Northeast Fisheries Science Center Reference Document 94-23

Report of the 18th Northeast Regional Stock Assessment Workshop (18th SAW)

The Plenary

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Northeast Fisheries Science Center
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Reports of the 18th Northeast Regional Stock Assessment Workshop (18th SAW)

CRD 94-15 Bluefish assessment, 1994 report of the SARC Pelagic/Coastal Subcommittee

CRD 94-16 Assessment of summer flounder (*Paralichthys dentatus*), 1994 report of the SAW Summer Flounder Working Group
by SAW Summer Flounder Working Group

CRD 94-17 Assessment of Gulf of Maine-Georges Bank witch flounder stock for 1994
by S. E. Wigley and R.K. Mayo

CRD 94-18 Application of a biomass dynamics model to the spiny dogfish (*Squalus acanthias*)
by J. Brodziak, P.J. Rago, and K. Sosebee

CRD 94-19 Distribution and dynamics of North Atlantic spiny dogfish (*Squalus acanthias*)
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CRD 94-20 Assessment of Georges Bank yellowtail flounder (*Pleuronectes ferrugineus*), 1994
by P. Rago, W. Gabriel, and M. Lambert

CRD 94-21 An evaluation of the consistency of age-structured assessment in the Northeast Region
by R. Conser, S. Cadrin, L. O'Brien, and K. Sosebee

CRD 94-22 Report of the 18th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee Consensus Summary of Assessments

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by F. Serchuk, R. Mayo, and L. O'Brien

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MEETING SUMMARY

MEETING SUMMARY

The **Plenary Meeting** of the **18th Northeast Regional Stock Assessment Workshop** was held during 9 - 10 August 1994 at the Kings Grant Inn, Danvers, Massachusetts just prior to the August meeting of the New England Fishery Management Council (NEFMC). Nearly 80 persons attended the meeting, including most of the NEFMC members and several members of the Mid-Atlantic Fishery Management Council (MAFMC). A list of participants is presented in Table 1 and the agenda in Table 2.

Opening

Douglas Marshall, Executive Director of the New England Fishery Management Council, welcomed the Plenary participants and indicated that the three species of most interest to the Mid-Atlantic people would be reviewed during the first day of the meeting and that the species of most interest to New England people would be reviewed during the second day.

Introduction

Dr. Vaughn Anthony, SAW Chairman, reviewed the SAW process. Based on management needs, the SAW Steering Committee decides what stocks should be reviewed and evaluates the SAW process and the sufficiency and style of its products. A Steering Committee meeting is both the conclusion of one set of SAW meetings (Subcommittees, SARC, and Plenary) and the beginning of next set of SAW meetings. The SAW 18/19 Steering Committee will meet on 18 August 1994 following the August meeting of the MAFMC.

After the Steering Committee has set the species/stocks and terms of reference for each species to be reviewed, assessments for these species are developed in a series of Subcommittee meetings. There are four species Subcommittees (Northern Demersal, Southern Demersal, Pelagic/Coastal, and Invertebrate) and an Assessments Methods Subcommittee. The SARC conducts a thorough peer review of all working papers submitted by the Subcommittees and guides the work of the methods group. Based on the materials presented, the SARC determines which papers will be published in the NEFSC Reference Documents series, produces a technical "Consensus Summary of Assessments" report which includes research recommendations for all species reviewed, and drafts an "Advisory Report on Stock Status." The advice is then presented at the Plenary and finalized for publication as a section in the Plenary Report, an NEFSC Reference Document.

SARC Meeting and Reports

Dr. Anthony discussed the composition of the SARC (Table 3), including the expertise of some of the members and the importance of membership from outside the region. The SARC met at the Northeast Fisheries Science Center in Woods Hole, MA during 20 -24 June 1994 to review analyses on bluefish, summer flounder, witch flounder, dogfish, Georges Bank yellowtail flounder, and Georges Bank cod and to hear the report of the Assessment Methods Subcommittee. A total of 14 working papers were reviewed. The working papers were submitted to the SARC as Subcommittee reports prepared in a number of meetings (Table 4), together with other technical papers containing the details of the assessments. The Committee selected eight of the working papers to be published as NEFSC Reference Documents (Table 5).

During the SAW-18 process, the Assessment Methods Subcommittee addressed three topics from its list of 9 terms of reference (potential biases in SARC assessment results, methods for medium-term stochastic projections, and designing user-friendly ADAPT software), and added two new terms of reference. The Subcommittee's recommendation for the development of the ADAPT software will be discussed at the Steering Committee Meeting (see page 62 of this report).

The SARC prepared the "Consensus Summary of Assessments" (SARC Report), with research recommendations for future implementation, and the draft "Advisory Report on Stock Status" (Advisory Report) to be discussed at the Plenary. SARC Leaders were chosen to assure that both reports accurately reflect the collective thoughts of the SARC.

Presentation of the Advice

Dr. Anthony announced that he would present the advice for all the species/stocks on the agenda except spiny dogfish. The advice on spiny dogfish would be presented by Dr. Emory Anderson (NEFSC) who chaired the Southern Demersal Subcommittee meeting on dogfish. Dr. Anthony reviewed the format of the Advisory Report and invited the meeting participants to comment and suggest how to further improve this report.

The stock classification chart in the Introduction section of the Advisory Report was reviewed. The stock level and exploitation rate of the species presented would later be matched to this chart. It was indicated that assessments require not only fisheries data but biological data as well, and that in many areas we are still "data poor."

During the presentation, terms of reference (see the SARC Report) which illustrate the scope of the work that was performed were reviewed for each species/stock, and reference was made to other selected information and data contained in the SARC Report, as well as information/data from other sources.

The advice presented is contained in the "Advisory Report on Stock Status" section of this report. Summaries from the presentations at the Plenary Meeting are provided below.

Bluefish

Dr. Anthony congratulated the Chairman and other experts who participated in the bluefish assessment. People had a significant amount of data and several analytical assessment models to examine. Four Subcommittee meetings were held to address all the terms of reference set for this species; two of the meetings were part of the SAW-17 process.

Bluefish is not an easy animal to assess and this assessment could not have been done without the participation of state experts and the contribution of data from a number of states. Data from any one survey are limited in their use. In fact, without the combination of data from various states, it would not have been possible to determine the abundance of bluefish over time.

One question raised during the discussion was whether or not it is possible that bluefish spawn twice in one year? To answer this question will require additional research.

Summer Flounder

The group that develops summer flounder assessments has been meeting for many years and is blessed with better data than bluefish. The Council (MAFMC) was congratulated for doing a good job of management, as catch quota regulations have dramatically decreased the fishing mortality of summer flounder in the last year and the stock is expected to rebuild. Someone in the audience, however, questioned the credit given to the Council, indicating that improvement in biomass could be a natural phenomenon.

Spiny Dogfish:

Dr. Emory Anderson indicated that this was the first time that spiny dogfish had been formally assessed. In spite of poor data, the group managed to make progress and to produce some innovative analyses.

Since this was the first major presentation on the species, some time was devoted to the discussion of background information and species distribution analysis. The unit stock distribution has been substantiated from early tagging studies. Dogfish are unusual in that they are extremely slow growing and school by size and sex. They prey on commercially important species, including herring, mackerel, and squid. There is still considerable uncertainty in the maximum age of dogfish, which in turn, contributes to uncertainty in the natural mortality rate for the species.

The bulk of the dogfish caught are females, the average size of which has declined in the last 12 years. The gestation period is 18 months to 2 years and there are usually 4 - 9 pups per litter.

The principal fishing gear used to capture this species is sink gill nets, followed by otter trawls. Although traditionally the fish are caught from June to September, recently dogfish have also been caught in autumn and winter. The total removal of dogfish may be double the reported landings.

Given the evidence of a single stock, the SARC recommended coordinated U.S. and Canadian assessment and management of spiny dogfish. Meeting participants expressed interest in what Canada is doing regarding the management of dogfish, and how important it is for the U.S. and Canada to adopt comparable management strategies.

Interest was also expressed in the predatory aspects of spiny dogfish and why there has been an increase in the dogfish biomass in recent years. Whether or not there would be any benefits (to other fisheries) if no dogfish existed was explored. Although possible benefits and consequences of a diminished dogfish biomass were discussed, available information does not support the theory that drastically reducing dogfish biomass would bring back cod and haddock. At present the increase in biomass cannot be fully explained.

Witch Flounder

This was the first time that witch flounder (gray sole) has been assessed by a SARC. Unlike other groundfish, this species is in fairly good condition, with recent good recruitment. Fishing mortality, however, is still too high (13% above the overfishing level and 40% above the F_{MAX} level). Discarding of small fish, especially in the northern shrimp fishery, continues to be a concern, although the Nordmore Grate should help in this regard.

Georges Bank Yellowtail Flounder

Yellowtail flounder has been assessed regularly. The stock has been at a low level of abundance for 7 or 8 years and is showing no signs of improvement. Although the stock is extremely overfished, it is not as much so as the Southern New England stock. The biomass has stabilized at a low levels and could be improved through effective management. Questions from the floor concerned the importance of temperature in the improvement of the spawning stock biomass and survival of the species, interactions among the regional stocks, and the effectiveness of current regulations. It was reported that the Regional Director (NMFS) has asked the Northeast Fisheries Science Center to look at all protection measures on yellowtail in Groundfish Amendment #5.

Georges Bank Cod

The trend of declining abundance of the Georges Bank cod stock has not really changed in ten years and the stock is nearing collapse. Catching more than one half of the stock each year has led to a rapid decline in abundance. Even if effort were reduced by 50% in 1994-1995, the spawning stock biomass is expected to continue to decline for several more years. Both NEFSC and Canadian data estimated the last three year classes to be the poorest on record. Further, evaluation of the five year 10% reduction scheme of Amendment 5 (see short-term stochastic projections, Table F16 of the SARC Report) indicates that a relatively low level of future recruitment is likely. The stock is overfished and current management measures will not be effective in reversing current trends. Meeting participants were interested in the affect that environmental conditions have on recruitment and explored the possible impact of implementing a 6" square mesh regulation throughout the range.

Suggestions to Improve Future Advisory Reports

Future advisory reports should state what information was used in support of estimates and contain a table listing the sources of data used in assessments.

Special Advisory on Groundfish Status on Georges Bank

Given the status of Georges Bank yellowtail flounder, cod, and haddock, the SARC prepared a Special Advisory. There is no evidence of environmental problems in the region. Conditions are so bad, however, that significant reductions in effort will be required to improve the situation. Control of fishing mortality via minimum mesh size alone is insufficient.

The Special Advisory, with editorial changes made after the Plenary Meeting, is contained in this report.

Closing

On behalf of the New England Fishery Management Council, Douglas Marshall thanked Dr. Vaughn Anthony for his contributions to the assessment process as SAW Chairman during the last two years and as long time Chief of the NEFSC Conservation and Utilization Division (CUD). "Losing Vaughn," he indicated, "is an end of an era."

Dr. Fred Serchuk was introduced as the new CUD Chief.

Table 1. List of Participants

SAW-18 PLENARY MEETING

National Marine Fisheries Service

Northeast Fisheries Science Center
Emory Anderson
Vaughn Anthony
Jon Brodziak
Ray Conser
Wendy Gabriel
Lisa Hendrickson
Ralph Mayo
Helen Mustafa
Steve Murawski
Allen Peterson
Fred Serchuk
Gary Shepherd
Terry Smith

Northeast Regional Office
Ken Beal
Jim Brigham
Pete Christopher
Peter Colosi
Bridgette Davidson
Hannah Goodale
Pat Kurkul
Chris McCarron
Susan Olsen
Myles Raizin
Jon Rittgers
Regina Spallone

NOAA General Counsel
Clare Blancke
Gene Martin
Barbara Green Whitbeck

Headquarters
Mark Millikin
Bill Papoulias

Atlantic States Marine Fisheries Commission
Paul Perra

Mid-Atlantic Fishery Management Council
Tony DiLernia
Bruce Freeman
Tom McVey
Chris Moore

New England Fishery Management Council
Richard Allen
Rodney Avila
David Borden
Joseph Brancaleone
Bill Brennan
Phil Coates
Tom Hill
James McCauley
Frank Mirarchi
Artie Odlin
Ben Rathbun
Loyall Sewall
Eric Smith
Lee Stevens
Barbara Stevenson
Louis Zglobicki
Pat Fiorelli
Philip Haring
E. Demet Heksever
Chris Kellogg
Douglas Marshall

Gloucester Fishing Worker Assistance
Angela Sanfilippo

Point Judith Coop
Ed MacLeod

Table 1. (Continued)

East Coast Fisheries Federation
James O'Malley

NECCA-Maine
Rob Bundy
Murray Keene

New Bedford Offshore Mariners Association
Howard Nickerson

Bell-Sea
Nick Emord

Newcomb Communications
Phil McLellan

Massachusetts Division of Marine Fisheries
David Pierce

Environmental Defense Fund
Jonathan Rosenthal

Conservation Law Foundation
Ellie Dorsey

Seafood Data Search
John Sackton

CCC Hook Fishermen's Association
S. Smith

Fish Weirs Inc.
Mark Simonitsch

North Coast Seafoods
Norman Stavis

East End Fisheries Corp.
Frank Grice

U.S. Coast Guard
Robert Beigman

Massachusetts Institute of Technology
Pat Ful

Commercial Fisheries News
Janice Plante

Boston Globe
Scott Allen

Cape Cod Times
Bryan Lantz

Table 2. Plenary Meeting agenda.

18th Northeast Regional Stock Assessment Workshop
(18th SAW)

PLENARY MEETING

King's Grant Inn
Danvers, Massachusetts

9 - 10 August, 1994

AGENDA

<u>Tuesday, August 9</u>

1:00	Opening	Executive Director NEFMC, D. Marshall
1:15	Introduction	SAW Chairman, V. Anthony
1:30	Stock Assessment Review Committee (SARC) Report	V. Anthony
2:00	**Advisory Report on Stock Status** Presentation and Discussion Introduction Bluefish Summer Flounder Spiny Dogfish	V. Anthony

<u>Wednesday, August 10</u>

9:00	Continue Advisory Report Presentation and Discussion Witch Flounder Georges Bank Yellowtail Flounder Georges Bank Cod	V. Anthony
11:00	Other Business	

Table 3.

SAW-18 SARC COMPOSITION

Chair, NEFSC Chief Scientific Advisor:

Vaughn Anthony

Four ad hoc assessment members chosen by the Chair:

Michael Fogarty
Steve Murawski
Anne Richards
Fred Serchuk

One person from NMFS, Northeast Regional Office:

Pete Colosi

One person from each Regional Management Council:

Andy Applegate, NEFMC
Chris Moore, MAFMC

Atlantic States Marine Fisheries Commission/State personnel:

Mark Gibson, RI FWE
Kim McKown, NY DEC
Jeff Ross, NC DMF

One Scientist from:

Canada - **John Neilson, DFO, St. Andrews Bio. Sta.**

Academia - **David Conover, State University of New York**

Other Region - **Dick Beamish, Pacific Biological Station, Nanaimo, BC**

Table 4.

18th SAW SARC SUBCOMMITTEE MEETINGS

DATE/PLACE	SPECIES	CHAIR
Northern Demersal Subcommittee		
24-28 May 1993 Woods Hole, MA	Witch Flounder	R. Mayo
8-12 November 1993 Woods Hole, MA	Georges Bank Cod	R. Mayo
23-27 May 1994 Woods Hole, MA	Georges Bank Cod Witch Flounder	R. Mayo R. Mayo
Southern Demersal Subcommittee		
2-5 November 1993 Woods Hole, MA	Georges Bank Yellowtail	W. Gabriel
9-13 May 1994 Woods Hole, MA	Summer Flounder Georges BankYellowtail	W. Gabriel
24-26 May Woods Hole, MA	Spiny Dogfish	E. Anderson
Pelagic/Coastal Subcommittee		
5 January 1994 Woods Hole, MA	Bluefish	F. Serchuk
5-6 April 1994 Old Lyme, CT	Bluefish	S. Murawski
Assessment Methods Subcommittee		
4-6 May 1994 Woods Hole, MA		R. Conser

Table 5.

18th SAW NEFSC REFERENCE DOCUMENTS

CRD 94-15	Bluefish assessment, 1994, report of the SARC Pelagic/Coastal Subcommittee
CRD 94-16	Assessment of summer flounder (*Paralichthys detatus*), 1994, report of the SAW Summer Flounder Working Group
CRD 94-17	Assessment of Gulf of Maine - Georges Bank witch flounder stock for 1994 by S.E. Wigley and R.K. Mayo
CRD 94-18	Application of a biomass dynamics model to the spiny dogfish (*Squalus acanthias*) by J. Brodziak, P. Rago and K. Sosebee
CRD 94-19	Distribution and dynamics of North Atlantic spiny dogfish (*Squalus acanthias*) by P. Rago, K. Sosebee, J. Brodziak, and E. Anderson
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CRD 94-22	Report of the 18th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee Consensus Summary of Assessments
CRD 94-23	Report of the 18th Northeast Regional Stock Assessment Workshop, The Plenary
CRD 94-25	Assessment of Georges Bank cod stock for 1994 by F. Serchuk, R. Mayo, and L. O'Brien

ADVISORY REPORT ON STOCK STATUS

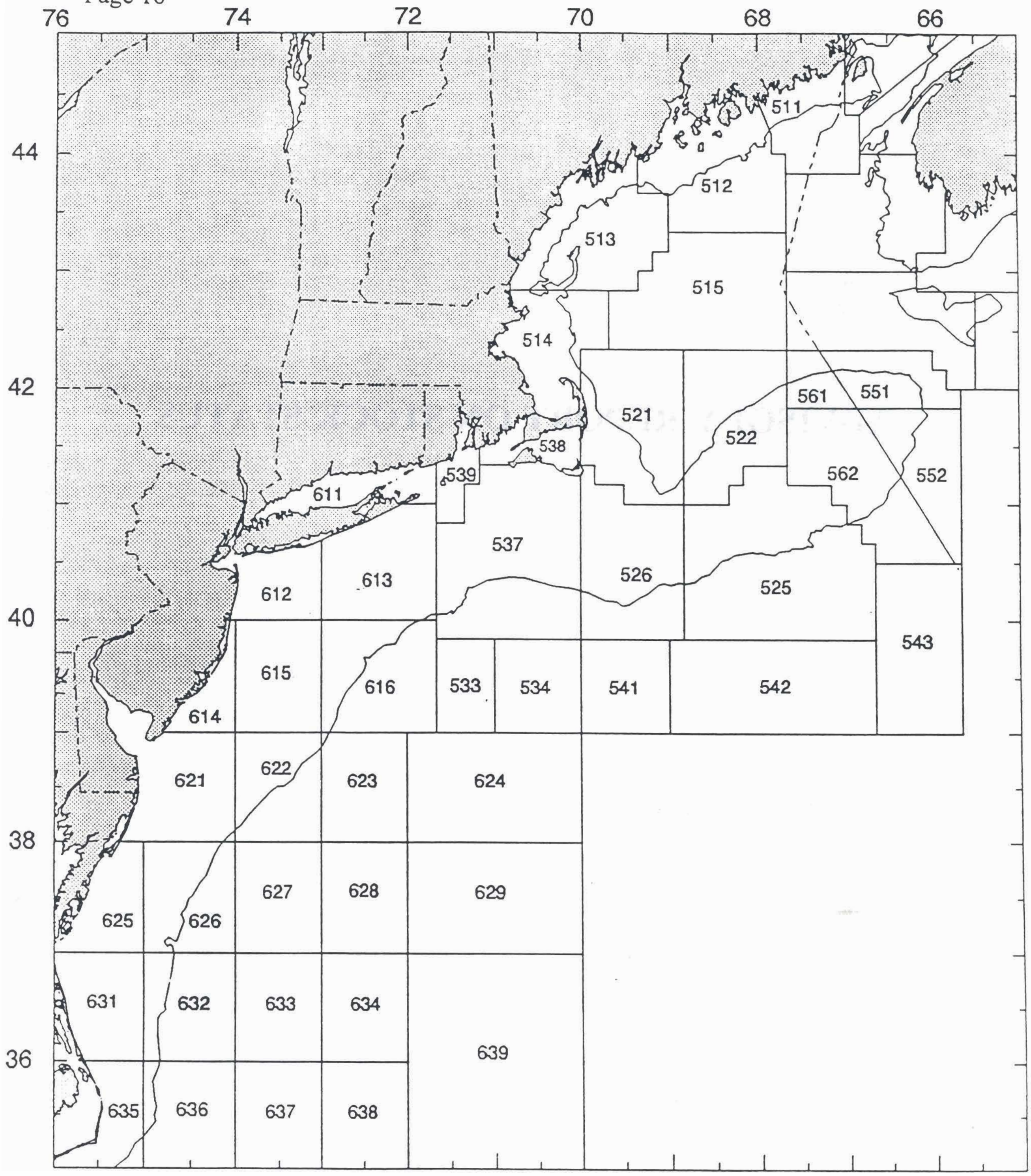


Figure 1. Statistical areas used for catch monitoring in offshore fisheries in the northeast United States

INTRODUCTION

The **Advisory Report on Stock Status** is a major product of the Northeast Regional Stock Assessment Workshop. It summarizes the technical information contained in the Stock Assessment Review Committee (SARC), Consensus Summary of Assessments and is intended to serve as scientific advice for fishery managers on resource status.

An important aspect of scientific advice on fishery resources is the determination of whether a stock is currently over-, fully-, or under-exploited. As these categories specially refer to the act of fishing, they are best thought of in terms of exploitation rates relative to the Councils' overfishing and maximum sustainable yield (MSY) definitions. The exploitation rate is simply the proportion of the stock alive at the beginning of the year that is caught during the year. When that proportion exceeds the amount defined by the Councils' overfishing definition, it is considered to be over-exploited. When the stock is at such a level that the MSY can be taken but the fishery is only removing a small portion of the stock, then it is considered to be under-exploited.

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

STOCK LEVEL

EXPLOITATION STATUS

	LOW	MEDIUM	HIGH
OVER EXPLOITED	REDUCE EXPLOITATION REBUILD STOCK BIOMASS	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

Glossary of Terms

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

Exploitation pattern: The pattern of fishing mortality on different age classes of the stock. This pattern often varies by type of fishing gear, area and seasonal distribution of fishing, and the growth and migration of the fish. The pattern can be changed by modifications to fishing gear, for example, increasing mesh or hook size, or by changing the proportion of harvest by gear type.

Mortality rates: Populations of animals decline exponentially. This means that the number of animals that die in an "instant" is at all times proportional to the number present. The decline is defined by survival curves such as

$$N_{t+1} = N_t e^{-z}$$

when the number of deaths is proportional to the number present, Z is the total instantaneous mortality rate which can be separated into deaths due to fishing (F) and deaths due to all other causes (M) and e is the base of the natural logarithm (2.71828).

To better understand the concept of an instantaneous mortality rate consider the following example. Suppose the instantaneous total mortality rate is 2 (i.e., Z = 2) and that we are interested in how many animals of an initial population of 1 million fish are alive at the end of one year. If we break the year up into 365 days (that is, the 'instant' of time is one day) then 2/365 or 0.548% of the population dies each day. On the first day of the year 5,480 fish die (1,000,000 x 0.00548), leaving 994,520 fish. On day 2, 5,450 fish die (994,520 x 0.00548) leaving 989,070 fish. At the end of the year there remain 134,593 fish (1,000,000 x $(1-0.00548)^{(365)}$). If, we had instead selected a smaller 'instant' of time, say an hour, at the end of the first time interval (an hour) 0.228% of the population would have died (2/8,760 hours per year) and we would calculate that there would be 135,304 fish remaining at the end of the year (1,000,000 x $(1-0.00228)^{(8760)}$). As our instant of time becomes shorter and shorter the exact answer to the number of animals surviving is given by the survival curve mentioned above, that is,

$$N_{t+1} = N_t e^{-Z}$$

or, for our example,

$$N_{t+1} = 1{,}000{,}000\, e^{-2} = 135{,}335 \text{ fish}$$

Exploitation rate: The proportion of a population at the beginning of the year that is caught during the year. That is, if 1 million fish were alive on January 1 and 200,000 were caught during the year, the exploitation rate is 200,000 divided by 1 million or 20%.

F_{MAX}: The rate of fishing mortality that produces the maximum level of yield-per-recruit. This is the point where growth overfishing begins.

$F_{0.1}$: The fishing mortality rate where the increase in yield-per-recruit for an increase in a unit-of-effort is only 10 percent of the yield-per-recruit produced by the first unit of effort on the unexploited stock (i.e., the slope of the yield-per-recruit curve for the $F_{0.1}$ rate is only one-tenth the slope of the curve at its origin).

F_{MSY}: The fishing mortality rate that maintains a stock at its maximum sustainable yield.

Growth overfishing: The rate of fishing above F_{MAX} ; a rate of fishing at which weight loss due to mortality exceeds weight gain due to growth.

MSY: The largest average catch that can be taken from a stock under existing environmental conditions.

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

Recruitment overfishing: The rate of fishing above which the recruitment to the spawning stock becomes significantly reduced. This is caused by a greatly reduced spawning stock, and is characterized by a decreasing proportion of older fish in the catch, and generally very low recruitment year after year.

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

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

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

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

Virtual population analysis (or cohort analysis): A retrospective analysis of the catches from a given year class over its life in the fishery. This technique is used extensively in fishery assessments.

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

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

A. BLUEFISH ADVISORY REPORT

State of Stock: The stock is now considered to be over-exploited and at a low level of abundance based on the information for the period in which recreational catch and survey abundance indices are available (1974-1993). Present recreational catch levels of 15,000 mt (33 million pounds) are about 25% of the catch levels of the early 1980s. Fully-recruited fishing mortality rates (Ages 1-2, unweighted) for bluefish increased from about 0.2 in 1982 to about 0.45 in 1993 and have been above F_{MSY} (0.15-0.25) since at least 1986 (Figure A1). Spawning stock biomass declined from 326,000 mt in 1982, the historic high, to 86,000 mt in 1993, a decrease of 74% (Figure A2). Recruitment varied from 75 to 87 million fish during 1982-1984, but has declined substantially since then, with the best recent year classes recruiting to the stock in 1988 and 1989 (Figure A2). Recruitment since 1989 has been below average, and the 1993 year class of 4 million fish is the poorest in the time series.

Management Advice: According to a recalculated overfishing reference level (F_{MSY} = 0.15-0.25), fishing mortality rates for bluefish have been in excess of the overfishing level since 1986. If the lower value in the range is used, the stock has been overfished since 1982. Fishing mortality should be reduced to the reference level. Even though the level of recruitment has declined substantially in recent years, spawning stock biomass resulting from whatever recruitment does occur could be increased by reducing exploitation on age 0 fish. For example, by maintaining the current fishing mortality rate and eliminating fishing on age 0 fish, spawning stock biomass would increase by 16%.

Forecast for 1994-95: Yield and stock size projections were made for 1994 and 1995. If the fishing mortality rate remains at the 1993 level (F_{93}=0.45) and recruitment is average (32 million at age 1), landings should be approximately stable in 1994 and 1995, but SSB will decline to 46,700 mt in 1995; a 46% decline relative to 1993 (Figure A4). If fishing mortality were reduced in 1994-1995 to the mid-range of F_{MSY} values (F= 0.2), landings in 1994 and 1995 would be 7,300 and 7,900 mt (16 million and 17.4 million pounds) and SSB, 59,300 and 56,500 mt. If year classes similar in size to that of 1993 occur in 1994 and 1995, landings and spawning stock biomass will continue to decline to very low levels.

Forecast for 1994-1995: Mean recruitment at age 0 = 32 million fish; F_{94} = F_{93} = 0.45; 1993 landings = 14,500 mt; 1993 SSB = 86,000 mt.

	1994 (1,000 mt)		1995 (1,000 mt)	
$F_{1994-1995}$	Landings	Spawning Stock Biomass	Landings	Spawning Stock Biomass
A) $F_{MSY-low}$ 0.15	5.6	59.8	6.2	58.8
B) $F_{MSY-med}$ 0.20	7.3	59.3	7.9	56.5
C) $F_{MSY-high}$ 0.25	9.0	58.9	9.5	54.4
D) F_{max} 0.30	10.5	58.5	10.7	52.5
E) F_{1993} 0.45	15.2	57.2	14.2	46.7

Consequences/Implications

A) Landings decrease 61% in 1994, SSB decreases 30%; landings in 1995 are 6,200 mt.
B) Landings decrease 50% in 1994, SSB decreases 31%; landings in 1995 are 7,900 mt.
C) Landings decrease 38% in 1994, SSB decreases 32%; landings in 1995 are 9,500 mt.
D) Landings decrease 28% in 1994, SSB decreases 32%; landings in 1995 are 10,700 mt.
E) Landings increase 5% in 1994, SSB decreases 33%; landings in 1995 are 14,200 mt.

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

Year	1986	1987	1988	1989	1990	1991	1992	1993	Max (1980-1993)	Min (1980-1993)	Mean (1980-1993)
U.S. Commercial Landings	6.7	6.6	7.2	4.7	6.2	6.2	5.0	4.0[1]	7.5	4.0	6.1
Discards, Commercial	Discards occur but reliable estimates are not available										
USA Recreational Mortalities[2]	51.1	36.0	28.6	18.2	18.2	15.3	12.2	10.5	64.6	10.5	36.4
Catch used in Assessment[3]	57.8	42.5	35.7	23.0	24.5	21.4	17.3	14.5	71.4	14.5	42.5
Spawning Stock Biomass[4]	286	225	173	142	127	110	99	86	326	86	193
Recruitment (Age 0)	30	19	41	45	28	24	17	4	87	4	32
F (age 1-2, unweighted)	0.30	0.44	0.39	0.32	0.33	0.39	0.38	0.45	0.45	0.20	0.33
Exploitation Rate	23%	32%	29%	24%	25%	29%	28%	32%	32%	16%	25%

1. Projected.
2. Includes recreational landings plus 25% of released fish (i.e., discard mortality is 25%).
3. Total fishing mortality: commercial and recreational landings plus 25% of recreational discards.
4. At the peak of the spawning season, April 1.

Stock Distribution and Identification: Atlantic coast bluefish spawn during two major periods of the year: during spring in the South Atlantic Bight and during summer in the Middle Atlantic Bight. However, available evidence does not suggest that these two spawning seasons represent two separate stocks. Chiarella and Conover (1990) suggest the two spawning seasons mix extensively on the spawning grounds. Graves et al. (1992) used analysis of mitochondrial DNA to investigate the genetic basis of stock structure and concluded that bluefish along the mid-Atlantic coast comprise a single genetic stock.

Catches: After peaking at over 71,000 mt in 1980 (157 million lbs), total catch (defined as landings plus 25% of recreational discards) has declined to less than 15,000 mt in 1993 (33 million lbs) (Figure A1). Most of the decline has been due to a decrease in the recreational component, from nearly 65,000 mt in 1980 (143 million lbs) to 10,500 mt in 1993 (23 million lbs). Recreational fishing effort for bluefish, defined as those trips catching or targeting bluefish, declined from a peak of about 14 million trips in 1980 to less than 8 million trips in 1993. Commercial landings remained stable from 1980-1992 at 5,000 - 7,000 mt (11-15 million lbs). Based on projections, commercial landings in 1993 were approximately 4,000 mt (9 million lbs).

Data and Assessment: Bluefish were last assessed in March, 1994 (SAW 17). The current assessment is an analytical assessment of commercial and recreational catch-at-age data using the CAGEAN model. Measures of fishing effort and survey catch-at-age were used in the model to calibrate estimates of stock size and fishing mortality rates. The current assessment is based on an approach which allows an increase in catchability (q) over the time period of the assessment. The natural mortality rate (M) was assumed to be 0.25.

Biological Reference Points: The analysis indicated that $F_{0.1} = 0.20$, $F_{MAX} = 0.30$, and $F_{20\%} = 0.37$ (Figure A3). F_{MSY}, previously estimated as 0.30-0.40, was recomputed using the new value for natural mortality (0.25 instead of 0.35); current estimates of F_{MSY} are 0.15-0.25.

Fishing Mortality: Fully recruited fishing mortality rates for bluefish increased from about 0.20 in 1982 to about 0.44 in 1987 (Figure A1). F declined to about 0.32 by 1989, and then increased to 0.45 in 1993. Bootstrap estimates indicate that there is a 90% probability that F in 1993 was greater than or equal to 0.25 (Figure A6).

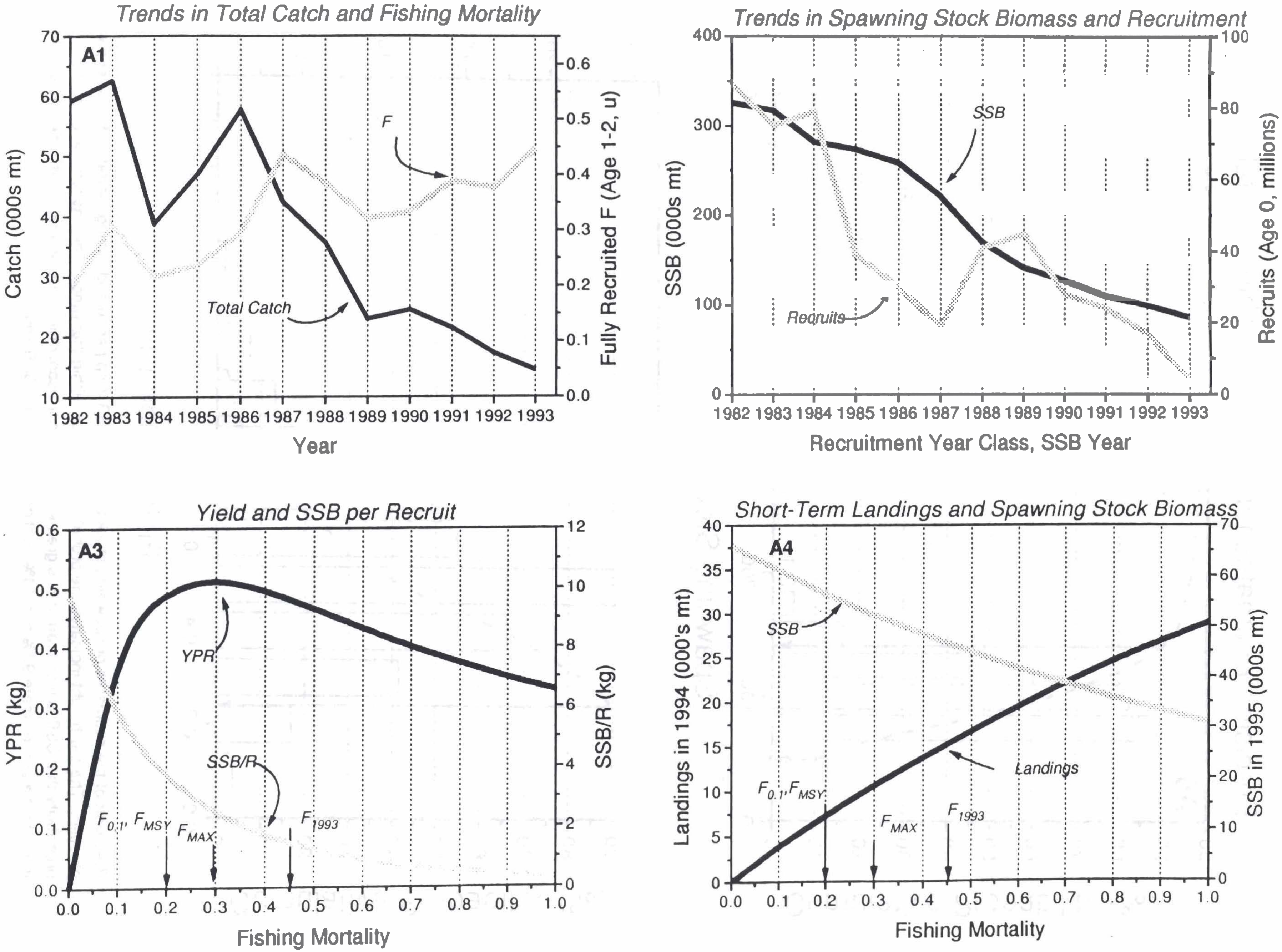
Recruitment: Indices of abundance for bluefish from research surveys were used to qualitatively detect recent trends in recruitment. Generally, recruitment, as estimated from the VPA at age 0, has declined over the time series; the 1993 recruitment estimate of 4 million fish is the lowest in the series and is 5% of 1982 recruitment. Most surveys indicate that the best recent year classes recruited in 1984 and 1988 and 1989, with relatively poor year classes in 1992 and 1993 (Figure A2).

Spawning Stock Biomass: Spawning stock biomass has declined from 326,000 mt in 1982 to 86,000 mt in 1993, a decrease of 74% (Figure A2). Bootstrap estimates of bluefish stock biomass indicated that there is an 80% probability that the 1993 spawning stock biomass was between 50,000 and 140,000 mt (Figure A5).

Special Comments: There is no evidence that predation by the increasingly abundant striped bass resource has had an adverse effect on bluefish recruitment. Bluefish primarily spawn off the continental shelf, with larvae and juveniles transported shoalward, whereas striped bass spawn in estuaries. Changes in a single oceanographic feature cannot, therefore, explain differences in recruitment trends among the two species.

Source of Information: Report of the 18th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC CRD94-22; Bluefish Assessment, 1994 Report of the SARC Pelagic/Coastal Subcommittee, NEFSC CRD94-15; Chiarella, L.A., and D.O. Conover, 1990, Spawning season and first-year growth of adult bluefish from the New York Bight, Trans. Am. Fish. Soc. 119:455-462; Graves, J.E., et al, 1992, Stock structure of the bluefsh *Pomatomus saltatrix* along the mid-Atlantic coast, Fish. Bull., U.S. 90:703-710.

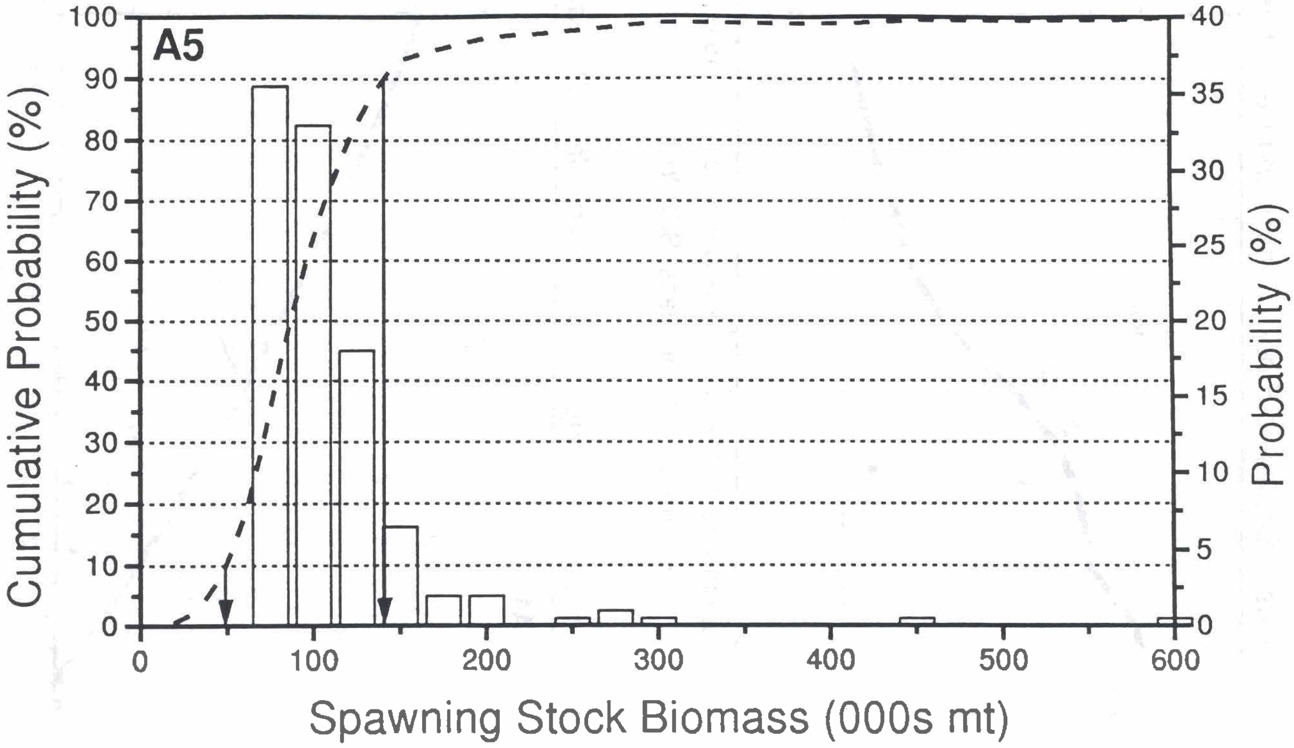
Bluefish

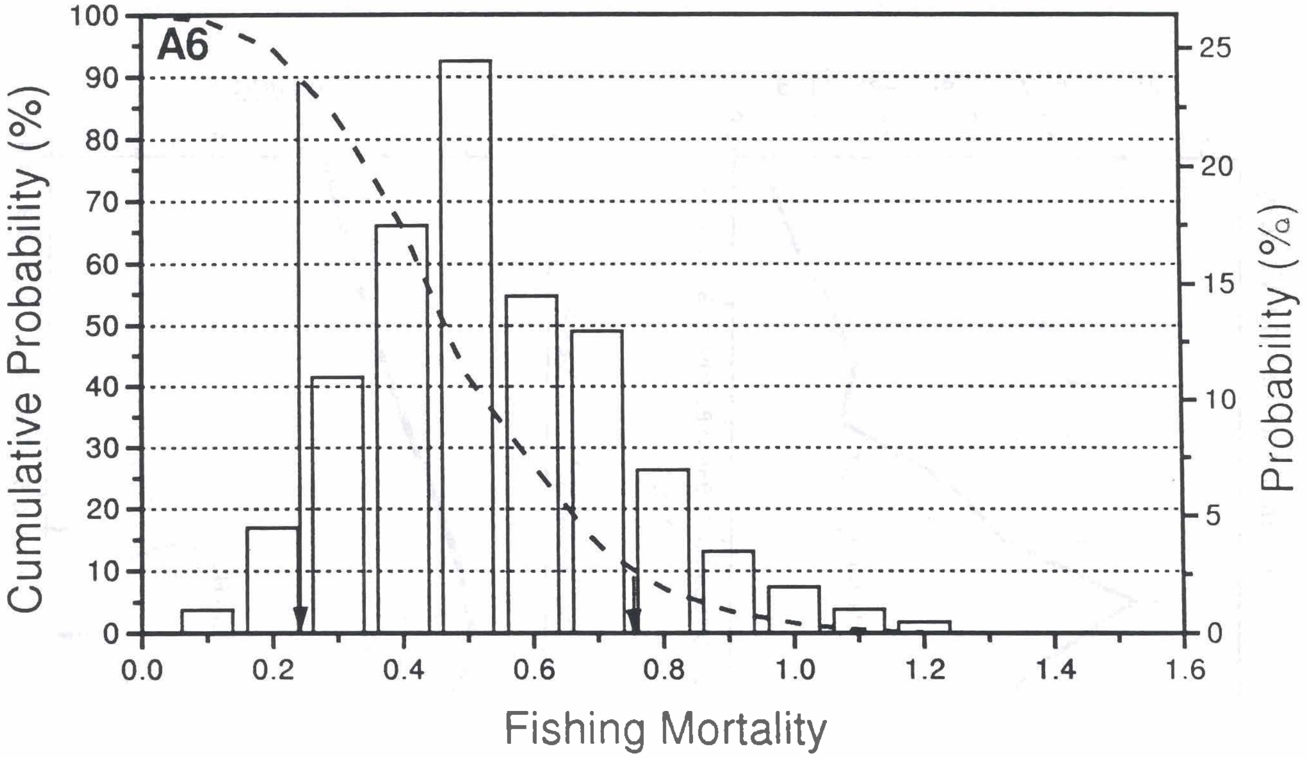


Trends in Total Catch and Fishing Mortality
A1
Catch (000s mt)
Fully Recruited F (Age 1-2, u)
F
Total Catch
Year
Trends in Spawning Stock Biomass and Recruitment
SSB (000s mt)
Recruits (Age 0, millions)
SSB
Recruits
Recruitment Year Class, SSB Year
Yield and SSB per Recruit
A3
YPR (kg)
SSB/R (kg)
YPR
SSB/R
$F_{0.1}$, F_{MSY}
F_{MAX}
F_{1993}
Fishing Mortality
Short-Term Landings and Spawning Stock Biomass
A4
Landings in 1994 (000's mt)
SSB in 1995 (000s mt)
SSB
Landings
$F_{0.1}$, F_{MSY}
F_{MAX}
F_{1993}
Fishing Mortality

Bluefish

Precision Estimates for SSB and Fishing Mortality





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

B. SUMMER FLOUNDER ADVISORY REPORT

State of Stock: The stock is overfished and at average levels of abundance. The fishing mortality rate on summer flounder has recently been very high, peaking at 1.8 in 1988-1989, but under management by target quota, has declined to 0.54 in 1993 (Figure B1). This is close to the target F of 0.53 but above the overfishing reference point of F_{MAX} = 0.23. Fishing mortality in 1994 will increase to between 0.7-0.8 if the 1994 quota is landed. This increase is due to poor recruitment of the 1993 year class (year class strength is the lowest since 1988) and a shift in exploitation pattern to younger fish. Spawning stock biomass increased from a record low in 1989 of 5,400 mt to about 14,000 mt in 1993 (Figure B2). The age structure of the spawning stock remains truncated, however, with only 12% of the biomass at ages 3 and older. In contrast, about 77% of the spawning stock would be expected to be aged 3 and older if the stock were rebuilt and fished at F_{MAX} = 0.23.

Management Advice: The target fishing mortality rates are F=0.53 for 1995 and F_{MAX} = 0.23 for 1996. If the 1994 quota is landed (12,100 mt or 27 million lbs), the fishing mortality rate in 1994 will be about 0.8, well above the target F. The 1991 and 1992 recruitment of 41 and 43 million fish, respectively, provide an opportunity for short-term rebuilding of the spawning stock. Continued protection of these and subsequent year classes by reductions in fishing mortality and increased protection of young fish is encouraged.

Forecast for 1994-96: Forecasts for 1994 landings, discards and biomass account for the uncertainty in future stock size and recruitment. If the 1994 quota is landed and no dramatic increase in discarding occurs, to meet the 1995 target F (0.53), 1995 landings would have to be reduced to about 9,000 mt (19 million lbs). To meet the target F for 1996 (F_{1996} = 0.23), landings in 1996 would have to be reduced to about 5,400 mt (12 million lbs).

Forecast for 1994-1996: (A) Low, (B) Median, and (C) High Recruitment and Age 1 Abundance and (D) $F_{94} = F_{tgt}$ = 0.53

(Recruitment, stock size - 1,000s of fish; landings, discard, SSB - 1,000s of mt; 1993 SSB = 14,000 mt)

$F_{94,\ 2\text{-}4,u}$	Recruitment at age 0 in 1994-96	Stock size at age 1 in 1994	1994			1995 F = 0.53			1996 F = 0.23		
			Land.	Disc.	SSB	Land.	Disc.	SSB	Land.	Disc.	SSB
A) 0.83	24698	10173	12.1	0.7	12.3	7.3	0.8	14.1	4.3	0.4	19.5
B) 0.77	32181	15774	12.1	1.0	14.4	8.8	1.1	17.4	5.4	0.5	24.9
C) 0.72	41932	21375	12.1	1.3	16.6	10.6	1.4	21.3	6.8	0.7	31.4
D) 0.53	32181	15774	9.2	0.7	16.8	10.5	1.1	19.8	6.0	0.5	27.0

Consequences/Implications

A) Landings decrease 40% in 1995, F target is met; SSB increases 15%. Landings in 1996 are 4,300 mt to meet F target.

B) Landings decrease 27% in 1995, F target is met; SSB increases 21%. Landings in 1996 are 5,400 mt.

C) Landings decrease 23% in 1995, F target is met; SSB increases 28%. Landings in 1996 are 6,800 mt.

D) Landings decrease 24% in 1994, F target is met; SSB increases 17%. Landings in 1995 are 10,500 mt,F target is met; SSB increases 18%. Landings in 1996 are 6,000 mt.

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

Year	1987	1988	1989	1990	1991	1992	1993	1994[1]	Max (1982-1993)	Min (1982-1993)	Mean (1982-1993)
Coastwide Quota							9.4	12.1			
Commercial Landings	12.3	14.7	8.1	4.2	6.2	7.3	5.7	7.3	17.1	4.2	10.5
Commercial Discards	N/A	N/A	0.7	1.2	1.1	0.9	0.6	0.3	1.2	0.7	1.1
Recreational Landings	5.7	8.5	1.5	2.4	3.5	3.4	4.0	4.8	16.4	1.5	7.3
Recreational Discards	1.3	0.9	0.1	0.7	1.0	0.9	2.1	0.4	2.1	0.1	1.0
Catch used in Assessment	19.3	24.3	10.4	8.5	11.8	12.5	12.4	12.8	31.6	8.5	18.9
Spawning Stock Biomass[2]	15.0	8.5	5.4	7.8	7.5	11.0	14.0	14.3	22.2	5.4	13.2
Recruitment (Age 0)	45.7	16.0	30.0	32.0	41.1	42.8	20.5	32.2	95.2	16.0	47.5
Mean F (Ages 2-4, u)	1.2	1.8	1.8	1.2	1.6	1.7	0.5	0.8	1.8	0.5	1.4
Exploitation Rate	65%	78%	78%	65%	74%	76%	36%	51%	78%	36%	70%

[1] Predicted
[2] At the peak of the spawning season, November 1.

Stock Distribution and Identification: The current assessment includes all summer flounder from the southern border of North Carolina to the U.S. - Canadian border.

Catches: Recent commercial landings peaked in 1984 at 17,100 mt; recreational landings peaked in 1983 at 16,400 mt. During the late 1980s, landings declined dramatically, reaching 4,200 mt in the commercial fishery in 1990 and 1,500 mt in the recreational fishery in 1989. In the last few years, however, landings in both fisheries have increased slightly. Commercial landings in 1993 were 5,700 mt (quota = 5,600 mt) and 4,000 mt in the recreational fishery (quota = 3,800 mt). In 1993, commercial discards, estimated from sea sampling data, were 650 mt and recreational discards about 2,100 mt, implying total removals of about 12,400 mt. If the 1994 quota is taken (12,100 mt; commercial = 7,260 mt and recreational = 4,840 mt) total catch will be about 40% of the peak level reached in 1984 (Figure B1).

Data and Assessment: An analytical assessment (VPA) of commercial and recreational total catch at age (landings plus discard) was conducted. Anticipated revisions to the recreational (MRFSS) data will be incorporated in the assessment when the revised time series becomes available. The natural mortality rate (M) was assumed to be 0.2. Information on recruitment and stock abundance was used from NEFSC winter and spring, Massachusetts spring and fall, Rhode Island fall, and Connecticut fall 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, Massachusetts, and Rhode Island.

Biological Reference Points: Biological reference points for summer flounder are based on a Thompson and Bell YPR model. That 1990 analysis indicated that $F_{0.1}$=0.14, F_{MAX}=0.23 and $F_{20\%}$= 0.27 (Figure B3).

Fishing Mortality: Over the last decade fishing mortality has been very high, varying between 0.7 and 1.8 during 1982-1992 (46% to 78% exploitation rates) (Figure B1), far in excess of the overfishing definition, F_{MAX} = 0.23 . Under target quota management, the fishing mortality rate showed a marked decline in 1993, to 0.54, in spite of stable catch in numbers, due to recruitment of the 1991 and 1992 year classes (Figure B3). Accounting for uncertainty in the estimation of the 1993 fishing mortality rate and spawning stock biomass, there is an 80% probability that the 1993 F was between 0.32 and 0.68 (Figure B6). If landings in 1994 are restricted to 12,100 mt as planned, 1994 F is expected to be about 0.7-0.8, above F_{tgt}, due to poorer 1993 recruitment than previously assumed and a shift in the exploitation pattern to younger fish.

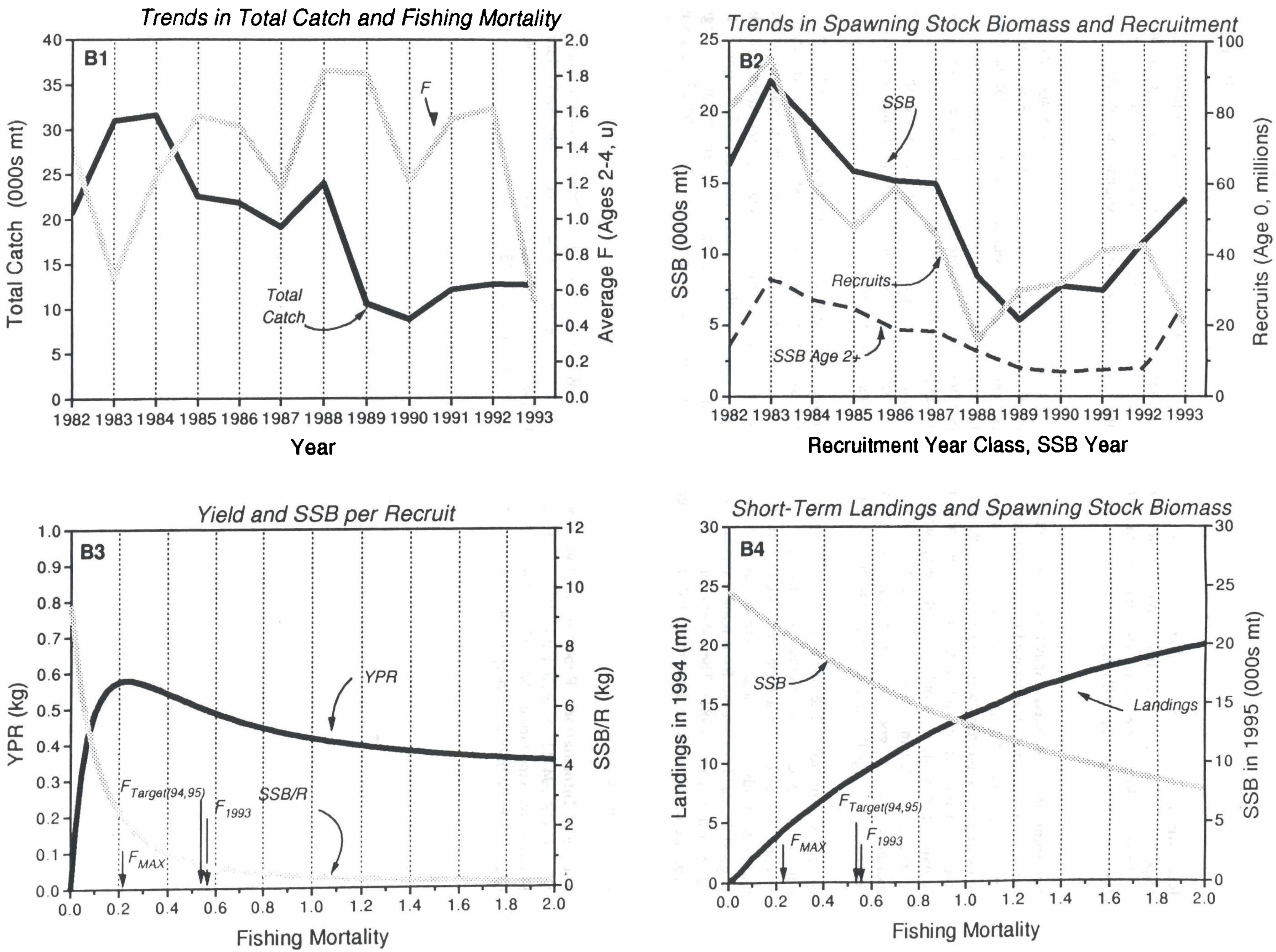
Recruitment: The 1982 and 1983 year classes are the largest in the VPA time series, at 81 and 95 million fish, respectively. Recruitment declined from 1983 to 1988, with the 1988 year class at only 16 million fish, the smallest in the series. Recruitment since 1988 has generally improved (30 million in 1989, 32 million in 1990, 41 million in 1991, and 43 million in 1992), but the 1993 year class may be the worst since 1988 and is estimated at only 20 million fish (Figure B2).

Spawning Stock Biomass: Spawning stock biomass declined 75% from 1983 to 1989 (22,200 mt to 5,400 mt), but has since increased with improved recruitment to 14,000 mt in 1993 (Figure B2). Accounting for uncertainty in the estimation of the 1993 fishing mortality rate and spawning stock biomass, there is about an 80% chance that the 1993 spawning stock biomass was between 9,500 mt and 18,500 mt (Figure B5). If the 1994 quota is landed, spawning stock biomass will remain at this level. Compared to the 1982-1986 period, the present age structure of the stock remains truncated, with only 12% of the spawning biomass composed of fish of ages 3 and older. In 1993, the proportion of SSB in the population aged 2 and older has dramatically increased due to reductions in the fishing mortality rate and good combined year class strength. Nevertheless, much of the current spawning biomass is contributed by age 0 and age 1 fish, which may spawn less successfully than older fish.

Special Comments: The benefits of expanding the age distribution of the stock include the ability of a fishery to continue in spite of a year class failure (e.g., the 1988 year class), and increased egg production as more larger, fecund, experienced female spawners accumulate in the stock. In addition, delaying harvest until individuals are older and larger leads to significant increases in yield, reducing current growth overfishing. Near current target F levels (e.g., 0.5), yield per recruit from female summer flounder can be about doubled by delaying age at first capture, to age 5 or 6 (Fogarty, 1981). The fishery for summer flounder is still driven by incoming recruitment, because the age structure of the stock remains truncated. Fish of ages 0-2 comprise 80-90% of the landings. The 1993 year class is estimated to be the weakest since the recruitment failure of 1988, and may be of comparable size. Stock rebuilding due to stable catches and recruitment of the 1991 and 1992 year classes may be short-lived if future recruitment continues to be poor.

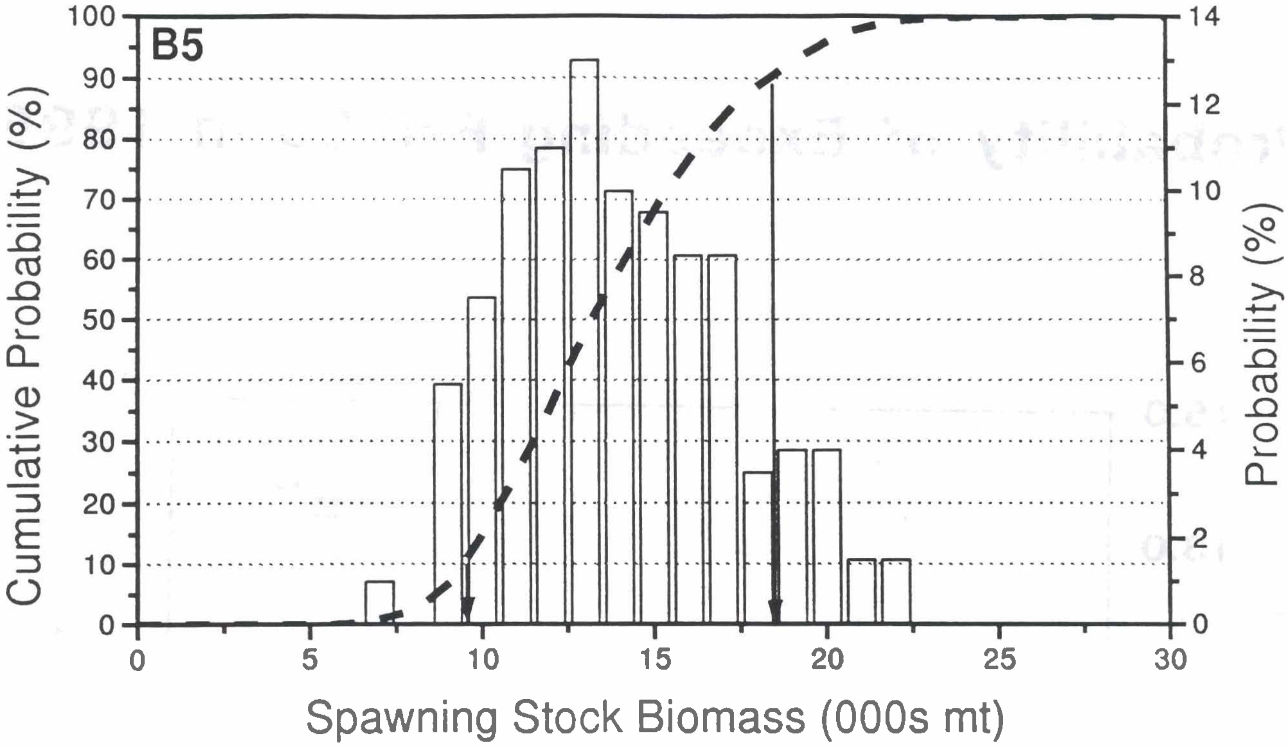
Source of Information: Report of the 18th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC CRD94-22; Assessment of Summer Flounder (*Paralichthys dentatus*), 1994 Report of the SAW Summer Flounder Working Group, NEFSC CRD94-16; Fogarty, M. J., 1981, Review and assessment of the summer flounder (*Paralichthys dentatus*) fishery in the northwest Atlantic. NEFC. WH LRD 81-25.

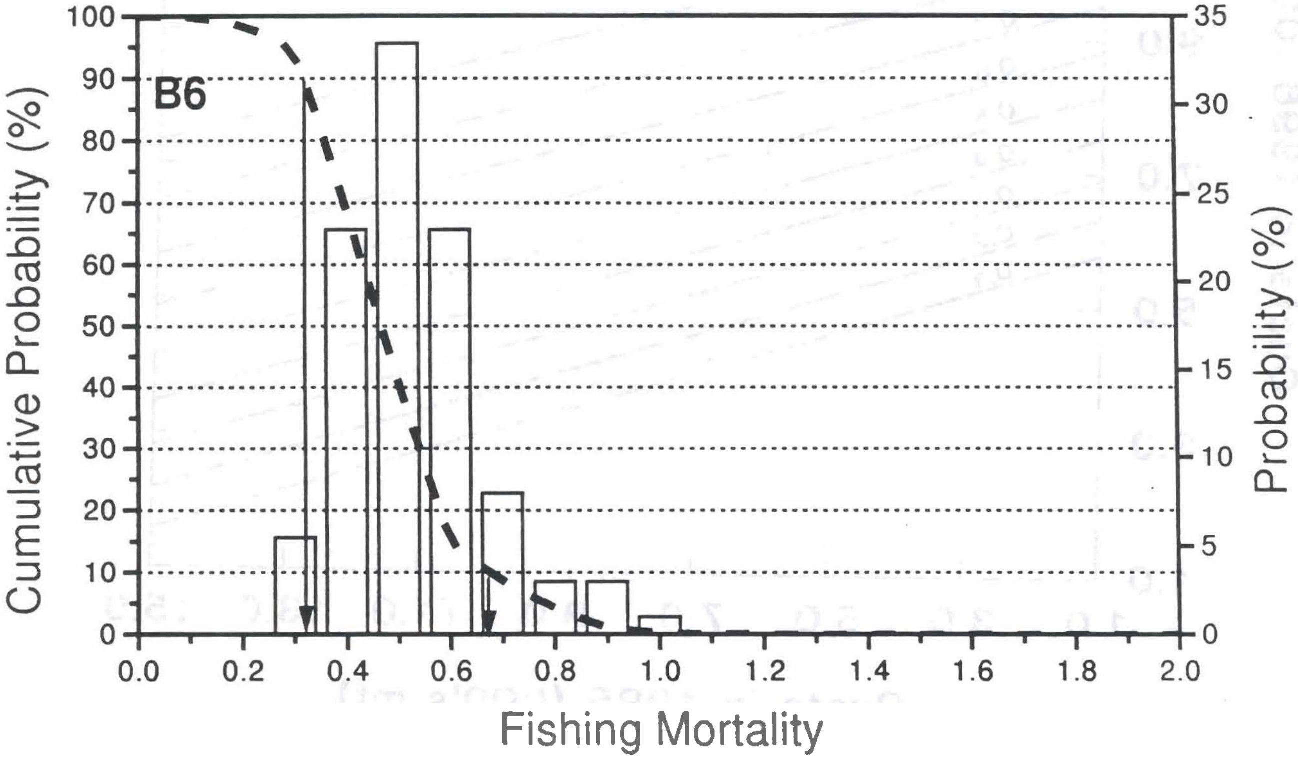
Summer Flounder



Summer Flounder

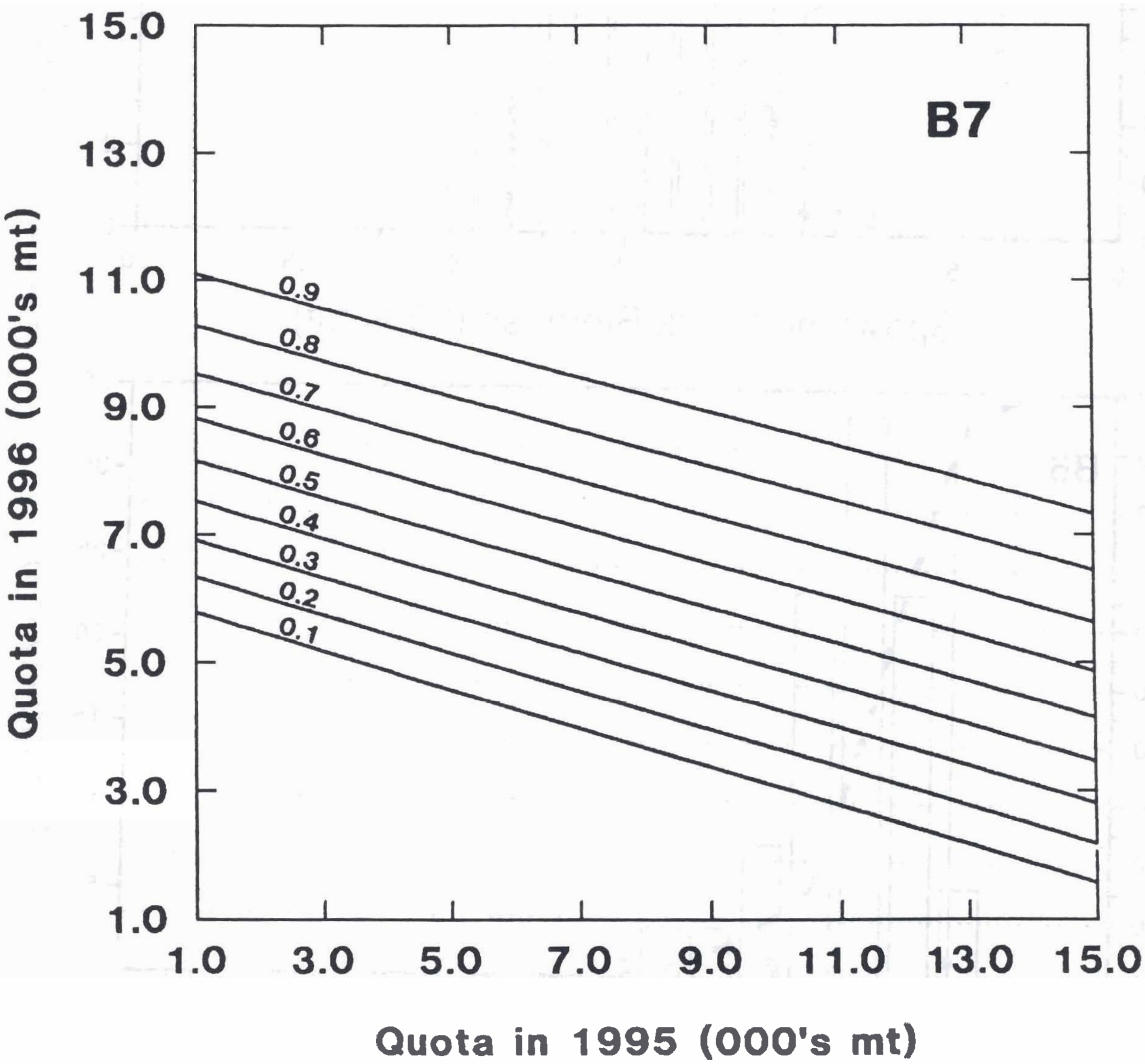
Precision Estimates for SSB and Fishing Mortality





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

Probability of Exceeding F=0.23 in 1996



C. GULF OF MAINE-GEORGES BANK WITCH FLOUNDER ADVISORY REPORT

State of stock: The stock is overexploited and at a low biomass level. Fishing mortality nearly doubled between 1991 and 1993 (Figure C1) to 0.45. There is about an 80% probability that current F exceeds the overfishing reference level of 0.39. Recruitment prospects appear favorable as the 1992 and 1993 year classes are estimated to be at or above long term average size. Spawning stock biomass (SSB) has fallen to record-low levels (Figure C2). In addition, since the mid-1980s, the age structure has become severely truncated.

Management Advice: The fishing mortality rate for this stock should be reduced to the reference point of 0.39. Targeting on pre-recruits should be discouraged to improve the overall exploitation pattern on this stock. To that end, continued use of the Nordmore grate in the shrimp fisheries which take witch flounder as bycatch and reduction in the minimum size for the species to 12", the length at which 25% of the species is likely to be retained by a 5 1/2" diamond or 6" square mesh (L_{25}), is recommended.

Forecast for 1995: Continued fishing at current levels of fishing mortality (0.45) will result in relatively stable catches of about 3,000 mt in 1994 and 1995 (Figure C4). If F_{1995} = 0.45, SSB in 1996 will increase to about the level seen in 1987. More specifically, forecasts for 1995 were made assuming $F_{1994}=F_{1993}=0.45$ and that the recruitment of the 1991, 1992 and 1993 year classes equaled the geometric mean of the 1979-1990 year classes at age 3 (9.1 million fish).

<u>Forecast for 1995</u>: F_{1994} = F_{1993} = 0.45; SSB estimated as 7,100 mt in 1993 and 8,700 mt in 1994.
(weights in '000 mt)

Basis	F(95)	Predicted SSB (95)	Predicted Catches (95)	Predicted SSB (96)	Consequences/Implications
F_{MAX}	0.27	10.6	1.9	11.5	SSB increases to 1986 level; catches decline to low 1991 level.
$F_{20\%}$	0.39	10.4	2.7	10.5	SSB increases to 1987 level; catches stable.
$0.9F_{93}$	0.41	10.4	2.9	10.3	SSB increases to 1987 level; catches increase slightly.
F_{93}	0.45	10.4	3.0	10.0	SSB increases to 1987 level; catches increase slightly.

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

Year	1986	1987	1988	1989	1990	1991	1992	1993	Max	Min	Mean
									(1982-1993)		
USA Commercial Landings	4.45	3.37	3.20	2.01	1.40	1.64	2.03	2.44	6.34	1.40	3.60
Total Discards	0.02	0.05	0.06	0.13	0.10	0.09	0.12	0.20	0.20	0.01	0.10
Shrimp Fishery	0.01	0.02	0.04	0.02	0.03	0.03	0.02	0.01	0.04	0.01	0.02
Large Mesh OT Fishery	0.01	0.03	0.02	0.11	0.07	0.06	0.10	0.20	0.20	0.01	0.08
Catch used in Assessment	4.47	3.42	3.26	2.14	1.50	1.73	2.15	2.64	6.43	1.50	3.70
Spawning stock biomass[1]	12.3	10.2	9.4	7.3	6.3	7.5	6.5	7.1	26.3	6.3	12.0
Recruitment (Age 3)	3.8	3.2	8.1	6.3	5.8	10.2	11.1	22.4	22.4	3.2	10.5
Mean F (Ages 7-9,u)	0.46	0.47	0.48	0.34	0.24	0.24	0.29	0.45	0.55	0.19	0.40
Exploitation Rate	34%	35%	36%	27%	20%	20%	23%	34%	40%	16%	31%

[1]At beginning of spawning season, March 1.

Stock Identification and Distribution: A single stock of witch flounder is considered to inhabit the region from the northern Gulf of Maine to southwestern Georges Bank. For this assessment, all witch flounder in U.S. waters were included.

Catches: U.S. landings increased during the 1960s from 1,200 mt to about 3,000 mt, then fluctuated between 2,000 and 3,000 mt until 1984 and 1985 when landings abruptly increased to about 6,000 mt. Landings have since declined to 2,400 mt in 1993 (Figure C1). Discards have increased steadily throughout the 1980s from less than 50 mt in 1986 to over 200 mt in 1993. Over the 1982-1993 period, estimated discards have represented between 0.5% and 8.0% of the total U.S. commercial catch. Recreational catches are negligible.

Data and Assessment: An analytical assessment (VPA) of U.S. commercial catch at age data (landings plus discards from the shrimp and large mesh otter trawl fisheries) 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.

Biological Reference Points: Yield and SSB per recruit analyses performed with an assumed M of 0.15 indicate that $F_{0.1} = 0.15$, $F_{MAX} = 0.27$ and $F_{20\%} = 0.39$ (Figure C3).

Fishing Mortality: Almost 100% of the fishing mortality on age 1 and 2 witch flounder is generated by discarding practices in the northern shrimp fishery. At age 3, 60% of fishing mortality is generated by shrimp fishery discards, 24% is generated by discards in the large mesh otter trawl fishery, and 16% of the mortality is generated by landings. By age 4, less than 10% of the F is generated by shrimp fishery discards, but 35% is generated by large mesh discards and 57% is generated by landings. At age 5 and older almost all of the F is generated by the landings component. Fishing mortality (ages 7-9, unweighted) increased from 0.19 (16% exploitation rate) in 1982 to 0.55 (40% exploitation rate) in 1985, declined to 0.24 (20% exploitation rate) in 1990 and 1991 and increased to 0.45 (34% exploitation rate) in 1993 (Figure C1). Survey total mortality (Z) increased from 0.34 (16% exploitation rate) during 1981-84 to 0.71 (40% exploitation) during 1985-88, and subsequently declined to 0.53 (29%) during 1989-1993. Accounting for the estimation uncertainty associated with the 1993 SSB (7,100 mt) and 1993 F (0.45), there is an 80% probability that the 1993 F lies between 0.33 and 0.59 (Figure C6).

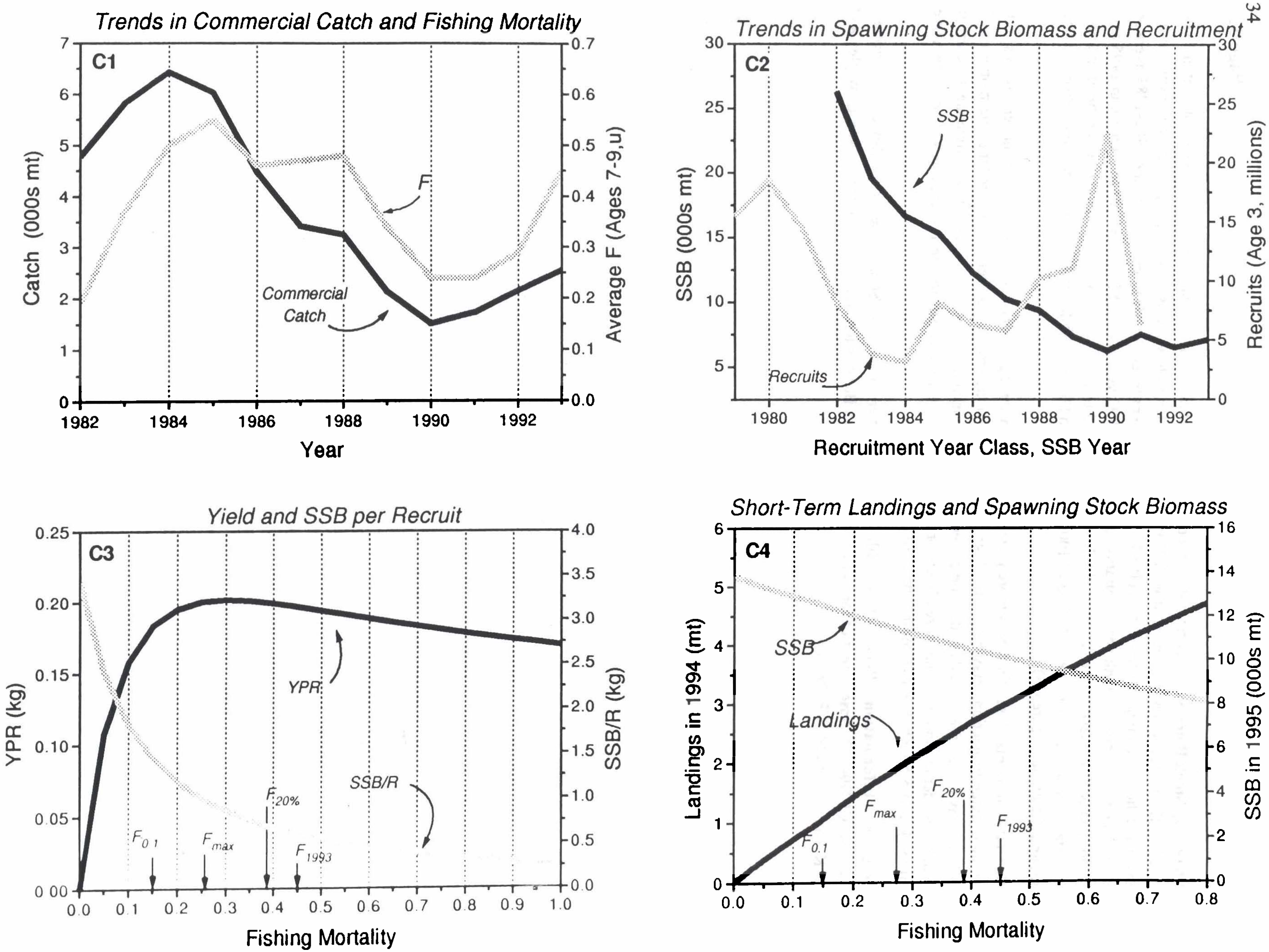
Recruitment: Improved recruitment prospects in the near term may eventually expand the age structure of the stock if discarding of age 3 and 4 fish in the northern shrimp fishery and the large mesh otter trawl fishery is reduced. The strong 1980 year class supported the sharp increase in landings in 1984 and 1985. The 1985, 1989 and 1990 year classes appear to be at or above average (Figure C2). The 1992 and, in particular, the 1993 year classes may also be better than average.

Spawning Stock Biomass: Spawning stock biomass (SSB) declined from 26,000 mt in 1982 to about 7,000 mt in 1989 and has fluctuated about that level through 1993. SSB has fallen to low levels following a period when exploitation exceeded the overfishing reference level (1984-1988). The present level of SSB is about 1/3 of the 1982-1983 average level. Due to continued growth and maturation of the strong 1990 year class, SSB is expected to increase in 1995 and 1996, and will increase further in 1996 if F is reduced in 1995 to F_{MAX} (0.27) or less. Accounting for the estimation uncertainty associated with the 1993 SSB (7,100 mt), there is an 80% probability that the 1993 SSB lies between 5,800 mt and 9,100 mt (Figure C5).

Special Comments: Use of the Nordmore grate in the northern shrimp fishery may reduce witch flounder discards and, as such, catch projections may be slightly high. Adherence to 6 inch mesh requirements in the large mesh otter trawl fishery may reduce the discards in this component. The L_{25} of 6 inch diamond mesh is likely to approximate the current witch flounder minimum landing size (36 cm or 14"), but the L_{25} for 6 inch square mesh is expected to be in the range of the L_{25} of 5.5 inch diamond mesh; about 30 cm or 12".

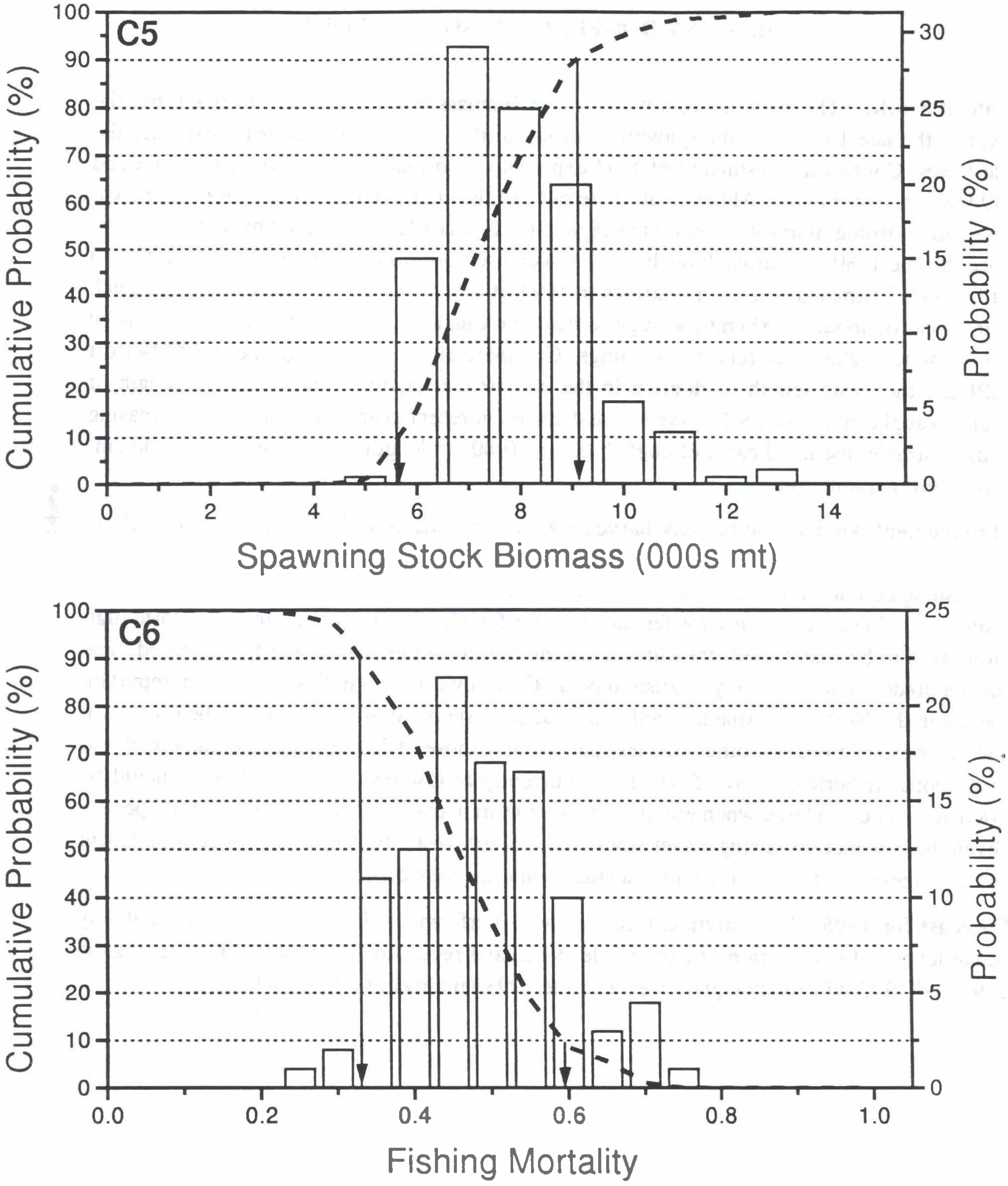
Source of Information: Report of the 18th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC CRD94-22; Assessment of the Gulf of Maine-Georges Bank witch flounder stock for 1994, S.E. Wigley and R.K. Mayo, NEFSC CRD94-17.

Witch Flounder



Witch Flounder

Precision Estimates for SSB and Fishing Mortality



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

D. SPINY DOGFISH ADVISORY REPORT

State of Stock: The stock is presently at a high biomass level, about four to five times the level of the late 1960s, but the spawning portion of the biomass has not increased since the late 1980s. Conservative estimates of 1994 exploitable and total biomass are 258,000 mt and 649,000 mt, respectively. Although absolute rates of fishing mortality (F) are not well known, the relative fishing mortality rates on the exploitable biomass have increased by a factor of five since the late 1980s. Total landings have also increased five-fold since 1987 to about 22,400 mt in 1993. Estimated discard mortalities in 1993 of at least 13,800 mt indicate a total catch in that year of about 36,000 mt and suggest that total catches in previous years may have been 2/3 or more higher than reported landings. Commercial fishery landings per-unit-of-effort (LPUE), the mean length of dogfish in the commercial landings and the mean length of dogfish caught in the NEFSC survey have declined in recent years. In light of the increasing F and a sizable discarded catch of dogfish in the 50-80 cm length range, the stock (>80 cm) is near full exploitation.

Management Advice: Selectively harvesting mature females will, if continued at levels in excess of replacement F, result in long term reduced recruitment. Currently there is no overfishing definition for this stock. One suggestion is the level of fishing mortality that would result in a value of less than 1 for female pups per female recruit. If the current historic high biomass is to be maintained, the current fishing mortality rate should not be increased. The current predominance of spiny dogfish in NEFSC survey catches implies that it is an important species in the Northwest Atlantic shelf demersal ecosystem. As such, its role in the ecosystem and ecological impact on other species, particularly those of importance to commercial and recreational fisheries, many of which are currently at low levels of abundance, should be evaluated and considered when establishing long-term management objectives for this species. Given the evidence for a single unit stock in the Northwest Atlantic, coordinated assessment and management of this stock with Canada should be considered.

Forecast for 1995: No analytical forecasts were performed. However, given the relatively stable level and distribution of exploitable stock, and recent increased targeting, landings in 1994 and 1995 will likely equal or exceed the 1993 landings of 22,000 mt.

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

Year	1987	1988	1989	1990	1991	1992	1993	1994	Max (1968-1993)	Min (1968-1993)	Mean (1968-1993)
USA commercial landings	2.7	3.3	4.6	14.9	13.4	17.2	20.4	-	20.2	<0.1	4.5
Foreign Commercial landings	0.4	0.6	0.4	1.7	0.5	0.9	1.0	-	24.5	0.4	6.1
Discards, commercial	Reliable estimates unavailable						13.5	-	N/A	N/A	N/A
USA recreational catch[1]	1.1	1.3	1.8	1.7	1.7	1.2	1.2	-	1.9	0.3	1.0
Total landings	4.2	5.1	6.9	18.2	15.8	19.0	22.6	-	25.6	2.3	11.6
USA commercial LPUE											
Otter trawl tonclass 3[2]	21.6	12.9	7.0	42.2	29.7	16.9	14.1	-	99.0	4.9	38.9
Sink gill net tonclass 2[3]	1.7	2.9	2.9	2.8	2.9	2.7	2.4	-	10.7	1.4	3.0
Spring survey index[4]	78.9	86.9	90.7	92.7	94.3	95.3	96.0	96.3	96.0	20.7	56.7
Total stock biomass											
Swept-area method	469	515	547	572	594	614	633	649	633	117	353
Biomass dynamics model	936	964	1022	1099	1063	1097	1090	-	1099	234	652
Fishable stock biomass[5]											
Swept-area method	278	294	294	290	283	276	268	258	294	48	187
Biomass dynamics model[6]	587	644	682	624	608	582	524	-	682	469	549
Recruitment index[7]	12.5	3.3	5.2	3.7	4.2	3.6	2.9	16.9	17.1	0.7	5.0

[1]Includes all landed and released recreational catch; recreational discard mortality assessed to be 100%.
[2]Mt per day fished; maximum, minimum, and mean values for 1977-1993.
[3]Mt per day fished; maximum, minimum, and mean values for 1976-1993.
[4]LOWESS smoothed NEFSC spring survey mean weight (kg) per tow.
[5]Individual ≥80 cm.
[6]Maximum, minimum and mean values for 1980-1993.
[7]NEFSC spring survey mean number per tow of individual ≤35 cm.

Species Distribution and Stock Identification: Spiny dogfish are distributed in the Northwest Atlantic between Labrador and Florida, are most abundant between Nova Scotia and Cape Hatteras (Figures D1 and D2), and are considered to be a unit stock in NAFO Subareas 2-6. Seasonal migrations occur northward in spring/summer and southward in autumn/winter. Analysis of spatial and temporal abundance patterns from NEFSC spring and autumn and Canadian summer research vessel survey catches suggests that the spring survey provides a valid abundance measure for the entire stock.

Catches: US commercial landings of dogfish were at most only several hundred mt per year until the late 1970s when they increased to average about 4,500 mt per year during 1979-1989. Landings climbed sharply to 14,900 mt in 1990 and to 20,200 mt in 1993. Substantial foreign landings of dogfish occurred during 1966-1977, averaging 13,000 mt per year and peaking at about 24,000 mt in 1972 and 1974, but, since 1978, have averaged only about 900 mt annually. US recreational catches increased from about 350 mt per year in 1979-1980 to about 1,700 mt in 1989-1991, with the 1993 estimate being 1,200 mt. Total landings climbed rapidly from the late 1960s to a peak of about 25,600 mt in 1974, were fairly stable at about 6,200 mt per year during 1977-1989, but then increased to over 18,000 mt in 1990 and further to 22,400 mt in 1993 (Figure D3). Quantitative estimates of discards for years other than 1993 (13,500 mt) are unavailable, but may have been at least of the same magnitude as reported landings. Otter trawlers in the Mid-Atlantic - Southern New England area probably account for most of the discards. The total catch in 1993, including discards, was about 36,000 mt.

Data and Assessment: Spiny dogfish were last assessed in October 1990 (SAW 11). The current assessment represents the first detailed analysis of the stock and includes several innovative approaches for estimating stock size, F, and biological reference points. Age composition of the landings and estimates of discarded catch (a major source of fishing mortality) are lacking. Indices of abundance were derived from research vessel survey catch per tow and US commercial LPUE data. Additional sampling, analysis, and research are required to reduce the uncertainty in the population biology, landings, and discard data of the present assessment. Natural mortality (M) was estimated to be 0.092 based on an assumed longevity of 50 years. Estimates of total and fishable biomass were derived from a biomass dynamics model (sensitive to changes in input data) and a survey swept-area method. Fishing mortality was estimated by the biomass dynamics model and by a change-in-ratio method applied to survey abundance indices. A size- and sex-structured equilibrium model incorporating known life history parameters was used to estimate yield per recruit and female pups per female recruit corresponding to varying levels of F and minimum size at entry to the fishery.

Biological Reference Points: Estimates of F_{MSY} = 0.18 and MSY = 30,000 mt for the fishable stock were obtained from the biomass dynamics model. The size- and sex-structured equilibrium model gave estimates of $F_{0.1}$ = 0.044 and F_{MAX} = 0.060 corresponding to the current minimum size at entry to the fishery (84 cm) (Figure D5). Population stability is theoretically ensured if the number of female pups per female recruit (PPR) equals 1.0. Replacement recruitment would be ensured at a minimum size at entry of 84 cm with F= 0.25 (Figure D6); lower Fs would be required at lower minimum landing sizes.

Fishing Mortality: Based on the biomass dynamics model and total reported landings, estimates of F on the total stock varied between 0.05 and 0.06 during the peak period of foreign landings of dogfish in 1972-1975, averaged only 0.006 during 1984-1989, but increased to 0.021 in 1993. Results from this model indicate that F on the fishable stock (≥80 cm in length) increased from 0.007 in 1987 to 0.044 in 1993. A doubling of the reported landings to account for probable discards would imply an F of 0.09 in 1993. Estimates of F on individuals ≥ 70 cm using the change-in-ratio method increased from 0.016 in 1989 to 0.270 in 1993. The higher of the two estimates of F in 1993, assuming a minimum landing size of 84 cm, is 4.5 times higher than F_{MAX} and indicates that PPR is about 1.0 (Figure D6). However, substantial discarded catches of dogfish in the 50-80 cm range suggests an even lower PPR, implying negative replacement at the present time. Even though the precise level of the current F is uncertain, it is apparent that a marked increase has occurred in recent years. Relative fishing mortality rates indicate sharply increasing recent trends in relative F (Figure D3).

Recruitment: Low fecundity (4-9 pups per litter) and high longevity (40 years or more) imply that interannual variations in recruitment should be small for dogfish relative to most teleosts. Annual pup production should be proportional to the number of spawning females. Defined as individuals ≤35 cm in NEFSC spring survey catches, recruitment was fairly constant from 1968-1994 (Figure D4) except for high values in 1981, 1983, 1985, 1987, and 1994. The utility of this recruitment estimator will depend on additional analyses, particularly the evaluation of incomplete vulnerability to the survey gear and sampling variability.

Stock Biomass: The biomass of individuals ≥80 cm (length at 50% maturity for females), calculated by the swept-area method, underwent a steady increase from about 50,000 mt in 1968 to 294,000 mt in 1989 before trending downward to slightly more than 250,000 mt in 1994 (Figure D4). Results from the biomass dynamics model indicate an increase from an average of 475,000 mt during 1980-1985 to a peak of about 680,000 mt in 1989 followed by a decline to about 525,000 mt in 1993. These two sets of estimates, both derived from trends in NEFSC spring survey data and consequently correlated, are both likely to be biased. Fishable and spawning stock biomass will continue to decline given the current level of exploitation.

Special Comments: Spiny dogfish are important predators of commercially important fish species. Bowman et al. (1984) reported that the dominant component of the diet of spiny dogfish greater than 60 cm comprised fish including several species of herring, Atlantic mackerel, redfish, Atlantic cod, haddock, silver, red, white, and spotted hake and sand lance. Squid were also a major component of their diet. The study concluded that predation mortality by spiny dogfish is a significant source of mortality on commercially important species. Preliminary calculations indicated that the biomass of commercially important species consumed by spiny dogfish was comparable to the amount harvested by man. Accordingly, the impact of spiny dogfish consumption on the population levels of other fish species should be considered in establishing management policies for the species.

Source of Information: Report of the 18th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC CRD94-22; Brodziak, J., P.J. Rago, and K. Sosebee, 1994, Application of a biomass dynamics model to the spiny dogfish (*Squalus acanthias)*, NEFSC CRD94-18; Rago, P. J., K. Sosebee, J. Brodziak, and E. D. Anderson, 1994, Distribution and dynamics of Northwest Atlantic spiny dogfish (*Squalus acanthias*), NEFSC CRD94-19; and Bowman, R., R. Eppi, M. Grosslein, 1984, Diet and consumption of spiny dogfish in the Northwest Atlantic, ICES C.M. 1984/G:27.

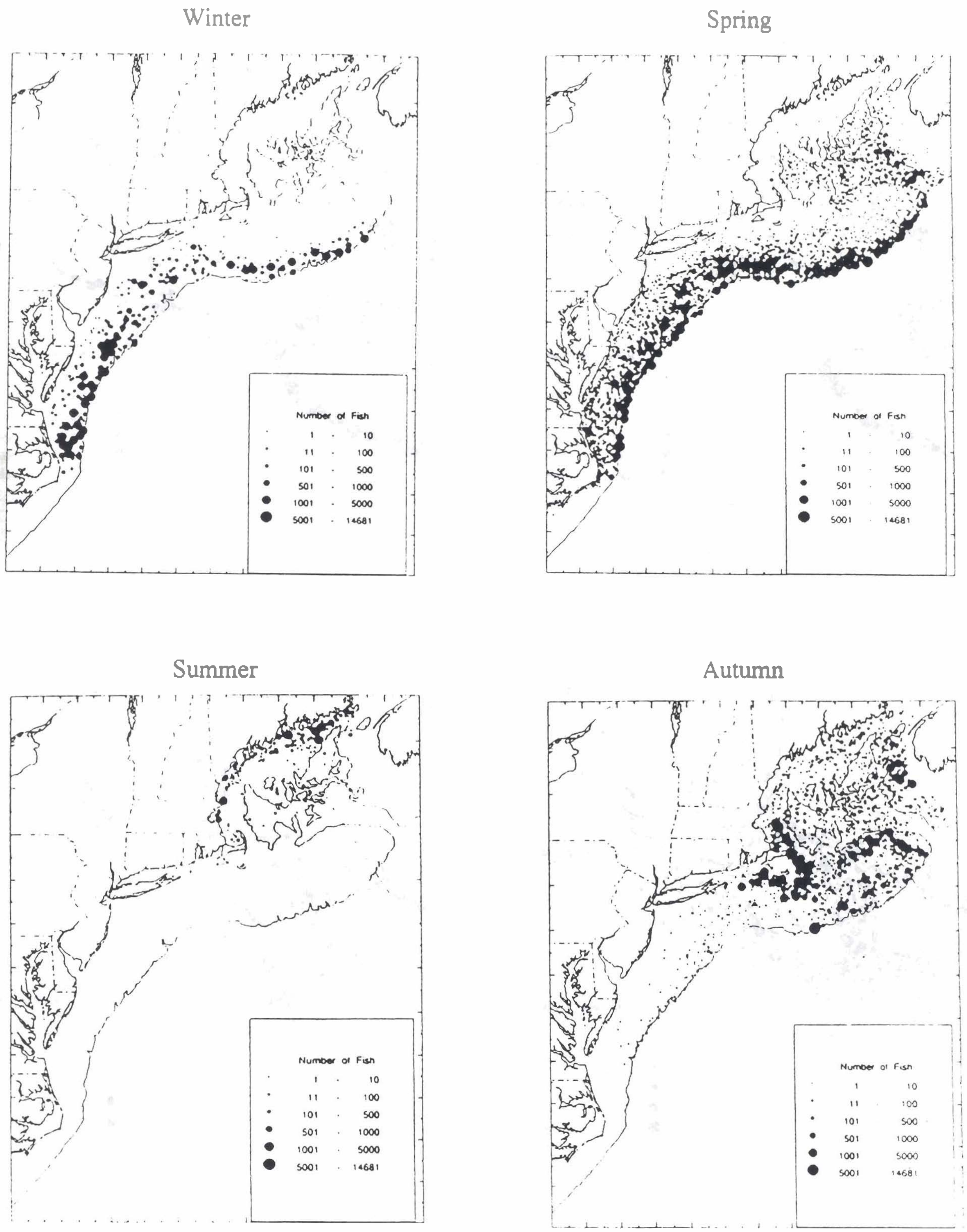


Figure D1. Distribution of catches of spiny dogfish ≤35 cm in NEFSC surveys (winter 1992-1994, spring 1980-1994, summer 1991-1993, autumn 1980-1993).

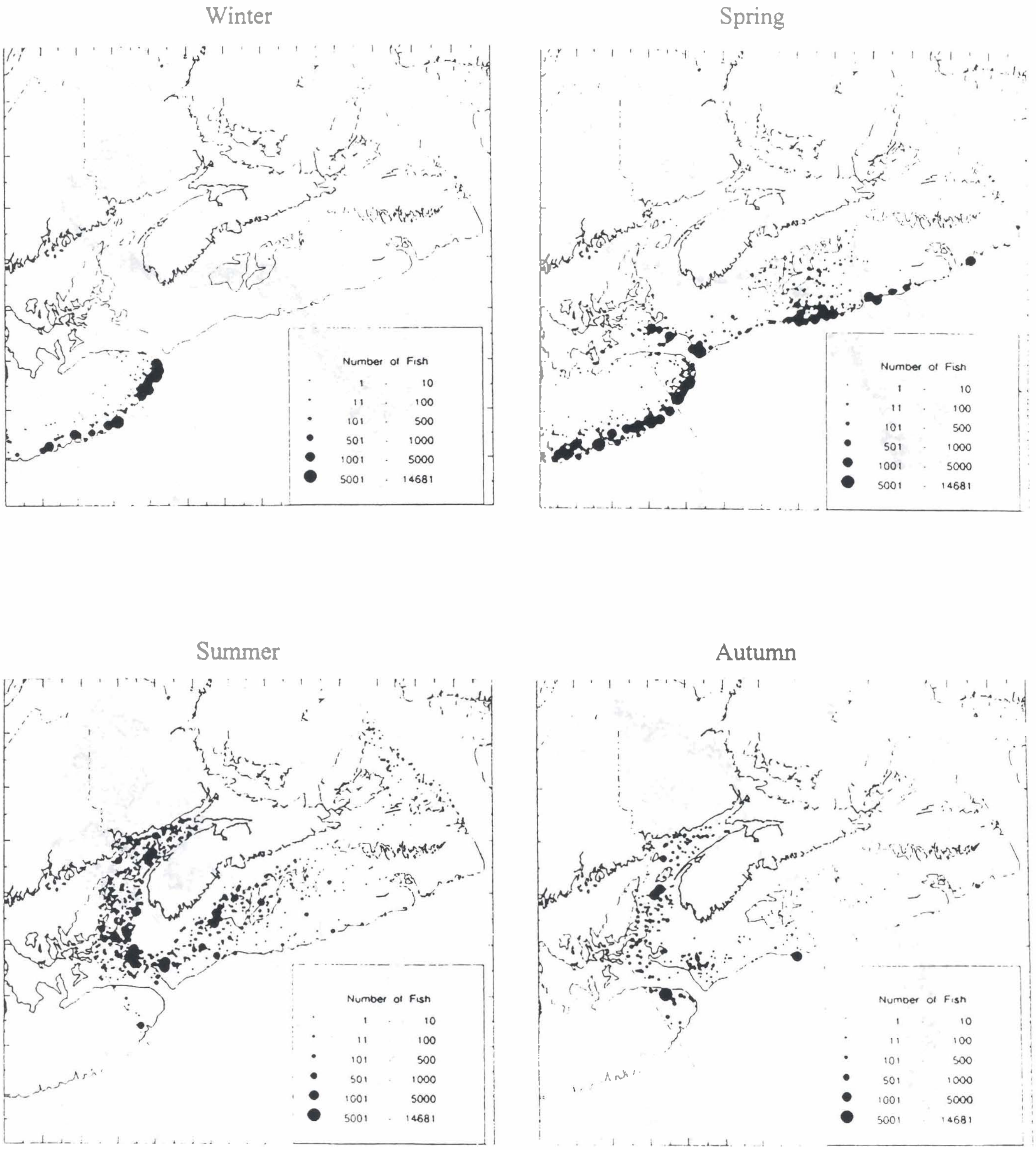
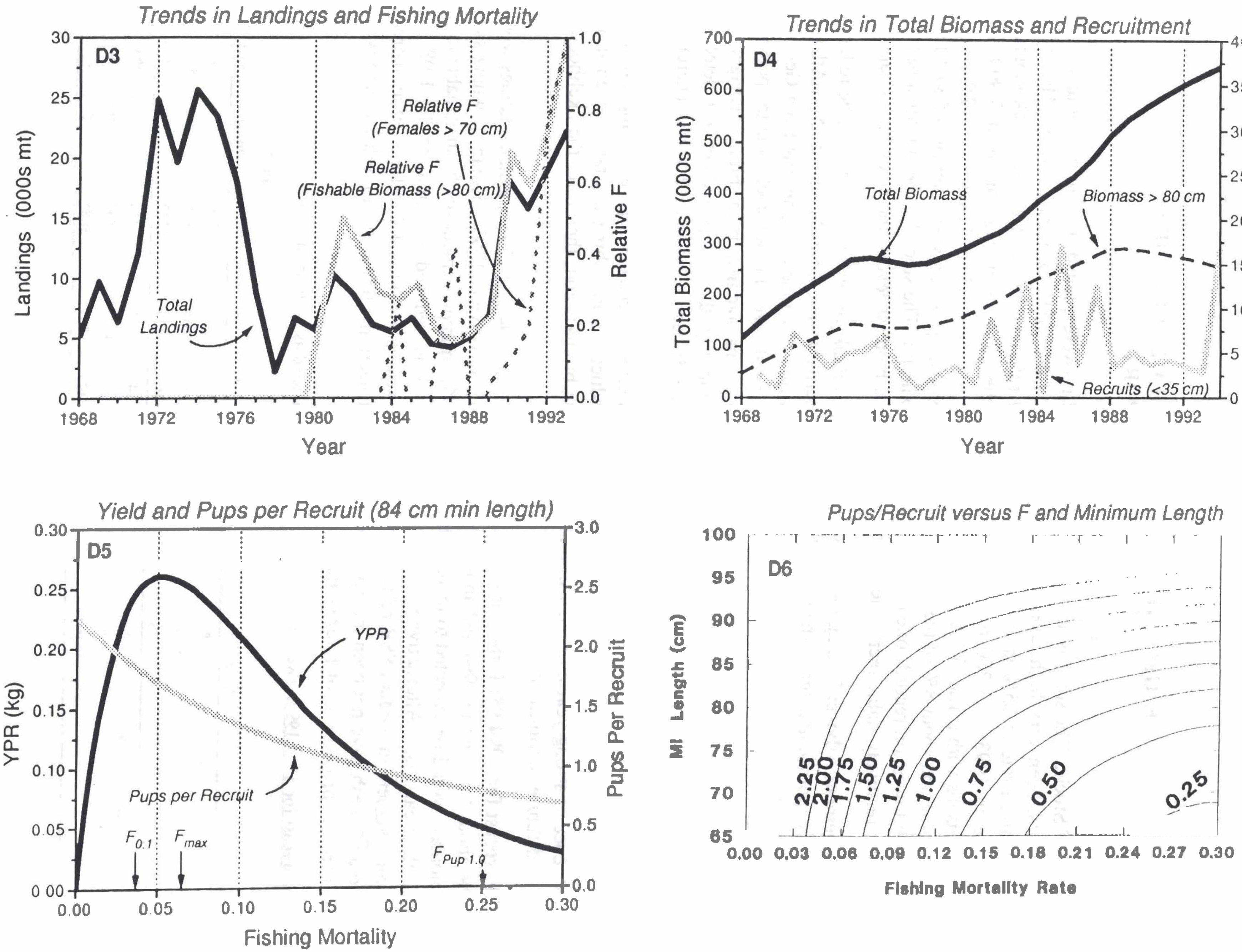


Figure D2. Distribution of catches of spiny dogfish in Canadian surveys by season from 1970-1994.

Spiny Dogfish



E. GEORGES BANK YELLOWTAIL FLOUNDER ADVISORY REPORT

State of Stock: The stock is at low biomass levels and is overexploited. Recent fishing mortality rates have been very high, averaging about 1.2 since 1990 (65% exploitation rate). The 1993 exploitation rate of 65% is well above any biological reference point. The total stock biomass estimate in 1993 (~3,200 mt) was slightly below the 1984-93 average of about 3,900 mt. Comparisons with earlier VPA-based estimates suggest that the 1993 stock was about 12% of the 1973 value and about 8% of the average stock in the 1960s. Spawning stock biomass of 3,010 mt is fourth lowest on record, one eighth of the 1973 maximum. The stock has been maintained by low but relatively stable recruitment. Relative to historic biomass levels, the stock has collapsed.

Management Advice: Fishing mortality on the Georges Bank yellowtail stock should be reduced to levels approaching zero. The Cape Cod stock, and perhaps the Gulf of Maine and Mid-Atlantic Bight stocks, are much smaller in size and exhibit different abundance patterns from Georges Bank and Southern New England stocks. In view of the small size of other stocks and the potential for overexploitation if these stocks are excluded from a management plan, future management should protect all stocks. At present levels of fishing mortality, the time period between detection of a "strong" year class and its effective removal by the fishery is less than 2 years. Therefore, strategies for protecting the 1992 yearclass should be initiated immediately. Projected reductions in fishing mortality rates under Amendment 5 will not effect detectable population improvements and will be inadequate to commence rebuilding. Reductions in fishing mortality, even in the absence of strong year classes, will improve spawning biomass and, therefore, the likelihood of good future recruitment.

Forecast for 1994-95: If the status quo F of 1.2 occurs in 1994 and 1995, median landings would be about 1,500 mt in 1994 and about 1,900 mt in 1995. Relative to 1993, median spawning stock biomass would be expected to increase by 88% in 1995, an improvement solely attributable to the 1992 yearclass. Alternatively, if F during 1994-95 is reduced by 10% to F=1.08, the improvement in median SSB relative to the first scenario is less than 4%. Effects of an increase to a 6" mesh have not been incorporated into these projections; however, a mesh increase would increase projections of future catches.

Forecast for 1994-1995: (weight in mt) F_{1993} = 1.2; SSB estimated as 3,010 mt in 1993.

			1994			1995		
F_{94}	F_{95}	Percentile	Landings	Discard	SSB	Landings	Discard	SSB
1.2	1.2	10%	1063	155	2660	1236	227	3497
		50%	1512	255	4402	1886	387	5635
		90%	2124	465	8144	3222	703	8876
1.08	1.08	10%	991	142	2725	1212	211	3646
		50%	1411	233	4492	1832	360	5846
		90%	1978	423	8232	3085	655	9224

Landings and Status Table (weights in '000 mt, recruitment in millions): Georges Bank Yellowtail Flounder

Year	1987	1988	1989	1990	1991	1992	1993	Max (1973-1993)	Min (1973-1993)	Mean (1973-1993)
Total Commercial Landings	2.7	1.9	1.1	2.7	1.8	2.8	2.1	15.9	1.1	6.4
US Commercial Landings	2.7	1.9	1.1	2.7	1.8	2.8	2.1	15.9	1.1	6.4
Discards	0.4	0.2	0.1	1.2	0.2	2.1	0.1			
US Recreational Landings	-	-	-	-	-	-	-			
Catch used in Assessment	3.1	2.1	1.2	3.9	2.0	4.9	2.2	15.9	1.1	6.4
Spawning Stock Biomass	2.7	2.2	5.6	5.1	3.7	5.1	3.0	25.0	2.2	9.0
Recruitment (Age 2)	5.3	5.6	15.4	6.7	7.0	14.7	4.1	52.1	4.1	18.3
Mean F (Age 4-5, u)	1.5	1.8	0.8	1.0	1.4	1.3	1.2	2.3	0.7	1.2
Exploitation Rate	72%	78%	51%	58%	70%	67%	65%	84%	46%	65%

Stock Identification: Tagging studies from the late 1950's and early 1960's suggested a unit stock on Georges Bank. Correlation analysis of the survey indices for SNE, GB and Cape Cod provide evidence of comparable trends for GB and SNE and independent trends for Cape Cod. The utility of phenotypic characteristics (e.g., weight at age, maturation) as a means of distinguishing stocks is compromised by the high likelihood of density-dependent responses in recent years. More sophisticated stock identification approaches could be applied but would have limited utility for management until the stock rebuilds.

Catches: Landings in 1993 of 2,100 mt were about equal to the 1987-1992 mean, but less than 29% of the 1973-1992 average (Figure E1) and less than 15% of the 1963-1972 landings. Peak landings of 18,300 mt occurred in 1969. Landings dropped to 4,500 mt in 1977 but, in 1983, increased to 11,300 mt, largely on the strength of a few strong year classes. At current levels of fishing mortality, fluctuations in landings generally parallel levels of recruitment 2 to 3 years earlier.

Data and Assessment: Georges Bank yellowtail flounder were last assessed at the 12th SAW in 1990; the Southern New England stock was assessed at the 17th SAW in 1993. The current assessment is based on virtual population analysis of commercial landings at age and estimated discard-at-age data. Natural mortality (M) was assumed to be 0.2. Information on recruitment and stock abundance was used from the NEFSC spring and autumn bottom trawl surveys and NEFSC scallop surveys. Survey data were adjusted for door, gear and vessel changes. The precision of assessment results is declining with declining stock status, and traditional methods are compromised by the truncated age structure of the stock.

Biological Reference Points: Biological reference points were calculated in 1990 based on a Thompson-Bell model (Conser et al. 1994). This analysis was not revised in this assessment because the partial recruitment vector has probably varied as a function of stock and year class abundance. Based on the 1990 analysis: $F_{0.1}$=0.28, F_{MAX}=0.63, and $F_{20\%}$=0.58 (Figure E3).

Fishing Mortality: Contemporary fishing mortality rates are well above all biological reference points Figure (E1, E3). For the 1991 to 1993 period, average F exceeded 1.3. The current minimum fish size (13 in), and mesh size regulations delay full recruitment to age 4. There is a 90% probability that fishing mortality exceeded 0.7 in 1993 (Figure E6).

Recruitment: Recruitment has declined from an average of 27.6 million age 2 fish (1971-1981 year classes) to an average of 9 million fish (1988-1991). Moderate year classes in 1987 and 1990 of about 15 million age 2 fish, were removed rapidly by the fishery. Although estimates of the 1992 year class are imprecise, the cohort appears to consist of 12 million fish, slightly above recent average recruitment.

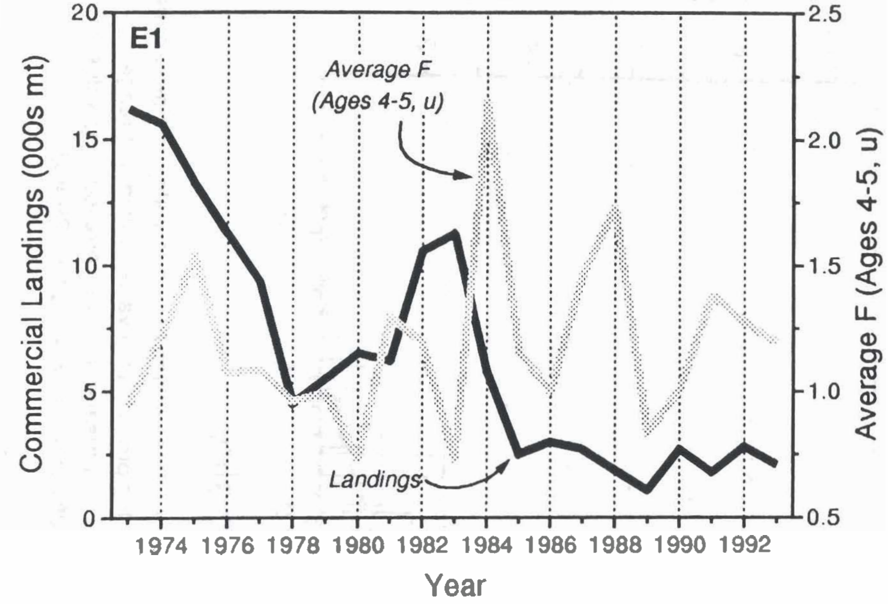
Spawning Stock Biomass: Spawning stock biomass in 1993 (3,010 mt) has declined from a moderate level of 17,385 mt in 1982 and an earlier high of 25,000 mt in 1973 (Figure E2). There is a 90% probability that the 1993 SSB is less than 3,900 mt (Figure E5). Hindcast estimates suggest even greater levels of abundance in the 1960 then in the early 1970s. Since 1984, SSB has fluctuated around a level which is approximately 8% of the 1963-1972 level.

Special Comments: Truncation of the age structure via overfishing, low frequency of sea-sampling trips on otter trawling vessels, and degradation of the precision of biological sampling of landings all act to decrease the precision of the current and future assessments. Other assessment models will likely be necessary. Compensatory responses of the population maturity and growth to high levels of exploitation should be investigated.

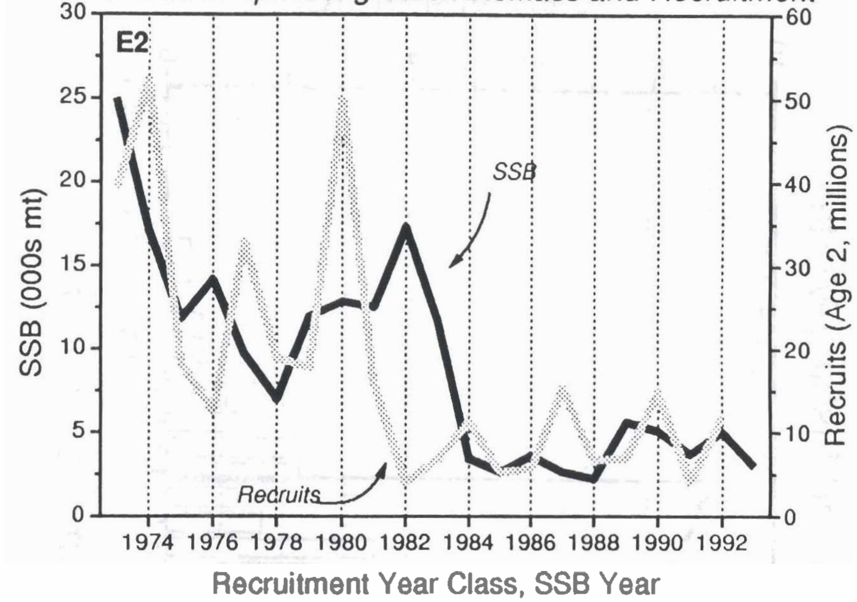
Sources of Information: Report of the 18th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee Consensus Summary of Assessments, NEFSC CRD94-22; Conser, R., S. Cadrin, L. O'Brien, K. Sosebee, 1994, An evaluation of the consistency of age-structured assessment in the Northeast Region, NEFSC CRD94-21; Rago, P., W. Gabriel, M. Lambert, 1994, Assessment of Georges Bank yellowtail flounder (*Pleuronectes ferrugineus*) NEFSC CRD94-20; Conser, R.J., L.O'Brien, W.J. Overholtz, 1991, Stock assessment of the Georges Bank and Southern New England yellowtail flounder stocks, NEFSC CRD91-12.

Georges Bank Yellowtail Flounder

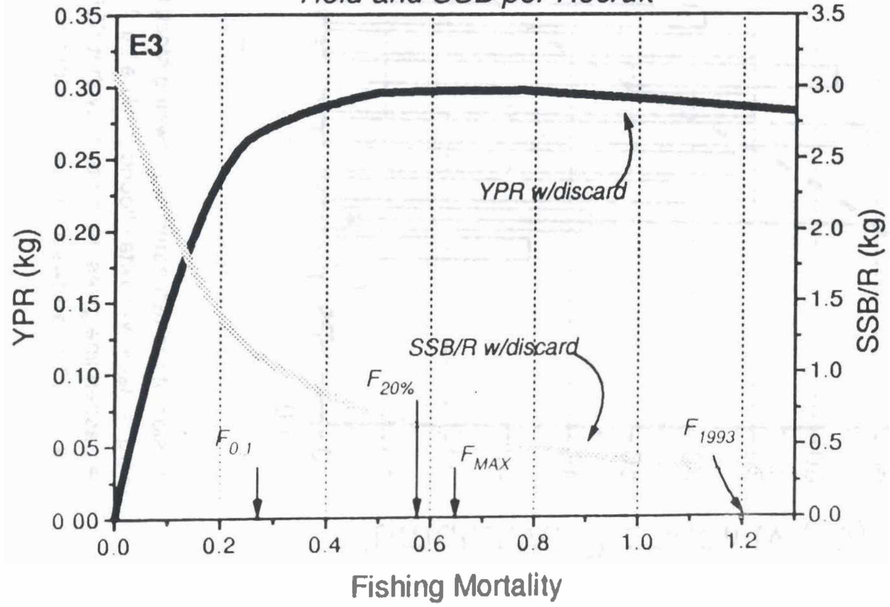
Trends in Commercial Landings and Fishing Mortality



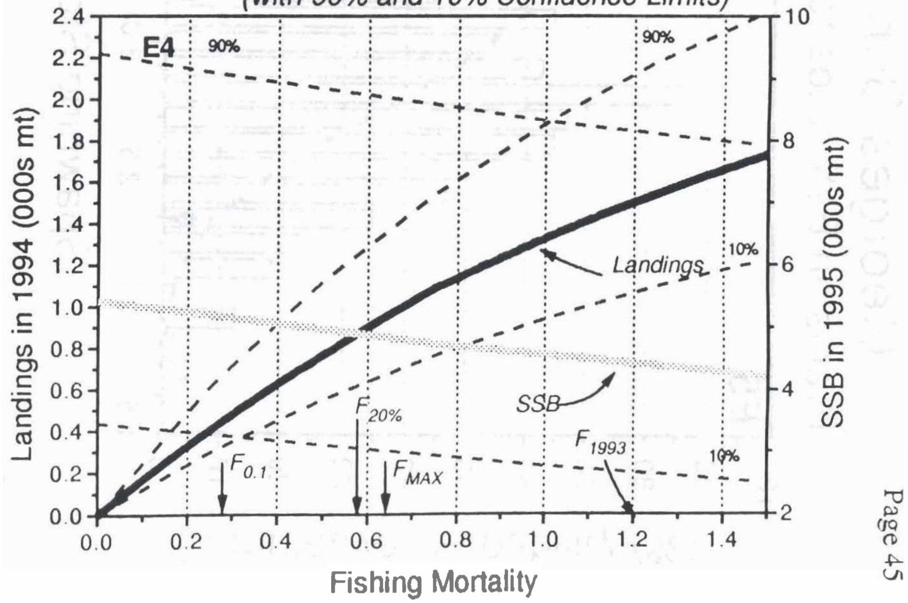
Trends in Spawning Stock Biomass and Recruitment



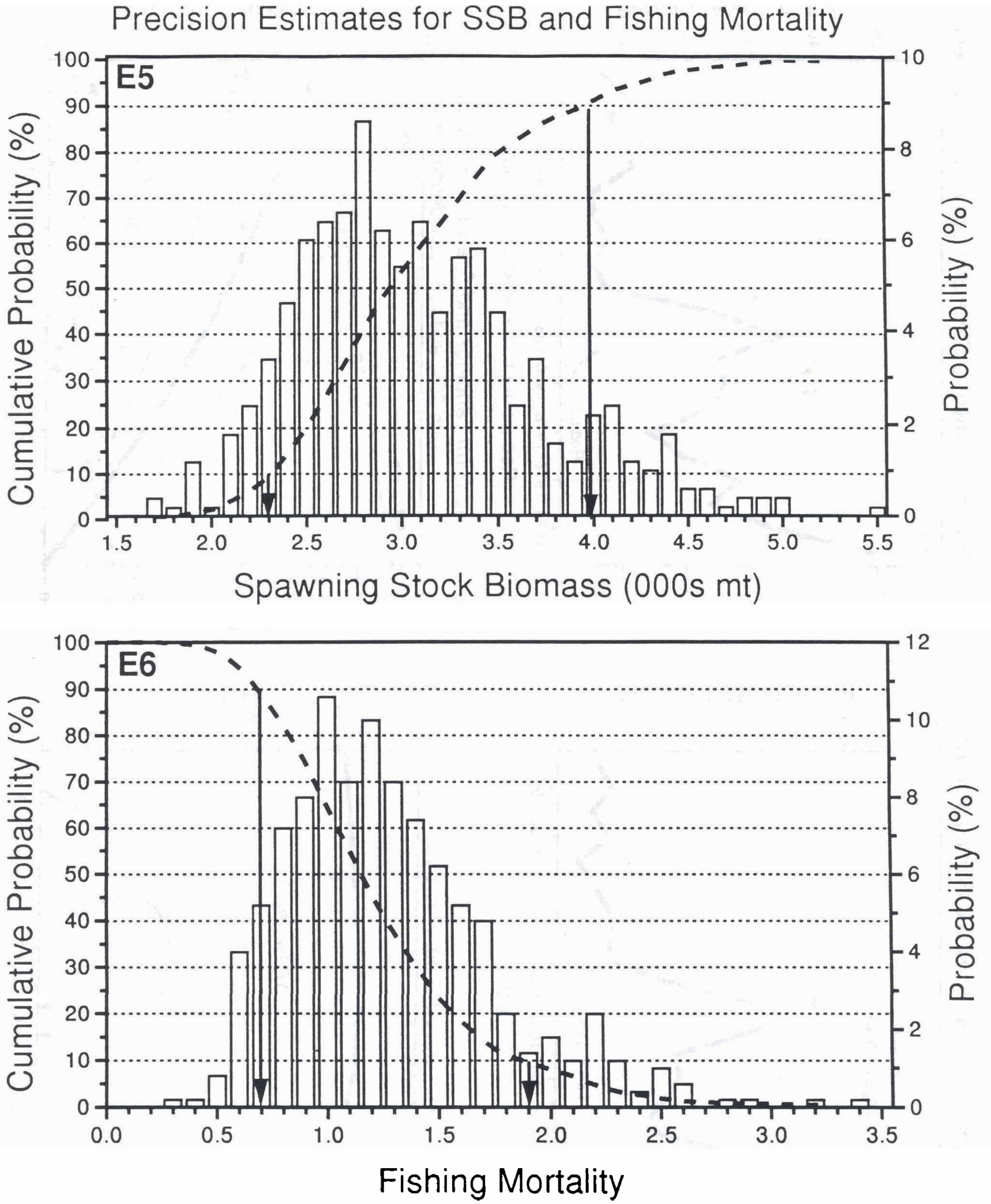
Yield and SSB per Recruit



Short-Term Landings and Spawning Stock Biomass
(with 90% and 10% Confidence Limits)



Georges Bank Yellowtail Flounder



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

F. GEORGES BANK COD ADVISORY REPORT

State of Stock: The stock is at a low biomass level and is overexploited. The fishing mortality rate (F) increased in 1993 to a record-high of 0.91 (Figure F1), and spawning stock biomass (SSB) continued to decline to a new record-low (Figure F2). The last three recruiting year classes (1991-1994) are the lowest on record. Assuming that the current fishing mortality rate is maintained in 1994, the landings in 1994 will be the lowest since the 1970s.

Management Advice: Fishing mortality on this stock should be reduced to levels approaching zero. Continued fishing under Amendment 5 scenarios will result in further declines in SSB to 17,000 mt in 1997. This implies a catch of 8,000-10,000 mt. If fishing mortality is reduced to $F_{20\%}$ in 1995 (0.36), spawning stock biomass will continue to decline through 1995, will begin to recover in 1996 and will eventually increase to 25,000 mt (the 1994 SSB). Stock recovery to abundance levels observed prior to 1990, however, are highly unlikely within the time frame of Amendment 5 unless fishing mortality rates are reduced to zero. Without substantial reductions in fishing mortality, there is the possibility of stock collapse.

Forecasts for 1995: The forecasts for 1995 were based on the 1994 VPA-calibrated stock sizes. Given the present uncertainty about the eventual 1994 fishing mortality, three projections were performed: 1) $F_{1994} = F_{1993}$ (0.91); 2) F_{1994} = the lower bound of the 1993 80% probability range (0.77); and 3) F_{1994} = the upper bound of the 1993 80% probability range (1.12). All projections assume the 1994 and 1995 year classes were equal to the average of the 1989-1992 year classes (10 million fish). Median projections (Scenario 1) for F, 1995 landings and 1996 SSB are provided below.

Forecast Table for 1995: $F_{1994} = 0.91$, Basis: Status Quo 1993 F point estimate. Recruitment of 1994 and 1995 year classes in 1995 and 1996 set equal to the average of the 1989-1992 year classes (10 million). SSB was estimated to be 37,200 mt in 1993 and 25,400 mt in 1994.

F_{94}=0.91 **(weights in '000 mt)**

Basis	F (95)	SSB (95)	Landings (95)	SSB (96)	Predicted Consequences/Implicatications
$F_{0.1}$	0.16	20.6	2.9	28.9	SSB increases but remains below 1993 level; landings decline to unprecedented low level.
F_{max}	0.30	20.3	5.1	26.3	SSB increases to 1994 level; landings decline to unprecedented low level.
$F_{20\%}$	0.36	20.1	6.0	25.2	SSB increases to 1994 level; landings decline to lowest since 1960.
$0.9F_{94}$	0.82	19.0	11.4	19.2	SSB stabilizes at record low 1995 level; landings decline to lowest since 1960.
F_{94}	0.91	18.7	12.3	18.3	SSB at record low 1995 level; landings decline to lowest since 1960.

Continued fishing at current levels of fishing mortality (i.e., $F_{94} = 0.91$) will lead to catches in 1995 declining to their lowest level since 1976. If $F_{95} = 0.91$, SSB in 1996 will decline to a new record-low.

Landings and Status Table (weights in '000 mt; recruitment in millions): Georges Bank Cod

Year	1986	1987	1988	1989	1990	1991	1992	1993	Max (1978-1993)	Min (1978-1993)	Mean (1978-1993)
Total Commercial Landings	25.9	30.9	39.2	33.1	42.5	37.6	28.6	23.1	57.2	23.1	37.9
US Commercial Landings	17.5	19.0	26.3	25.1	28.2	24.2	16.9	14.6	40.1	14.6	27.5
Canadian Commercial Landings	8.4	11.9	12.9	8.0	14.3	13.4	11.7	8.5	17.8	5.8	10.4
Discards	Discards occur but reliable estimates not presently available										
US Recreational Landings[1]	1.1	1.2	4.3	1.9	1.7	1.3	0.5	2.2	5.3	0.5	2.5
Catch used in Assessment	25.9	30.9	39.2	33.1	42.5	37.6	28.6	23.1	57.2	23.1	37.9
Spawning Stock Biomass[2]	55.8	67.0	73.1	71.8	71.8	58.0	47.1	37.2	92.8	37.2	70.1
Recruitment (Age 1)	42.9	16.5	23.8	16.3	9.0	22.2	6.3	4.0	42.9	4.0	19.8
Mean F (Ages 4-8, u)	0.49	0.48	0.78	0.59	0.64	0.80	0.72	0.91	0.91	0.30	0.60
Exploitation Rate	35%	35%	50%	41%	43%	51%	47%	55%	55%	24%	41%

[1]Not used in assessment.
[2]At beginning of spawning season, March 1.

Stock Identification and Distribution: The Georges Bank cod stock is distributed primarily from the Northeast Peak of Georges Bank to Nantucket Shoals, but includes some fish caught incidentally in the Southern New England and the Mid-Atlantic regions.

Catches: Commercial landings increased in the late 1970s and early 1980s, peaking at a record-high 57,000 mt in 1982. During 1983-1986, landings declined but subsequently increased through 1990 (Figure F1). Total commercial landings have since declined to 23,100 mt in 1993. Recreational catches have ranged from 500 mt to 5,300 mt, and have 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 and Canadian spring survey catch-per-tow at age data and from standardized US commercial LPUE indices. The influence of discards and recreational catches were not included in the assessment.

Biological Reference Points: Yield and SSB per Recruit analyses performed with an assumed M of 0.20 indicate that $F_{0.1}$ = 0.16 (13% exploitation rate), F_{MAX} = 0.30 (24% exploitation rate) and $F_{20\%}$ = 0.36 (28% exploitation rate).

Fishing Mortality: Fishing mortality doubled between 1979 and 1985 (0.35 to 0.74) (27% to 48% exploitation rates), declined to 0.48 in 1986-87 (35% exploitation rate), but increased in 1988 to 0.78 (50% exploitation rate) (Figure F1). F increased again in 1991 (F=0.80; 51% exploitation rate) and peaked at a record-high in 1993 (F=0.91; 55% exploitation rate), far in excess of $F_{0.1}$, F_{MAX} and $F_{20\%}$. There is a 90% probability that the 1993 F exceeded 0.78 (Figure F6).

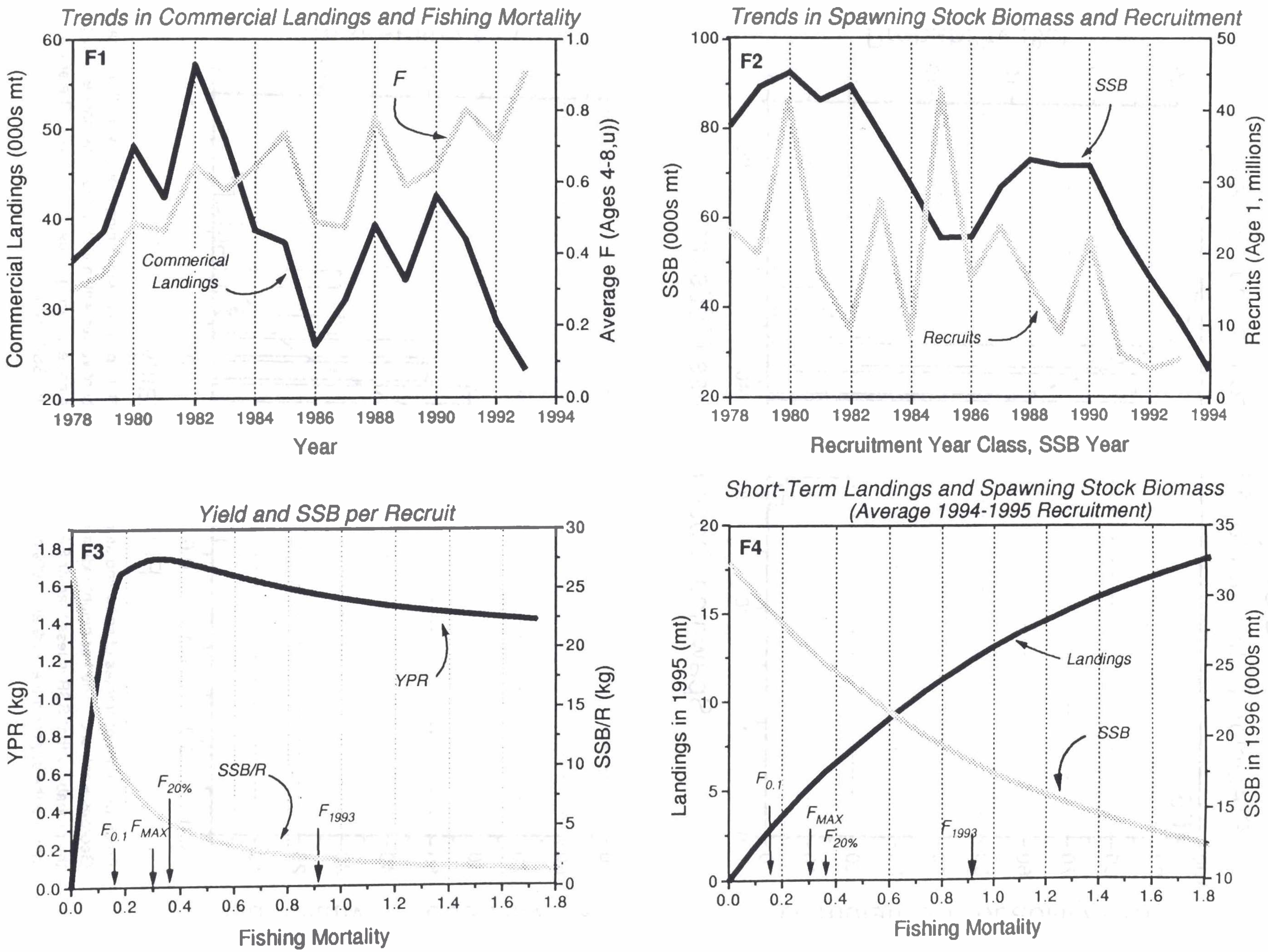
Recruitment: Strong year classes were produced in 1980, 1983, and 1985 (Figure F2). The 1990 year class was slightly above average but the 1991, 1992 and 1993 year classes are among the lowest on record.

Spawning Stock Biomass: SSB declined by about 50% between 1980 and 1986 (92,800 mt to 56,000 mt), increased to 73,000 mt in 1988, but declined to 47,000 mt in 1992, fell to a record-low of 37,000 mt in 1993 and is projected to decline further to 25,400 mt in 1994 (Figure F2). There is a 90% probability that the 1993 SSB is less than 43,000 mt (Figure F5).

Special Comments: Lack of discard data in the assessment may result in an underestimate of F on the youngest ages.

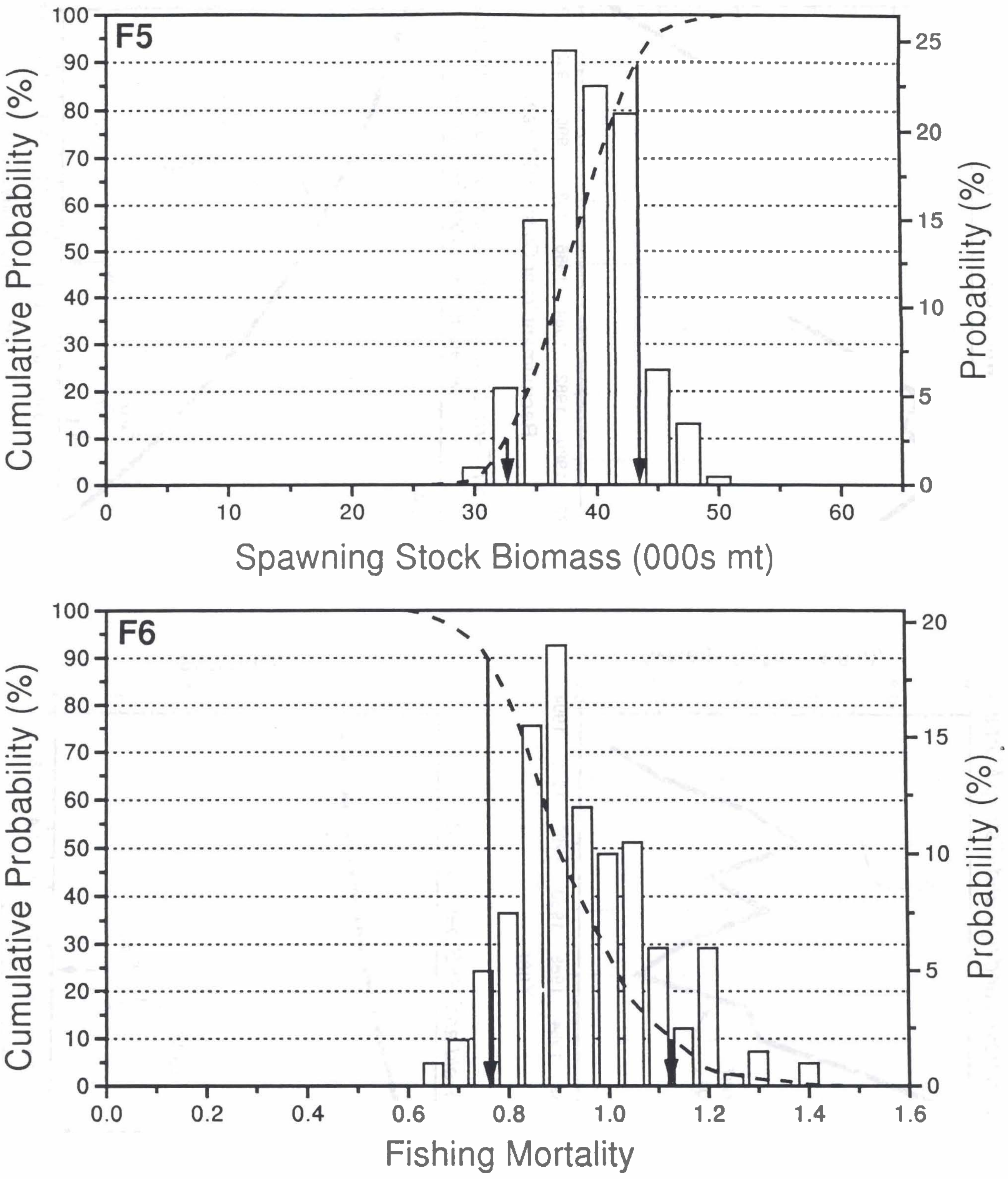
Sources of Information: Report of the 18th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee Consensus Summary of Assessments, NEFSC CRD94-22; Serchuk, F., R. Mayo, and L.O'Brien, 1994, Assessment of the Georges Bank cod for 1994, NEFSC CRD 94-25.

Georges Bank Cod



Georges Bank Cod

Precision Estimates for SSB and Fishing Mortality



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

SPECIAL ADVISORY
GROUNDFISH STATUS ON GEORGES BANK

SPECIAL ADVISORY
GROUNDFISH STATUS ON GEORGES BANK

The Advisory Report presents revised stock status and management advice for Georges Bank yellowtail flounder and Georges Bank cod. Together with haddock, these three stocks have historically dominated landings of groundfish species on Georges Bank. The aggregate MSY of these three stocks is 98 thousand metric tons per year (cod = 35 thousand, yellowtail flounder = 16 thousand, haddock = 47 thousand). Landings of these stocks in 1993 were 29.8 thousand mt, or 30% of MSY. Landings in 1994 are projected to decline further to 22.9 thousand MT or 23% of MSY (Figure 1). Projections for 1995 are for further declines in cod (now the dominant groundfish stock on Georges Bank).

Management advice provided for yellowtail flounder and haddock concludes that these stocks have 'collapsed'. This term is generally used to describe the condition of chronic low recruitment due to reduced spawning biomass, truncated age structure, and prolonged periods of yields less than about 25% of the MSY value. These conditions are clearly met in the cases of Georges Bank yellowtail and haddock (Figures 1-3). Furthermore, the last three year classes of cod are the lowest on record (Figure 3). There is imminent danger that unless the sharp declining trend in SSB is halted, that cod too will collapse.

Recently enacted conservation measures for haddock are expected to reduce fishing mortality, affording protection to the spawning stock and new recruits. The stock is still in a collapsed condition but current harvest rates are likely below the level at which the stock is simply maintained. Because the overfishing definition for cod and yellowtail are based on a replacement level of fishing mortality, however, current F levels on cod and yellowtail need to be reduced by 60% and 52%, respectively, **just to maintain the current low level of abundance.**

Simulation studies conducted for cod and yellowtail flounder indicate that Amendment #5 scenarios will not result in sufficient fishing mortality rate reductions to allow appreciable stock rebuilding. In the case of cod, this means that there is a significant probability of stock collapse (as defined by the above criteria). Good year classes of yellowtail have not been observed since 1980. It appears that chronic low spawning stock biomass is a contributing factor to the poor recruitment that has been observed. The SARC, therefore, concluded that fishing mortality for cod and yellowtail **'should be reduced to as low a level as possible, approaching zero'**. Similar advice was offered at SARC-17 for the Southern New England yellowtail stock.

How much can F be reduced on Georges Bank stocks under current management measures? Amendment #5 calls for a 10% reduction in fishing effort for each of 5 years. Total effort on Georges Bank has been approximately stable at about 25 thousand standardized (class 3) days fished since 1984 (Figure 4). Fishing mortality rates on yellowtail flounder and haddock have varied without trend in recent years, whereas F on cod has trended upward, nearly doubling since the mid-1980s. At best, we can expect that the weighted average F will be reduced by 50% by 1999, however, whatever effort results will be concentrated on any recruitment event generated by the three major stocks. Prospects for cod are poor for the next several years. The fishery is now concentrating on the remnants of the 1990 year class, and subsequent cohorts are very weak. The 1992 year class of yellowtail is not good, but better than earlier years. Likewise, the 1992 year class of haddock is marginally better than recent year classes. While trip limits and large closed areas might be effective in lowering fishing mortality for groundfish stocks on Georges Bank, such drastic measures would unfortunately displace most fishing effort to other already overexploited stocks in the Gulf of Maine and in Southern New England. The result will be to increase F on other stocks already at risk.

If a stock collapse for Georges Bank cod is to be averted, and rebuilding of yellowtail begun, measures provided in Amendment #5 are clearly inadequate. The severity of recent declines in the Georges Bank cod stock is illustrated in Figure 5. In this plot, the spawning stock biomass of Georges Bank cod is compared with the spawning biomass (age 7+) for the northern Grand Banks cod stock. Although the scales are different, reflecting the larger overall stock on the Grand Banks, the trends are generally similar. Periods of declining SSB were temporarily halted in the mid-1980s, followed by dramatic declines in recent years. In the case of the northern cod stock, current stock biomass is only about 3% of the maximum, whereas current Georges Bank SSB is about 20% of the maximum. The two stocks are not completely comparable. Severe cold water conditions have exacerbated recruitment overfishing on the Grand Banks. Extremely slow growth rates in more northern waters imply longer recovery times on the Grand Banks. Nevertheless, the pattern of stock declines are coherent. An important factor in both cases is the extremely high fishing mortality rates in recent years. Failure to take strong management actions now to preserve the limited spawning biomass for Georges Bank cod may have severe and potentially long-lasting consequences for both the stock and the fishery.

Given these considerations, the SARC recommends substantial, immediate reductions in groundfish fishing mortality on Georges Bank. Bycatch interactions among various species suggest that species-specific area closures and trip limits will not be sufficient, in and of themselves, in reducing fishing mortality rates for cod haddock and yellowtail, simultaneously. It is recognized that transferring a substantial portion of the 25 thousand Georges Bank fishing days to Southern New England or the Gulf of Maine will exacerbate overfishing there. Serious consideration should be given to immediate attention to rebuilding all components of the groundfish resource.

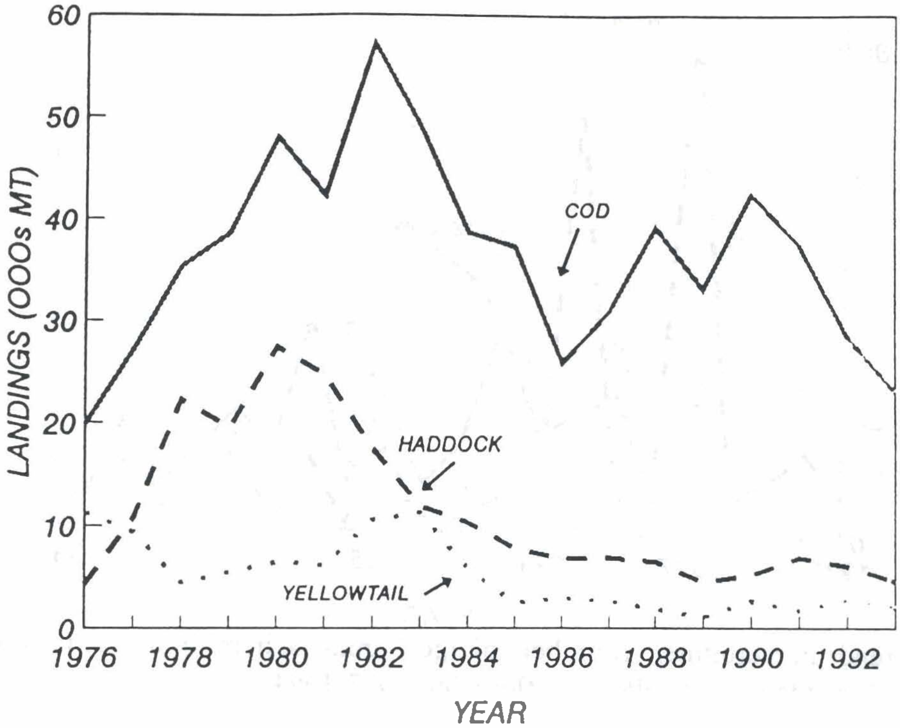


Figure SA1. Total landings (USA and Canada) of Georges Bank cod, haddock, and yellowtail flounder, 1976-1995.

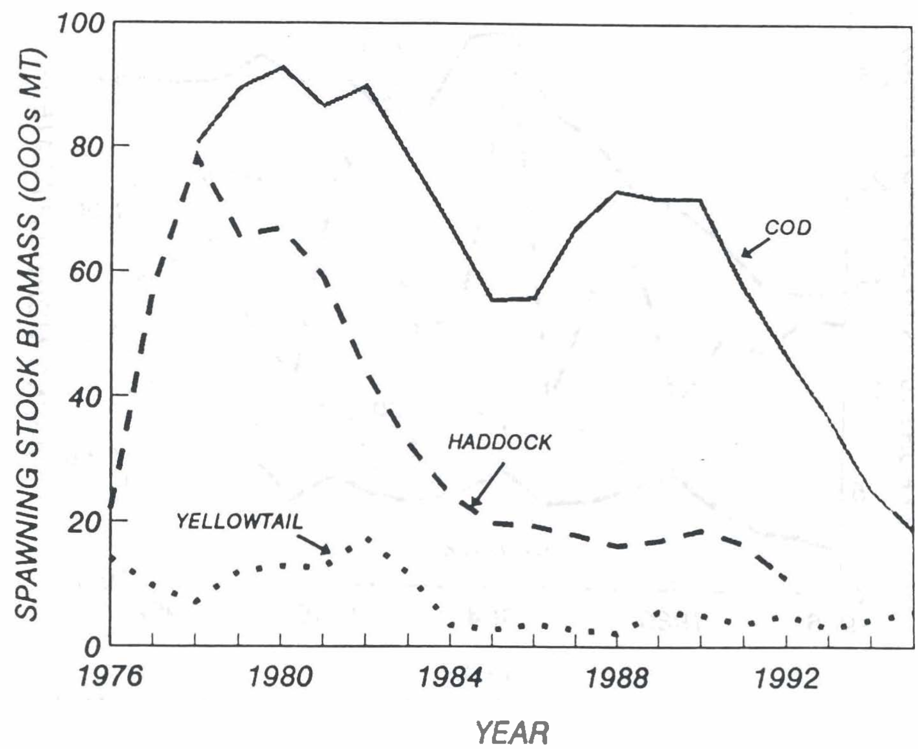


Figure SA2. Trends in spawning stock biomass of Georges Bank cod, Haddock, and yellowtail flounder, 1976-1995.

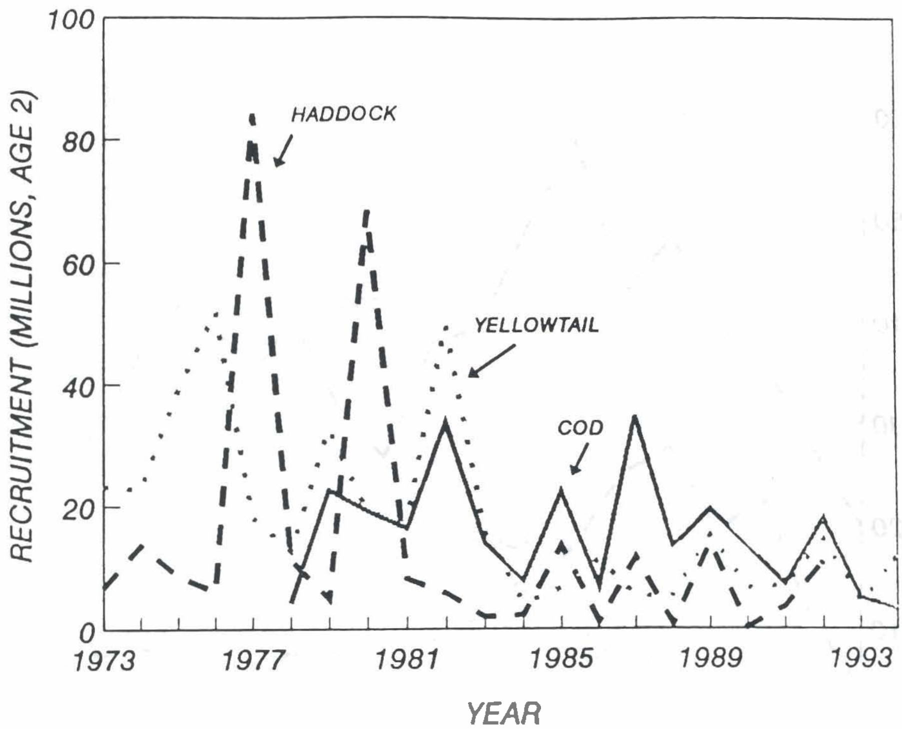


Figure SA3. Trends in recruitment (numbers of age 2 animals, in millions) for Georges Bank cod, haddock, and yellowtail flounder, 1973-1994.

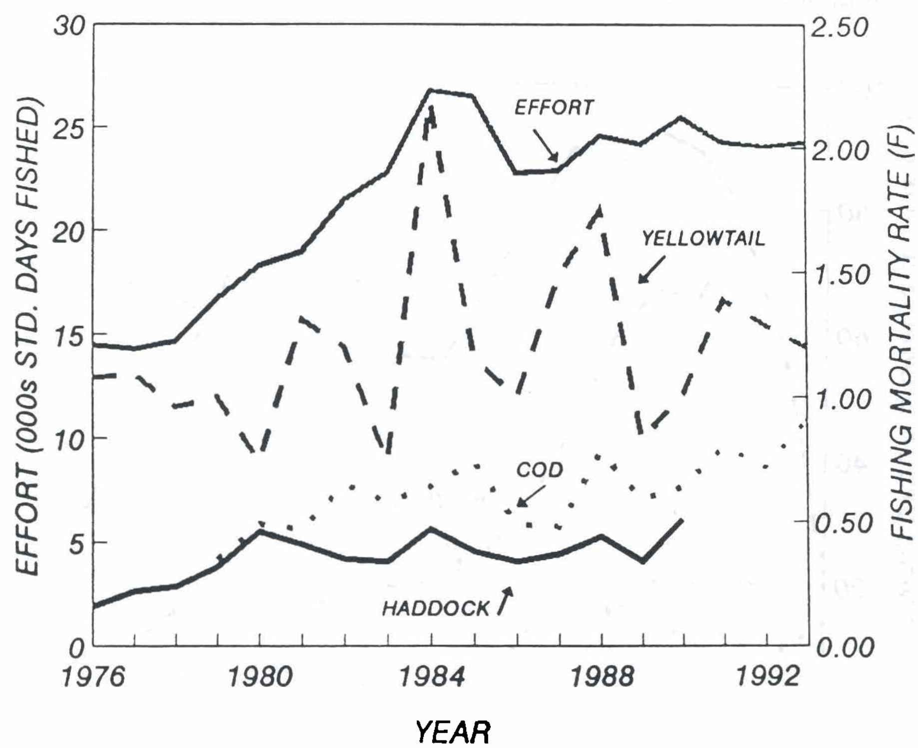


Figure SA4. Trends in otter trawl fishing effort and fishing mortality rates for Georges Bank stocks, 1976-1994. Effort is standardized days fished (class 3 otter trawlers are the standard). Fishing mortality rates are based on most recent USA assessments.

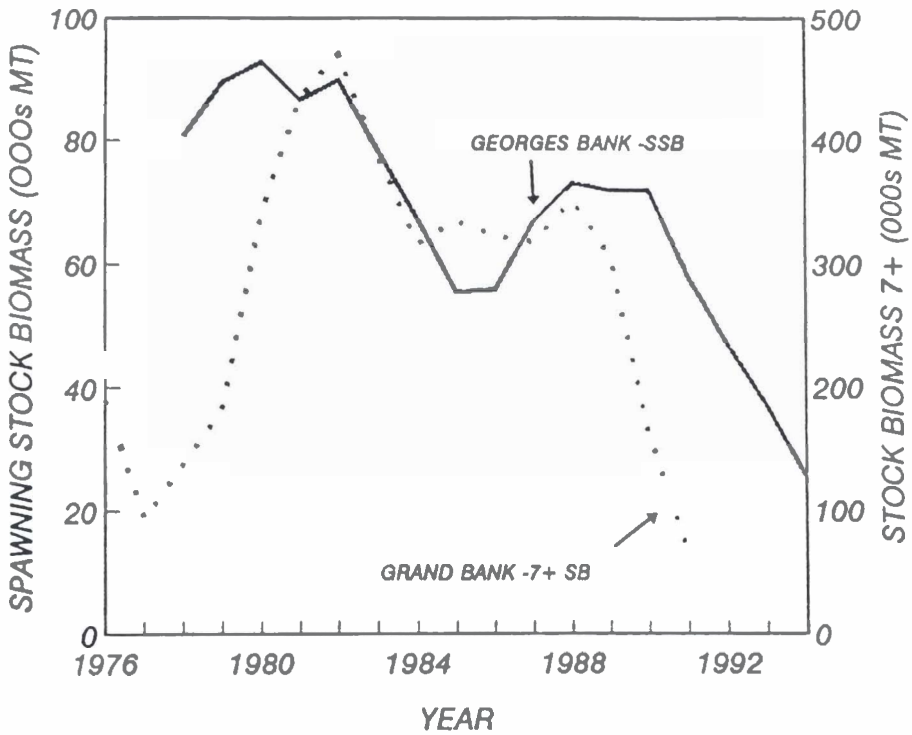


Figure SA5. Trends in spawning stock biomasses of Georges Bank and northern Grand Banks cod stocks, 1976-1995.

CONCLUSIONS OF THE SAW STEERING COMMITTEE

CONCLUSIONS OF THE SAW STEERING COMMITTEE

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

The SAW-18/19 Steering Committee Meeting was held on 18 August 1994 in Philadelphia, Pennsylvania, immediately following the Mid-Atlantic Fishery Management Council August meeting. In addition to the Steering Committee members, participants included T.P. Smith, SAW editor, and Helen Mustafa, SAWs Coordinator, NMFS/NEFSC.

Dr. Smith led the discussions outlined in the agenda (Table 6). After reviewing the highlights and documentation of the SAW-18 meetings, including the research recommendations and the special advisory document, the Steering Committee set the dates for and species to be considered by SAW-19, and preliminarily established dates and species for SAWs-20 and 21.

1. SAW-18

1a. The SARC Meeting

The SARC Agenda (Table 7) and the meeting process were discussed. The Steering Committee was pleased that it was possible to review all species as scheduled. The SARC was able to complete reviews of six species and an Assessment Methods Subcommittee report in 4-1/2 days, by reviewing only one, instead of two, drafts of the SARC and Advisory Reports for each species and by more effectively using the SARC Leaders. The final review of SAW documents was conducted by mail after the drafts were edited. Further savings in time during SARC meetings may be accomplished by streamlining the preparation of the Advisory Report. To develop a consensus among the SARC members, items could be presented in bullet form.

The composition of the SARC was reviewed (Overview Table 3). The ASMFC's facilitation in the appointment of three persons from the states was beneficial, as was the appointment of several individuals with considerable expertise on the species being assessed.

The SARC recommended that eight working papers be published in the NEFSC Reference Document series. The Steering Committee recommended that the bluefish assessment document (CRD 94-15), as well as other Subcommittee reports, should not specify an editor nor bear any authorship.

1b. Assessment Methods Subcommittee

The candidate terms of reference of the Assessment Methods Subcommittee were reviewed. For SAW-18, the Subcommittee addressed three distinct topics under the terms of reference: (1) bias in SARC assessment results; (2) stochastic projections -- noted to be especially important to the

Councils; and (3) Assessment methods software. Terms of reference 8 and 4-7 will be addressed at a future SAW.

1c. The Plenary Meeting

The background that led to the development and the circumstances surrounding the presentation of the "Special Advisory on Groundfish Status" were discussed. As the report was not reviewed by members of the SARC before its presentation at the Plenary, there seemed to have been some confusion relative to its origin and purpose . The Steering Committee concluded that the confusion was not due to the content of the report but due to a misunderstanding of the charge given to the editorial group by the SARC. To avoid such misunderstandings in the future, the Committee recommended that the SARC's directions to the editors be clearly stated in writing. All SARC documents should be reviewed by the SARC before distribution and no SARC document should be released without SARC review.

2. Research Recommendations

2a. Species Recommendations

Common or recurring research recommendations from each species section of the SARC Report were summarized, including inadequate biological sampling, the quality of the MRFSS (Marine Recreational Fisheries Statistics System) length-frequency data, the complexity of the transition to a mandatory reporting system, and the adequacy of the precision and sampling design of the Sea Sampling Program. Allen Peterson, on behalf of the Committee, will convey to the Fisheries Statistics Division at NMFS Headquarters the SARC's advice for improving the MRFSS length-frequency data.

Discussed also was the Atlantic Coastal Fisheries Initiative Memorandum of Understanding, an attempt to establish better coordination in the development of state-federal recreational and commercial fisheries databases. Although there has been some progress in the cooperative development of a better program, there is the need to expand the steering group and to involve the NMFS Regional and Center Directors in the effort.

The use of fishery independent data and the issues of sampling and surveys were discussed, as was the specific problem of ageing samples. Cooperative Marine Education and Research programs operating at the Universities of Massachusetts and Rhode Island and Rutgers State University may provide opportunities for developing new ageing databases.

2b. Assessment Methods Recommendations

The need for second generation, operational, ADAPT software was discussed. Establishment of an Oversight Committee (core group) composed of two NEFSC persons, and 1 state person was suggested. Required resources include 1/2 time assignments of the core group, $50,000 for hardware and software, and $50,000 - $100,000 for programming support. Although this is internal to the NEFSC, the ASMFC and the states have an interest in assessment software delivery. The NEFSC Director should develop a proposal which lays out the personnel and fiscal tradeoffs associated with the assignment. The CMER programs may be able to provide programming assistance.

An ADAPT tutorial is still planned. Since operational software will be developed, it is no longer appropriate to hold a hands on session. Instead, the emphasis will be on the exploration of the ADAPT concept and getting feedback from potential users. Terms of reference for the tutorial include: background and history, data requirements for use, description of methods and assumptions, use of model diagnostics, and interpretation of the output. The ASMFC should be notified of the resources required to conduct the tutorial so that these may be programmed into the general plans of a series of ASMFC workshops for next year.

The benefits of participating in International Council for the Exploration of the Sea working groups for the acquisition of additional knowledge in assessment technology was also discussed.

3. Advisory Report

The outline and format of the Advisory Report were reviewed. There is currently no need to change the format of the report as the current form is becoming more familiar and accepted.

4. SAW-19

4a. Meeting Dates and Places

SAW-19 Stock Assessment Review Committee (SARC) Meeting
Woods Hole, Massachusetts
28 November (1:00 PM) - **2 December** (6:00 PM) **1994**

SAW-19 Plenary Meeting
In conjunction with MAFMC meeting
30 (PM) - 31 (AM) January 1995

SAW-19/20 Steering Committee Meeting
In conjunction with the February 1995 of ASMFC or NEFMC meeting

4b. Species/Stocks

SPECIES/STOCK	SUBCOMMITTEE	CHAIR
Gulf of Maine Cod	Northern Demersal	R. Mayo
White Hake	Northern Demersal	R. Mayo
Scup	Pelagic/Coastal	E. Anderson
Surf Clam	Invertebrate	S. Murawski
Ocean Quahog	Invertebrate	S. Murawski

Due to changes in personnel at the NEFSC, the Center is not in the position to do a scallop assessment for review by the SAW-19 SARC. Surf clam and ocean quahog were recommended in place of a scallop assessment with scallop survey results and implications to be presented at the SAW-19 Plenary Meeting.

The Center is also not in the position to prepare both scup and black sea bass for SAW-19 SARC review because it is not possible to adequately age both species before this meeting. As more work has been done on ageing scup, scup was recommended. It was noted, however, that the MAFMC will need advice on black sea bass soon.

4b. Terms of Reference

The Committee approved the following species/stocks terms of reference:

GULF OF MAINE COD

a. Assess the status of Gulf of Maine cod through 1993 and characterize the variability of estimates of abundance and fishing mortality rates.

b. Provide 1995 projected estimates of catch and 1996 SSB options at various levels of 1995 F.

WHITE HAKE

a. Characterize current and historic length and age composition, abundance and catch of the population as data permit.

b. Provide current information of stock structure and biological parameters including growth and maturation and, if possible, conduct yield and spawning stock biomass per recruit analyses, and provide appropriate biological reference points.

Provide estimates of fishing mortality and MSY as data permit.

SCUP

a. Summarize landings, length composition, and available age/length data for the Cape Cod-Cape Hatteras stock of scup.

b. Summarize all available indices of stock abundance/biomass based on commercial and recreational CPUE and state and NEFSC survey catch per tow.

c. Attempt, if possible, to estimate the age composition (i.e., numbers at age) of recent scup landings.

d. Provide estimates of mortality using all available sources of data.

e. Review revised yield-per-recruit and spawning-stock biomass-per-recruit analyses.

f. If possible, conduct a full virtual population analysis (VPA).

SURF CLAM

a. Summarize trends in landings, size composition, areal distribution, and CPUE for appropriate population units.

b. Summarize fishery-independent abundance indices, including research vessel data from NMFS and state surveys.

Provide estimates of current stock size, fishing mortality rates, and likely trends in abundance for a 10-year period under alternative recruitment and quota levels.

OCEAN QUAHOG

a. Summarize trends in landings, CPUE, size composition, areal distribution and CPUE for the Middle Atlantic and Gulf of Maine Management areas.

b. Summarize fishery-independent abundance indices, including NMFS research vessel survey data.

Provide estimates of current stock size and fishing mortality, as data permit, and trends in abundance over a 30-year period, under alternative recruitment and quota levels.

5. Future SARC and Plenary Meetings

The Committee discussed the feasibility of doing both the Georges Bank and Gulf of Maine cod stocks at the same SAW, how often species assessments should be updated and reviewed within the SAW process, and how to deal with other information needs of the Councils and the ASMFC. A two-tier review system for data/analyses was suggested where there would be regular assessment maintenance through routine updates of fisheries and fishery independent data, and peer reviewed (SARC) assessments.

A list of stocks reviewed by the SARC was provided. Stock assessments reviewed within the SAW process are presented in Table 8.

5a. SAW-20

Suggested dates:

SAW-20 SARC Meeting
19-23 June 1995, Woods Hole, MA

SAW-20 Plenary Meeting
9 - 10 August 1995, possibly in Providence right after an ASMFC meeting and before a NEFMC meeting, if this can be arranged.

Suggested species:

Georges Bank Cod	Black Sea Bass
Scallop	Shad
Summer Flounder	Tautog
Mackerel	

The states and ASMFC will lead the development of analyses for shad and tautog.

Tautog to was added the Pelagic/Coastal Subcommittee list of species (Table 9).

5b. SAW-21

Suggested dates:

SAW-21 SARC Meeting
27 November - 1 December 1995

SAW-21 Plenary Meeting
In conjunction with MAFMC meeting or possibly a ASMFC meeting (see above).

Suggested species:

Gulf of Maine Cod	SNE Yellowtail Flounder
Lobster	Herring
Winter Flounder	

Although the possibility of revisiting the squids in a couple of years was raised, it was concluded that in the case of these species, as well as salmon and monkfish, the need for biological information is more important than SARC assessments. As assessments of the squids and salmon would be in "real-time," they would not necessarily involve the SARC as we know it.

The SAW Process and Documentation

The Steering Committee is satisfied in the way the SAW process has evolved. The process has generally been accepted by all concerned and should continue with only some fine tuning of procedure.

Table 6.

SAW-18/19 Steering Committee Meeting

Doubletree Hotel
Broad Street at Locust
Philadelphia, PA

18 August 1994
(Beginning immediately following the MAFMC Meeting,
about 11:30 AM)

AGENDA

Report on SAW-18 SARC and Plenary Meetings
a. SARC Meeting
b. Assessment Methods Subcommittee
c. Plenary Meeting
Special advisory on Georges Bank

Research Recommendations
a. Species recommendations
b. Assessment Methods recommendations

3. Steering Committee Functions
Advisory Document
- Recommended changes to advice
changes to glossary: fishing mortality,
stock collapse
changes to sections: short term forecasts

SAW-19 SARC, Woods Hole, 28 November - 2 December 1994
SAW-19 Plenary, at MAFMC Meeting, 30 - 31 January 1995
a. Species
proposed - Gulf of Maine cod, scallop, white hake, scup, black sea bass
b. Terms of Reference

Future SARC and Plenary Meetings
a. SAW-20 SARC, Woods Hole, when?
b. SAW-20 Plenary, in conjunction with NEFMC or ASMFC meeting

SAW Process
a. SARC
b. SARC membership
c. Plenary

Table 7

18th Northeast Regional Stock Assessment Workshop
(SAW-18)
Stock Assessment Review Committee (SARC) Meeting

Woods Hole, Massachusetts
June 20 - 24 1994

AGENDA

SPECIES/STOCK	SUBCOMMITTEE & PRESENTER	SARC LEADER	RAPPORTEUR
MONDAY JUNE 20 (12:00 PM - 7:30 PM)			
Opening		V. Anthony, Chairman	
Welcome			
Agenda			
Conduct of Meeting			H. Mustafa/ T. Morrissey
Bluefish (A)	Pelagic/Coastal S. Murawski	J. Ross	C. Moore
TUESDAY, JUNE 21 (9:00 AM 6:00 PM)........			
Summer Flounder (B)	So. Demersal W. Gabriel	K. McKown	M. Terceiro
Assessment Methods Subcommittee Report (G)	Assessment Methods R. Conser	S. Murawski	A. Rosenberg
Witch Flounder (C)	No. Demersal R. Mayo	J. Neilson	T. Helser
Review available drafts			
WEDNESDAY, JUNE 22 (9:00 AM - 6:00 PM)........			
Spiny Dogfish (D)	So. Demersal E. Anderson	R. Beamish	K. Sosebee
Georges Bank Yellowtail Flounder (E)	So. Demersal W. Gabriel	M. Gibson	P. Rago
Review available drafts			
THURSDAY, JUNE 23 (9:00 AM - 6:00 PM)........			
Georges Bank Cod (F)	No. Demersal R. Mayo	D. Conover	L. O'Brien
Review available drafts			
Barbecue at the Anthony's (7:00 PM)			
FRIDAY, JUNE 24 (9:00 AM - 6:00 PM)........			
Complete unfinished discussion of species/stocks under review			
Complete SARC Report sections			H. Mustafa/ T. Morrissey (Coordination)
Complete Advisory Report sections			T.P. Smith (Editor)
Other Business			H. Mustafa/ T. Morrissey

Table 8.

SAW Assessment Reviews by Species

YEAR	'85	1986		1987		1988		1989		1990		1991		1992		1993		1994		1995	
SAW #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
BLACK SEA BASS	X				+	+			X		X		X							X	
BLUEFISH	X		X	X	X	X					X						X	X			
BUTTERFISH	X	X		X		X		X		X		X					X				
COD-GB	X		X				X				X		X		X			X		X	
COD-GM	X		X				X					X			X				X		X
CUSK	X																				
FLDR, AM. PLAICE	X	X		X							X			X							
FLDR, SUMMER	X		X			X	+	+	X		X		X			X		X		X	
FLDR, WINTER	X		X																		X
FLDR, WINTER-INSH	X		X		+	+	+						X								
FLDR, WITCH	X	X																X			
FLDR, YT	X	X					X					X					X				X
FLDR, YT-GB																		X			
GOOSEFISH														X							
HADDOCK-GB	X	X		X									X								
HADDOCK-GM	X	X																			
HERRING					X				X		X		X			X					X
LOBSTER	X		X							X		X		X		X					X
MACKEREL	X	X		X		X		X		X		X								X	
OCEAN POUT	X										X										
OCEAN QUAHOG	X		X							X					X				X		
POLLOCK	X		X						X	X						X					
RED HAKE	X	X									X										
REDFISH	X	X													X						
RIV. HERRING/SHAD	X					X														X	
SALMON	X																				
SCALLOPS	X	X				X			X	X	X	X	X	X						X	
SCUP	X			X			X		X		X								X		
SHRIMP	X		X		X																
SILVER HAKE	X	X		X						X	X						X				
SKATES	X																				
SPINY DOGFISH	X										X							X			
SQUID, ILLEX	X	X		X		X		X		X		X		X			X				
SQUID, LOLIGO	X	X		X		X		X		X		X		X			X				
STRIPED BASS	X																				
SUR⁻ CLAM	X		X				X		X						X				X		
TAUTOG																				X	
TILEFISH	X													X		X					
WEAKFISH			+																		
WHITE HAKE	X	X									X								X		
WOLFFISH	X																				

fpa10/26/94

+ = No formal assessment review; research needs, working group or special topic report.

Note: The Stock Assessment Review Committee (SARC) was first implemented during SAW-11.

Table 9.

SUBCOMMITTEE STRUCTURE

SUBCOMMITTEE	SPECIES
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, herring, salmon, dogfish, butterfish, shad, river herring, striped bass, black sea bass, bluefish, scup, tautog
Invertebrate	scallop, lobster, squids, northern shrimp, surf clam, ocean quahog