

**Report of the
16th Northeast Regional
Stock Assessment Workshop
(16th SAW)
*The Plenary***

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

October 1993

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October 1993

Nine documents associated with the 16th Northeast Regional Stock Assessment Workshop (16th SAW) have been published as Northeast Fisheries Science Center reference documents. For copies of these documents, contact the NMFS/NEFSC, Information Services Unit, 166 Water St., Woods Hole, MA 02543-1097, (508)548-5123.

**Reports Associated with the 16th Northeast Regional
Stock Assessment Workshop (16th SAW)**

- CRD 93-13 Assessment of pollock, *Pollachius virens*, L., in Divisions 4VWX and Subareas 5 and 6, 1993
by R. K. Mayo and B. F. Figuerido
- CRD 93-14 Assessment of summer flounder (*Paralichthys dentatus*), 1993: Report of the Stock Assessment Workshop (SAW) Summer Flounder Working Group
M. Terceiro, ed.
- CRD 93-15 Analytical assessment of the Atlantic herring coastal stock complex
by D. Stevenson, D. Libby, and K. Friedland
- CRD 93-16 Report of the Workshop on Atlantic Herring Science and Assessment in the Gulf of Maine/Georges Bank Area
NOAA/NMFS/NEFSC
- CRD 93-17 Evaluation of available data for the development of overfishing definition for tilefish in the Middle Atlantic
by G. Shepherd
- CRD 93-18 Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW), Stock Assessment Review Committee (SARC) and Consensus Summary of Assessments
NOAA/NMFS/NEFSC
- CRD 93-19 Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW), The Plenary
NOAA/NMFS/NEFSC
- CRD 93-20 Calculating biological reference points for American lobsters
by J. Idoine and M. Fogarty
- CRD 93-21 Assessment of American lobster stock status off the Northeast United States, 1993
by S. Murawski, B. Estrella, J. Idoine, J. Krouse, R. Conser, T. Angell, M. Blake, K. Sosebee, P. Briggs, S. Cadrin, M. Fogarty, and A. Richards

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SUMMARY

The Plenary Meeting of the Sixteenth Northeast Regional Stock Assessment Workshop (16th SAW) was held at the Ramada Hotel in Boston, Massachusetts on July 29, 1993. More than 60 persons attended the meeting (Table 1). The Plenary agenda is presented in Table 2.

Opening

The SAW Chairman, Dr. Vaughn Anthony (NEFSC) reviewed the current SAW structure emphasizing the changes implemented for the 16th SAW. He indicated that we are not yet where we want to be in terms of doing science, as assessing 45 species represents an extensive workload. The process will continue to be implemented as the next SAW is developed.

The SARC Subcommittee structure and membership were reviewed (Tables 3 and 4), as well as the proposed reorganization of the NEFSC Population Dynamics Branch (Figure 1) to better accommodate the increasing workload as the Councils move forward in management. Initially, the NEFSC Investigation Chiefs have been appointed to chair the species subcommittees. In the future, it may be appropriate to replace various chairs by personnel from other organizations. Although recently chairs of the ASMFC Technical Committees were nominated to serve on the SARC Subcommittees, Dr. Anthony emphasized the need for additional members, particularly more state members on the Northern Demersal Subcommittee; and, pointed out the importance of representation from the state of Maine on the Invertebrate Committee, relative to the work on lobster.

In preparation for the 16th SAW Stock Assessment Review Committee (SARC) meeting, the subcommittees did a tremendous amount of work, more than what was expected. All terms of reference for the 12 species/stocks were met in spite of priority. Unfortunately, the SARC had time to review and formulate advice on only five species.

The Assessment Methods Subcommittee, which will consider generic problems relative to assessment methods and techniques across the species, has not yet met. The terms of reference for this subcommittee have been drafted on the basis of discussions at the SARC meeting and are presented in the SARC report on pages 113-114. An enormous amount of work will be required to meet these terms of reference. Their completion will result in significant contributions to assessment science.

The assessment process, explained Dr. Anthony, is overseen by the SARC which is composed of a broad spectrum of experts (Table 5) meeting in open session. The SARC reviews the materials prepared by its subcommittees making sure that the subcommittees are not inwardly biased in their work and that the established terms of reference are met.

In addition, the committee determines the scientific advice for managers. The SARC forum facilitates feedback on data problems and the Northeast Fisheries Science Center's effectiveness in interacting with the states.

The 16th SAW SARC reviewed working materials and determined advice for 5 species (1st priority -- pollock, summer flounder, Atlantic herring, and American lobster; and 2nd priority -- tilefish). The two reports of that meeting, the Report of the Sixteenth Stock Assessment Workshop (16th SAW), Stock Assessment Review Committee Consensus Summary of Assessments (NEFSC Reference Document 93-18) and the draft Advisory Report on Stock Status (both distributed at the Plenary). In addition, there will be 7 other documents, based on material presented at the SARC meeting, in the NEFSC Reference Documents series (Table 6).

The current SAW process was discussed at the SARC meeting and, in a few weeks, will be reviewed by the Steering Committee.

Advisory Report on Stock Status

Dr. Vaughn Anthony reviewed the advice of the SARC for American lobster, pollock, summer flounder, Atlantic herring, and tilefish as well as relevant information from the SARC report. Plenary participants discussed this material and offered a number of suggestions regarding the presentation of the advice. The Advisory Report on Stock Status contained in this report is the SARC draft edited by Drs. V. Anthony, T.P. Smith, and S. Murawski of NEFSC according to the specific suggestions of the Plenary.

General suggestions on how to improve the presentation of advice and the SAW process are highlighted below:

- o Standardization and consistency is important to managers. Shifts in methodology (e.g., lobster) must be explained, as unexplained shifts are disruptive to the management process. Methodology should obviously keep improving, but changes due to improved methodology should not conflict with previous scientific advice.
- o Risk assessment of fishing mortality (F) and spawning stock biomass (SSB) incorporated into the Advisory Report were considered a positive addition to the report and a useful cross reference to the SARC Report.
- o A more detailed Advisory Report is desirable.
- o To facilitate better state participation, enhanced communication with state experts directly involved with assessments must be encouraged. Sending announcements of subcommittee meetings to state directors may further facilitate participation.

The Advisory Report and general suggestions of the Plenary will be discussed at the next Steering Committee meeting.

Species/Stocks to Review at SAWs 17 and 18

Members of the SAW Steering Committee, or their designees, met briefly at the end of the Plenary Meeting to identify priorities in assessing species for the next two SAWs.

Species/stocks recommended for assessment at SAW-17 SARC are:

<u>SUBCOMMITTEE</u>	<u>1st PRIORITY</u>	<u>2nd PRIORITY</u>
No. Demersal	Gulf of Maine Cod	Georges Bank Cod
So. Demersal	So. New England Yellowtail Flounder	Georges Bank Yellowtail Flounder
Pelagic/Coastal	Bluefish	Butterfish
Invertebrate	Long Fin Squid	Short Fin Squid

The terms of reference for these species/stocks will be developed for approval at the next Steering Committee meeting.

Species/stocks discussed as possible candidates for review at the SAW-18 SARC were: scallops, haddock, shrimp, shad, and river herring.

Although the group briefly touched on policy issues such as prioritization of species for review and assignment of assessment documents to the NEFSC Reference Documents series, it was agreed to discuss these issues in depth at a regularly scheduled meeting of the Steering Committee, in addition to the terms of reference for the species to review and the candidate terms of reference for the Assessment Methods Subcommittee.

Conclusions of the SAW Steering Committee

The SAW Steering Committee met in Saugus on 21 September 1993. The conclusions of the Committee, including the final list of species to review at SAW-17, are summarized at the end of this report (pages 45 - 57).

Table 1. List of Participants

<u>National Marine Fisheries Service</u>	<u>NOAA Eastern Administrative Support Center</u>
Northeast Fisheries Science Center	Robert Smith
Vaughn Anthony	
Steve Clark	<u>Mid-Atlantic Fishery Management Council</u>
Ray Conser	
Mike Fogarty	Rich Seagraves
Kevin Friedland	
Wendy Gabriel	<u>New England Fishery Management Council</u>
Dan Hayes	
Tom Helser	
Marjorie Lambert	Philip Haring
Phil Logan	Chris Kellogg
Ralph Mayo	Douglas Marshall
Steve Murawski	Howard Russell
Helen Mustafa	
Loretta O'Brien	<u>Atlantic States Marine Fisheries Commission</u>
Allen Peterson	
Paul Rago	Jack Dunnigan
Anne Richards	Paul Perra
Fred Serchuk	
Terry Smith	
Mark Terceiro	<u>Connecticut Department of Environmental Protection</u>
Jim Weinberg	
Susan Wigley	Ernie Beckwith
	Eric Smith
Northeast Regional Office	
Paul Jones	<u>Maine Department of Marine Resources</u>
Gene Martin	
Jon Rittgers	Bill Brennan
Regina Spallone	
Office of Research and Environmental Information	
Andy Rosenberg	

Table 1. (Continued)

Massachusetts Division of Marine Fisheries

Steve Cadrin
Steven Correia
Bruce Estrella
Phil Gates
Arnold Howe
Dan McKiernan
David Pierce

New Hampshire Fish and Game

Bruce Smith
Ted Spurr

New York Department of Environmental Conservation

John Mason

Rhode Island Division of Fish and Wildlife

David Borden

Conservation Law Foundation

Ellie Dorsey

University of Maine

Bob Steneck

Atlantic Offshore Lobstermens Assn.

Richard Allen

Keene Narrows Lobster, Inc.

Loyall Sewall

Maine Lobstermens Assn.

David Cousens
Pat White

Massachusetts Lobstermens Assn.

Bill Adler

New Bedford Seafood Coop

John Bullard

Noank, CT

Benjamin Rathbun

Point Judith Fishermen's Coop

Jake Dykstra
James McCauley

Harris Fishing

Dick Harris
Pat Harris

Portsmouth, NH

Bob McDonough

Commercial Fisheries News

Janice Plante

Cape Cod Times

Bryan Lantz

Table 2.

**16th Northeast Regional Stock Assessment Workshop
(16th SAW)**

Plenary Meeting

Ramada Hotel
225 McClellan Highway
Boston, Massachusetts

Thursday, 29 July 1993

AGENDA

9:00	Opening	SAW Chairman	V. Anthony
9:15	Report of the Stock Assessment Review Committee (SARC)*		V. Anthony
9:45	Advisory Report on Stock Status Presentation and Discussion		V. Anthony
	Introduction Lobster Pollock		
12:15	Lunch		
1:30	Continue Advisory Report Presentation and Discussion		
	Summer Flounder Atlantic Herring Tilefish		
4:00	Other Business		

* V. Anthony, R. Conser, D. Hayes, S. Murawski, P. Rago (NMKFS/NEFSC); P. Colosi (NMFS/NERO) A. Applegate (NEFMC); T. Hoff (MAFMC); M. Gibson (ASMFC/RI); Anne Lange (ASMFC/MD); D. Stevenson (ASMFC/ME); J. Collie (URI); M. Fabrizio (USF&WS/NFRC/GL); D. Pezacki (DFO, Canada).

Table 3. SARC Subcommittee Structure

<u>SUBCOMMITTEE</u>	<u>SPECIES</u>
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)	

Note: Subcommittee species assignments are subject to change.

Table 4. SARC Subcommittee membership.

NORTHERN DEMERSAL SUBCOMMITTEE

NMFS/Northeast Fisheries Science Center

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

Fishery Management Councils

A. Applegate, NEFMC

SOUTHERN DEMERSAL SUBCOMMITTEE

NMFS/Northeast Fisheries Science Center

R. Conser	P. Rago
W. Gabriel (Chair)	G. Shepherd*
J. Idoine*	M. Terceiro
M. Lambert	

NMFS/Northeast Regional Office

H. Goodale

Fishery Management Councils

A. Applegate, NEFMC	T. Hoff, MAFMC
	C. Moore, MAFMC

States/Atlantic States Marine Fisheries Commission

S. Correia, MADMF	S. Michels, DEDFW
T. Currier, MADMF	R. Monaghan, NCDMF
M. Gibson, RIDFW**	L. Rugolo, MDDNR
P. Howell, CTDEP**	D. Simpson, CTDEP
A. Lange, MDDNR	

Academia

J. Musick, VIMS

Table 4. (Continued)

PELAGIC/COASTAL SUBCOMMITTEE

NMFS/Northeast Fisheries Science Center

J. Brodziak*	W. Overholtz (Chair)
K. Friedland	A. Richards
R. Haas	G. Shepherd
J. Kocik	M. Terceiro*

Fishery Management Councils

T. Hoff, MAFMC	H. Russell, NEFMC
C. Moore, MAFMC	

States/Atlantic States Marine Fisheries Commission

V. Crecco, CTDEP**	D. Stevenson, MEDMR**
D. Libby, MEDMR	

INVERTEBRATE SUBCOMMITTEE

NMFS/Northeast Fisheries Science Center

J. Brodziak	S. Murawski
S. Clark*	A. Richards
R. Conser	F. Serchuk (Chair)
M. Fogarty*	K. Sosebee
D. Hayes	J. Weinberg
J. Idoine	

Fishery Management Councils

A. Applegate, NEFMC	T. Hoff, MAFMC
H. Russell, NEFMC	

States/Atlantic States Marine Fisheries Commission

P. Diodati, MADMF**	J. Krouse, MEDMR**
---------------------	--------------------

Table 4. (Continued)

ASSESSMENT METHODS SUBCOMMITTEE

NMFS/Northeast Fisheries Science Center

J. Brodziak

R. Conser (Chair)

W. Gabriel

R. Mayo

P. Rago

W. Overholtz

F. Serchuk

NMFS/Office of Research and Environmental Information

A. Rosenberg

Fishery Management Councils

C. Moore, MAFMC

States/Atlantic States Marine Fisheries Commission

V. Crecco, CTDEP**

L. Rugolo, MDDNR**

*Transitional members

**Appointed ASMFC Technical Committee Chairs

Table 5.

**STOCK ASSESSMENT REVIEW COMMITTEE (SARC)
COMPOSITION**

Chair, NEFSC Chief Scientific Advisor:

Vaughn Anthony

Four ad hoc members:

**Ray Conser
Dan Hayes
Steve Murawski
Paul Rago**

NMFS Northeast Regional Office:

Pete Colosi

Regional Fishery Management Councils:

**Andy Applegate, NEFMC
Tom Hoff, MAFMC**

Atlantic States Marine Fisheries Commission /State personnel:

**Mark Gibson, RI
Anne Lange, MD
David Stevenson, ME**

Others:

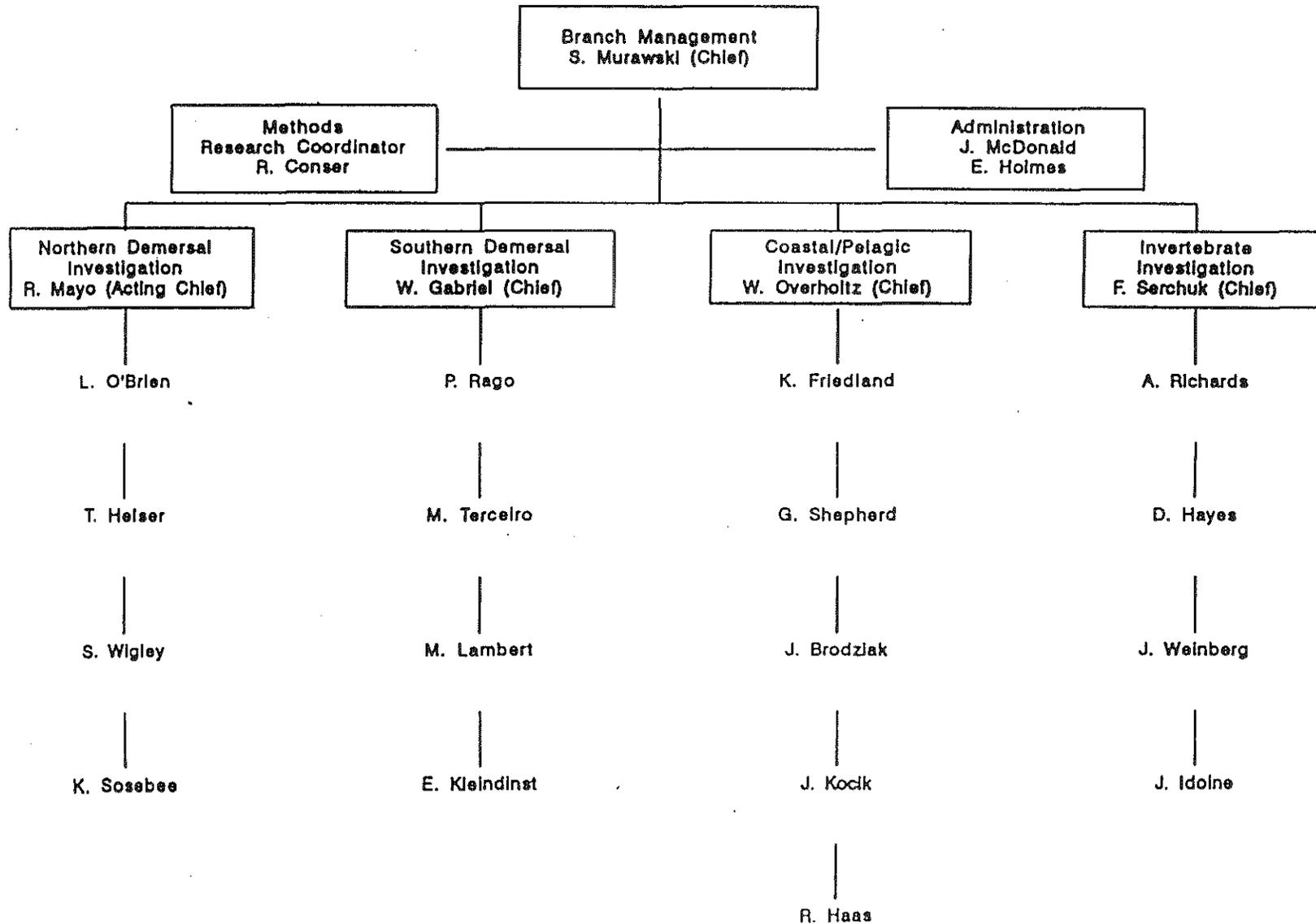
**Canada - Doug Pezzack, DFO
Academia - Jeremy Collie, URI
Other Region - Mary Fabrizio, USF&WS/NFRC/GL**

Table 6.

16th SAW NEFSC REFERENCE DOCUMENTS

Document Number	Title	Author(s)
93-13	Assessment of Pollock, <u>Pollachius virens</u> (L), in Divisions 4VWX and Subareas 5 and 6, 1993	R.K. Mayo B.F. Figuerido
93-14	Assessment of Summer Flounder, <u>Paralichthys dentatus</u> , 1993: Report of the Stock Assessment Workshop Summer Flounder Working Group	M. Terceiro, ed.
93-15	Analytical Assessment of the Atlantic Herring Coastal Stock Complex	D. Stevenson D. Libby K. Friedland
93-16	Report of the Workshop on Atlantic Herring Science and Assessment in the Gulf of Maine/Georges Bank Area	Stock Assessment Workshop
93-17	Evaluation of Available Data for the Development of Overfishing Definition for Tilefish in the Middle Atlantic	G. Shepherd
93-20	Calculating Biological Reference Points for American Lobster	J. Idoine M. Fogarty
93-21	Assessments of American Lobster Stock Status Off the Northeast USA	Murawski et al
93-18	Report of the Sixteenth Northeast Regional Stock Assessment Workshop (16th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments	
93-19	Report of the Sixteenth Northeast Regional Stock Assessment Workshop (16th SAW), The Plenary	

Population Dynamics Branch Proposed Organizational Structure



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Figure 1. Proposed organizational structure of the NEFSC Population Dynamics Branch.

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 the Councils' overfishing and maximum sustainable yield (MSY) definitions. The exploitation rate is simply the proportion of the stock alive at the beginning of the year that is caught during the year. When that proportion exceeds the amount defined by the Councils' overfishing definition, it is considered to be over-exploited. When the stock is at such a level that the MSY can be taken and the fishery is removing such a small portion of the stock that it may be increasing in abundance, then it is considered to be under-exploited. Another important factor for classifying the status of a resource is the current stock level, e.g., spawning stock 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, where possible, stocks were classified as high, medium, or low biomass compared to historic levels. The figure below describes this classification.

		STOCK LEVEL		
		LOW	MEDIUM	HIGH
EXPLOITATION STATUS	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

The geographic research area and statistical reporting areas pertaining to the species in this report are presented in Figures 1 and 2.

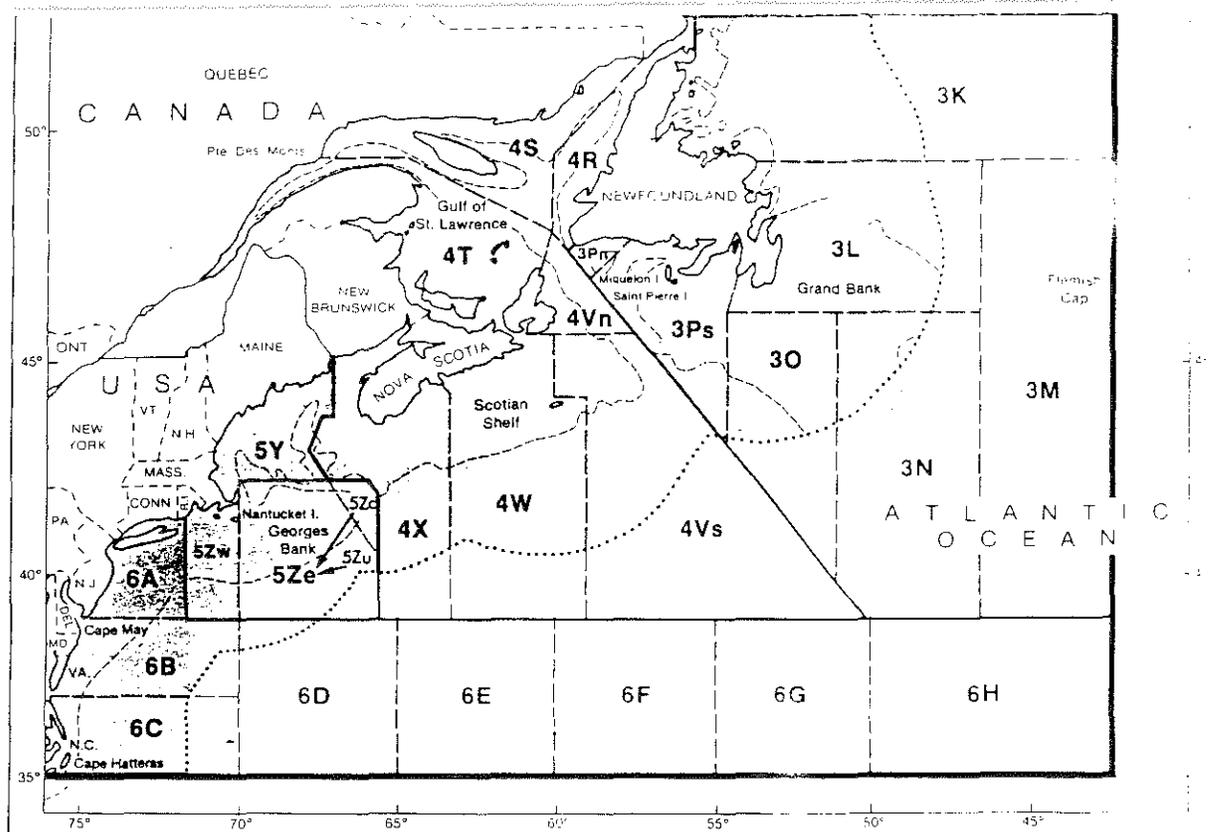


Figure 1. NAFO Divisions and principal geographic features off the Northeastern United States.

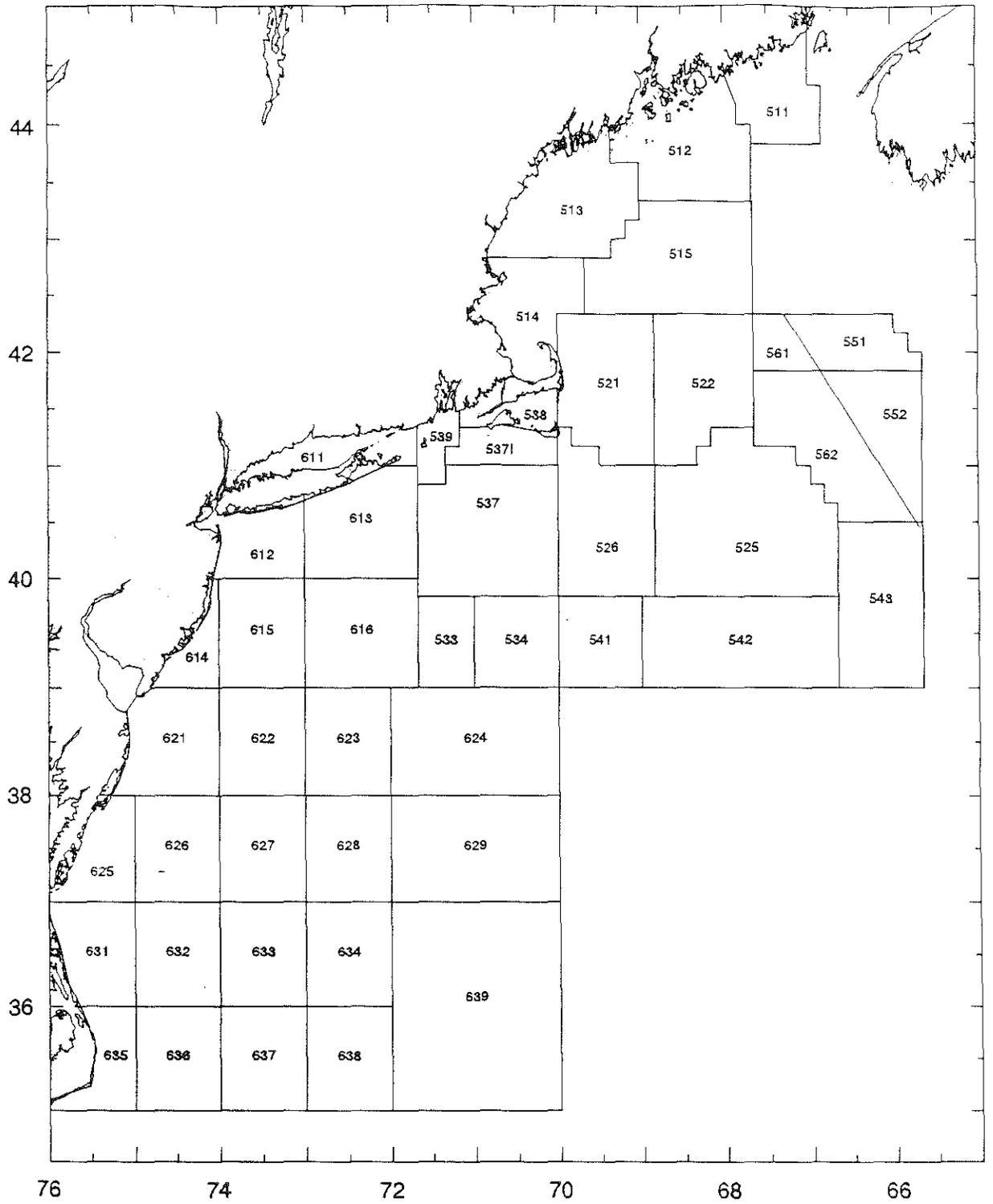


Figure 2. Three digit statistical areas off the Northeastern United States.

A. POLLOCK ADVISORY REPORT
Scotian Shelf-Gulf of Maine-Georges Bank (Divisions 4VWX and Subareas 5 and 6)

State of the Stock: The spawning stock has been declining since the mid-1980s and is near the long-term average of 144,000 mt. The stock is fully-exploited and at a medium biomass level. Fishing mortality increased in 1991, with the 1992 estimated F of 0.72 (42% exploitation rate) above $F_{20\%}$ (0.65, 41% exploitation) and well above F_{med} (0.47, 35% exploitation). Accounting for the estimation uncertainty associated with the 1992 SSB (125,100 mt), and F estimates (0.72), there is an 80% probability that the 1992 SSB lies between 98,000 mt and 137,000 mt (Figure A5), and that the 1992 fully recruited F lies between 0.54 and 0.93 (38%-46% exploitation) (Figure A6). There is a 90% probability that the 1992 F was greater than 0.47 (F_{med}) but was not statistically significantly different from 0.65 ($F_{20\%}$) or 0.76 (F_{max}).

Management Advice: Coordinated management with Canada is needed. Until this is achieved, landings should be maintained at or below current levels. Currently it is possible that each country's management strategy would be conflicting so as to defeat the management objectives of both countries. Continued fishing at the current level of F implies total landings in 1993 of about 60,000 mt, a 41% increase over 1992. The USA portion of the total could increase to 10,000 mt in 1993. However, given the 1993 Canadian TAC of 35,000 mt, and allowing for a 1,000-2,000 mt distant water fleet catch, the total catch is not likely to exceed 45,000 mt in 1993 even with an increase in the USA catch. This implies a reduction in the 1993 F to about 0.5 (36% exploitation rate). Assuming average recruitment in 1994 and 1995, fishing at an F of 0.5 would result in a 1994 catch of 45,000 mt and would stabilize SSB at about the long-term mean in 1995. In the longer term, based on maximizing yield-per-recruit, F should not exceed 0.4-0.5 (32%-36% exploitation rate), which is consistent with F_{med} (0.47, 35%). For the purpose of comparison, the current reference point for Canada is $F_{0.1}$ which implies an F of 0.20.

Forecast for 1994 (weights in '000 mt): Forecasts for 1994 assume that total landings 1993 remain the same as in 1992 (i.e., 43,000 mt). This implies that the fishing mortality rate in 1993 will be about 0.48 (36% exploitation). This represents a 33% decrease from the estimated 1992 rate. Average recruitment of age 2 fish (38.2 million fish) was assumed for the 1992 and 1993 year classes.

Forecast 1994-1995

Option	Basis	F(94)	Predicted			Consequences/Implications
			SSB (94)	Landings (94)	SSB (95)	
A	F _{20%} , or 90% F ₉₂	0.65	147.0	57.3	131.9	SSB declines below 1974-92 average level; landings increase to 1988 level.
B	F _{med}	0.47	147.0	44.1	144.8	SSB stabilizes at 1974-92 average; landings slightly above 1992 level.
C	Landings(92)	0.48	147.0	44.8	144.2	SSB remains at 1974-92 average level; landings slightly above 1992 level.

Catches: Total landings declined from an average of 38,000 mt during the early 1960s to an average of 24,500 mt by the late 1960s. Landings increased to a record high of 68,500 mt in 1986 and declined to 42,400 mt by 1992. Since 1987, Canadian landings have declined from 45,000 mt to 33,000 mt in 1992. US landings declined sharply from 24,500 mt in 1986 to 7,200 mt in 1992.

Data and Assessment: Pollock was last assessed in 1990 (SAW 10). The data used in the current analytical assessment, included USA, Canadian, and Distant Water Fleet 1974-1992 commercial landings-at-age data. The ADAPT method (an assessment methodology which uses Virtual Population Analysis or VPA) was calibrated using indices derived from NEFSC, Canadian, and Massachusetts research survey data and USA and Canadian commercial landings per unit effort data. Catch-at-age data prior to 1974 are not reliable. Estimates of discards and recreational catch were not included in the assessment. The precision and uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1992 were quantitatively evaluated (Figures A5, A6).

Fishing Mortality: The current (1992) F is estimated at 0.72 (42%). The mean unweighted F for ages 7-11 increased from 0.4-0.5 (32%-36% exploitation rate) during the mid-1980s and has fluctuated between 0.6 (40% exploitation) and 0.7 (42% exploitation) since 1987, except in 1991 when mean F increased to 0.85 (45% exploitation).

Recruitment: The 1992 and 1993 estimate of recruitment at age 2 are 34 and 35 million fish. The geometric mean recruitment over the 1974-1990 period was 38 million fish and ranged from 9 to 97 million fish. The 1979 year class at 97 million fish and the 1980 and 1982 year classes at 59 and 56 million fish, respectively, are the strongest to have recruited during the 1980s. The 1981 and 1985 year classes were slightly above the long-term mean and the 1987 and 1988 year classes well above the mean. The 1983, 1984, and 1986 year classes were below average (Figure A2).

Spawning Stock Biomass (SSB): Spawning stock biomass is estimated as of January 1. In 1992, SSB was 125,000 mt, slightly below the long term mean (143,600 mt). SSB doubled from 89,000 mt in 1974 to 204,000 mt in 1985 and has declined in recent years to 122,000 mt (1991) (Figure A2). The 1993 SSB was estimated as slightly above the long term mean. Compared to the mid-1980s, when SSB was dominated by as many as 6 moderate to strong year classes, the current spawning stock is composed of only 2-3 moderate year classes.

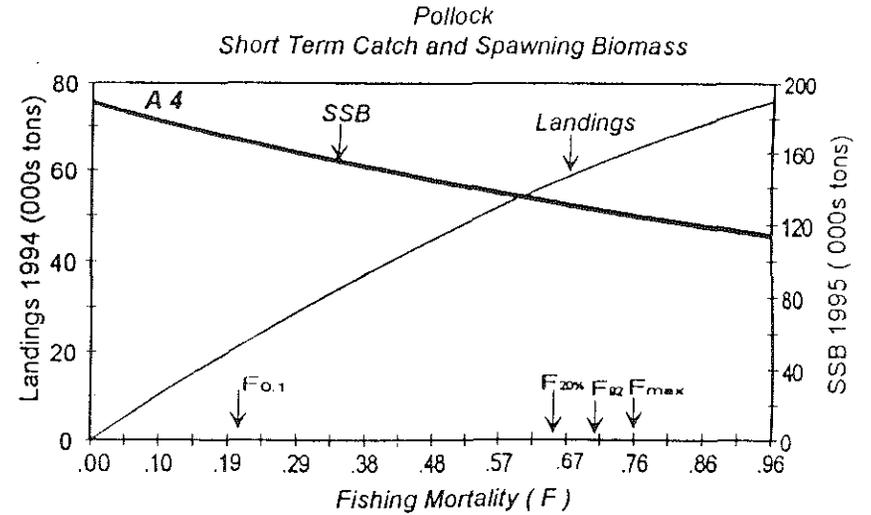
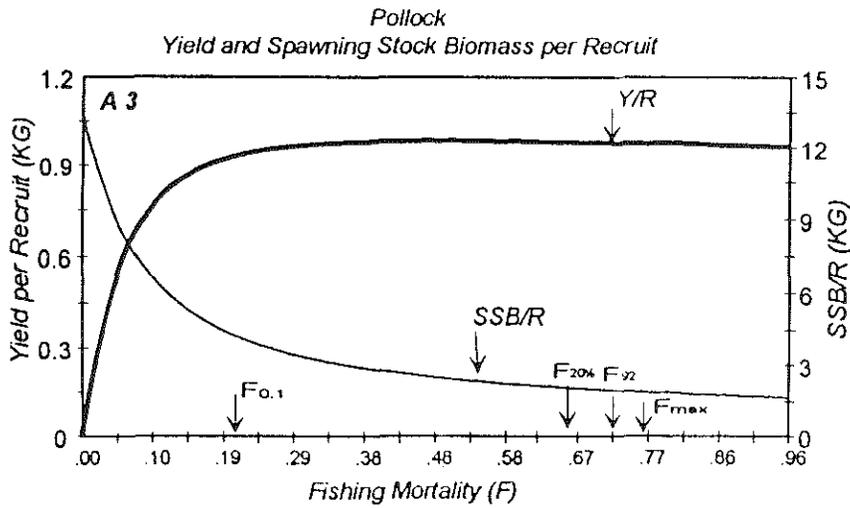
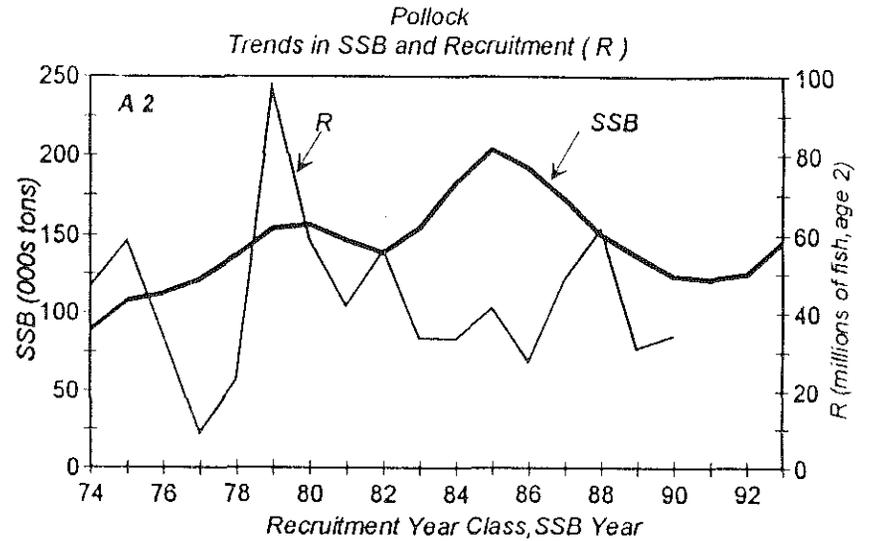
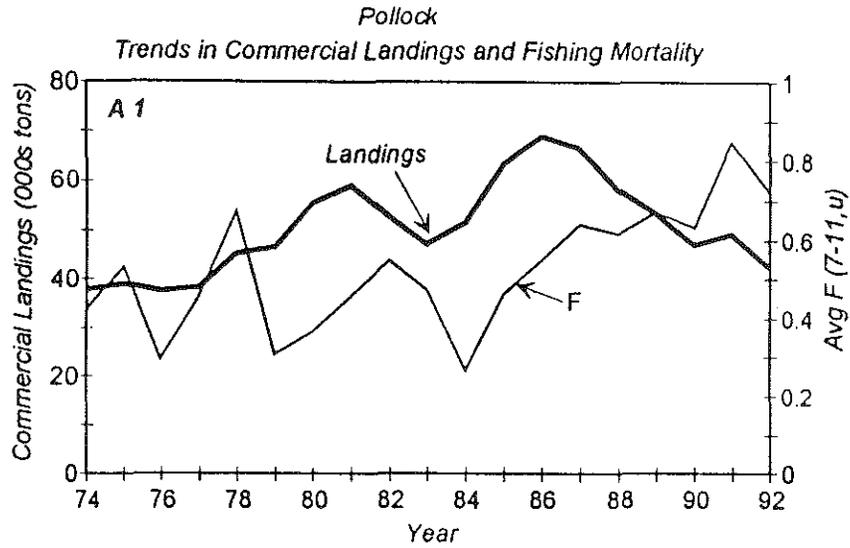
Landings and Status Table (weights in '000 mt, recruitment in millions):

Year	1986	1987	1988	1989	1990	1991	1992	1993 (Predicted)	Max (74-92)	Min (74-92)	Mxn
USA Comm Landings	24.5	20.4	15.0	10.6	9.6	7.9	7.2	-	24.5	7.2	14.3
Otter Trawl	16.5	12.1	7.6	5.4	5.5	4.8	4.5	-	16.5	4.5	8.8
Sink Gill Net	7.8	8.1	7.2	5.1	4.0	3.0	2.6	-	8.1	1.9	5.0
Other Gear	0.2	0.2	0.2	0.1	0.2	0.2	0.1	-	1.9	0.1	0.5
CAN Comm Landings	43.2	45.3	41.8	41.0	36.2	38.0	33.2	-	45.3	23.6	34.7
Other Comm Landings	1.1	0.7	1.3	1.8	1.3	3.3	2.1	-	4.1	0.3	1.5
Total Comm Landings	68.9	66.4	58.1	53.4	47.2	49.2	42.4	-	68.9	37.6	50.5
Discards	Discards occur but reliable estimates not presently available										
USA Rec Landings	0.2	0.3	0.5	0.7	0.2	0.3	0.1	-	2.8	0.1	0.8
Catch used in Assessment	58.9	66.4	58.1	53.4	47.2	49.2	42.4	-	68.9	37.6	50.5
Sp. stock biomass(Jan 1)	192.1	172.8	150.7	136.9	123.8	122.0	125.1	145.5	203.8	89.0	143.6
Recruitment (Age 2)	33.4	41.4	27.6	49.0	61.6	30.9	34.3	34.7	97.2	9.2	38.0 ¹
Mean F (7-11,u)	0.55	0.64	0.62	0.67	0.63	0.85	0.72	0.48	0.85	0.27	0.52
Exploitation Rate	38%	41%	40%	41%	40%	45%	42%	35%	45%	25%	37%

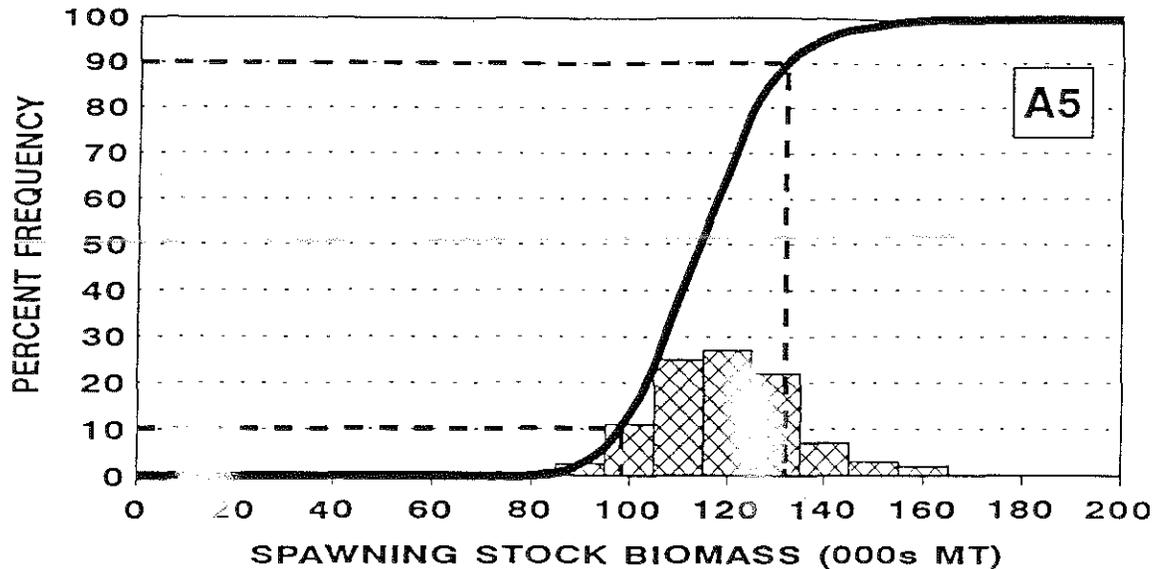
¹Geometric mean; 1974-1990

Special Comments: The pollock stock is distributed primarily in Canadian waters and is assessed as a unit stock. Although pollock range from Cape Breton to Southern New England, the center of abundance is considered to be off southwestern Nova Scotia and in the Gulf of Maine. A slight shift in the center of abundance could affect USA landings. The Canadian fleet accounted for 5/6 of the 1992 landings. Any discarding that may occur in the Canadian fishery will have a greater impact on the stock than discards occurring in the US fishery. Pollock is a transboundary stock, fished heavily by both US and Canada and should be assessed jointly. The overfishing definition of $F_{20\%}$ needs to be re-evaluated given the updated F_{med} estimate ($F_{med} = F_{25\%}$).

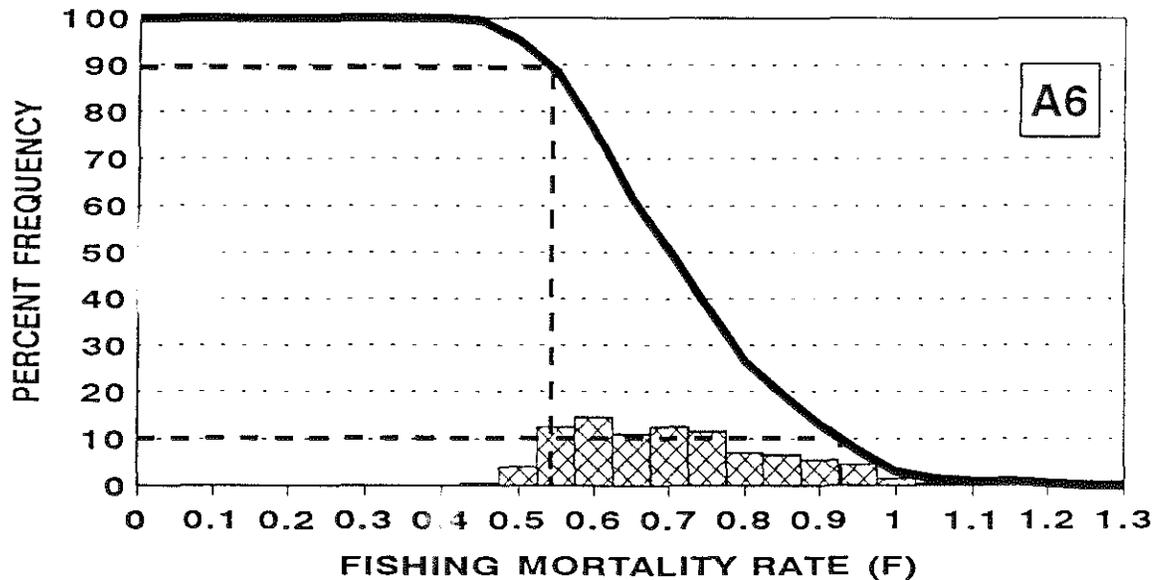
Source of Information: Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 93-18); and Mayo, R.K, and B. Figuerido, 1993, Assessment of pollock, *Pollachius virens*, in Divisions 4VWX and Subareas 5 and 6, 1993 (NEFSC Ref. Doc. 93-13).



SCOTIAN SHELF-GULF OF MAINE-GEORGES BANK POLLOCK
PRECISION ESTIMATES - SSB



SCOTIAN SHELF-GULF OF MAINE-GEORGES BANK POLLOCK
PRECISION ESTIMATES - FISHING MORTALITY



Precision of the estimates of spawning stock biomass (A5) and fishing mortality rate (A6) for Scotian Shelf-Gulf of Maine-Georges Bank pollock. 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 (A5) and the probability that F is greater than any selected value on the X-axis (A6). The dashed lines indicate the value at the 10 and 90 percent probability levels. The precision estimates were derived from a statistical procedure known as the bootstrap.

B. SUMMER FLOUNDER ADVISORY REPORT

State of Stock: The stock is at low biomass level and is over-exploited. The fishing mortality rate on summer flounder has recently been very high, peaking at 1.8 in 1988-1989, but has declined to 1.1 for 1992 (Figure B1). Fishing mortality in 1993 is expected to decline further to about 0.5 if the 1993 quota is landed. Spawning stock biomass increased from a record low in 1989 to about 15,000 mt in 1992 (Figure B2). The age structure of the spawning stock remains truncated, however, with only 11% of the biomass at ages 3 and older. Summer flounder have a protracted spawning season that spans calendar years (October - January), with a peak in November. Fish spawning during this period recruit to the fishery the following autumn. For example, fish spawning in November 1987 recruit to the fishery as age 0 fish in 1988 (Figure B2). Accounting for uncertainty in the estimation of the 1992 fishing mortality rate and spawning stock biomass, there is an 80% probability that the 1992 spawning stock biomass was between 10,000 mt and 20,000 mt (Figure B6) and that fishing mortality was between 0.7 and 2.0. There is a greater than 95% probability that the 1992 F exceeded 0.53 (Figure B5).

Management Advice: The FMP has set a target fishing mortality rate (F_{tgt}) of 0.53 for 1993-1995, with a target of F_{max} (0.23) for 1996 and beyond (Figure B3). If the 1993 quota is landed, discarding does not increase, and no recruitment failure occurs, F should decline to about 0.5 and spawning stock biomass will continue to increase in 1993. If the target fishing mortality is achieved in 1994, both landings and spawning stock biomass will increase. If managers wish to increase spawning stock biomass at a faster rate, each 1,000 mt decrease in annual landings will result in a greater than 1,000 mt increase in spawning stock biomass. If the 1994 quota is held at 9,400 mt, the fishing mortality rate would decrease to about 0.3 (Figure B4). The 1991 recruitment of 53 million fish provides an opportunity for short-term rebuilding of the spawning stock. Continued protection of this and subsequent year classes by reductions in fishing mortality and increased protection of young fish is encouraged.

Forecast for 1994: The forecast for 1994 uses estimated stock sizes in 1993 and assumes that patterns of discarding through 1992, which were due to the impact of minimum size regulations, continue over the time span of the projections. Different discarding patterns during 1993-1995 due to trip and bag limits and fishery closures (e.g., high grading and dumping) have not been evaluated. If the 1993 quota is landed (9,400 mt; commercial landings = 5,600 mt; recreational landings = 3,800 mt) and no dramatic increase in discarding occurs, a forecast using mean recruitment suggests that landings could increase to 14,400 mt in 1994 and still meet the $F_{tgt} = 0.53$.

Forecast for 1993-1995

Option ¹	Stock size at age 0 in 1993-95	Stock size at age 1 in 1993	1993 '000 mt			1994 '000 mt			1995 '000 mt		
			Land.	Disc.	SSB	Land.	Disc.	SSB	Land.	Disc.	SSB
A) 0.52	22721	24492	9.4	0.9	18.2	12.1	0.6	21.0	12.6	0.7	21.8
B) 0.48	33858	32887	9.4	1.1	21.1	14.4	1.0	26.1	16.2	1.0	28.8
C) 0.46	50453	41282	9.4	1.3	24.4	17.0	1.5	32.6	20.8	1.5	38.1

Note: Landings and SSB for 1994 and 1995 assume $F_{tgt} = 0.53$.

¹Recruitment scenarios based on the distributions of stock sizes from a bootstrap analysis are: (B) stock size at age 0 and 1 are at the mean of the projected series; (A) stock size at age 0 and 1 are 1 standard error below the mean; and, (C) stock sizes are 1 standard error above the mean.

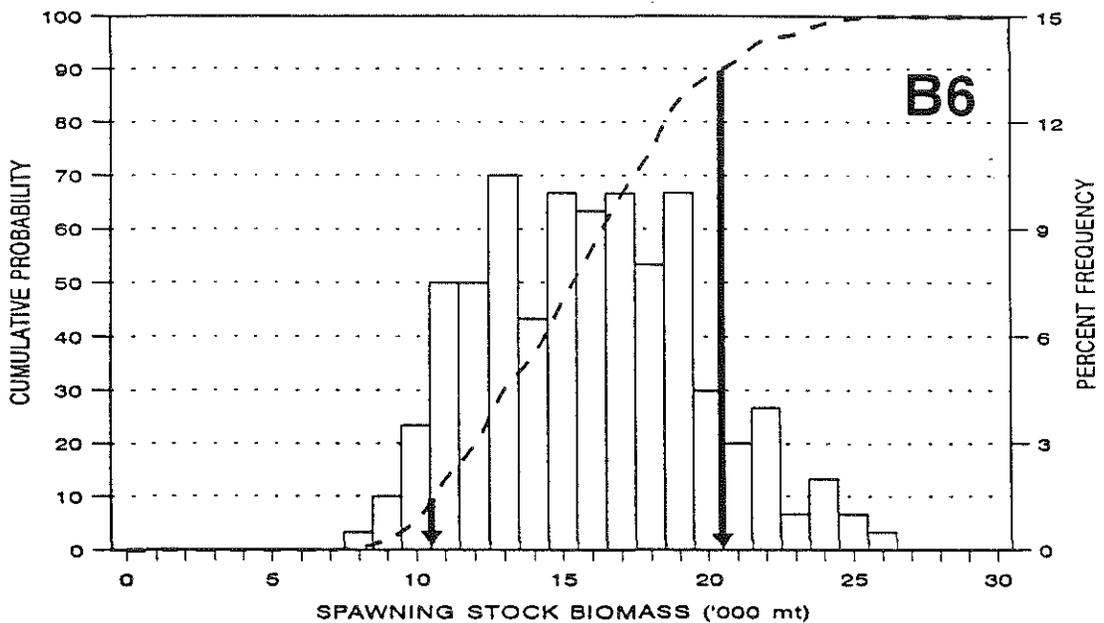
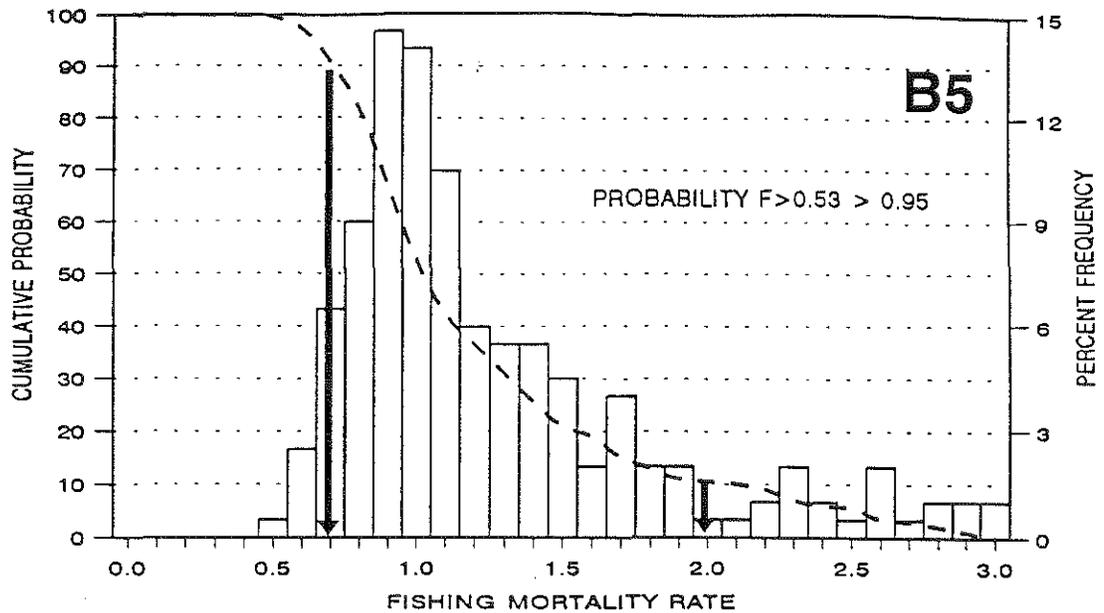
Option Consequences/Implications

- A) Landings increase 30% in 1994, F target is met; SSB increases 39% over 1992 estimate to near early 1980s levels.
- B) Landings increase 57% in 1994, F target is met; SSB increases 73% over 1992 estimate to highest level since 1982.
- C) Landings increase 86% in 1994, F target is met; SSB increases 115% over 1992 estimate to highest level in VPA time series.

Catchings: Recent commercial landings peaked in 1984 at 17,100 mt; recreational landings peaked in 1983 at 16,400 mt. During the late 1980s and into 1990, landings declined dramatically, reaching 4,200 mt in the commercial fishery in 1990 and 1,500 mt in the recreational fishery in 1989. Landings in both fisheries have increased in the early 1990s, to 7,300 mt in the commercial fishery in 1992 and 3,400-3,500 mt in the recreational fishery in 1991-1992. If the 1993 quota is not exceeded (9,400 mt; commercial = 5,600 mt and recreational = 3,800 mt) landings will be about 30% of the peak 1984 level of 31,600 mt (Figure B1).

Data and Assessment: Summer flounder were last assessed by the SAW in December, 1991 (SAW 13). The current assessment is an analytical assessment (VPA) of commercial and recreational total catch-at-age (landings plus discard). The natural mortality rate (M) was assumed to be 0.2. Information on recruitment and stock abundance was used from NEFSC spring, Massachusetts spring and fall, Rhode Island fall, and Connecticut summer trawl survey catch-per-tow at age data. In addition, recruitment indices were developed from young-of-year surveys conducted by the states of Virginia, Maryland, North Carolina, Delaware, and Massachusetts. The uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1992 was evaluated (Figures B5 and B6).

SUMMER FLOUNDER 1992



Precision of the estimates of fishing mortality rate (B5) and spawning stock biomass (B6) for summer flounder. 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 F is greater than any selected value on the X-axis (B5) and the probability that SSB is less than any selected value on the X-axis (B6). The dashed lines indicate the value at the 10 and 90 percent probability levels. The precision estimates were derived from a statistical procedure known as the bootstrap.

C. ATLANTIC HERRING ADVISORY REPORT

State of Stock: The stock is at a high biomass level and is under-exploited. Fishing mortality (F) in 1992 decreased to a record-low (Figure C1) while spawning stock biomass (SSB) in 1993 increased to a record-high (Figure C2). Accounting for the estimation of uncertainty associated with the 1992 SSB (1,255,000 mt) and 1992 F (0.038) estimates, there is an 80% probability that the 1992 SSB lies between 815,000 mt and 1,920,000 mt (Figure C4), and the 1992 F lies between 0.027 and 0.056 (Figure C5). This implies a 90% probability that the 1992 F is less than 0.056 and thus well below the overfishing definition of $F_{20\%}$ ($F=0.29$).

Management Advice: The ASMFC limited landings above the domestic harvest of herring to 100,000 mt for the year 1993. It is thus anticipated that the total landings in 1993 might reach 180,000 mt, but this fishing mortality is unlikely to equal or exceed the tonnage associated with fishing at $F_{20\%}$ (Figure C3). A 100,000 mt limit on IWP fisheries was chosen to encourage the orderly redevelopment of coastal and offshore herring fisheries; this approach still appears appropriate considering the results of the current assessment and the sources of uncertainty associated with these results. Concentrating effort in IWP fisheries on a single age or spawning component of the stock complex should be discouraged.

Forecast for 1994: No forecasts were performed.

Catches: Commercial landings were at their highest levels during the 1960s and 1970s when the offshore fishery for herring on Georges Bank was still in existence and exceeded 400,000 mt in 1968. After the Georges Bank spawning stock collapsed, the landings for the coastal stock complex (New Brunswick fixed gear, Gulf of Maine and Georges Bank) leveled off at between 50,000 and 100,000 mt per year throughout the 1980s to the present (Figure C1).

Landings and Status Table (weights in 1,000s mt, recruitment in billions):

Year	1985	1986	1987	1988	1989	1990	1991	1992	Max	Min	Mean
US Comm Landings	27.7	29.2	39.7	41.1	53.0	63.0	54.7	59.7	414.9	25.0	128.0
Canada Comm Landings	27.9	27.9	27.3	33.4	44.1	38.8	24.6	32.0	44.1	3.3	25.7
Discards	0.0	0.0	0.1	0.3	0.7	1.4	0.9	0.0	1.4	0.0	0.1
Catch used in	55.6	57.1	67.1	74.8	97.8	103.1	80.2	91.7	448.0	36.4	153.8
SSB	200.7	263.3	333.6	459.8	602.1	728.2	905.3	1254.6	1254.6	27.8	337.0
Recruitment (Age 2)	3.2	2.4	2.7	4.2	4.4	4.8	15.8	17.3	17.3	0.3	2.2 ¹
Mean F (Age 2+,U)	0.27	0.18	0.15	0.14	0.12	0.11	0.05	0.04	1.20	0.04	0.56
Exploitation Rate	24	17	14	13	11	10	5	4	70	4	39

Max, Min, Mean for assessment time series, 1967-1992; 1. Geometric Mean.

Data and Assessment: Herring were last assessed in December, 1991 (SAW 13). The current assessment is an analytical assessment (VPA) of commercial landings-at-age and discards. Catch data from US commercial fisheries, New Brunswick (Canada) fixed gear fisheries, distant water fleets, and discards from US mackerel JV fisheries were used to develop the catch-at-age matrix. Mean weight was determined from US coastal fisheries only. Information on abundance and size of the spawning stock was taken from NEFSC spring survey catch-per-tow disaggregated by age and from a regionally weighted index of larval herring abundance. The uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1992 was evaluated (Figure C4 and C5).

Fishing Mortality: Fishing mortality has exceeded 1.0 in the past, but has been low in recent years (mean for 1983-1992 = 0.22) and has declined to a record-low in 1992 (F=0.04) (Figure C1). Current fishing mortalities are well below all mortality reference points: $F_{0.1}=0.19$, $F_{20\%}=0.29$, and $F_{max}=0.34$.

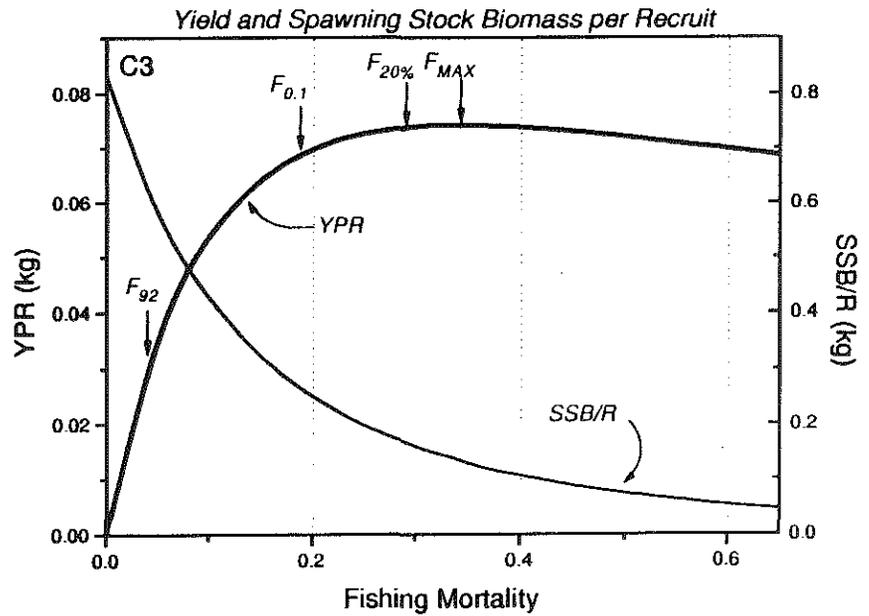
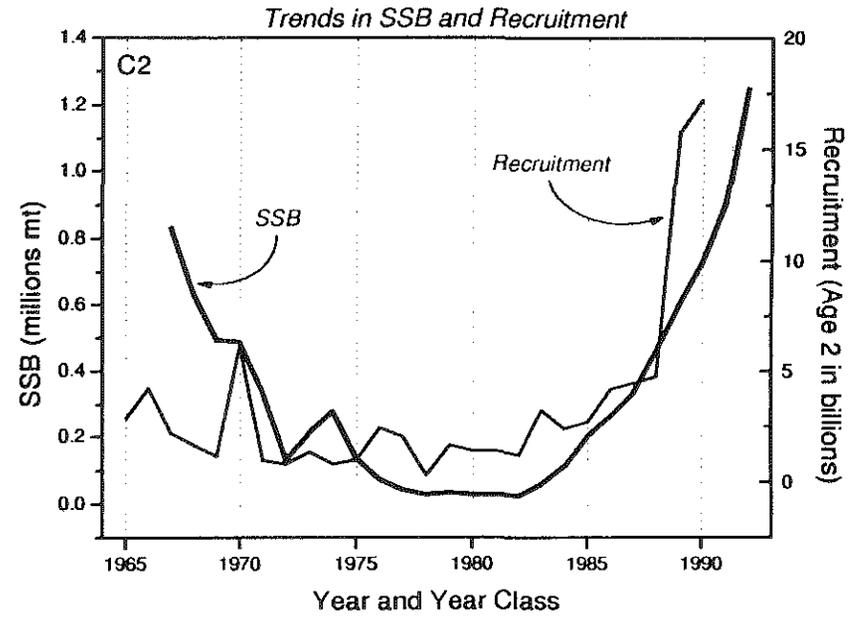
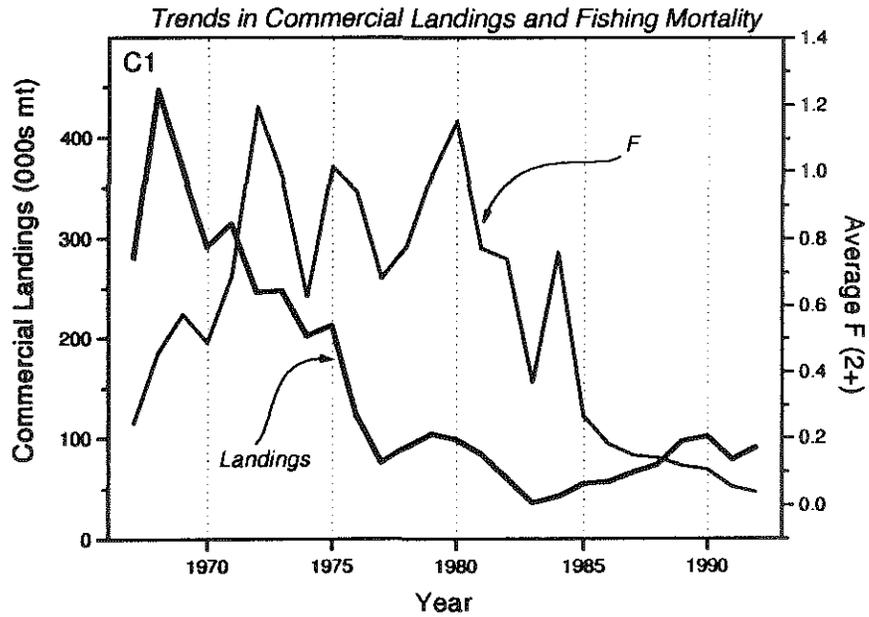
Recruitment: Indications are the 1989 and 1990 year classes may be very strong (Figure C2). However, these data may be estimated with low precision since the size of these year classes is determined from only 2 years and 1 year of survey catch-per-tow data, respectively.

Spawning Stock Biomass: Spawning stock biomass has increased in recent years to a record-high level of 1,255,000 mt in 1992. Prior to collapse of the Georges Bank spawning stock, spawning stock biomass of the complex was as high as 839,000 mt and may have been at higher levels prior to the assessment time series. If recruitment of the 1989 and 1990 year classes are as high as initially predicted, spawning stock biomass should increase in future years

Special Comments: If the level of fishing mortality on the stock complex remains low, analytical assessments and the provision of advice should be done no more often than biennially. The assessment and management advice for the herring coastal stock complex could be improved with development of a survey specifically for pelagic resources, resolution of stock identification issues, better tracking of weight data used in the assessment, and examination of historical data from a variety of sources including former eastern block resource agencies. The current assessment has produced low precision estimates of F and SSB, this condition is in part due to the low fishing mortality on the stock complex. Because part of the catch from the complex will be taken in Canadian waters, a joint assessment by representatives of the two countries is highly recommended.

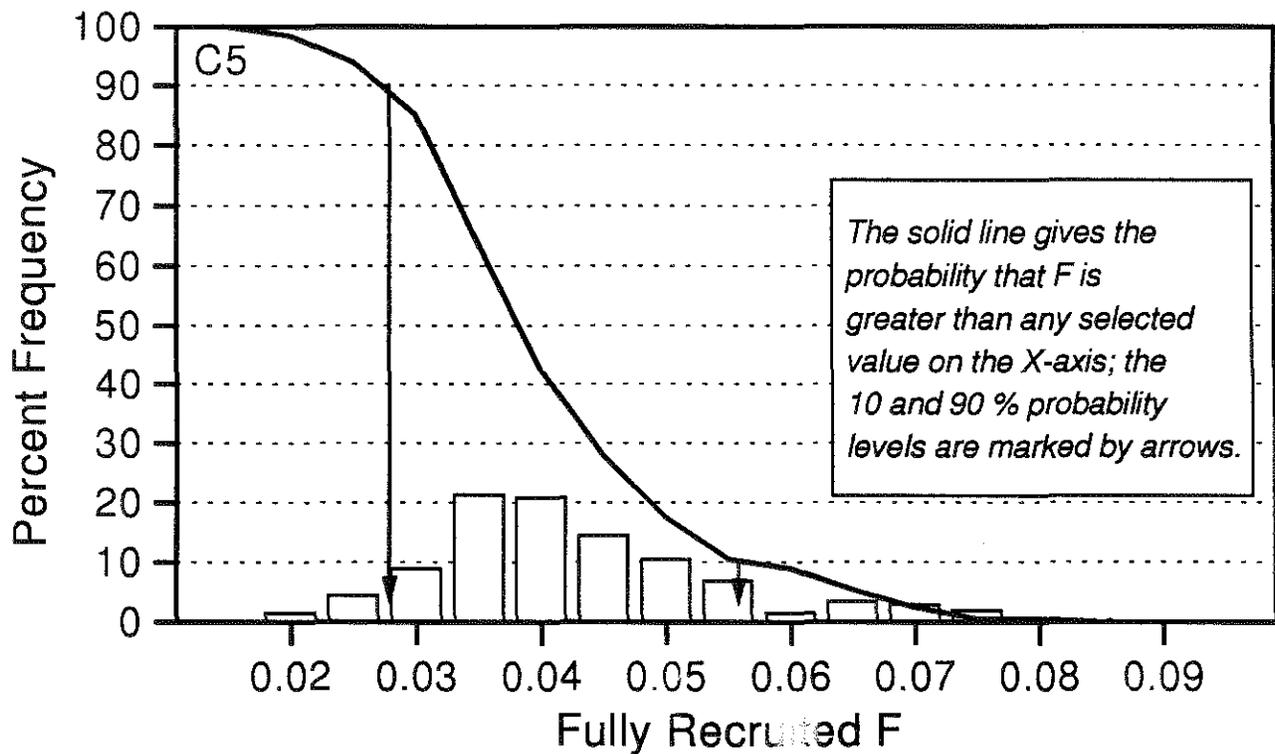
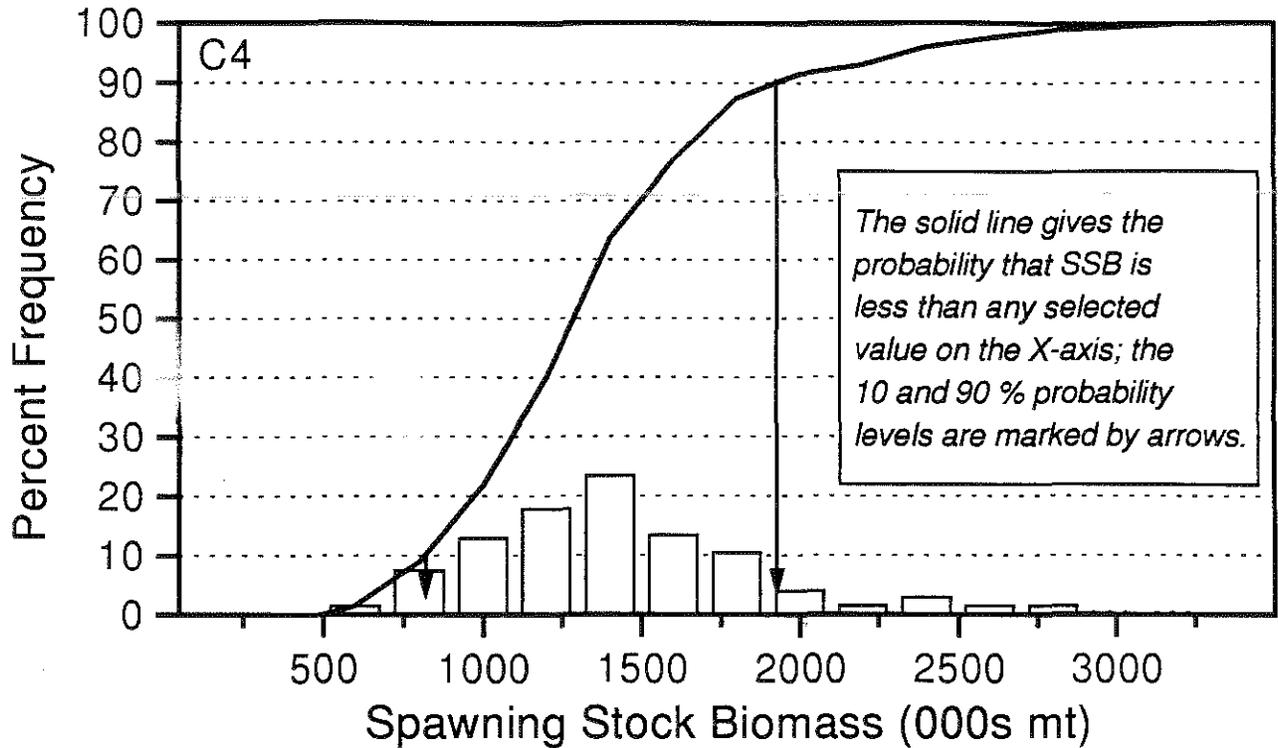
Sources of Information: Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 93-18); and Stevenson, D., D. Libby, and K. Friedland, 1993, Analytical Assessment of the Atlantic Herring Coastal Stock Complex (NEFSC Ref. 93-15).

Atlantic Herring-Coastal Stock Complex



Atlantic Herring-Coastal Stock Complex Precision Estimates-SSB and Fishing Mortality

The precision estimates were derived from a statistical procedure known as bootstrap. The vertical bars on both plots give the range and probability of individual values within that range.



D. AMERICAN LOBSTER ADVISORY REPORT

State of stock: The lobster stock is at high biomass level and, in terms of the entire range, over-exploited. Total landings of American lobster rose consistently from the mid-1960s to the early 1990s to a record high in 1991, however, in 1992 landings declined significantly in both US and Canadian waters. The fishery has been increasingly dependent on newly-recruited animals. The Gulf of Maine landings in the last three years have been comprised of an average of 89% new recruits. The increase in landings through 1991 has been driven in part by favorable recruitment and by significant increases in fishing effort (Figure D2). Relative abundance indices from commercial LPUE and research vessel trawl surveys increased significantly from the mid-1980s to 1991 (Figures D2 and D4). Fishing mortality is now computed from rates associated with landings rather than catch. This change in methodology was chosen by the SARC to better account for resource protection measures (minimum size, discard of egg-bearing and v-notched females), and, in and of itself, resulted in a reduction in the overfishing F for the Gulf of Maine portion of the stock from 1.0 to 0.52. For the purposes of this assessment, the resource has been divided into three stock areas (Gulf of Maine; Georges Bank and South Offshore; Southern Cape Cod/Long Island Sound Inshore) based on determination of different life history parameters for the three areas. Calculated fishing mortality for the Gulf of Maine region indicates that there is a 78% probability that the current level of F is in excess of the overfishing definition (Figure D5). The portion of the stock that is inshore, south of Cape Cod to Long Island Sound (SCC-LIS) is certainly overfished ($F_{10\%}EPR = 0.68$ and average 1989-1991 fishing mortality = 1.47; Figures D6, D8), even when one takes into account any reasonable level of emigration. The offshore region from Georges Bank and south appears to be near the overfishing level ($F_{10\%}EPR = 0.44$ and average 1988-1990 fishing mortality = 0.24-0.51; Figures D10, D11). Taken as a whole, the resource is considered overfished.

Management Advice: The lobster fishery is almost completely dependent on new animals molting into legal size each year. Fishing mortality rates for the major components of the resource exceed recruitment overfishing definitions established by the NEFMC. For the Gulf of Maine stock (currently accounting for over 70% of landings) the overfishing definition can be met by reducing fishing mortality by at least 20% or by increasing the minimum legal size from 83 mm (3.25") to about 89 mm (3.5"), or some combination of the two. Likewise, fishing mortality rates for the southern inshore area need to be reduced by approximately 50%. Reductions in F and/or increases in minimum size will significantly increase yield per recruit in all assessment areas. Given the increase in reported numbers of traps in the Gulf of Maine region since 1986, F 's are expected to increase in the absence of direct controls.

Forecast for 1994: No forecasts were performed as the methodology for forecasting under this assessment technique is not fully developed.

Catches: Total lobster landings increased steadily from the mid-1960s to the early 1990s. Landings peaked at a record high of 29,089 mt (64 million pounds) in 1991 and then declined by 13% in 1992 to 25,329 mt (56 million pounds). These trends are consistent with those reported by Canada in Scotia-Fundy waters during this same period. Recreational landings represent a minor proportion of the total and are not well estimated.

Data and Assessment: This stock was last assessed in June, 1992 (SAW 14). Previous assessment did not include data for the southern stock areas and inshore areas. For the current assessment, the resource was divided into three stock areas: Gulf of Maine (GOM), Georges Bank and South Offshore (GB/South) and Southern Cape Cod-Long Island Sound Inshore (SCC-LIS). Length-based assessments (modified DeLury) were conducted, using bottom trawl survey indices (standardized mean number per tow from NEFSC autumn and Rhode Island trawl surveys) of pre-recruit and full recruited female lobsters (Figures D4, D9, D12) calibrated with commercial landings numbers at size (Figures D1, D6, D10). Further length-based assessment (Length Cohort Analyses) utilized the commercial catch at size data. Additionally, biological reference points of F_{max} and $F_{10\%}$ of maximum egg production per recruit (EPR Figure D3, D8, D11) were calculated with a length based yield and egg production per recruit model utilizing regionally-specific growth and egg production parameters. All analyses were conducted assuming a natural mortality rate (M) = 0.1.

Fishing Mortality: Fishing mortality on female lobsters in the Gulf of Maine, averaged over 1989-1991, is estimated to be at 0.65 (80% confidence interval = 0.47-0.87). The average for the period from 1982-1988 is 0.53 (Figure D1). Current F exceeds the $F_{10\%}$ EPR level (0.52) for this area and greatly exceeds F_{max} (0.29). For the SCC-LIS region, the average (1989-1991) F is 1.47 (Figure D6). This level, even discounted by any reasonable rate of emigration, is above the $F_{10\%}$ EPR level (0.68) for this area and greatly exceeds F_{max} (0.38). Fishing mortality rates on the southern offshore portion of the resource are estimated to be 0.24-0.51 (Figure D10). This is near the overfishing level ($F_{10\%}$ EPR = 0.44) for the offshore stock.

Special Comments: Further work is needed to better define stock areas for biological assessment and management purposes, but the uncertainty in this aspect does not effect the resource-wide management advice. Sea sampling of commercial lobster fisheries and/or other methods of obtaining better biological characteristics of lobsters is also needed.

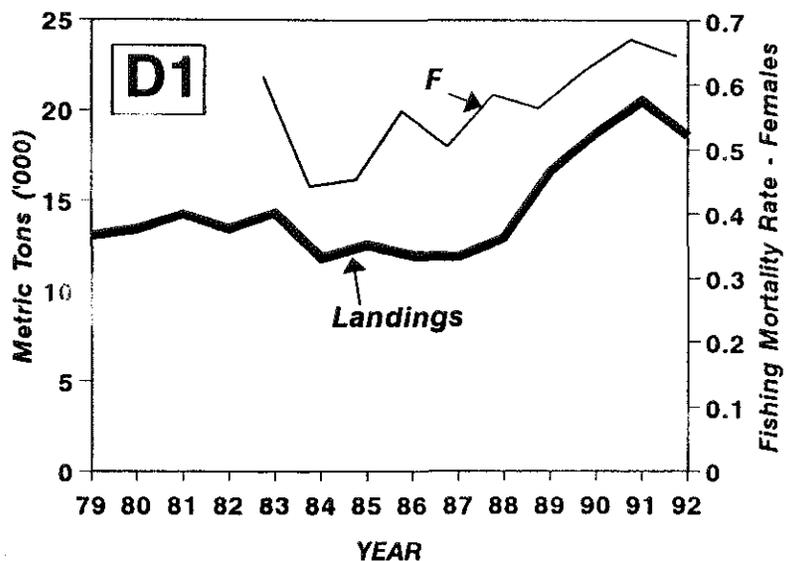
Sources of Information: Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments (NEFSC Ref. Doc. 93-18); Idoine, J. and M. Fogarty, 1993, Calculating Biological Reference Points for American Lobster (NEFSC Ref. Doc 93-20); Murawski, S., et al, 1993, Assessments of American Lobster Stock Status Off the Northeast USA (NEFSC Ref. Doc. 93-21); and Fogarty, M. and J. Idoine, 1988, Trans. Am. Fish. Soc. 117:350-362.

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

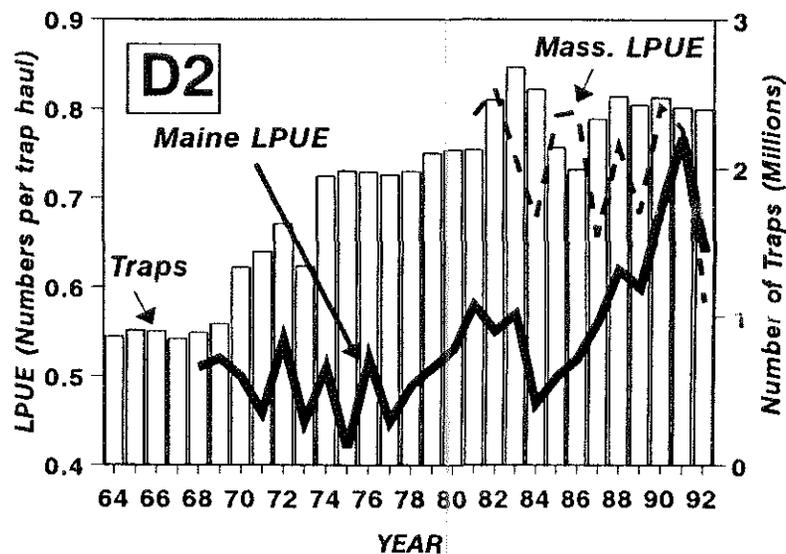
Year	1985	1986	1987	1988	1989	1990	1991	1992	Max.	Min.	Mean (1979 - 1992)
USA Comm Landings	21.3	20.8	20.8	22.2	23.8	27.6	29.1	25.3	29.1	16.9	21.6
Gulf of Maine	12.6	12.0	11.9	12.9	16.7	18.8	20.5	18.6	20.5	11.9	14.6
Georges Bank/South	5.9	6.0	5.9	6.1	3.7	4.7	4.3	2.8	6.1	2.0	4.3
SCC-LIS	2.8	2.8	3.0	3.2	3.4	4.1	4.3	3.9	4.3	1.3	2.8
Gulf of Maine:											
Mean F (F 1+ ¹)	0.56	0.50	0.58	0.56	0.62	0.67	0.64	---	0.67	0.44	0.56
Exploitation Rate	41%	38%	42%	41%	44%	47%	45%	---	47%	34%	41%
Georges Bank/South:											
Mean F (F 1+ ¹)	0.36-	0.31-	0.32-	0.29-	0.28	0.14	---	---	0.36-	0.08-	0.22-
	0.72	0.62	0.69	0.65	0.59	0.29	---	---	0.72	0.17	0.45
Exploitation Rate	29%-	25%-	26%-	24%-	23%-	12%-	---	---	29%-	7%-	19%
	49%	44%	48%	46%	43%	24%	---	---	49%	15%	35%
S. Cape Cod - LIS:											
Mean F (F 1+ ¹)	2.69	1.12	1.20	1.26	1.59	1.50	1.31	---	3.59	1.12	1.82
Exploitation Rate	90%	65%	67%	69%	77%	75%	70%	---	95%	65%	81%

¹F 1+ : All animals likely to molt into harvestable size during the survey year (Oct 1 - Sept 30).

**Gulf of Maine American Lobster
Trends in Commercial Landings and Fishing Mortality**

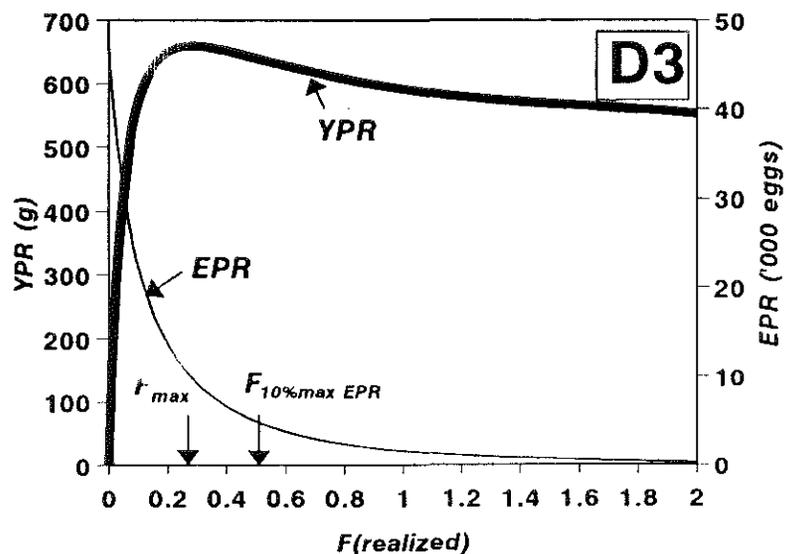


**Gulf of Maine American Lobster
Landings per Unit of Effort Indices**

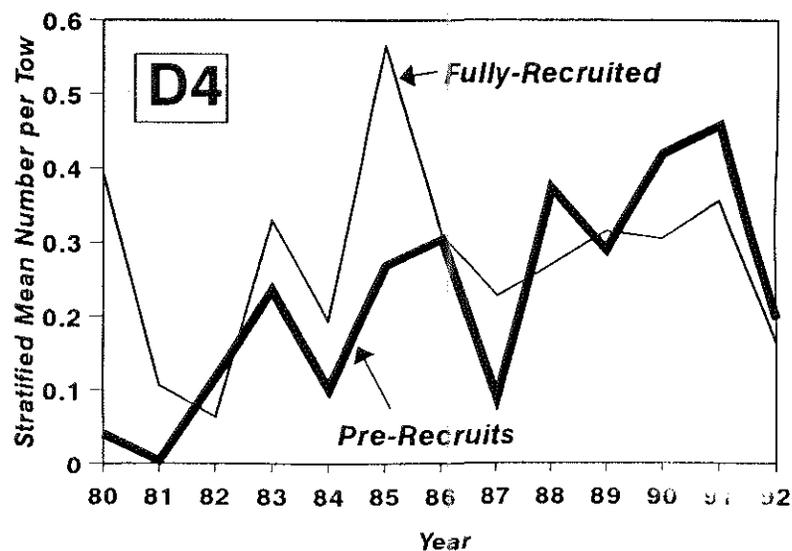


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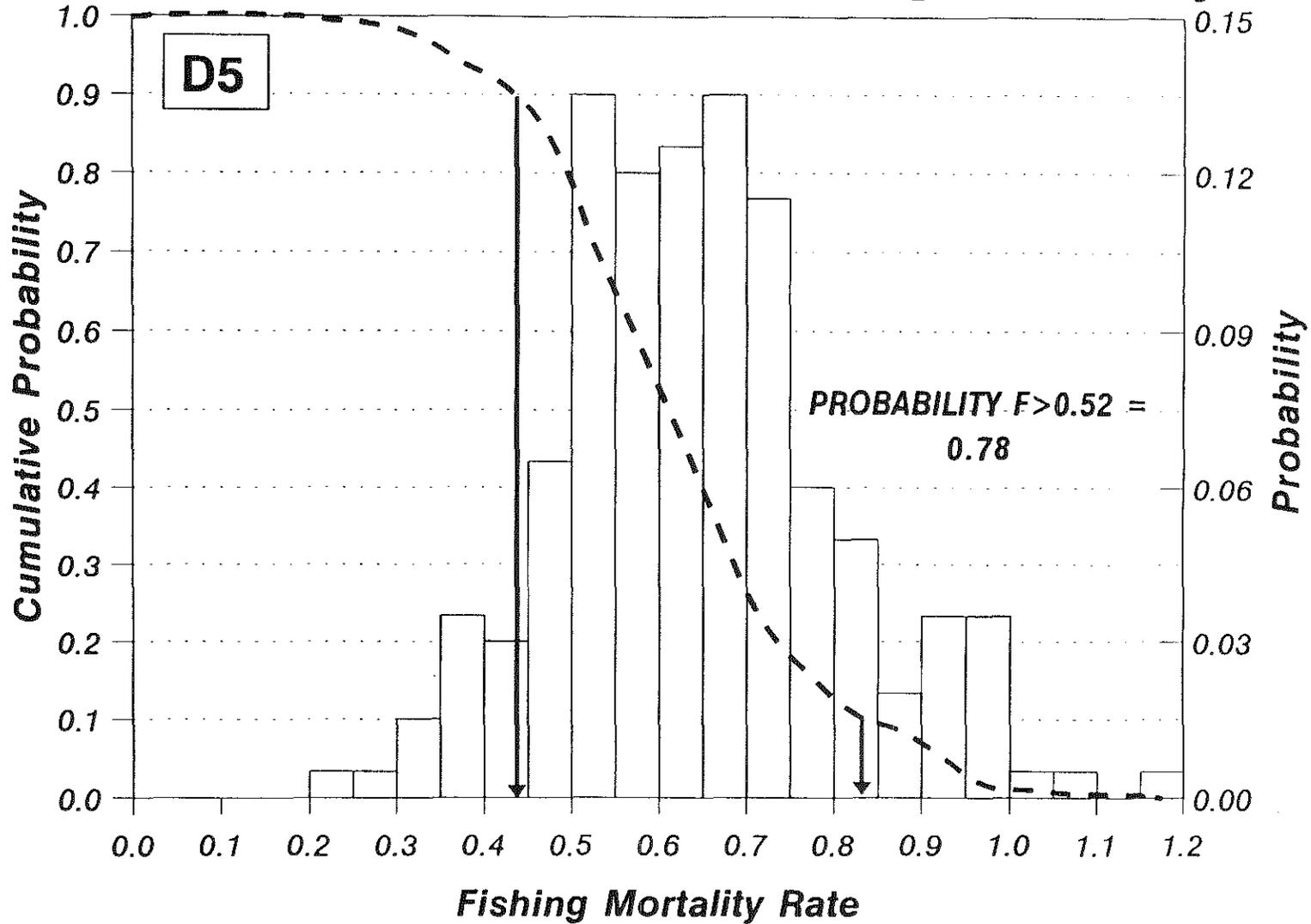
**Gulf of Maine American Lobster
Yield and Egg Production per Recruit - Females**



**Gulf of Maine American Lobster
NEFSC Autumn Trawl Survey Indices - Females**

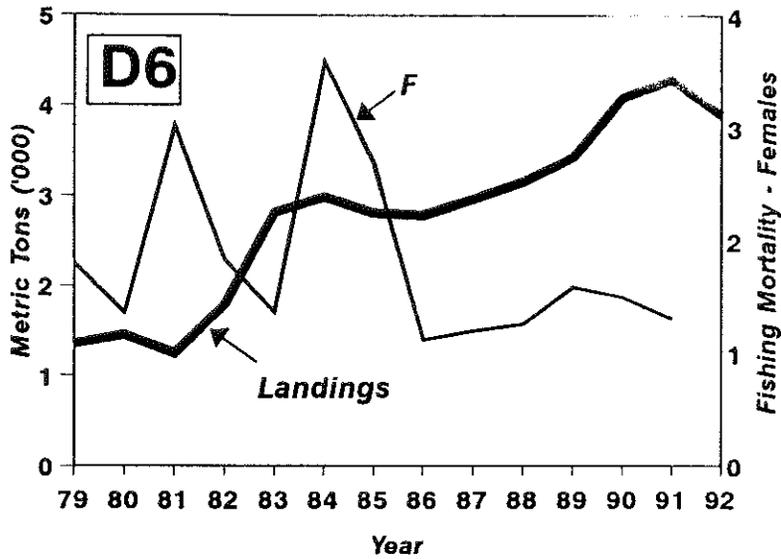


Gulf of Maine American Lobster Precision Estimates - Fishing Mortality

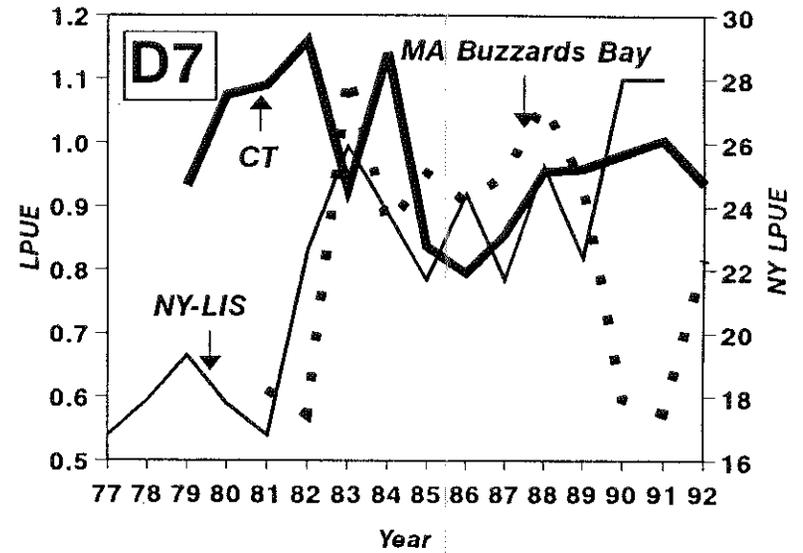


Precision of the estimates of fishing mortality (D5) for American Lobster. The vertical bars display both the range of the estimators and the probability of individual values within that range. The dashed line gives the probability that F is greater than any selected value on the x-axis (D5). The arrows indicate the 80 percent confidence interval. The precision estimates were derived from a statistical procedure known as the bootstrap.

SCC-LIS American Lobster
Trends in Commercial Landings and Fishing Mortality

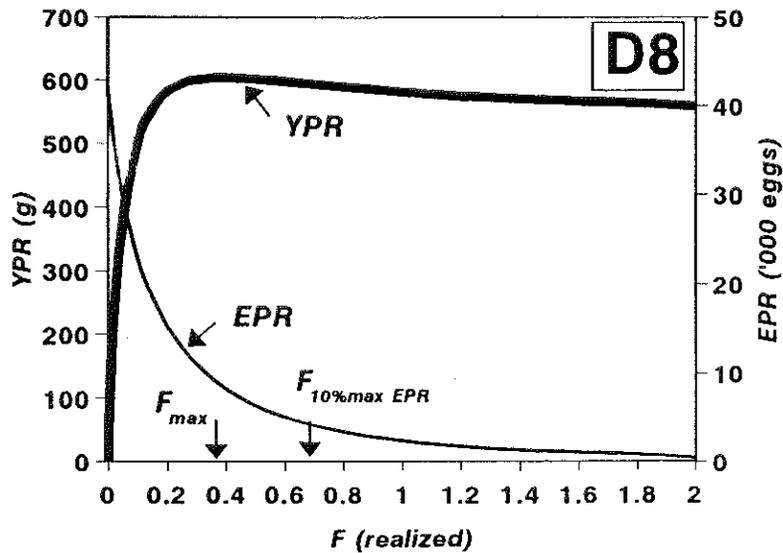


SCC-LIS American Lobster
Landings per Unit of Effort Indices

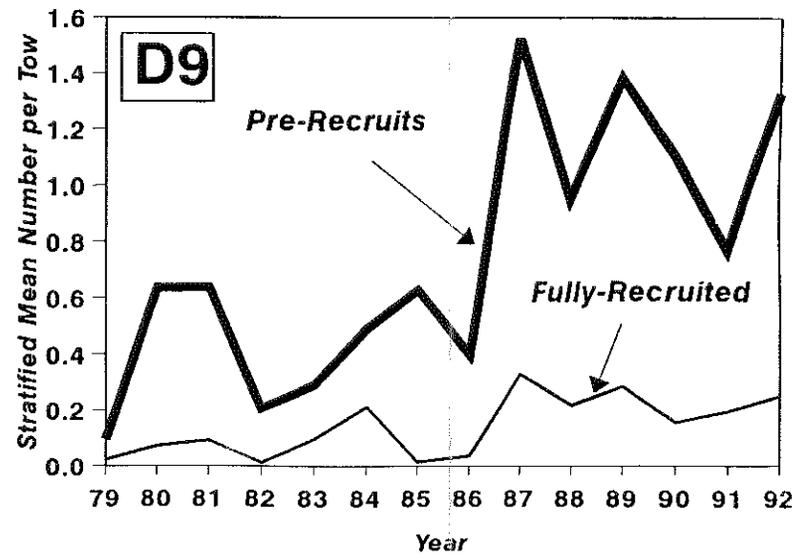


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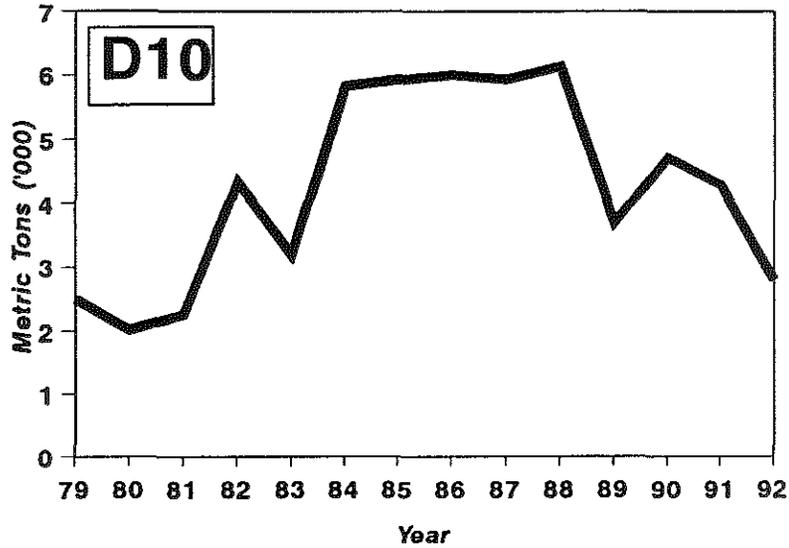
SCC-LIS American Lobster
Yield and Egg Production per Recruit Females



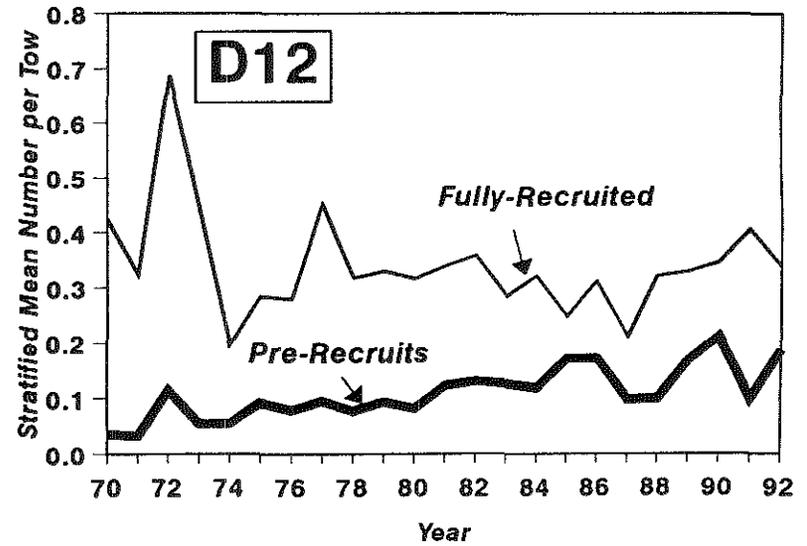
SCC-LIS American Lobster
RI Autumn Trawl Survey Indices - Females



Georges Bank and South American Lobster Trends in Commercial Landings

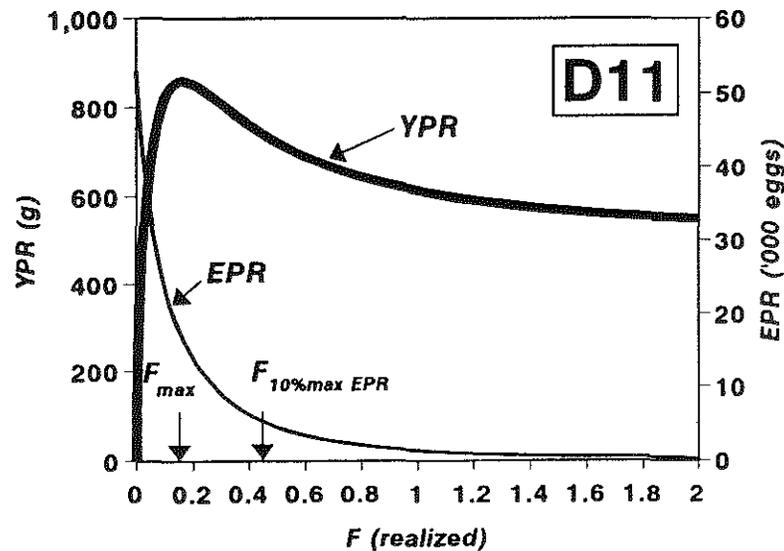


Georges Bank and South American Lobster NEFSC Autumn Trawl Survey Indices - Females



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Georges Bank and South American Lobster Yield and Egg Production per Recruit - Females



G. TILEFISH ADVISORY REPORT

State of Stock: The stock is at low biomass and is overfished. MSY is estimated at around 1200 mt with F_{MSY} approximately 0.1. Current biomass levels are at about 40% of the level producing MSY and fishing mortality rates are about 3.5 times larger than F_{MSY} . Management measures should reduce current F and rebuild SSB.

Management Advice: Limited stock assessment data are available for the development of an overfishing definition for tilefish. Definitions based on direct estimates of minimum SSB and/or stock-recruitment data cannot be developed from available data. An age-based assessment (VPA, F_{max}) developed by Turner (1986) is based on only 6 years of catch data and there are no recent age or length data collected to update this assessment. Catch and effort data from the longline fishery can currently be used to estimate F_{MSY} and B_{MSY} , although caution should be used in interpreting these initial estimates.

Forecast for 1994: No forecasts were performed.

Catches: Catches were first recorded in 1915 (148 mt); 4,500 mt were taken in 1916, which is the largest annual catch to date, but only 5 mt were reported by 1920. Landings briefly increased to 1000 - 1500 mt during the early 1950s, followed by a decline to 30 mt in 1968-1969. Most recently, catches increased to 3,800 mt in 1979 but have since declined, with 1992 landings of 1,650 mt. Since the 1970s, generally more than 90% of the landings have been from longline vessels. A small recreational fishery developed during the late 1960s in New York and New Jersey with landings never exceeding 100 mt. Recent recreational catches are insignificant.

Data and Assessment: The most recent assessment of tilefish was in June, 1992 (SAW 14). Limited stock assessment data are available for the development of an overfishing definition for tilefish. The most reasonable approach to date may be based on a non-equilibrium surplus production-type model applied to a CPUE time series constructed from information from the longline fishery from 1973 to present. The use of the yield per recruit model to produce estimates of F_{max} is a possibility. The major uncertainty and drawbacks are changes in life history parameters detected by Turner (1986) between the 1977-81 period and 1982, which resulted in different values of F_{max} . New data on mean weight, maturity, and partial recruitment at-age are needed before F_{max} (or $F_{0.1}$ or $F_{\%MSP}$) can be re-calculated. Data on the age and length structure of the catch would also be needed to monitor fishing mortality rates. No fishery-independent sources of information exist. At present, length data from the commercial fishery is intermittent and suitable age composition data do not exist. Relatively reliable catch and effort data are available however, and this application of the surplus production model is currently the only feasible method for assessing stock status. However, caution should be used when interpreting the analysis, because precision and accuracy of the model results are still being investigated.

Fishing Mortality: Fishing mortality has been very high relative to the level that would produce MSY. F in 1992 (as estimated with the surplus production model) was roughly 3.5 times larger than the F level for MSY. This relative level of current F is more reliably estimated than absolute levels of current F and F_{MSY} .

Recruitment: No stock-recruitment relationship is yet defined, but since the intrinsic rate of increase is low, a fairly strong stock-recruitment relationship may exist.

Stock Biomass: Stock biomass has significantly declined throughout the past 20 years with the current levels at about only 40% of the biomass level that would produce MSY.

Landings and Status Table (weights in mt):

Year	1986	1987	1988	1989	1990	1991	1992	Max	Min	Mean
	(1973 - 1992)									
Commercial Landings	1763	3212	1371	471	872	1187	1650	3841	390	1870
Discards	May occur but reliable estimates not presently available									
Recreational Landings	Insignificant									
Longline Effort ¹	1462	1888	1207	538	996	1599	1800	1948	57	1040
Longline LPUE ²	1.16	1.60	1.10	0.81	0.86	0.73	0.82	6.54	0.73	2.39

¹ Standard days fished

² Mt per standard day fished

Special Comments: Tilefish are long-lived and the age structure of the population may induce lags in the population's response to fishing mortality.

Sources of Information: Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW) Stock Assessment Review Committee SARC Consensus Summary of Assessments (NEFSC Ref. Doc. 93-18); G. Shepherd, 1993, Evaluation of Available Data for the Development of Overfishing Definition for Tilefish in the Middle Atlantic (NEFSC Ref. Doc. 93-17); and S.C. Turner, 1986, Population Dynamics of and Impact of Fishing on tilefish, Lopholatilus chamaeleonticeps, in the Middle Atlantic-Southern New England Region During the 1970s and early 1980s (PhD dissertation, Rutgers University, New Brunswick, NJ).

CONCLUSIONS OF THE SAW STEERING COMMITTEE

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

The SAW Steering Committee met in Saugus on 21 September 1993, with the exception of J. Bryson and D. Keifer who participated via telephone. Other meeting participants were: T. Hoff and C. Moore, MAFMC (via telephone); C. Kellogg and A. Applegate, NEFMC; V. Anthony; T.P. Smith, and H. Mustafa, NMFS/NEFSC.

Dr. Vaughn Anthony, SAW Chairman, led the discussions outlined on the agenda (Table 1). SAW documentation, the current SAW structure, and the 16th SAW process were thoroughly discussed; and the research recommendations of the Stock Assessment Review Committee (SARC) and its subcommittees were reviewed. The Steering Committee then set the agenda, terms of reference for species to be reviewed, and timing for SAW-17; suggested species/stocks for review in the near future; and confirmed the timing of SAW-18.

1. Advisory Document

Dr. Vaughn Anthony reviewed the changes that were made in the draft Advisory Report on Stock Status given the suggestions of the 16th SAW Plenary, and members of the Steering Committee offered additional suggestions to clarify the text and generally improve the report. These suggestions have been incorporated into the final version of the report contained in this document.

The general consensus of the Committee was that the current format of the Advisory Report is satisfactory and it presents useful information in sufficient detail. As far as complete standardization of sections is concerned, this should fall within the discretion of the SAW Chairman, as details vary from species to species.

The consensus among members of the Steering Committee was to continue the practice of not distributing information from the SARC prior to the Plenary meeting. Members agreed that as a result of the current process, and the opportunity to discuss the advice in the Plenary meeting, misinformation is kept under control.

2. Restructuring the SAW

2a. Subcommittees

State representation on Subcommittees is extremely important and state directors should be encouraged to make formal appointments. The importance of state commitment and the opportunity to develop a broader level of expertise, in addition to the particular species of

opportunity to develop a broader level of expertise, in addition to the particular species of interest to a state or an individual, should be discussed at the upcoming meeting of the ASMFC. Attendance of PDT (Plan Development Team) members at relevant subcommittee meetings should also be encouraged.

As currently there is no state representation on the Northern Demersal Subcommittee, this group is in particular need of augmentation by state personnel. ASMFC will see about getting at least one person from Maine and one from Massachusetts to augment the Subcommittee. Canadian participation on the Northern Demersal Subcommittee is also desirable. As Subcommittee meetings may be held at locations outside Woods Hole, it may be possible for Canadian experts to participate at such locations as Boothbay Harbor ME, for example.

The responsibility for dogfish was moved from the Pelagic/Coastal Subcommittee to the Southern Demersal Subcommittee, as this species is a formidable part of the bottom trawl fishery.

2b. Stock Assessment Review Committee (SARC)

SARC membership should be flexible to allow participation appropriate to the stocks under review. The SARC should not be composed exclusively of assessment experts but, ideally, also include persons with a management (or another compatible) orientation capable of translating science into management advice. Members must, however, be productive regardless of their familiarity with the specific species or techniques.

Quality of assessments, regardless of the time that it takes for SARC review, was deemed to be the most important consideration of the SARC. In the interest of quality, it is acceptable for the SARC not to be able to cover all species/stock assessments on the agenda if this cannot be done adequately (as determined by the SARC) within the allotted time frame and the review period cannot be extended. The SARC is expected to do what can reasonably be done on the basis of a "normal" working day, as are its subcommittees. Consequently, the value of the assessments not reviewed can not be equal to those reviewed by the SARC, although they may be released (or published) through other review procedures or outlets.

Obviously, there needs to be a better match between what the SARC can do and the prioritized workloads of the Subcommittees. Although the SARC's timetable should not be constrained, SARC meetings can be made more efficient. In addition, it may be necessary to extend the duration of each SARC (add days) or add a third SARC meeting during the year to meet the growing needs of management vis a vis the 48 species of marine fish and invertebrates that need to be periodically assessed.

The following points should clarify the responsibilities of the SARC and its Subcommittees as well as the SARC procedure in general:

- o Subcommittee reports should be drafted as sections for the SARC Report, to be approved by the SARC.
- o Subcommittee working papers should be forwarded to SARC members two weeks before the SARC meeting. More lead time may be needed for SARC members not familiar with specific species under review.
- o Relative to Subcommittee workloads, in addition to the species terms of reference, the general guidance is to do what can reasonably be done on the basis of a "normal" workday. The Steering Committee is not always the best judge of how much work is involved or how to handle the workload.
- o As the SARC is responsible for all assessment advice, the review of details is contingent on the particular assessment.
- o If there is no indication that stock status has changed from a previous assessment, or is not about to change, then the SARC could report this as the only advice for that stock.
- o Subcommittees should submit all tables and figures required for the Advisory document in the standard format.
- o It is not desirable for Rapporteurs to be SARC members. Rapporteurs from outside the SARC (NEFSC or states) may be appointed to allow the SARC members to fully participate in all SARC discussions. Although Rapporteurs use their ability to interpret, SARC members make the final judgement. An additional Rapporteur (editor) will coordinate the production of the Advisory Report to assure continuity from stock to stock within the agreed-upon format.

2c. SAW Plenary

The SAW Plenary is a forum for presenting scientific advice to managers. This one day meeting should be planned as part of, or in conjunction with Council or ASMFC meetings whenever possible, making sure that there are no conflicting meetings that day for potential participants. (Care should be taken so as not to fractionate the Plenary meeting, as this would diminish the process to finalize the Advisory Report.)

Plenary meeting participants should include the following:

- o Members of the Saw Steering Committee
 - Executive Director, NEFMC
 - Executive Director, MAFMC
 - Executive Director, ASMFC
 - Regional Director, NMFS/NER
 - Science and Research Director, NMFS/NEFSC
- o Council Members
- o At least 2 Council staff from each Regional Council
- o ASMFC Commissioners (Maine to North Carolina)
- o Chair of each SARC Subcommittee
- o SAW Chair
- o Others interested in fisheries management

2d. 4th Meeting

A fourth meeting in the SAW process should occur only to reiterate status and advice. Brief reviews of specific species may be presented at Council or other relevant meetings as necessary.

2e. SAW Documentation

SAW documentation represents steps in an additive process to develop its documentation that includes:

- o Subcommittee Reports and Working Papers are distributed to SARC members two weeks prior to the meeting. After SARC review, selected working papers will be upgraded to NEFSC Reference Documents (see below).
- o The SARC Report (a NEFSC Laboratory Reference Document) is a summary of peer reviewed assessment documents with recommendations and appropriate tables and other information. Sections of this document are drafted by Subcommittees and modified and approved by the SARC. The final draft of this report is available at the time of the Plenary.

- o The Advisory Report is also prepared at the SARC meeting. The first draft of this report is provided to members of the Steering Committee two weeks prior to the SAW Plenary. This draft is then reviewed at the Plenary and changed according to suggestions at that meeting. A second draft is presented to the Steering Committee before the report is finalized.
- o The SAW Plenary Report (a NEFSC Laboratory Reference Document) contains the final Advisory Report On Stock Status, a summary of the Plenary Meeting, and conclusions of the SAW Steering Committee.
- o SAW NEFSC Reference Documents include the SARC and Plenary Reports and selected SARC Working Papers. Working Papers not selected for this series will have no SAW status. If, on occasion, there are SARC Working Papers for species/stocks on the SARC agenda which the SARC was not able to review because of time constraints, they could be released through another review process or outlet, although such papers will be without SARC status.

3. Research Recommendations

Dr. Vaughn Anthony reviewed the research recommendations from the SARC Report. It was agreed to bring these recommendations to the attention of the states, other management agencies, and NEFSC with regard to planning, prioritization, and program guidance.

4. SAW - 17

SAW-17 Stock Assessment Review Committee (SARC) Meeting
Woods Hole
29 November - 3 or 4 December 1993

SAW-17 Plenary Meeting
In conjunction with the MAFMC Meeting
24 January 1994

SAW Steering Committee Meeting
In conjunction with the NEFMC Meeting
King's Grant Inn, Danvers, MA
15 February 1994

It was agreed that the SARC Meeting would run from 9 AM to 6 PM and may have to be extended through Saturday, 4 December to complete the agenda. The Plenary Meeting will take place in conjunction with the January meeting of the Mid-Atlantic Fishery Management Council Meeting.

4a. Species

Members of the Committee recommended the following changes to the species list developed at an earlier meeting (see page 3 of this document): 1) MAFMC recommended that butterfish along with the both squids be a high priority for assessments as all three species are in one FMP; 2) NEFMC would like to elevate silver hake (2 stocks) to high priority and demote cod; 3) both ASMFC and MAFMC consider bluefish as a high priority as well. The Committee consensus on the species to review was as follows:

<u>SUBCOMMITTEE</u>	<u>1st PRIORITY</u>	<u>2nd PRIORITY</u>
No. Demersal	Silver Hake 2 stocks	Cod Georges Bank
So. Demersal	Yellowtail Flounder So. New England	Yellowtail Flounder Georges Bank
Pelagic/Coastal	Bluefish Butterfish	
Invertebrate	Squid Long-finned Short-finned	

4b. Terms of Reference

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

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.
- d. Review past biological reference points.

SOUTHERN NEW ENGLAND YELLOWTAIL FLOUNDER

- a. Assess the status of SNE yellowtail flounder through 1992 and characterize the variability of estimates of stock abundance and fishing mortality rates.
- b. Provide 1994 projected estimates of catch and 1995 SSB options at various levels of F.

BLUEFISH

- a. Agree on standard aging methodology and or length based aging methods for bluefish.
- b. Compile catch-at-age data for commercial and recreational bluefish fisheries from Florida to Maine.
- c. Compile research catch-per-tow indices for bluefish from available state and federal surveys from Florida to Maine.
- d. Assess the status of bluefish through 1992 and characterize the variability of estimates of stock abundance and fishing mortality rates. Review past biological reference points and update as necessary.
- e. Provide 1994 projected estimates of catch and 1995 SSB options at various levels of F.

BUTTERFISH

- a. Compute revised R/V 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. Assess the role of discards in the fishery.
- d. Review MSY.

LONG-FINNED SQUID (Loligo)

- a. Provide updated calculation of yield and spawning stock biomass per recruit and other standard biological reference points
- b. Provide updated minimum biomass and recruitment estimates based on areal expansion of R/V survey data.
- c. Continue the development of DeLury population estimators based on R/V 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 R/V surveys.
- e. Review MSY.

SHORT-FINNED SQUID (Illex)

- a. Compute revised R/V 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.
- e. Review MSY.

2nd PRIORITY (Subcommittees and/or SARC must decide how much can be done):

GEORGES BANK COD

- a. Assess the status of Georges Bank cod through 1992 and characterize the variability of estimates of stock abundance and fishing mortality rates.
- b. Provide 1994 projected estimates of catch and 1995 SSB options at various levels of F.

GEORGES BANK YELLOWTAIL FLOUNDER

- a. Assess the status of Georges Bank yellowtail flounder through 1992 and characterize the variability of estimates of stock abundance and fishing mortality rates.
- b. Provide 1994 projected estimates of catch and 1995 SSB options at various levels of F.

Assessment Methods Subcommittee

Dr. Anthony indicated that no guidance from the Steering Committee is expected in regard to this Subcommittee, but he would like to bring to the Committee's attention the highest priority terms of reference as presented in the 16th SAW SARC Report (pages 113-114): 3 (multiple indices of abundance within the DeLury Model); 7 (selectivity of ADAPT results to multiple indices); 2 (methods for medium-term stochastic projections); 4 (CPUE-based indices of abundance for VPA tuning). Time permitting, the terms of reference will be reviewed at the SARC meeting. Subsequently it may be necessary to set up a Special SARC on Assessment Methods, made up of appropriate experts.

An ADAPT tutorial will be conducted within the next six months.

4c. Special Studies

There should be a general understanding that biological reference points will be reviewed at the SARC meeting insofar as possible.

5. Future SAWs

Should the Inter-Jurisdictional Fisheries Legislation Act be enacted, ASMFC would likely be asked to update a large number of FMPs and may need the assistance of the SAW.

SAW-18

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

Plenary Meeting
In conjunction with the NEFMC Meeting
9 August 1994, King's Grant Inn, Danvers, MA

Species suggested for evaluation were: mackerel, witch flounder, summer flounder, dogfish, and lobster.

SAW-19

No dates were set for SAW-19 meetings.

Species suggested for evaluation were: cod, scallops, white hake, scup, and black sea bass; and possibly shad, and river herring.

Table 1.

SAW-16/17 Steering Committee Meeting

Saugus, MA
21 September 1993

1. Advisory Document
 - a. Need more detail?
 - b. Delay of advice after SARC
2. SAW Restructuring
 - a. Subcommittees (membership, interface with other committees, responsibilities)
 - b. SARC (open meeting, 2 per year, membership)
 - c. Plenary
 - d. 4th Meeting - report to Councils
 - e. Documentation (NEFSC Reference Documents, Advisory Document)
3. Research Recommendations
4. SAW-17 SARC - Woods Hole, 29 November-3 December 1993
SAW-17 Plenary - In conjunction with Mid-Atlantic Council, January 1994
 - a. Species
 - August 25 letter from Mid-Atlantic
 - SAW-16 priority list
 - b. Terms of Reference
 - SAW-17 SARC Proposed Terms of Reference from NEFSC
 - SAW-16 SARC Terms of Reference
 - Methods Subcommittee Terms of Reference
 - c. Special studies
5. Future SARCs and SAWs
 - a. SAW-18 SARC - Woods Hole, 20-24 June 1994
 - b. SAW-18 Plenary - In conjunction with New England Council, July 1994