probably last for 13-17 years. The quahog stock in the entire region (NC-Georges Bank) could support the current catch for 22-32 more years. Increases in the quota will lead to a more rapid depletion of the stocks. Areas north of the Mid-Atlantic have only been lightly exploited to date. Ocean quahogs take at least 30 years before becoming harvestable. The extremely slow growth rate and aperiodic recruitment make this species very vulnerable to local depletion.

Forecast for 1993: Continued fishing at current levels of fishing mortality (i.e., $F<0.1$) will lead to a gradual decline in abundance in the Mid-Atlantic and, based on trends in CPUE, a moderate-strong decline in CPUE. Assuming low levels of natural mortality ($m=0.02$-0.06) the present catch levels could continue for 13-17 years in the Mid-Atlantic Region (NC-LI) and for 22-32 years for the entire stock (NC-Georges Bank).

Landings and Status Table (weights in 000s mt meats):

Year	1985	1986	1987	1988	1989	1990	1991	1992	Max	Min	Mean
										(1968 -1992)	
Quota - EEZ TAC	27.2	27.2	27.2	27.2	23.6	24.0	24.0	24.0	-	-	-
Landings - EEZ	23.6	19.8	22.8	20.6	22.9	21.1	22.2	22.6	23.6	0.0	10.9
State	<0.1	0.8	0.0	0.4	0.2	0.1	0.1	-	1.5	0.0	0.6
Discard				insignificant							
Total Comm Landings	23.6	20.6	22.8	21.0	23.1	21.2	22.3	22.6	23.6[1]	0.1[1]	11.5[1]
Data Used in Assessments				EEZ Catch Data							
										(1980-1992	
Minimum Biomass Estimate											
Total	-	1,137[1]	-	-	655[1]	-	-	1,135[1]	1,137[2]	655[2]	996[2]
NJ		262	-	-	132	-		153			
DMV		81	-	-	67	-		56			

[1]Includes N. Carolina through Georges Bank. [2]Research Surveys: 1980-1992.

__Catches__: Landings have been stable since 1985 (Figure B1), with EEZ quotas. State-water landings are insignificant. In the Mid-Atlantic there are no discards, no size limits, and small quahogs are rare. There is some discarding in the Gulf of Maine due to the size composition of the populations and the market. Most quahogs in the Mid-Atlantic catch are greater than 30 years of age. Catches in eastern Maine are variable and subject to closure due to PSP contamination.

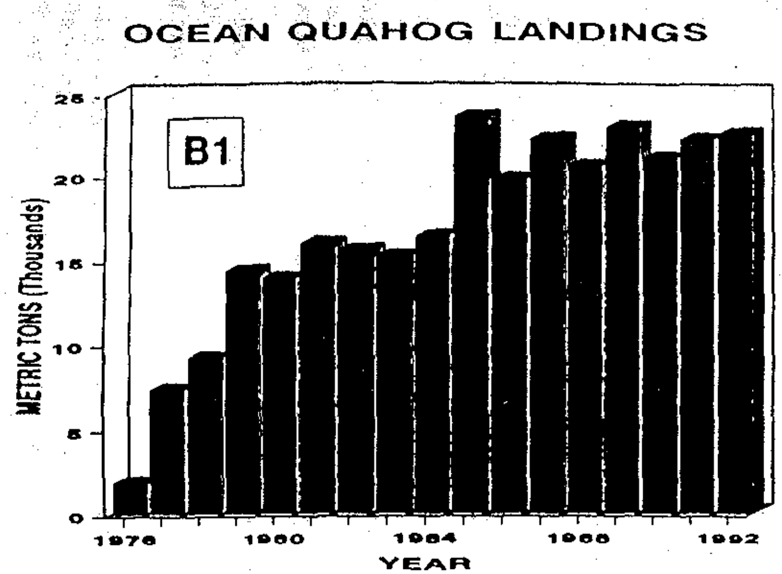
Data and Assessment: CPUE was computed by area and vessel size class. A Leslie Model was used to derive depletion estimates by region. Mortality was estimated from research vessel survey and CPUE data. Data on the Gulf of Maine are from a single exploratory cruise in 1992.

Fishing Mortality: For New Jersey, where 50% of the harvesting occurred in 1991, Z = 0.04-0.07 (annual survival = 93-96%). For Delmarva, where most harvesting took place before 1989, Z = 0.03-0.09. In some 10 minute squares at least 3/4 of the quahogs have already been harvested.

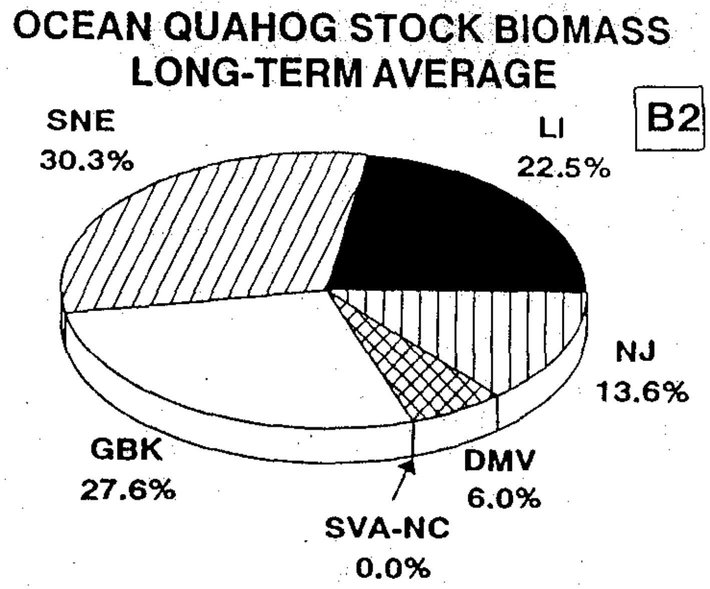
Recruitment: There has been no significant recruitment to the Mid-Atlantic Region, Southern New England or Georges Bank in at least 30 years. The Mid-Atlantic fishery harvests animals about 2-3/4 inches (7cm) and larger. These sizes are achieved at ages of 25-30 in the Mid-Atlantic region. The fishery in eastern Maine primarily exploits small quahogs (2 inches or 5cm). Recent growth studies indicate that it takes about 30 years for quahogs to reach 2 inches in eastern Maine. Recruitment of quahogs in the Gulf of Maine appears to have been more continuous than in the Mid-Atlantic in the last 30 years.

Special Comments: The fishery is similar to a mining operation. Calculation of years of supply assumes two rates of natural mortality and no significant recruitment for the next 3 decades. The next NEFSC regionwide survey is scheduled for 1995. Because of the slow growth and low mortality rates of adults, annual surveys are not necessary to monitor the population. Nevertheless, additional sampling effort in certain areas might be needed to closely monitor stock depletion through time.

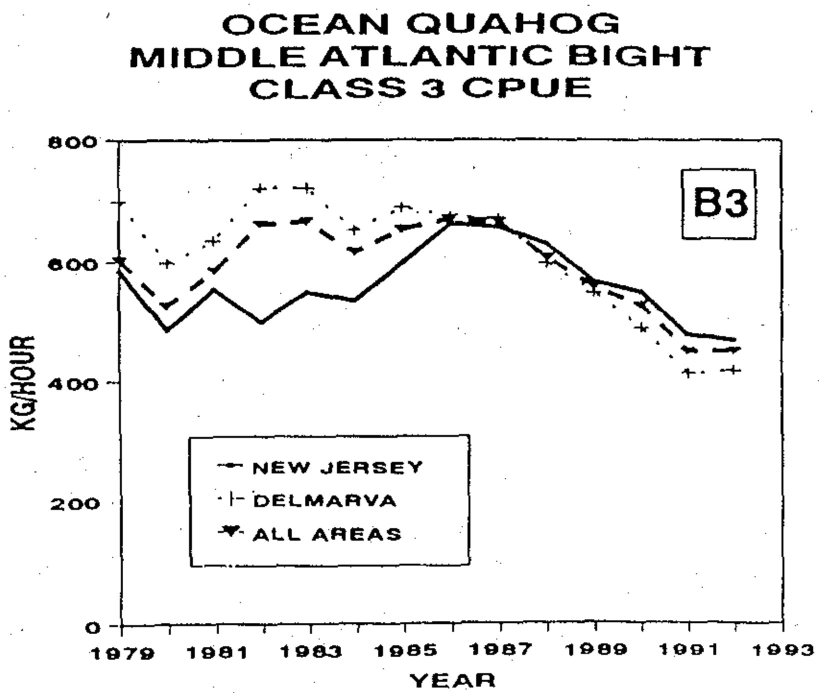
Source of Information: Report of the 15th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC Ref. Doc. 93-06, and NEFSC Ref. Doc. 93-02 (Ocean quahog populations of the Middle Atlantic, Southern New England, Georges Bank and the Gulf of Maine for 1992 by J. Weinberg).



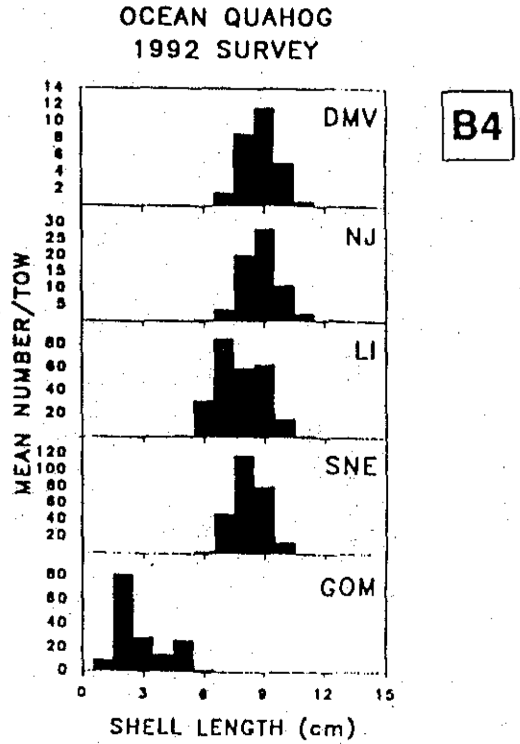
OCEAN QUAHOG LANDINGS
B1
METRIC TONS (Thousands)
0
5
10
15
20
25
1976
1980
1984
1988
1992
YEAR



OCEAN QUAHOG STOCK BIOMASS
LONG-TERM AVERAGE
B2
SNE
30.3%
LI
22.5%
NJ
13.6%
DMV
6.0%
SVA-NC
0.0%
GBK
27.6%



OCEAN QUAHOG
MIDDLE ATLANTIC BIGHT
CLASS 3 CPUE
B3
KG/HOUR
0
200
400
600
800
NEW JERSEY
DELMARVA
ALL AREAS
1979
1981
1983
1985
1987
1989
1991
1993
YEAR



OCEAN QUAHOG
1992 SURVEY
B4
DMV
NJ
LI
SNE
GOM
MEAN NUMBER/TOW
SHELL LENGTH (cm)
0
3
6
9
12
15

C. GULF OF MAINE-GEORGES BANK REDFISH ADVISORY REPORT

State of Stock: The current exploitation rate is probably quite low but the stock remains at a very low level. Recruitment has been extremely poor in recent years, with the possibility of a slight improvement in 1992 due to recruitment of the 1988 year class. Compared to previous decades, the current population is composed of very few contributing year classes. Landings are very low, but increased by 70% in 1992.

Management Advice: Because the 1988 year class will become increasingly vulnerable to the fishery in 1993 and is likely to attract additional directed effort, landings will probably continue to increase in 1993. At age 5 in 1993, redfish from this year class will be at or above the minimum size of 9 in. (23 cm), thereby providing additional incentive for increasing fishing effort, although only about 50% of the fish will be sexually mature. Because this year class now comprises the majority of the stock, any increase in exploitation will seriously jeopardize attempts to rebuild the spawning biomass. Therefore, directed fishing on redfish should be prohibited and by-catch should be minimizes to the greatest extent possible.

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

Year	1985	1986	1987	1988	1989	1990	1991	1992	Max	Min	Mean
								Predicted	(1934 - 1991)		
Total Comm Landings	4.3	2.9	1.9	1.2	0.6	0.6	0.5	0.9	55.9	0.5	17.4
USA	4.2	2.8	1.9	1.1	0.6	0.6	0.5	0.9	55.9	0.5	17.0
CAN	0.1	0.1	<.1	0.1	<.1	<.1	<.1		0.3	0.0	0.1
Discards	Discards occur, but estimates not presently available										
USA Rec Landings	Recreational catches considered negligible										
										(1969 - 1983)	
Sp. stock biomass									137.6	34.4	84.3
Recruitment (Age 5)	---------		Not Available		---------------------				177.6	0.5	21.2
Mean F (Ages 9+)									0.26	0.12	0.19
NEFSC Autumn kg/tow	5.7	8.0	5.5	6.3	6.8	12.2	8.4	8.2	54.6[1]	3.4[1]	17.9[1]

[1] Over period 1963-1992.

Catches: After reaching a peak level of 56,000 mt in 1942, total landings declined to less than 10,000 mt during the mid-1960's. Landings subsequently increased to 20,000 mt in 1971, but have since declined steadily to less than 1000 mt since 1989 (Figure C1). Landings in 1992 increased to 900 mt. High landings in early years were supported by the large accumulated stock.

Data and Assessment: An analytical assessment (VPA) was conducted in 1986 using 1969-1985 commercial landings. Abundance indices are from NEFSC Spring (1968-1992) and Autumn (1963-1992) bottom trawl surveys. Commercial LPUE (50% redfish trips) and total effort are available through 1991; the 1990 and 1991 data are considered unreliable and were not included in the calculations (Figure C4).

Fishing Mortality: Average fishing mortality was calculated for ages 9 and older. Fishing mortality remained high throughout the 1970's (Figure C1). F was above 0.2 (18% exploitation rate) between 1977 and 1981, but declined to 0.17 (15% exploitation rate) in 1983. Given the rapid reduction in landings, recent F's are probably less than $F_{0.1}$(0.06) and considerably below F_{max} (0.13) and $F_{20\%}$(0.12) (Figure C3). F is likely to have increased in 1992 due to a sharp increase in landings.

Recruitment: After the appearance of several moderate year classes from the 1950's and early 1960's, recruitment has been poor. Only the relatively strong 1971 and moderate 1978 year classes have been notable during the past three decades. Some improvement in recruitment has occurred in recent years from low level year classes seen during the mid-1980's. Of these, the 1988 year class appears to be the strongest (Figure C2).

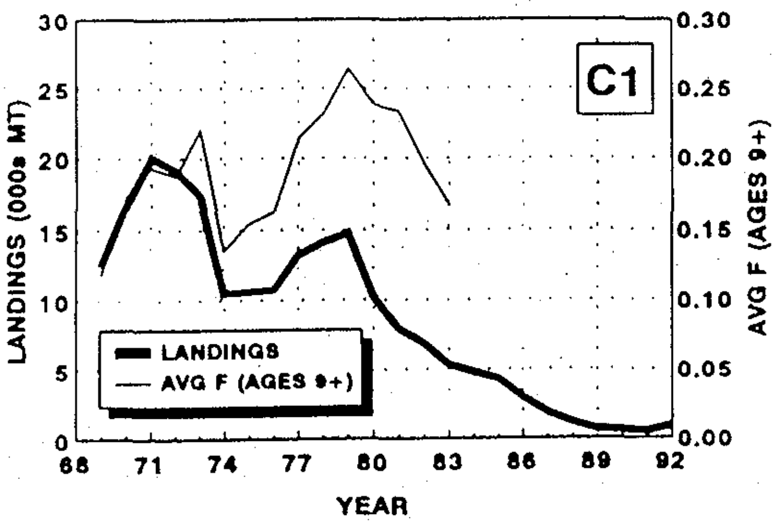
Spawning Stock Biomass: SSB declined by 75% between 1969 and 1984 and has not increased substantially since then. SSB continues to remain at very low levels, although NEFSC survey indices suggest a slight increase in total abundance and biomass since the late 1980's (Figure C2).

Special Comments: Although the VPA was discontinued after 1984, NEFSC trawl survey indices have indicated continued low levels of abundance throughout the 1980's into 1992. The moderate 1988 year class recruited to the fishery beginning in 1992. The 1971 and 1978 year classes have been reduced significantly, and the SSB will remain dependent on the 1988 year class.

Source of Information: Report of the 2nd Stock Assessment Workshop (May 1986), Report of the 15th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC Ref. Doc. 93-06, and NEFSC Ref. Doc. 93-03 (Historic and Recent Trends in the Population Dynamics of Redfish in the Gulf of Maine - Georges Bank Region by R.K. Mayo).

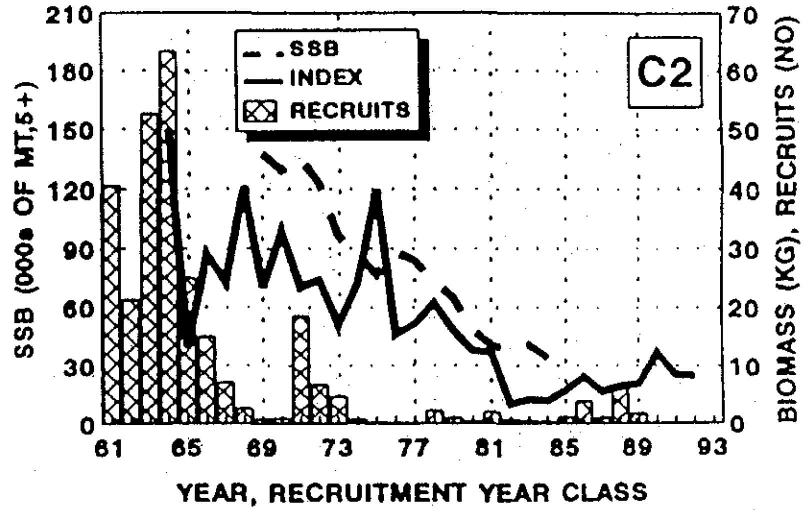
REDFISH

TRENDS IN LANDINGS AND FISHING MORTALITY, 1969 - 1992



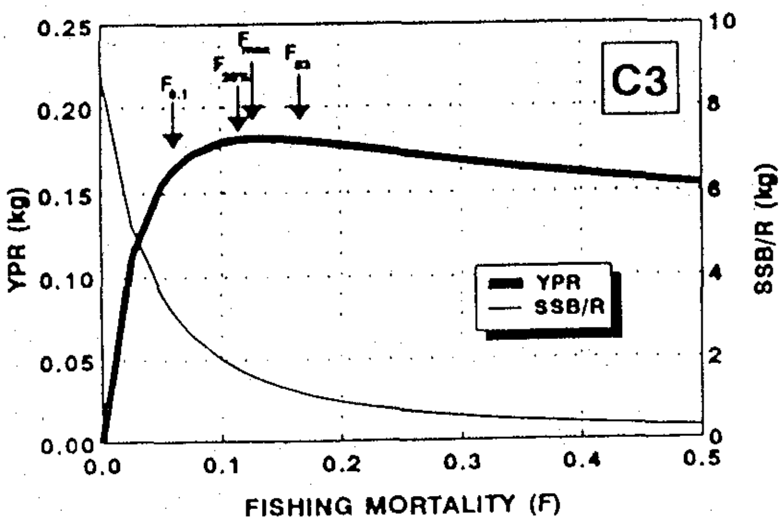
REDFISH

SPAWNING STOCK BIOMASS, AUTUMN SURVEY BIOMASS INDEX AND AUTUMN SURVEY AGE 2 RECRUITMENT INDEX



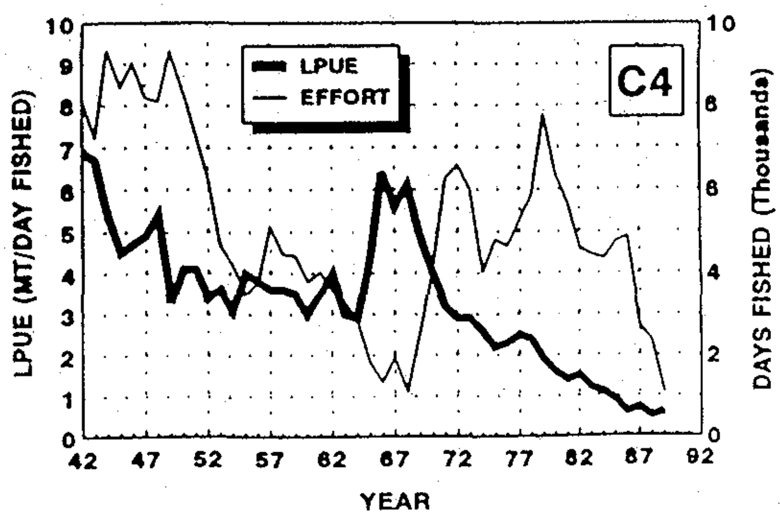
REDFISH

YIELD AND SPAWNING STOCK BIOMASS PER RECRUIT



REDFISH

TRENDS IN FISHING EFFORT AND LANDINGS PER DAY FISHED



D. GULF OF MAINE COD ADVISORY REPORT

State of Stock: The stock is at a low biomass level and is over exploited. Fishing mortality (F) in 1991 increased to a record-high (Figure D1) while spawning stock biomass (SSB) in 1992 declined to a record-low (Figure D2). Accounting for the estimation uncertainty associated with the 1991 SSB (21,200 mt) and 1991 F (1.14) estimates, there is an 80% probability that the 1991 SSB lies between 17,000 mt and 24,000 mt (Figure D5), and that the 1991 F lies between 0.87 and 1.38 (Figure D6). This further implies a 90% probability that the 1991 F is greater than 0.87 (i.e., 2.4X the overfishing definition, $F_{20\%} = 0.36$).

Management Advice: Continued fishing at current levels of fishing mortality (i.e., F=1.14) will lead to catches in 1993 declining to their lowest level since 1973. At a minimum, fishing mortality should be reduced to avoid further declines in stock size. A 10% reduction in fishing mortality in 1993 would not result in any appreciable short-term increase in SSB between 1993 and 1994. Recovery of the stock will require a marked reduction in fishing mortality. Assuming average recruitment in 1993 and 1994, a 70% reduction in F to $F_{20\%}$ in 1993 would increase SSB in 1994 to near the 1982-1991 average (Figure D4), and enhance the prospects for a sustained recovery. At $F_{20\%}$, spawning stock biomass per recruit would nearly triple over the long-term. SSB in 1994 will no longer be dominated by the 1987 year class (which will only constitute 8% of the SSB). If recruitment in 1993 and 1994 is average or below average, SSB in 1994 will remain at record-low levels.

Forecast for 1993 :

The forecasts for 1993 were performed assuming that the fishing mortality in 1992 was the same as in 1991 (i.e., F = 1.14). This fishing mortality rate implies that commercial landings in 1992 will be about 11,000 mt which is consistent with preliminary estimates of the 1992 USA commercial landings of Gulf of Maine cod. Projections were run under 3 different recruitment options: (1) assuming that the 1991 and 1992 year classes were equal to the lowest ever observed [3.2 million fish at age 2]; (2) assuming that the 1991 and 1992 year classes were equal to the 1982-1990 average [6.2 million fish at age 2]; and (3) assuming that the 1991 and 1992 year classes were equal to the highest ever observed [16.3 million fish at age 2]. SSB in 1992 was estimated to be 13,595 mt.

(weights in '000 t);

Option	Basis	F(93)	Predicted SSB (93)	Predicted Landings (93)	Predicted SSB (94)	Consequences/Implications
(1)	<u>Record-Low Recruitment Assumed for the 1991 and 1992 Year Classes</u>					
	F_{max}	0.25	11.4	2.2	15.0	
	$F_{20\%}$	0.36	11.2	3.0	14.0	
	$0.9F_{92}$	1.03	10.4	6.7	9.6	
	F_{92}	1.14	10.3	7.1	9.1	
(2)	<u>Average Recruitment Assumed for the 1991 and 1992 Year Classes (Results displayed in Figure D4)</u>					
average	F_{max}	0.25	12.8	2.2	19.1	SSB increases to just below 1982-91 level; landings decline to record-low.
	$F_{20\%}$	0.36	12.7	3.0	18.1	SSB approaches 1982-91 average level; landings decline to lowest since 1963.
	$0.9F_{92}$	1.03	11.9	6.8	13.6	SSB remains at record-low 1992 level; landings decline to lowest since 1973.
level;	F_{92}	1.14	11.7	7.2	13.0	SSB remains below record-low 1992 landings are lowest since 1973.
(3)	<u>Record-High Recruitment Assumed for the 1991 and 1992 Year Classes</u>					
	F_{max}	0.25	17.8	2.3	34.4	
	$F_{20\%}$	0.36	17.6	3.1	32.3	
	$0.9F_{92}$	1.03	16.8	7.1	27.2	
	F_{92}	1.14	16.7	7.6	26.5	

Under all three of the recruitment options, continued fishing at current levels of fishing mortality (i.e., $F_{92} = 1.14$) will lead to catches in 1993 declining to less than 8,000 t. If fishing continues at this rate in 1993, SSB in 1994 will: (1) decline to a new record-low if recruitment is below average; (2) remain approximately at the record-low 1993 SSB level if recruitment is average; or (3) increase to approximately the record-high 1990 SSB level if recruitment is a record-high.

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

Year	1985	1986	1987	1988	1989	1990	1991	1992 Predicted	Max (1982 - 1991)	Min (1982 - 1991)	Mean (1982 - 1991)
Total Comm Landings	10.7	9.7	7.5	8.0	10.4	15.2	17.8	11.0	17.8	7.5	11.8
Otter Trawl	7.2	6.7	4.3	4.5	6.2	10.4	13.0	-	13.0	4.4	7.9
Sink Gill Net	3.1	2.7	3.0	3.3	4.0	4.4	4.2	-	4.4	2.6	3.6
Handline/Line Trawl	0.1	0.1	0.1	0.1	0.1	0.2	0.3	-	0.3	<0.1	0.1
Other Gear	0.3	0.2	0.1	0.1	0.1	0.2	0.3	-	0.3	<0.1	0.1
Discards	Discards occur but reliable estimates not presently available								-	-	-
USA Rec Landings[1]	3.1	2.4	2.6	3.0	4.2	3.5	2.5	-	4.2	2.4	3.0
Catch used in Assessment	10.7	9.7	7.5	8.0	10.4	15.2	17.8	11.0	17.8	7.5	11.8
Sp. stock biomass[2]	15.0	14.0	13.9	17.2	24.2	27.5	21.2	13.6	27.5	13.9	19.6
Recruitment (Age 2)	6.3	3.9	6.0	8.0	16.3	3.2	2.2	3.7	16.3	2.2	6.2
Mean F (Ages 4-7)	1.11	1.07	1.14	0.82	0.97	1.00	1.14	1.14	1.14	0.62	0.98
Exploitation Rate	62%	61%	63%	51%	57%	58%	63%	63%	63%	42%	58%

[1]Not used in assessment. [2]At beginning of the spawning season (i.e., March 1)

Catches: Commercial landings increased in the mid 1970s and early 1980s, reaching 14,000 t in 1983. During 1974-1986, catches declined, but have since markedly increased (Figure D1). Total commercial landings in 1991 were a record-high 17,800 t, but are expected to decline to about 11,000 mt in 1992.

Data and Assessment: An Analytical assessment (VPA) of commercial landings-at-age data was conducted. Information on recruitment and abundance was taken from standardized NEFSC spring and autumn and Massachusetts DMF spring survey catch-per-tow at age data and standardized USA commercial LPUE indices. Discards and recreational catches were not included in the assessment. The uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1991 were evaluated (Figures D5 and D6).

Fishing Mortality: Fishing mortality has been very high (varying between F= 0.82 and F= 1.14; 51% to 63% exploitation rates) since 1983 (Figure D1), and far in excess of $F_{0.1}$(0.15), F_{max}(0.25) and $F_{20\%}$(0.36). The 1991 F (1.14) is equal to the highest on record.

Recruitment: Aside from the strong 1987 year class (16.3 million), recruitment has ranged from 2.2 to 9.1 million. All subsequent year classes appear to be poor.

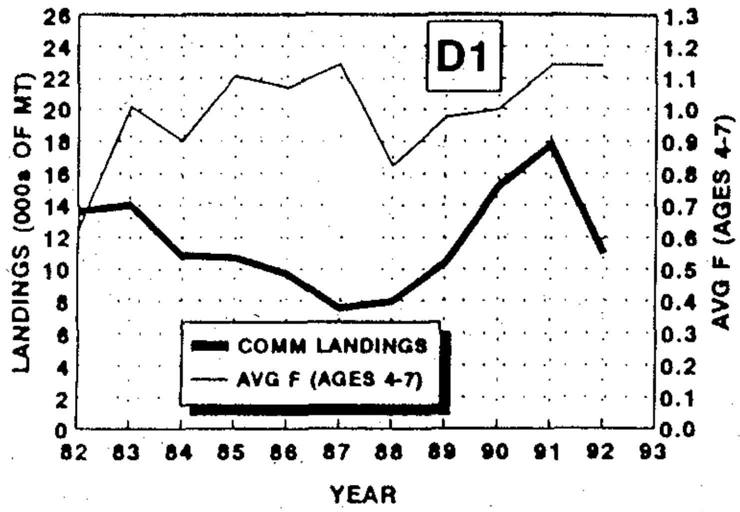
Spawning Stock Biomass: SSB declined by nearly 50% between 1982 and 1987 (25,700 t to 13,900 t), increased to a record-high level in 1990 of 27,500 t [due to recruitment of the strong 1987 year class to the spawning stock], but has since fallen to a record-low level of 13,600 t in 1992 (Figure D2). Further declines in SSB are expected in 1993 as the 1987 cohort is fished down and the poor 1988-1990 cohorts recruit to the spawning stock.

Special Comments: Lack of discard data in the assessment may result in an underestimate of F on the youngest ages, and lack of recreational catches may affest F at all ages, although the extent is unknown.

Source of Information: Report of the 15th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC Ref. Doc. 93-06, and NEFSC Ref. Doc. 93-04 (Assessment of the Gulf of Maine cod stock for 1992 by Mayo *et al.*).

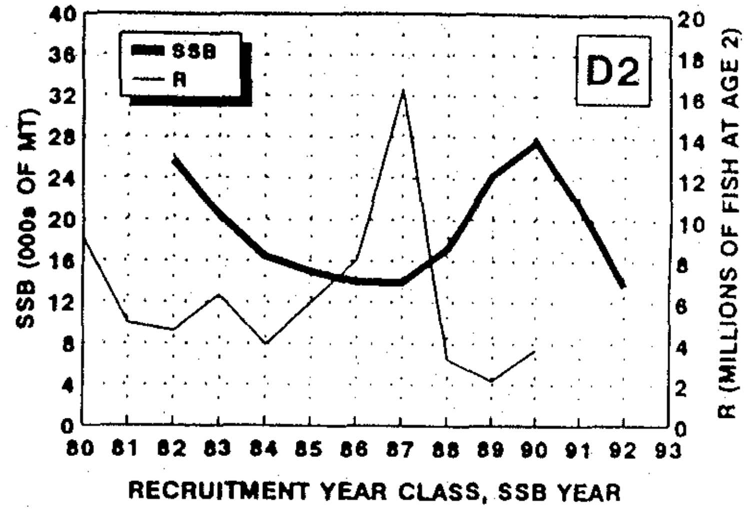
GULF OF MAINE COD

TRENDS IN COMMERCIAL LANDINGS AND FISHING MORTALITY



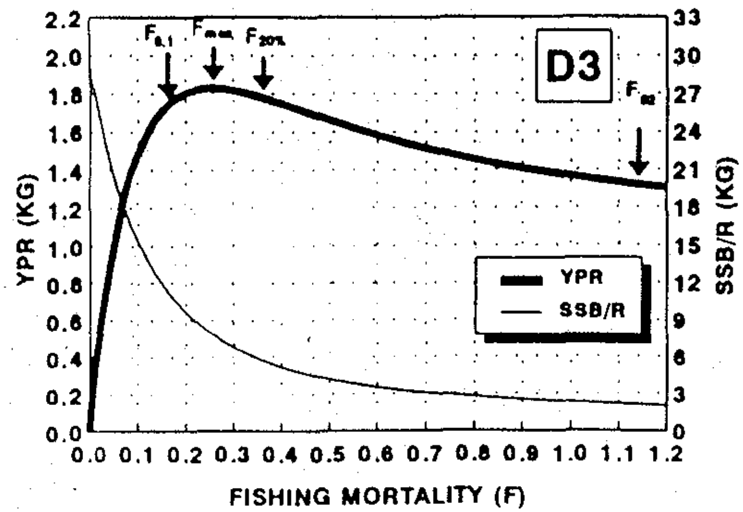
GULF OF MAINE COD

TRENDS IN SSB AND RECRUITMENT (R)



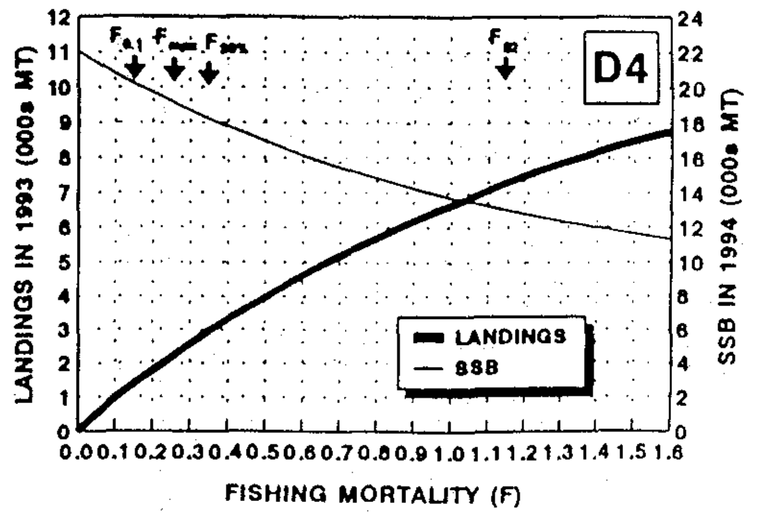
GULF OF MAINE COD

YIELD AND SPAWNING STOCK BIOMASS PER RECRUIT



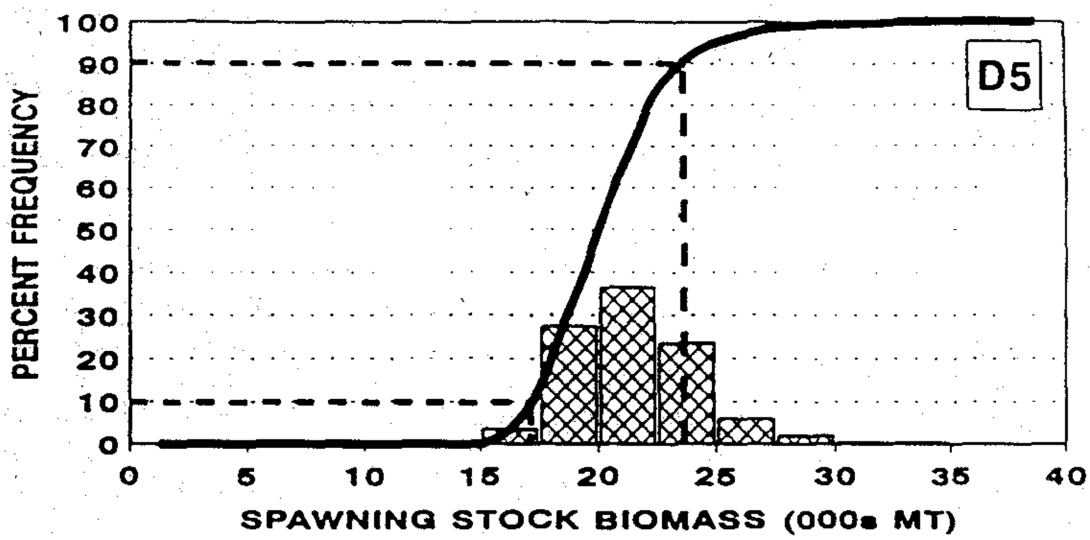
GULF OF MAINE COD

SHORT-TERM LANDINGS AND SPAWNING STOCK BIOMASS



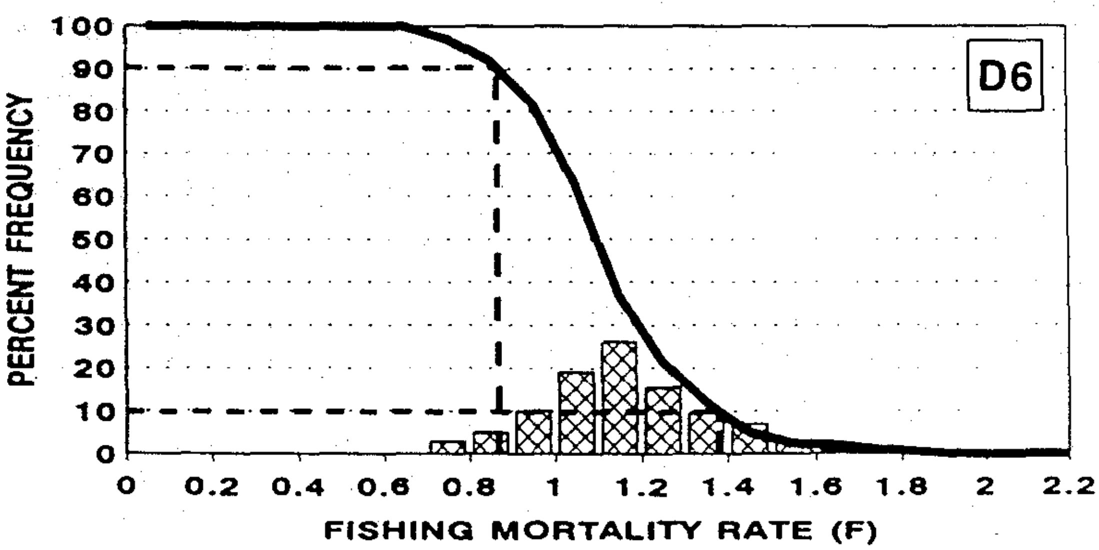
GULF OF MAINE COD

PRECISION ESTIMATES - SSB



GULF OF MAINE COD

PRECISION ESTIMATES - FISHING MORTALITY



Precision of the estimates of spawning stock biomass (D5) and fishing mortality rate (D6) for Gulf of Maine cod. The vertical bars display both the range of the estimators and the probability of individual values within that range. The solid line gives the probability that SSB is less than any selected value on the X-axis (D5) and the probability that F is greater than any selected value on the X-axis (D6). The dashed lines indicate the value at the 10 and 90 percent probabilility levels. The precision estimates were derived from a statistical procedure known as the bootstrap.

E. GEORGES BANK COD ADVISORY REPORT

<u>**State of Stock:**</u> The stock is at a low biomass level and is over exploited. Fishing mortality (F) in 1991 increased to a record-high (Figure E1) while spawning stock biomass (SSB) declined to a record-low (Figure E2). Accounting for the estimation uncertainty associated with the 1991 SSB (54,700 mt) and 1991 F (1.07) estimates, there is an 80% probablity that the 1991 SSB lies between 48,000 mt and 61,000 mt (Figure E5), and that the 1991 F lies between 0.86 and 1.22 (Figure E6). This further implies a 90% probability that the 1991 F was greater than 0.86 (i.e, 2.5X the overfishing definition, $F_{20\%} = 0.35$) (Figure E5).

<u>**Management Advice:**</u> Continued fishing at current levels of fishing mortality will result in further declines in SSB to all-time low levels. At a minimum, fishing mortality should be reduced to avoid further declines in stock size. A 10% reduction in fishing mortality in 1993 would not result in any appreciable short-term increase in SSB. Recovery of the stock will require a marked reduction in fishing mortality. Assuming average recruitment in 1993 and 1994, a 60% reduction in F to $F_{20\%}$in 1993 would rebuild SSB in 1994 to the 1991 level (Figure E4) and enhance the prospects for subsequent recovery. At $F_{20\%}$,spawning stock biomass per recruit would double over the long-term (Figure E3).

If recruitment in 1993 and 1994 is below-average and fishing mortality in 1993 is unchanged from 1992 (F=0.87), SSB in 1994 will be lower than 37,000 t. Conversely, even if recruitment in <u>both</u> 1993 and 1994 is the highest on record (42.4 million fish at age 1), continued fishing in 1993 at the 1992 F level will only result in a rebuilding of SSB in 1994 back to the low 1991 level.

<u>**Forecast for 1993:**</u> The forecasts for 1993 were performed assuming that the total landings in 1992 would be 28,100 t. The fishing mortality needed to take the 1992 catch would be $F_{92} = 0.87$. Projections were run under three different recruitment options: (1) assuming the 1992 and 1993 year classes were equal to the lowest ever observed [8.3 million at fish age 1]; (2) assuming the 1992 and 1993 year classes were equal to the 1978-1989 average [20.7 million fish at age 1]; and (3) assuming that the 1992 and 1993 year classes were equal to the highest ever observed [42.4 million fish at age 1]. In all of the forecasts, the strength of the 1991 year class was assumed to be 10 million fish at age 1 (i.e., about half the size of an average year class). SSB in 1992 was estimated to be 41,400 mt.

(weights in '000 mt)

Option	Basis	F(93)	Predicted SSB (93)	Predicted Landings (93)	Predicted SSB (94)	Consequences/Implications
(1)	Record-Low Recruitment Assumed for the 1992 and 1993 Year Classes					
	F_{max}	0.29	38.2	10.2	44.6	
	$F_{20\%}$	0.35	37.9	12.0	42.5	
	$0.9F_{92}$	0.78	35.8	22.7	30.7	
	F_{92}	0.87	35.4	24.5	28.8	
(2)	Average Recruitment Assumed for the 1992 and 1993 Year Classes (Results displayed in Figure E4)					
	F_{max}	0.29	40.2	10.2	53.6	SSB increases to about 1991 level; Landings decline to lowest since 1955.
	$F_{20\%}$	0.35	39.9	12.1	51.5	SSB increases but remains below 1991 level; landings are lowest since 1960.
	$0.9F_{92}$	0.78	37.8	22.7	39.5	SSB stable at record-low level; landings increase lowest since 1976.
	F_{92}	0.87	37.4	24.5	37.6	SSB stable at record-low level; landings are lowest since 1976.
(3)	Record-High Recruitment Assumed for the 1992 and 1993 Year Classes					
	F_{max}	0.29	43.8	10.3	69.4	
	$F_{20\%}$	0.35	43.5	12.1	67.3	
	$0.9F_{92}$	0.78	41.4	22.8	55.0	
	F_{92}	0.87	41.0	24.5	53.0	

Under all three of the recruitment options, continued fishing at current levels of fishing mortality (i.e., $F_{92} = 0.87$) will lead to catches in 1993 declining to their lowest level since 1976. If $F_{93} = 0.87$, SSB in 1994 will: (1) decline to a new record-low if recruitment is below average; (2) remain at the record-low 1993 SSB level if recruitment is average; or (3) increase to near the low 1991 SSB level if recruitment is a record-high.

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

Year	1985	1986	1987	1988	1989	1990	1991	1992 Predicted	Max	Min (1978 - 1991)	Mean
Total Comm Landings	37.3	25.9	30.9	39.2	33.1	42.5	37.6	28.1	57.2	25.9	39.7
USA Comm Landings	26.8	17.5	19.0	26.3	25.1	28.2	24.2	15.7	40.1	17.5	29.2
Otter Trawl	23.2	14.5	15.2	21.8	19.7	23.7	19.3	-	35.0	14.5	24.9
Sink Gill Net	2.6	1.8	1.7	2.0	3.4	2.5	2.3	-	4.7	0.1	2.4
Handline/Line Trawl	0.8	1.1	2.0	2.4	1.9	1.8	2.4	-	3.8	0.8	1.8
Other Gear	0.2	0.1	0.1	0.1	0.1	0.2	0.2	-	0.3	0.1	0.2
CAN Comm Landings	10.5	8.4	11.9	12.9	8.0	14.3	13.4	12.4	17.8	5.8	10.5
Discards	Discards occur but reliable estimates not presently available								-	-	-
USA Rec Landings[1]	4.6	1.1	1.2	4.3	1.9	1.7	1.3	-	5.3	0.5	2.6
Catch used in Assessment	37.3	25.9	30.9	39.2	33.1	42.5	37.6	28.1	57.2	25.9	39.7
Sp. stock biomass[2]	55.3	55.2	65.9	71.1	68.7	68.4	54.7	41.1	92.7	54.7	73.1
Recruitment (Age 1)	8.5	42.4	15.9	21.9	19.3	8.3	18.3	10.0[3]	42.4	8.3	20.7
Mean F (Ages 4-8)	0.74	0.49	0.48	0.81	0.63	0.73	1.07	0.87	1.07	0.30	0.60
Exploitation Rate	48%	36%	35%	51%	42%	47%	61%	53%	61%	24%	41%

[1] Not used in assessment. [2] At beginning of the spawning season (e.g., March 1). [3] Assumed.

Catches: Commercial landings increased in the late 1970s and early 1980s, peaking at a record-high 57,000 mt in 1982. During 1983-86, landings declined but subsequently increased through 1990 (Figure E1). Total commercial landings declined in 1991 to 37,600 mt and are predicted to be only 28,100 mt in 1992. Recreational catches have ranged from 500 mt to 5,300 mt, and accounted for between 3-10% of the total cod catch.

Data and Assessment: An analytical assessment (VPA) of commercial landings-at-age data was conducted. Information on recruitment and abundance was taken from standardized NEFSC spring and autumn survey catch-per-tow at age data and from standardized USA commercial LPUE indices. Discards and recreational catches were not included in the assessment. The uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1991 were evaluated (Figures E5 and E6).

Fishing Mortality: Fishing mortality doubled between 1979 and 1985 (0.34 to 0.74) (28% to 46% exploitation rates), declined to 0.49 in 1986-87 (36% exploitation rate), but increased in 1988 (F=0.81; 51% exploitation rate) (Figure E1). F peaked at a record-high in 1991 (F=1.07; 61% exploitation rate), which is far in excess of $F_{0.1}$(0.16), F_{max}(0.29) and $F_{20\%}$(0.35)

Recruitment: Strong year classes were produced in 1980, 1983, and 1985 (Figure E2). The 1988, 1989, 1990 and 1991 year classes are all below-average, and the 1989 and 1991 year classes appear to be among the poorest on record.

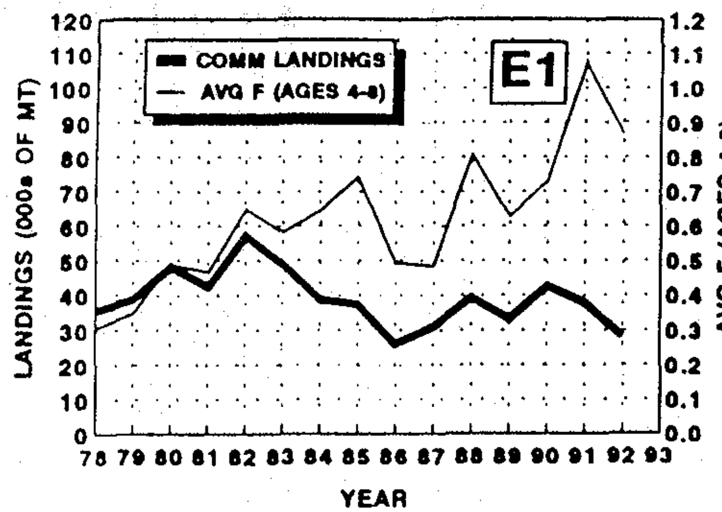
Spawning Stock Biomass: SSB declined by about 50% between 1980 and 1985/86 (92,700 mt to 55,000 mt), increased to 71,000 mt in 1988, but declined to 55,000 mt in 1991 and fell to a record-low of 41,000 mt in 1992 (Figure E2).

Special Comments: Lack of discard data in the assessment may result in an underestimate of F on the youngest ages, and lack of recreational catches in the assessment may affect all ages, although the extent is unknown.

Source of Information: Report of the 15th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC Ref. Doc. 93-06, and NEFSC Ref. Doc. 93-05 (Assessment of the Georges Bank cod stock for 1992 by Serchuk *et al*).

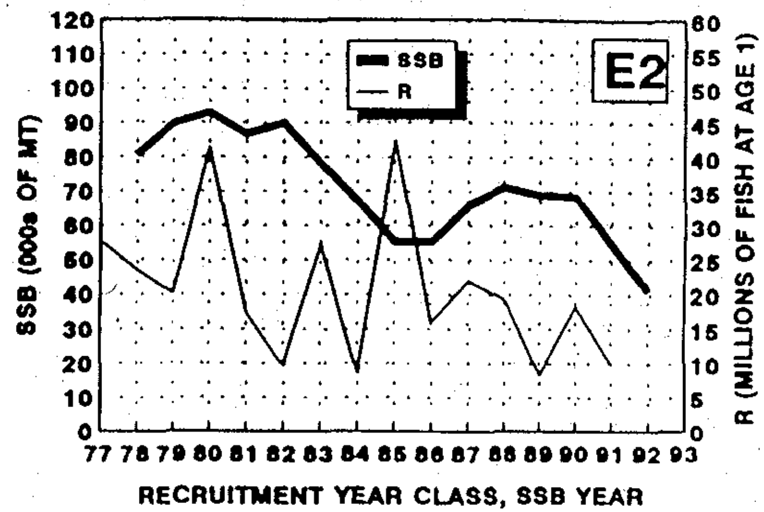
GEORGES BANK COD

TRENDS IN COMMERCIAL LANDINGS AND FISHING MORTALITY



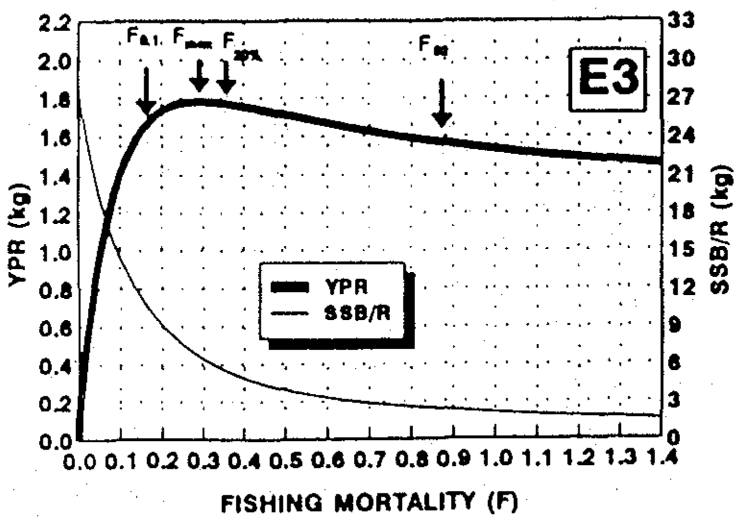
GEORGES BANK COD

TRENDS IN SSB AND RECRUITMENT (R)



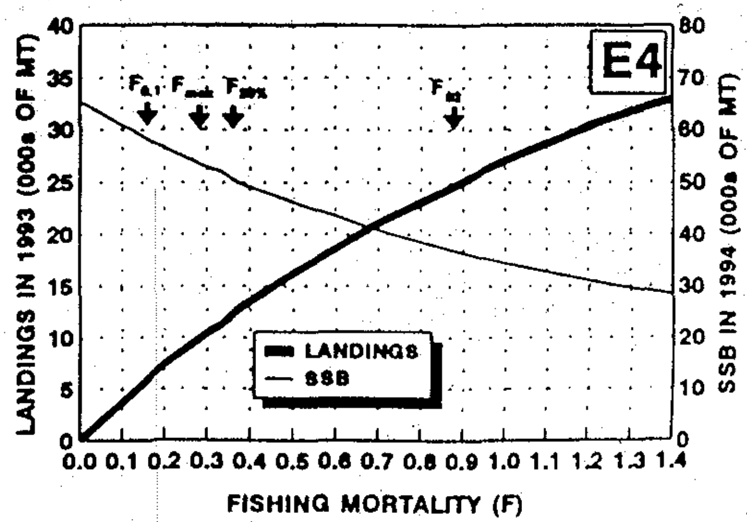
GEORGES BANK COD

YIELD AND SPAWNING STOCK BIOMASS PER RECRUIT



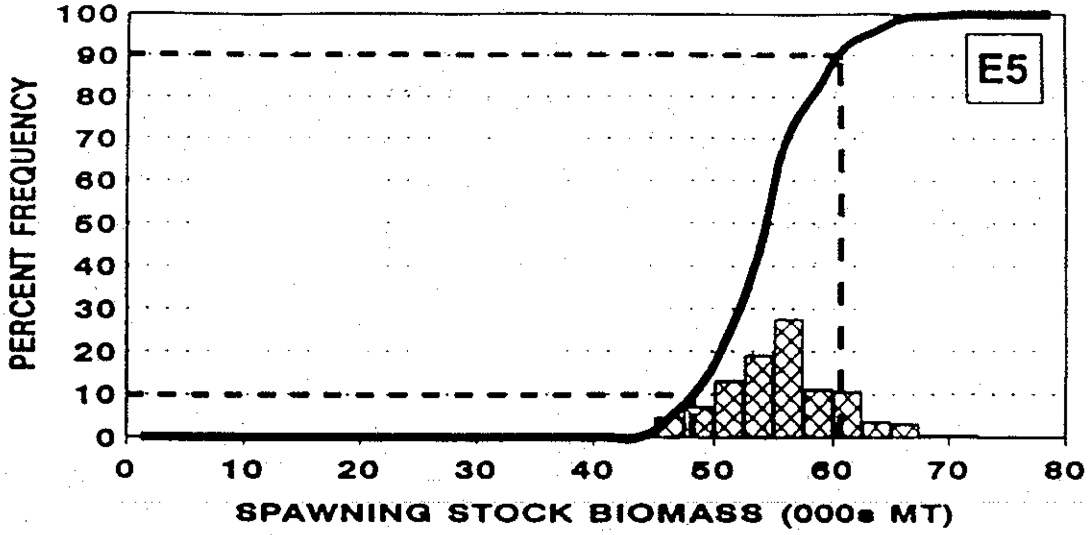
GEORGES BANK COD

SHORT-TERM LANDINGS AND SPAWNING STOCK BIOMASS



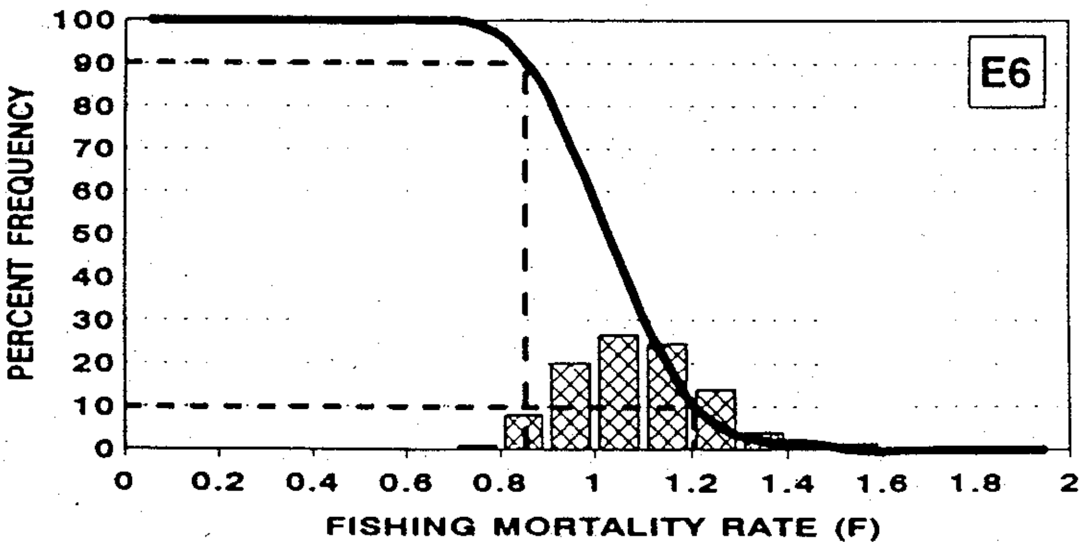
GEORGES BANK COD

PRECISION ESTIMATES - SSB



GEORGES BANK COD

PRECISION ESTIMATES - FISHING MORTALITY



Precision of the estimates of spawning stock biomass (E5) and fishing mortality rate (E6) for Georges Bank cod. The vertical bars display both the range of the estimators and the probability of individual values within that range. The solid line gives the probability that SSB is less than any selected value on the X-axis (E5) and the probability that F is greater than any selected value on the X-axis (E6). The dashed lines indicate the value at the 10 and 90 percent probabillity levels. The precision estimates were derived from a statistical procedure known as the bootstrap.

F. GEAR RESEARCH ADVISORY REPORT

MESH SELECTIVITY FOR ATLANTIC COD AND YELLOWTAIL FLOUNDER: Selectivity studies reviewed by the SARC indicate that useful preliminary advice on mesh selection characteristics can be provided for Atlantic cod and yellowtail flounder. Although lengths at 50%, 25% and 75% retention vary due to cod-end mesh and other experimental factors, several general relationships are nevertheless clear from the studies conducted to date.

Figures F1 and F2 give information on selection lengths (L25, L50, L75) for diamond and square mesh based on relevant historical studies and selectivity work currently in progress. For yellowtail flounder-diamond mesh (Figure F1), relevant studies ranged over mesh sizes from 4 inches to 6 inches. Two square-mesh trials have been completed: for 5-1/2 and 6 inch cod-end meshes. A significant relationship between L50 and mesh size exists for diamond mesh experiments with yellowtail flounder (Figure F1). The experimental L50 of about 15 inches at 6 inch mesh is consistent with L50 values derived from smaller meshes. Values of L25 for diamond mesh are, however, much more variable. The L25 value for the 6 inch diamond mesh experiment is not considered to be reliable, given the greater selection range (L25 -> L75) observed in other mesh experiments. Moreover, the 6 inch mesh work is still preliminary and in progress. For yellowtail flounder, values of L50 and L25 for square mesh are considerably lower than for the same-sized diamond meshes. The value of L25 for 6 inch square mesh is about 12 inches (the current minimum fish size).

For Atlantic cod, none of the square mesh studies are considered appropriate for projecting L50 and L25 for USA populations. Nevertheless, the likely values of L50 and L25 can be derived based on the differences seen between square and diamond mesh results observed from non-USA studies, and the diamond mesh studies relevant to USA cod populations. For diamond mesh there are 4 relevant studies (Figure F2). Although no USA experimental work has been completed with 6 inch mesh, results from studies with smaller mesh can be extrapolated to 6 inch mesh, but the results must be considered preliminary. The projected L50 for 6 inch diamond mesh is about 22-24 inches. The projected L25 for 6 inch diamond mesh is 20-22 inches. Based on comparative square vs. diamond mesh trials, the values of L50 and L25 for square mesh are higher than those for diamond mesh for Atlantic cod. A general relationship based on square vs diamond mesh studies indicates that L50 for square mesh is about 10% or 1.1 times the L50 value for diamond mesh. Thus, the projected L50 for 6-inch square mesh is about 24-26 inches for 6 inch square mesh. The current minimum size of 19 inches for Atlantic cod is thus slightly lower than the projected L25 for 6 inch diamond mesh, and about two inches below the L25 value for 6-inch square mesh.

PROTOCOL FOR FUTURE MESH STUDIES: The comparisons of mesh selection trials for Atlantic cod and yellowtail flounder reviewed in the SARC report, revealed important deficiencies that limit our ability to draw inferences from the studies. The most difficult problem encountered in relating the various studies is the differences in experimental protocols among studies. The mesh studies reviewed in the SARC report used differing cod-end mesh (the control variable of interest), but also were conducted with widely differing trawl characteristics (mesh materials, mesh size in the body of the trawl, etc.). Most importantly, the size compositions of the populations available to the studies were in some cases vastly different. For example, yellowtail flounder populations in the late 1960s and early 1980s contained a wider size range than at present. The constricted size range will necessarily result in biased selection parameters, as compared with earlier data.

It is critical, then, that a definitive experimental protocol for future mesh studies be developed and used in any future studies. There is a recognition of this need world-wide, and several groups are working on such a protocol. The SAW therefore advises that any future mesh selection studies be conducted in accordance with these new standards for such work, and that a regional implementation of such a plan include provisions for central archival and reporting of gear research results.

<u>CONDUCT OF FUTURE GEAR STUDIES:</u> This data review provided useful insights into mesh selection advice available for yellowtail flounder and Atlantic cod. Similar reviews should be conducted prior to additional mesh selection trials for other species (e.g. previous selection studies on summer flounder). For other species regulated by minimum fish size/minimum mesh size regulations (e.g. New England groundfish, black sea bass, scup) sufficient data on mesh characteristics to conduct such a summary are generally lacking.

Given the reliance of current regulatory programs on mesh/minimum fish size, and increasing concerns regarding the effects of technology improvement on the stocks, there is a need for additional controlled experimentation on gear. Likewise, analysis of <u>existing</u> data on size characteristics and discarding based on sea sampling data are considered a priority. Any new mesh trials should be conducted in a systematic manner so as to generate data on the complexes of species caught and managed with primary species (e.g. the 10 'large mesh' species regulated under the Northeast Multispecies FMP, and the species taken with summer flounder).

In order to provide meaningful advice on the selection characteristics of fishing gear, field studies should focus on additional factors other than the cod-end mesh size. As noted in the SARC report, there are other, equally important gear characteristics influencing the size selection of both mobile and fixed fishing gear. As technology regulation becomes more important in the various regulatory programs, the emphasis on multi-factorial gear experimentation will increase.

<u>CONCLUSIONS AND RESEARCH RECOMMENDATIONS</u>

Mesh selection data obtained from published and ongoing studies, provide some useful information on the general selectivity characteristics that can be anticipated for 5.5 and 6 inch cod-end mesh sizes for yellowtail flounder and Atlantic cod. Square mesh results in larger L-50s than diamond for the same mesh size for cod; and vice-versa for yellowtail flounder. No definitive conclusions can be drawn regarding the selection range of square vs. diamond mesh. However, the likely values of L50 and L25 for regulated meshes can, in some cases, be approximated from existing studies. Mesh selection data plotted in Figures F1 to F2 are not completely comparable owing to the various experimental factors confounding cod-end mesh selection. These studies also vary greatly in quality and completeness of reporting of experimental conditions.

Several specific directions for future research were recommended by the SARC:

- A thorough analysis of existing mesh trial data should precede any new data collection (e.g. for summer flounder).

- Sea sampling data collected by the NEFSC should contain information on gear characteristics, catch and discard length frequencies. Although mesh sizes are not measured by sea samplers, mesh sizes indicated by the captains are recorded for each tow. There may be great utility in comparing catch and discard size compositions in relation to reported mesh size and other gear characteristics.

- Interpretation of historical studies is confounded by the extreme variability in protocols followed, and by experimental conditions. To the greatest extent practicable, future mesh work should conform to standardized guidelines.

- A critical problem faced in conducting mesh experiments for New England groundfish and summer flounder has been the fact that these stocks are generally at low levels of abundance, and that not all sizes of fish appropriate for the selection ranges of the experimental gear are available. Therefore, any experimental results obtained under these conditions must be considered provisional, pending adequate and representative sampling of the entire potential length span of the populations.

- One difficulty in interpreting historical selectivity data is that many reports contain only processed selection curves, and their statistics, and not all experimental data, such as length frequencies. The SAW strongly recommends that data reported in such studies should be as complete as possible, thereby allowing interpretation of the experimental conditions encountered.

YELLOWTAIL FLOUNDER
DIAMOND, SQUARE MESH

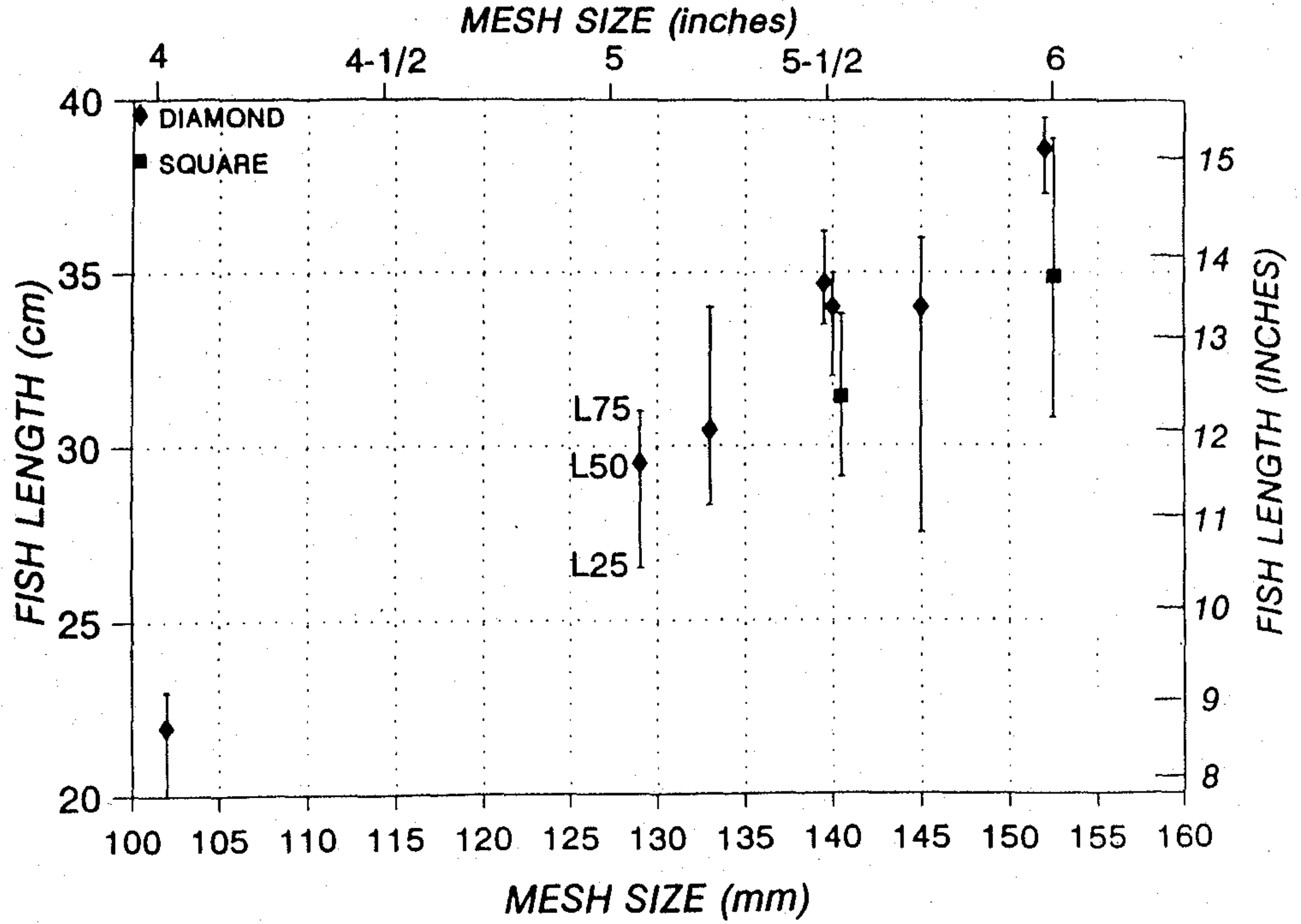


Figure F1. Estimated values of fish length at 50% selection (L-50), length at 25% selection (L-25) and length at 75% selection (L-75) for yellowtail flounder, based on nine research studies. Data for diamond and square mesh studies are plotted separately. Selection data are plotted against the experimental cod-end mesh used in the various studies. Only data from mesh selection studies conducted off the northeast USA are plotted.

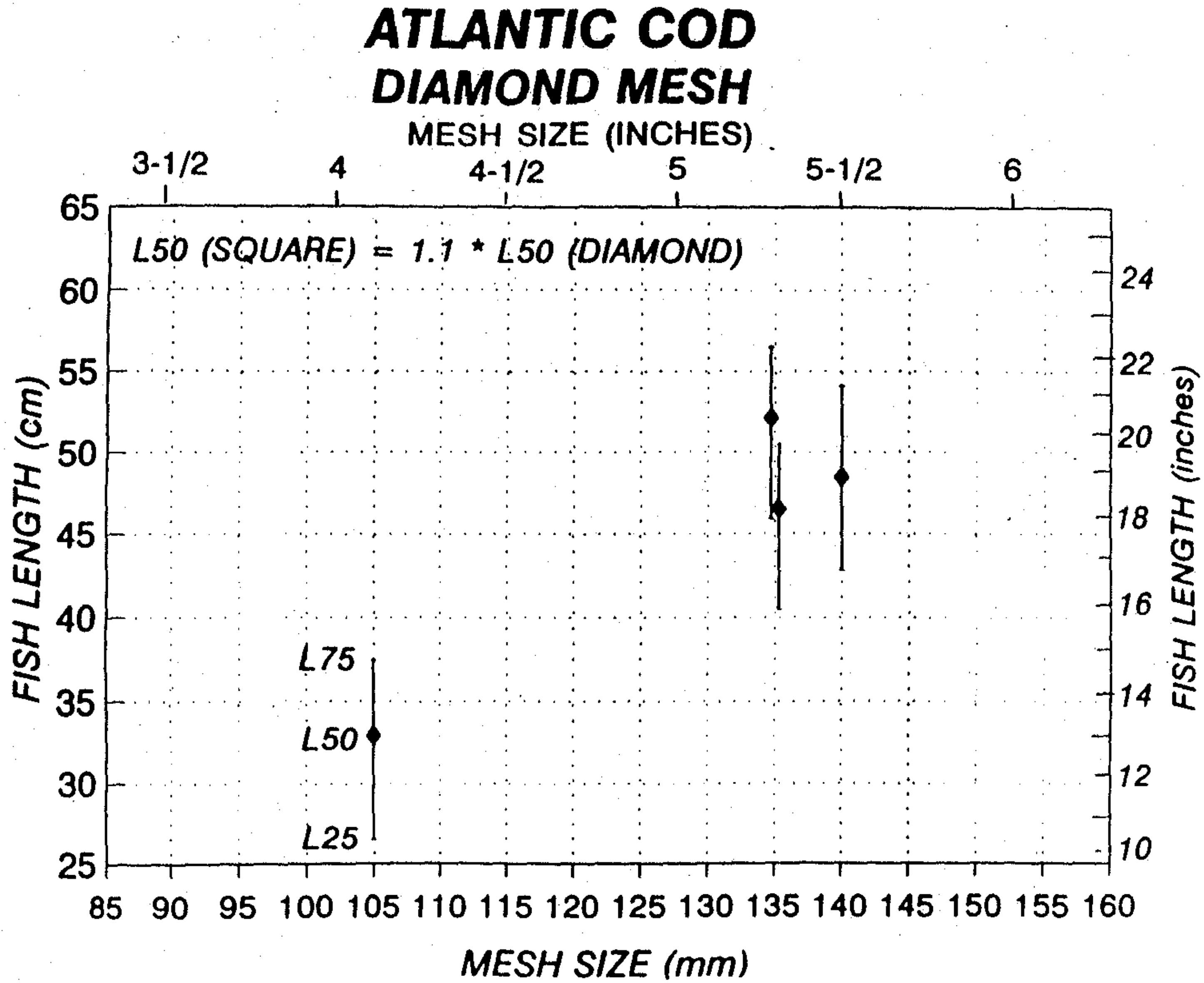


Figure F2. Estimated values of fish length at 50% selection (L-50), length at 25% selection (L-25) and length at 75% selection (L-75) for Atlantic cod, based on four research studies using only diamond mesh. Selection data are plotted against the experimental cod-end mesh used in the various studies. Only data from selection studies in the northwest Atlantic are plotted. Data from other studies indicate that L-50 for square mesh is approximately 1.1 times the L-50 values for equivalent sized diamond mesh (range 1.02-1.22).

SPECIAL TOPICS

FUTURE MESH SELECTION STUDIES

Presenter: Peter Colosi | Rapporteur: Tom Morrissey

Peter Colosi led a discussion on future mesh selection studies. The discussion has been summarized in section "F" of the Advisory Report. One conclusion which can be drawn is that the likely values of L50 and L25 for regulated meshes can, in some cases, be approximated from the existing studies.

Specific directions recommended by the SARC for future research, in addition to those included in the Advisory Report, are:

- The priorities for additional mesh trials for cod and yellowtail flounder include: (a) 6 inch square and diamond mesh experiments for cod, and (b) 6 inch diamond mesh trials to obtain L25 estimates for yellowtail. Estimates of L50 and L25 are also required for other "large mesh species" regulated under the Northeast Multispecies FMP.

- To date, mesh studies have generally focused only on comparing size compositions from the experimental mesh to some control, with all other factors influencing selectivity held constant. A preferable experimental protocol would involve a factorial design, recognizing that cod-end mesh selection is but one control variable available to managers to improve the selectivity of trawl gear.

SEA SAMPLING PLAN FOR 1993

Presenter: Darryl Christensen Rapporteur: David Dow

Darryl Christensen presented an overview of the rationale behind the NEFSC Sea Sampling Program. In the past, program coverage was largely for research purposes to provide information on bycatch and discards for selected fisheries. Information was provided on biological samples for age, growth, and maturity; while tissue samples were collected for measurements of biotoxins, toxic chemicals, and bacteriological safety.

Increasingly, the sea sampling program has been required to obtain information needed to address regulatory issues such as quotas (swordfish FMP catch, sea turtle bycatch, and summer flounder FMP discards) and monitoring (Marine Mammal Protection Act requirements).

Between 1989 and 1992, the foreign trawl fishery sea sampling program diminished from 758 days to 0 days, while the domestic sea sampling program increased from 1112 days in 1989 to 3131 days in 1992. At the peak sampling intensity in 1992, the following fisheries were sampled (days absent are in parentheses): New England gillnet (1441), swordfish gillnet (171), tuna pair trawl (67), swordfish longline (296), otter trawls (893), scallop dredge (191), lobster pot (17), and groundfish longline (55). Days sampled for most fisheries, except gillnets, were less than a 1% of the days fished.

NMFS Headquarters administers the funds that support the New England gillnet, swordfish gillnet, tuna pair trawl, and swordfish longline sampling programs, while the NEFSC budget funds all other sea sampling programs. This latter effort was funded at $615K for work completed in 1992 and will be referred to as the discretionary budget. The $615K included FY91 carryover funds ($244K) FY92 stock depletion funds ($321K), and FY92 end of year money ($50K).

Suggested priorities for sea sampling were: shrimp trawlers (NMFS/NEFSC); summer flounder exemption permit holders and shrimp trawlers (NMFS/NER); summer flounder trawlers, freezer trawlers fishing for squid, mackerel and butterfish, and a few sea bass pot trips (MAFMC); and scallop vessels, freezer trawlers, and a few lobster pot trips (NEFMC Plan Development Teams). Due to severe budget cuts in discretionary funding for FY93, however, there will only be approximately 579 sea sampling days available. The table below lists the allocation of these sampling days among different types of fisheries and the resulting sampling intensity (% coverage based on 1991 effort).

CONTRACT YEAR 1993 COVERAGE
(April 1, 1993 - March 31, 1994)
NON-MAMMAL RELATED PURPOSES

(579 Estimated Days Available)

FISHERY	OBSERVER DAYS	FISHING DAYS	PERCENT COVERAGE
Otter Trawl			
Northern Shrimp	70	7,397	0.95
Gulf of Maine	62	73,240	0.08
Georges Bank	84	73,870	0.11
Southern New England	38	23,706	0.16
Mid-Atlantic	38	65,556	0.06
Groundfish Pair Trawl	30	384	7.81
Scallop Dredge	209	62,321	0.34
Lobster Pot	48	12,457	0.39

Discussion

Discussion among workshop participants centered around the question of how to resolve the demand/supply dilemma. While it was indicated that the FMP sea sampling requirements (triggers in plans and need to evaluate efficacy of plans) should take top priority, some felt that the proposed 1993 sea sampling program was inadequate to provide quantitative estimates of discards and, therefore, that each year the program should concentrate on one or two fisheries. Post-sampling analysis of the marine mammal sea sampling program helped design a sampling effort that will achieve statistical relevance. The Sea Sampling Investigation has a backlog in processing these data (currently up to March/April 1992) due to a major redesign of forms for data collection and software for data entry and management. Few personnel are available to analyze the existing data and improved sampling strategies are recommended for future research. Other Center personnel will need to be utilized in order to perform this quantitative analysis.

The proposed 70 day Northern shrimp otter trawl sea sampling effort recommendation was discussed for the April 1993 - March 1994 contract year. The sampling effort was based on the discard goals contained in the FMP. Post sampling analysis has been conducted and now forms the basis for sampling strategies aimed at documenting the impact of the Nordmore grate on both shrimp catch and discards in the fishery. This is a priority fishery for coverage by sea samplers. Concern was expressed on how well the Nordmore grate would separate flatfish (discards) from the shrimp.

RECREATIONAL FISHERIES STATISTICS WORKING GROUP REPORT

Presenter: Paul Perra Rapporteur: Tom Morrissey

Working Group Members: P. Perra, Chair (ASMFC); C. Moore (MAFMC); J. Witzig (NMFS, WO); M. Terceiro and T. Morrissey (NEFSC)

Chairman Paul Perra reported that the Recreational Fisheries Statistics Working Group was not active during 1992. A meeting of the working group will be scheduled as soon as possible following release of the results of the 1992 Marine Recreational Fisheries Statistics Survey, probably in April, 1993. In response to discussions at SAW-13 relative to use of MRFSS data in assessments of the cod stocks, the MRFSS interview questionnaire for the intercept portion of the Survey was modified in 1992 to include a question on whether the angler was fishing on Georges Bank. The intent was to determine whether any cod taken during the interviewed trip was from the Gulf of Maine stock or Georges Bank and South stock. The working group will evaluate the usefulness of the information obtained on the location of the fishing trip.

Mr. Perra reported that the Atlantic States Marine Fisheries Commission (ASMFC) has received a Wallop/Breaux grant to hire a statistician to work on recreational fisheries statistics. The ASMFC plans to conduct a series of recreational statistics workshops as the first step in addressing critical data needs. The workshops will bring state and federal data managers together in a hands-on forum working with the MRFSS and other data bases, and will review NMFS and state surveys for the purpose of recommending needed changes. A user manual will be developed as a tool for statistical programs among state and federal agencies. The workshops will also be used to develop understanding of goals and objectives for recreational statistics programs and, if possible, to develop a consensus on common recreational fisheries statistics needs.

OVERVIEW OF THE SECOND ANNUAL NATIONAL STOCK ASSESSMENT WORKSHOP

Presenter: Andrew Rosenberg Rapporteur: Andrew Rosenberg

Andrew Rosenberg gave an overview of the National Stock Assessment Workshop held 31 March - 2 April 1992 at the Southwest Fisheries Science Center in La Jolla, CA. Over 70 NMFS and Council staff scientists attended the meeting. The theme for the presentations and discussions was, " Defining Overfishing - Defining Stock Rebuilding." A full report of the workshop is in press as a NMFS Technical Memorandum.

The first session of the national workshop was on defining overfishing. The session consisted of a national overview of the types of overfishing definitions presently in place, and a series of five contributed papers on different approaches to the problem. The overview, by Rosenberg, Swartz and Darcy (NMFS Headquarters) described the types, basis and relatively (subjectively determined) conservative nature of 95 definitions currently in place in fishery management plans around the country. Rick Methot (AFSC) described the approach taken by the NPFMC in defining overfishing for Alaska groundfish stocks. Fred Serchuk (NEFSC) presented an overview of the ICES approach to providing management advice on the status of resources. Under new procedures, the ICES Advisory Committee on Fishery Management (ACFM) is advising on minimum biomass levels below which poor recruitment is more likely as a key biological reference point analogous to U.S. overfishing definitions. Grant Thompson (AFSC) discussed the theoretical implications of assuming a depensatory model for the relationship between stock and recruitment. He found that threshold levels for a range of life histories are generally around 20% of virgin biomass or 30% MSP. Phil Goodyear (SEFSC) described simulation studies on the use of F_{med}(the fishing mortality rate corresponding to a replacement line which bisects the data of a stock and recruitment plot). Mike Prager (SEFSC) described the use of a production model framework for providing management advice as an alternative to age or size structured models.

Key points in the discussion from the first session were: 1) a distinction needs to be made between a stock that is being overfished and one that has been overfished in the past; 2) both fishing mortality rates and minimum stock biomasses are useful for defining overfishing; 3) it is important to make a distinction between overfishing thresholds and target fishing levels; 4) the development of harvest control laws would considerably improve the overall framework for overfishing and rebuilding definitions.

The second session was on evaluating definitions of overfishing. The overview paper by Keith Sainsbury (CSIRO Australia) described the framework for evaluating management policy and two examples of simulation studies specifically designed to test the effectiveness of harvest control strategies. Sainsbury emphasized the interrelationship between policy development, resource dynamics and analysis and strategy implementation. There were six contributed papers in this session: Ray Conser and Wendy Gabriel (NEFSC) described the estimation and incorporation of uncertainty into estimates of current resource status and biological reference point estimates; Doug Vaughan (SEFSC) described an event tree analysis for menhaden fishery, where a large number of indicators of resource status are used in series to determine needed management action; Tim Smith (NEFSC) described in more detail the simulation studies conducted by the International Whaling Commission which evaluate the performance of difference management procedures given information on the resources of different types; Larry Jacobson (SWFSC) described the development and evaluation of strategies for managing northern anchovy; Martin Dorn (AFSC) described the performance of harvest rate definitions for the Pacific hake fishery where variability in year class abundance is extreme; and Anne Hollowed (AFSC) described attempts to develop a definition for Gulf of Alaska pollock when only a very short time series of contradictory data are available.

The utility of the control law approach to defining overfishing was again discussed. Harvest control laws have been debated and used by the North Pacific and the Pacific Fishery Management Councils in their management plans. The advantages are that there is agreement in advance on what will be done in given situations, the control law applies to both fishing up and rebuilding, assessment of resource status is directly linked to management, and uncertainty in the assessment can be explicitly included.

The third session was concerned with rebuilding programs. Alec MacCall (SWFSC) presented an overview paper on the underlying ecological and management principles associated with developing resource rebuilding programs. There were five contributed papers: Doug Demaster (AFSC) described the history of the west coast pinniped stocks, which are now recovering from previous harvesting at a rapid rate; Joe Powers (SEFSC) and Victor Restrepo (U. Miami) described a simulation study on the importance of research for the management of rebuilding stocks, using king mackerel as an example; Dan Ito (AFSC) described studies on Pacific Ocean Perch in support of a rebuilding program; Bill Overholtz, Ralph Mayo, Wendy Gabriel and Steve Murawski (NEFSC) described the stochastic simulation studies on New England groundfish used to give advice to the NEFMC on rebuilding programs; and Dick Parrish (SWFSC) talked about the problems of rebuilding stocks of small pelagic fish which are indeterminate spawners with high environmental variability in spawning success and distribution.

Subsequent discussion noted that it is very important in the development of a rebuilding program to define clearly the stock levels or conditions under which the resource will be considered depleted and the conditions under which it will be considered not depleted. This is a major, often difficult task. Both the population and ecosystem characteristics of the preferred state need to be considered to develop an adequate rebuilding program. To work effectively, the program must define fishing mortality rates over the entire time frame. The program may be adaptive to changing conditions, but the strategy must be agreed to a priori. Finally, socio-economic criteria need to be explicitly considered for developing rebuilding programs. While the biology can serve as a guide on what needs to be done, how to do it may be largely a socio-economic debate.

Dr. Rosenberg noted that the next (third) national workshop will be hosted by the NEFSC in Woods Hole this coming July (see announcement below). The theme for the meeting will be on bycatch and discard mortality, its estimation, assessment, and implications for resource management.

NATIONAL MARINE FISHERIES SERVICE
THIRD ANNUAL NATIONAL STOCK ASSESSMENT WORKSHOP
JULY 20-22, 1993
NORTHEAST FISHERIES SCIENCE CENTER
WOODS HOLE, MA

First Announcement

"Bycatch and Discard Mortality: Sampling, Estimation and Implications for Scientific Advice"

The theme of the NMFS 3rd annual stock assessment workshop will be on the analysis of bycatch and discard mortality of marine animals. The three day meeting will focus on the estimation of mortality of non-target fish, shellfish, mammals and turtles due to fishing, and the incorporation of such estimates in scientific advice for management. Incidentally caught animals ("bycatch") may be undersized fish of a target species, species which are discarded due to bycatch limits, low value or other reasons and protected species such as marine mammals and sea turtles. Sampling may be conducted by dockside interview, logbooks, or at sea observer programs. Estimates from such sampling schemes need to be included in stock assessment analyses to clarify the impact of bycatch on management schemes in place or under consideration in all regions of the country.

The meeting will be organized in three, one day sessions. Each session will begin with an invited overview paper braoadly addressing the session's topic to open discussion. Submitted papers from NMFS and Fishery Management Council scientists are invited for each session, but the number of accepted papers will be limited to 8 for each day in order to leave time for discussion. In addition, there will be an open poster session which will be held on day 2 and 3 for any participant who would like to present their work. Time will be allocated specifically for the poster session during the meeting.

The first session will focus on the sampling and estimation of the number and composition of animals incidentally caught and discarded. In this session papers on sampling schemes, estimation methods and evaluation of accuracy and precision are solicited. The second session will be on the incorporation of discard estimates into assessment analyses. Papers on methods of mortality estimation, mixed species analysis, and the estimation of uncertainty due to discard mortality will be discussed in this session. The third session will be on the impact of discard and bycatch mortality for management. Studies on the short and long term consequences of discard mortality and the assessment of risk due to bycatch and the provision of advice for management of bycatch will be discussed.

This meeting is open to NMFS scientists, Fishery Management Council staff scientists and invited participants only. The steering committee for the workshop is: V. Anthony, NEFSC (co-convenor); R. Kope, SWFSC; L. Low, AFSC; M. Prager, SEFSC; A. Rosenberg, NMFS HQ (co-convenor). Please contact the steering committee member in your region for more information or to submit a paper. Titles and summaries of contributions are needed by May 1, 1993.

BIOLOGICAL REFERENCE POINTS WORKING GROUP REPORT

Presenter: Andrew Rosenberg Rapporteur: Helen Mustafa

Working Group Members: A. Rosenberg, Chair (NMFS/RE); A. Applegate (NEFMC); J. Brodziak (NEFSC); E. Dorsey (CLF); T. Hoff (MAFMC); D. Pierce (MA DMF/ASMFC)

Andrew Rosenberg reported that formation of the Working Group was recommended at the Plenary meeting of the 14th SAW. The terms of reference were developed at the first meeting of the group, held in December 1992, in conjunction with the Stock Assessment Review Committee (SARC) meeting.

Suggested Terms of Reference:

- o Describe in detail the biological reference points utilized for stocks in the northeast, how they are used (as overfishing definitions, harvesting targets, warning signs) how they have been estimated for each stock and what is known concerning their uncertainty.

- o For the different types of reference points, determine their advantages and pitfalls for different applications and different types of stocks. Investigate the robustness of reference points to model, process, and estimation errors in different applications.

- o Examine the robustness of setting %MSP levels by analogy. What are the effects of density dependent maturity, natural mortality, and growth rates? If the reference stock has a certain set of density dependent characteristics, how different can the characteristics of the analyzed stock be before the %MSP analogy breaks down?

- o Evaluate how the reference points can be utilized in the development of harvest control laws for northeast fisheries and outline the process of control law definition.

Dr. Rosenberg indicated that although members of the Working Group would participate in the activities suggested in these terms of reference, it will be necessary for the SAW Steering Committee to task people to assist in the performance of related work.

Discussion

It was suggested that it may be useful to examine the definition of overfishing along with biological reference points and their relation to plan objectives. The examination of the robustness of setting %MSP by analogy was noted to be one of the more important of the terms of reference as far as lobster stocks were concerned. The first and second items under the terms of reference were suggested to imply the need for simulation work.

RESTRUCTURING THE SAW

Presenter: Vaughn Anthony Rapporteur: Terrence Smith

Background

During the Plenary meeting of the 13th Stock Assessment Workshop (13 - 14 January 1992), it was agreed that the 14th SAW (July 15 - 16, 1992) would consider a special topic - the consistency of SAW documentation and development of standardized formats for presenting SAW reports.

To that end, a working paper, "Standardization of SAW Documentation," by Fred Serchuk, was presented and discussed (Research Document 14/1, Summer, 1992) at the 14th SAW Plenary. The Plenary recommended formation of a "SAW Procedures Study Group" to develop new protocols for improving the SARC/SAW procedures and asked that the group prepare a report for the next SAW Steering Committee meeting.

A report, "A Proposal for Restructuring the Northeast Regional Stock Assessment Workshops," was reviewed by the SAW Steering Committee at its August 17, 1992 meeting with general agreement on the proposed revised model.

On January 27, 1993, the 15th SAW Plenary considered the revised SAW model under the agenda item "Restructuring the SAW."

The Proposed Model

The proposed restructuring suggested a three part model:
(1) creation of working groups or sub-committees to perform the assessments; (2) a closed SARC with membership selected from NEFSC staff, the states, and federal management institutions; and, (3) a SAW Plenary as currently configured.

More specifically, standing sub-committees would be organized by sets of species as described below:

Northern Demersal
Cod, haddock, pollock, plaice, redfish, witch flounder, silver hake, cusk, wolffish, white hake

Southern Demersal
Summer flounder, yellowtail flounder, goosefish, red hake, tilefish, skates, winter flounder, windowpane flounder, ocean pout

Pelagic/Coastal

Mackerel, Atlantic herring, Atlantic salmon, dogfish, butterfish, river herring, striped bass, black sea bass, bluefish, scup

Invertebrate

Scallop, lobster, squids, northern shrimp, surf clam, ocean quahog

Assessment

The sub-committees would meet from 1 to 4 times a year to develop assessments for one or more species. Each sub-committee might include 8 or 9 individuals, including outside assessment experts (state, other federal, academic), and would be responsible for preparation of a consensus report for delivery to the SARC. The documents would be peer reviewed by the sub-committee and the meetings would be working sessions in that revised analyses could be prepared and delivered to the sub-committee during a meeting. It may be necessary to revise the current investigations sub-structure of the population dynamics branch to reflect the sub-committee organization.

The assessment sub-committee would provide a general overview on improving assessments with some (or all) of its membership serving on other sub-committees.

The second part of the SAW model is a revised SARC composed of the Chief Scientific Advisor (Chair); Chief, Population Dynamics Branch; subcommittee chairs; representatives from each state (NC to ME); the Fishery Management Councils (NEFMC, MAFMC); the Regional Office; and the Atlantic States Marine Fisheries Commission. Additionally, the committee would have one assessment scientist each from Canada, a U.S. academic institution and another federal institution.

The final part of the suggested model is a SAW Plenary during which an advisory document (drafted by the sub-committee, finalized by the SARC) would be presented. Presumably, the SAW Steering Committee would also be in attendance.

Discussion

Considerable discussion followed this presentation. Most of the comments related to the peer review role of the SARC and whether the representation based structure of the proposed SARC would provide effective peer review. Additional commenters objected to the closed nature of the SARC and suggested that the current ad hoc practice of inviting knowledgeable and skilled reviewers should be continued.

The motivation for change is the result of general dissatisfaction with the current model, especially the compressed time available to the SARC and Plenary which results in overruns of the agenda, late documentation and related problems.

Allen Peterson explained that the SAW was intended to: (1) bring state and federal managers into the assessment process; (2) include other outside scientists to standardize science and terminology; (3) be responsive to managers.

It was also suggested that the current SAW Advisory Report was too brief and was inaccessible to Fishery Management Council members and other end users.

The function of the SAW process should be reexamined such that peer review, and translation of technical assessment to the end users be considered as the only rationale for change.

Discussion returned to the need for peer review and the appropriate forum for that review. A suggestion was made to use the suggested SARC representation based structure for the SAW Plenary with the SARC remaining as it is currently constituted.

Under this model the SARC would write the advisory report and the SAW Plenary would present it to the relevant audience.

Subsequent discussion supported this model, further discussed problems with the existing model, peer reviews under the revised model and formation of additional sub-committees on socioeconomics and marine mammals.

Consensus

There was not consensus on how the entire process should be restructured. In particular, the role of the Plenary remained unclear, as did the necessity of a suggested 4th level of interaction - presentation of the advisory report at a Council meeting.

Consensus was reached on several points, however.

- The standing sub-committee structure as outlined above should be adopted and used in developing the 16th SAW.
- The SARC would remain an ad hoc body charged with peer review of the reports produced by the sub-committees.
- The advisory report should not be as brief or as terse as the current version and should be made more accessible to managers.

The Plenary also generally agreed that the SAW Plenary could be representation-based and that the SARC should be semi-closed (open attendance, but the chair could limit discussion to the committee if time or circumstances dictated).

The group did not agree on the exact structure and role of the Plenary, the need for a formal presentation to Council, nor exact details on composition and duties of the various bodies.

Discussion of restructuring should continue at the next SAW Plenary with implementation of the sub-committee part of the model prior to the next SARC.

OTHER BUSINESS

OTHER BUSINESS

SAW Chairman: Vaughn Anthony Rapporteur: Helen Mustafa

Species/Stocks to Review at SAW-16

The following species/stocks were identified as possible candidates for review at the next Stock Assessment Review Committee (SARC) meeting and recommended for SAW Steering Committee consideration:

Silver Hake	Short-Finned Squid (Illex)
Witch Flounder	Long-Finned Squid (Loligo)
Herring	Butterfish
Pollock	Summer Flounder
Lobster	

SAW-16 Timing

The following dates were recommended for the two SAW-16 sessions:

21 - 25 June 1993 -- Stock Assessment Review Committee Meeting

28 - 29 July 1993 -- Plenary Meeting

CONCLUSIONS OF THE SAW STEERING COMMITTEE

CONCLUSIONS OF THE SAW STEERING COMMITTEE

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

SAW Chairman: Vaughn Anthony Rapporteur: Helen Mustafa

The SAW Steering Committee, with the exception of Douglas Marshall, met on 25 March 1993. Other meeting participants included T. Hoff (MAFMC); P. Perra (ASMFC); C. Kellogg and A. Applegate (NEFMC); and V. Anthony, T. P. Smith, and H. Mustafa (NEFSC). The meeting was conducted by telephone conference from the NEFMC Office (NEFSC, NER, NEFMC) to MAFMC and ASMFC. Dr. Vaughn Anthony lead the discussions outlined on the agenda (Table 1).

Members of the SAW Steering Committee reviewed the functions of the Committee, agreed on a revised SAW structure, considered SAW-15 documentation, set the terms of reference and timing for SAW-16, and suggested timing of future SAWs.

1. Steering Committee Functions

- Attend the SAW Plenary and discuss management advice;
- Set priorities for review of the 48 stocks in the region, allocate resources (people and funding), and oversee the assessment and advisory process;
- Select species/stocks to review at the next SARC;
- Set terms of reference for assessments;
- Set Dates and places for SARC and SAW Plenary meetings;
- Evaluate sufficiency and style of SARC and Advisory reports and additional communication required;
- Set subcommittees in force and functioning.

2. Restructuring the SAW

Stronger commitment will be required from all concerned to maintain an efficient system of regional workshops, producing the best information available. The NEFSC proposes to change how it will meet its requirements relative to the SAW. In the past, the SAW was an ad hoc activity added to the duties of assessment scientists. Henceforth, Center commitment to the SAW will be much stronger. The Center plans to restructure the organization of its Population Dynamics Branch in support of the new SAW structure and to document the staff's responsibilities relative to the SAW in their "work plans". Support and participation of the Councils and ASMFC, and commitment on the part of the states is also extremely important. ASMFC will convey to the State Commissioners the benefits of technology transfer and inclusion of state information and participation in assessment activities.

The new SAW structure will include five sub-committees, two open Stock Assessment Review Committee (SARC) meetings per year, and two open SAW Plenary meetings per year; as well as other presentations (including reports to the Councils and ASMFC and other fishery groups) and a SAW Steering Committee.

2a. <u>SARC Sub-Committee Structure</u>

The sub-committee structure will facilitate the participation of the states and present a better opportunity to coordinate with ASMFC and Fishery Management Council committees. The groups can and should meet at any appropriate location, often in conjunction with other meetings of common interest, perhaps 3 - 4 times a year. This will require additional data and computer portability which must be addressed this year.

The following sub-committee structure was approved:

SUB-COMMITTEE	SPECIES
Northern Demersal (A)	Cod, haddock, pollock, plaice, redfish, witch flounder, silver hake, cusk, wolffish, white hake
Southern Demersal (B)	Summer flounder, yellowtail flounder, goosefish, red hake, tilefish, skates, winter flounder, windowpane flounder, ocean pout
Pelagic/Coastal (C)	Mackerel, herring, salmon, dogfish, butterfish, shad, river herring, striped bass, black sea bass, bluefish, scup
Invertebrate (D)	Scallop, lobster, squids, northern shrimp, surf clam, ocean quahog
Assessment Methods (E)	

Species assigned to a particular sub-committee are subject to change and addition as needs change.

While stock assessments will be performed in Sub-Committees A through D, the role of the Assessment Methods Sub-Committee (E) will be:

- o to address practical methodological and statistical problems encountered by the species oriented sub-committees in the course of carrying out their respective assessments;

- o to suggest alternative procedures or methods to address these problems;

- o to evaluate new assessment methods (e.g. methods developed elsewhere) and make recommendations regarding their usage in SAW/SARC assessments; and

- o to develop new assessment methods, as needed, to address recurring problems or to improve the quality and precision of SAW/SARC assessments.

The terms of reference for the Assessments Methods Sub-Committee (AMSC) will be closely tied to the ongoing work within the species oriented sub-committees. Members of this group may also serve on the species oriented sub-committees, and will participate fully in the ongoing assessment work. Outside experts will be invited to participate in meetings of this sub-committee.

The first assignment of the AMSC is to convene an ADAPT tutorial this summer (1993).

The Sub-Committees will prepare the working papers for SARC review. They will not be looking at all the species under the terms of reference at once, as the SAW Steering Committee will prioritize the species/stocks to review each time.

Committee member assignments to date are presented in Table 2. For the time being, Sub-Committee Chairs have been chosen from NEFSC Investigations (this may change as time goes on). The Councils, for example, may nominate members only to those sub-committees of interest to them. The Mid-Atlantic Council has already nominated two persons for participation in three sub-committees and the New England Council and ASMFC have agreed to provide names from the Council and the states soon. It was agreed that many ongoing committees now can be combined with this sub-committee structure to streamline present assessment activities. Specifically, the ASMFC will think about this and provide advice at a later date. As the restructuring of the assessment process is a continuing one, it will be discussed again at the next SARC and Plenary sessions.

2b. Stock Assessment Review Committee (SARC)

The SARC will take a broader look at assessments. Its emphasis will be on the development of management information. Specifically the SARC will:

- o Oversee the assessment process;
- o Review the information prepared by Sub-Committees and provide peer review to the assessments;
- o Develop research needs for next assessment; and
- o Determine the advice to managers.

There will be two open SARC meetings each year. Ideally, each SARC will have at least 12 members. The proposed SARC composition is as follows:

- o NEFSC Chief Scientific Advisor (Chair)
- o Four ad hoc assessment members chosen by the Chair
- o State personnel from Maine through North Carolina (not necessarily with interest in species under review)
- o One person from each Regional Fishery Management Council
- o One person from ASMFC
- o One person from NMFS Northeast Regional Office
- o If possible, one scientist from each:
  - Canada
  - Academia
  - Outside the region

In addition to the review of specified stock analyses, the SARC agenda may include special topics of a technical nature.

As participation of state personnel is problematic, it was agreed that states should be asked to accept a stronger role in the total assessment process, not just research of inshore species such as lobster, herring, bluefish, etc.

2c. SAW Plenary

The SAW Plenary will be a forum for vetting scientific advice to a broad group of people. The agenda will be limited to the presentation and discussion of scientific advice (special, technical topics will be discontinued). Plenary meetings will be of one day duration held at any suitable location and may be planned in conjunction with Council and ASMFC meetings. The composition of the Plenary is as follows:

- Steering Committee
  - Executive Director, NEFMC
  - Executive Director, MAFMC
  - Executive Director, ASMFC
  - Regional Director, NMFS/NER
  - Science and Research Director, NMFS/NEFSC
- At least 2 Council staff from each Regional Council
- ASMFC Commissioners (Maine to North Carolina)
- Chair of each Sub-Committee
- SARC Chair
- Any others interested in fisheries management

2d. Other Presentations of Scientific Advice

It may be necessary to present scientific advice at additional meetings, including Council, ASMFC, and fishery groups. Presentations will be specified as the need arises.

2.e SAW Documentation

SAW documentation will include:

- SARC Sub-Committee Papers

  All working papers must be available for distribution to SARC two weeks prior to each SARC meeting.

  Some working papers will be upgraded to NEFSC Reference Documents. Working Papers not chosen to be upgraded will not be retained by the SARC for further distribution.

o SARC Report

Sub-Committees will draft relevant sections of this report which will be reviewed by the SARC. All sections will be due to the Chairman at least two weeks before the meeting.

The final SARC report will be available at the Plenary and become an NEFSC Reference Document

o Advisory Report on Stock Status

This report will be drafted by the SARC and presented at the Plenary. It will be provided to members of the Steering Committee at least two weeks prior to the Plenary meeting.

It will be the responsibility of the SAW Chair, Chief of the NEFSC Population Dynamics Branch, and NEFSC Liaison to the Fishery Management Councils to modify the Advisory Report according to the recommendations of the Plenary.

The format of the Advisory Report on Stock Status was discussed and will be reviewed again as the SAW process continues. The format, as it appears in this report, was chosen from two discussed options mailed to members for review: option A, with stock status, management advice, and forecast information up front in larger print; and option B, with the technical information leading up to stock status, management advice, and forecast information.

o SAW Plenary Report

This report will include the final Advisory Report on Stock Status with a summary of the Plenary meeting, and conclusions of the SAW Steering Committee.

The Plenary Report will not be available until after the SAW Steering Committee meets and approves it.

The final SAW Plenary Report will be an NEFSC Reference Document.

3. SAW-15 Research Recommendations

The generic research recommendations from the SAW-15 Plenary (listed in Summary section of this report) were discussed. It was concluded that an NEFSC, in-house, working group would be appropriate to address precision of recruitment prediction for Atlantic cod.

4. SAW-16 Terms of Reference

The Steering Committee prioritized and set terms of reference for species to be reviewed during SAW-16.

SUB-COMMITTEE	1st PRIORITY	2nd PRIORITY	3rd PRIORITY
No. Demersal	Pollock	Silver Hake (2 stocks)	WitchFlounder
So. Demersal	Summer Flounder	Tilefish	Goosefish
Pelagic/Coastal	Herring	Butterfish	
Invertebrate	Lobster	Squids	

1st PRIORITY (all terms of reference should be met):

o Pollock

a. Assess the status of pollock in Divisions 4VWX and SA5 through 1992 and provide catch and SSB options at various levels of F and, F_{max},$F_{20\%}$,F_{sq}, and $F_{92\text{-}10\%}$. Perform bootstrap replications of the assessment to characterize the variability of the estimates.

b. Investigate the utility of incorporating additional age-disaggregated tuning indices in the ADAPT formulation.

c. Evaluate gillnet sea sampling data for pollock as a means of measuring CPUE.

d. Evaluate estimation procedures for discards and recreational catches, and include these estimates in the catch at age matrix if appropriate.

e. Revise estimates of F_{med}.

o Summer Flounder

a. Provide updated assessment for the coast-wide stock of summer flounder and provide catch and SSB options at various levels of F including F_{max},$F_{20\%}$,and F_{sq}.

b. Evaluate the utility of NMFS winter surveys in providing indices of relative recruitment strength and population size. Provide recommendations on the design and conduct of future such surveys.

c. Evaluate NEFSC and North Carolina sea sampling data for area and time coverage, and recommend appropriate sea sampling coverage to improve the estimates of fishery discards.

o Atlantic Herring

a. Describe the status of the coastal stock complex of Atlantic herring.

b. Provide an age structured assessment of the coastal stock complex of Atlantic herring including estimates of fishing mortality on fully recruited ages, spawning stock biomass, and exploitable biomass at the beginning of 1992. Perform bootstrap replications of the assessment to characterize the variability of the estimates.

c. Specify data deficiencies and research needs.

o American Lobster

a. Examine selectivity of survey gear relative to pre-recruit and fully recruited lobsters and relative availability and incorporate these estimates to the DeLury analysis for the three stock areas.

b. Estimate research vessel survey abundance indices of pre-recruit and fully-recruited lobsters.

c. Provide length-based cohort and DeLury model estimates of fishing mortality rates and stock sizes for the three stock areas.

d. Initiate estimation of growth parameters appropriate to discontinuous growth models, specifically probability molt and molt increment by sex, where feasible.

e. Calculate revised biological reference points including F_{max}, $F_{0.1}$, $F_{10\%}$, EPR, and F_{med} which are appropriate to the three stock areas.

f. Evaluate the status of lobster stocks relative to overfishing definitions and biological reference points.

2nd PRIORITY (sub-committees must decide how much they can do):

o Silver Hake (2 Stocks)

a. Update the analytical assessments of the Gulf of Maine-Northern Georges Bank and Southern Georges Bank-Middle Atlantic silver hake stocks through

1992. If possible, include estimates of discards in the catch-at-age matrix.

b. Evaluate catchability differences for silver hake between the '36 Yankee' and '41 Yankee' survey trawls, and determine the most appropriate conversion factor between the two nets. Standardize the spring survey indices and use the standardized indices in the VPA tuning.

c. Provide any new information on the natural mortality rate of silver hake, with reference to whether the natural mortality rate used in previous assessments (M=0.40) is still reasonable.

o Tilefish

Review data possibilities for developing overfishing definition.

o Butterfish

a. Compute revised research vessel survey indices and evaluate the stock with respect to survey-based management reference points.

b. Develop CPUE series based on GLM models incorporating area, vessel and % directed fishing.

c. Review discards and the role they play in total mortality.

o Long-Finned Squid (Loligo)

a. Provide updated calculation of yield and spawning stock biomass per recruit and other standard biological reference points. In particular, review the level of MSY.

b. Provide updated minimum biomass and recruitment estimates based on areal expansion of research vessel survey data.

c. Continue the development of DeLury population estimators based on research vessel survey and commercial CPUE and length composition data.

d. Recalculate CPUE series based on general linear models, by vessel size class, area and season. Investigate the predictability of fishery success from research vessel surveys.

(It was noted that more data are needed to regulate this fishery as it becomes nearly fully exploited.)

- o Short-Finned Squid (Illex)

  a. Compute revised research vessel survey indices from spring and autumn surveys. Estimate minimum stock sizes from area-swept calculations. Evaluate the stock with respect to survey-based management reference points.

  b. Estimate catch in numbers by cohort.

  c. Examine time-series CPUE data based on GLM formulations.

  d. Provide updated projections of yield and stock size based on current fishery patterns. Evaluate the stock relative to management reference points. Review the level of MSY.

  (It was noted that more data are needed to regulate this fishery as it becomes nearly fully exploited.)

3rd PRIORITY (only if possible for sub-committee to address):

- o Witch Flounder

  a. Assess the status of witch flounder by updating research vessel survey and commercial landings and sampling data through 1992. Make preliminary estimates of current fishing mortality through catch curve or MULTIFAN based cohort analysis.

  b. Initiate efforts to upgrade the assessment from an 'index' assessment to an 'age-structured' assessment.

  c. Provide an initial evaluation, based on the NEFSC sea sampling data base, of witch flounder discards.

- o Goosefish (unlikely that Council could use results before 17th SARC)

  a. Review data possibilities for developing overfishing definition.

  b. Develop information for setting minimum size in management advice.

5. Timing of Future SAWs

SAW-16 Timing

Stock Assessment Review Committee Meeting
21 - 25 June 1993
NEFSC Conference Room,
Woods Hole, Massachusetts

Plenary Meeting
29 July 1993
Air Port Ramada,
East Boston, Massachusetts
or Woods Hole

SAW-17 Timing

Stock Assessment Review Committee Meeting
29 November - 3 December 1993
NEFSC, Woods Hole, Massachusetts

Plenary Meeting
Day before January 1994 meeting of the Mid-Atlantic Fishery Management Council Meeting

SAW-18 Timing

Stock Assessment Review Committee Meeting
20 - 24 June 1994
NEFSC, Woods Hole, Massachusetts

Plenary Meeting
Day before July 1994 meeting of the New England Fishery Management Council

Table 1.

SAW STEERING COMMITTEE MEETING

AGENDA

1. Steering Committee Function

2. SAW Restructuring

   a) Sub Committees
      Members, where meet, how often,
      interface with other committees

   b) SARC
      open meetings, 2 per year,
      membership

   c) Plenary
      participation

   d) 4th Meeting
      report to Councils

   e) Documentation
      NEFSC Reference Documents
      Advisory Document

3. Research Recommendations

4. SAW-16
   Species
   Terms of reference
   Special studies

5. Timing of Future SAWs

Table 2.

SARC ASSESSMENT SUB-COMMITTEES MEMBERSHIP
(To date)
(Members in brackets are transitional)

NORTHERN DEMERSAL (A)

R. Mayo (Chair)
L. O'Brien
T. Helser
K. Sosebee
A. Applegate
S. Wigley
(D. Hayes)
(F. Serchuk)

SOUTHERN DEMERSAL (B)

W. Gabriel (Chair
P. Rago
M. Terceiro
R. Conser
T. Hoff
A. Applegate
M. Lambert
(G. Shepherd)
(J. Idoine)
C. Moore

PELAGIC/COASTAL (C)

W. Overholtz (Chair)
K. Friedland
A. Richards
G. Shepherd
J. Kocik
C. Moore
R. Haas
(M. Terceiro)
(J. Brodziak)
T. Hoff
H. Russell

INVERTEBRATE (D)

F. Serchuk (Chair)
D. Hayes
J. Brodziak
J. Weinberg
T. Hoff
A. Applegate
J. Idoine
(M. Fogarty)
(S. Clark)
H. Russell

ASSESSMENT METHODS (E)

R. Conser (Chair
P. Rago
J. Brodziak
A. Rosenberg
F. Serchuk
W. Overholtz
R. Mayo
W. Gabriel
C. Moore