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Report of the Eighth NEFC Stock Assessment Workshop (Eighth SAW)

24-27 April, 1989

National Marine Fisheries Service
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EXECUTIVE SUMMARY

The 1989 Spring Stock Assessment Workshop (SAW 8) was held in Woods Hole, Massachusetts from 24-27 April. The workshop involved 56 participants from: state fisheries agencies from Massachusetts, Rhode Island, Connecticut, New York, Maryland, Virginia, and North Carolina; New England and Mid-Atlantic Fishery Management Council staff; representatives from academia; and, National Marine Fisheries Service personnel from the Northeast Fisheries Center (NEFC), Northeast Regional Office (NERO), and the Southeast Fisheries Center (SEFC). The objectives of SAW 8 were to: review the status of butterfish, squid, and mackerel stocks; review and evaluate ongoing research to improve the biological and technical aspects of the assessments; and, review the progress of various SAW Working Groups related to specific topics of special interest. In addition, workshop participants attended a special session on the progress of the Chesapeake Bay Stock Assessment Committee (CBSAC).

Butterfish landings in 1988 were the lowest observed since 1977 while effort was the lowest recorded since 1982. Although 1988 autumn bottom trawl survey abundance and biomass indices increased substantially from extremely low 1987 levels, the low 1988 commercial catch was attributed to decreased availability of marketable sized butterfish on the traditional Southern New England fishing grounds. The USA catch of short-finned squid decreased by 81% from the high 1987 level, and the total catch was the lowest since 1981. Commercial CPUE and bottom trawl survey abundance indices were well above their respective long-term means in 1988 suggesting that the sharp decline in 1988 landings was not due to availability of the resource, but, rather to a lack of effort resulting from market conditions. Catches of long-finned squid increased substantially in 1988 from the relatively low level observed in 1988. Commercial CPUE declined slightly in 1988 but remained well above the long-term average. Stock biomass estimates derived from autumn bottom trawl surveys indicate moderate abundance levels sufficient to support catches of between 29,000 and 33,000 metric tons during 1989. Favorable recruitment and low exploitation in recent years have contributed to an increase in mackerel biomass from less than 500,000 metric tons in 1977-1981 to about 2 million tons at the beginning of 1988. The low level of fishing mortality on this stock continues to cause difficulties in calibrating a VPA, although forcasts of catches at various levels of F, including $F_{0.1}$ (0.29), were performed for the 1990-1993 period under various fishing scenarios. Annual catches of between 200,000 and 300,000 tons did not adversely affect stock biomass levels.

The summer flounder Working Group reported considerable progress in evaluating marine recreational and commercial canvass data bases for use in constructing a catch at age matrix, but more work is needed before discard estimates can be incorporated. The long-term potential yield Working Group is continuing to develop the concept of Long-Term Potential Catch (LTPC) as an alternative to MSY. This concept is intended to be a more realistic assessment of likely catches in the next 5-10 years, reflecting current conditions of exploitation patterns and the influence of competing fisheries.

Several research topics were presented where progress was reported in the following areas: commercial and survey age sampling requirements; modelling individual vessel behavior in the scallop and otter trawl fisheries; analyses of growth-maturation interactions; evaluation of long-term temperature trends; impact of marine mammal-gillnet interactions; and the incorporation of discard estimates in catch at age matrices.

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1.0. INTRODUCTION

1.1. OVERVIEW

The Eighth Northeast Fisheries Center (NEFC) Stock Assessment Workshop (SAW-8) was held at the Woods Hole Laboratory from 24-27 April 1989. Fifty-six participants from marine fisheries management and scientific institutions and agencies attended all or part of the workshop. The reports of these workshops serve as the most current source of information on the status of the fishery resources in the New England and Mid-Atlantic areas, and are designed for use by groups with fisheries management responsibilities. SAW-8 included assessments of the status of four Mid-Atlantic stocks, reports of four working groups, and discussions of 11 special topics which provide an overview of ongoing research programs which are undertaken to improve the biological and technical aspects of the assessments. A source document which provides more detailed background information is listed as part of the description of each assessment, special topic, and working group discussion.

1.2. TERMS OF REFERENCE

At the Seventh Stock Assesment Workshop (Fall 1988), the participants recommended that several terms of reference be considered at the spring 1989 workshop. These recommendations formed the basis of the adopted terms of reference for SAW-8:

1.2.1 Assessment Revisions or Updates
- Update status of *Loligo* and *Illex* squid
- Update status of butterfish
- Review status of mackerel

1.2.2 Special Topics
- Report of the NEFC Maturity Working Group on growth-maturity interactions and the effects on SSB/R
- Report on available temperature data and long-term temperature trends
- Report by ASMFC Recreational sub-committee on recreational surveys
- Examine the extent of the bottom-tending gillnet fishery/marine mammal interactions in the Northwest Atlantic
- Report on the adequacy of age sampling data and the role of states in meeting sample needs
- Update of SAFE requirements
- Review CBSAC assessment research program and results to date
- Review of methods for inclusion of discards and recreational catch data in the development of catch at age matrices
- Review of individual effort statistics

1.2.3 Working Group Reports
- Black sea bass and scup working group (WG 22): In support of MAFMC plans to expand the summer flounder FMP, the working group was asked to: 1) develop biological reference points over the geographic range, and 2) examine available fisheries statistics
- Summer flounder working group (WG 21)
- Long-term potential yield working group (WG 9)

1.3. IDENTIFICATION OF WORKING PAPERS

Several working papers listed in Appendix 1 were prepared in advance of the workshop for distribution to participants. SAW-8 working papers are labeled SAW-8 Working Paper # and are provisional in nature. These are not to be cited without permission of the author(s). Some SAW-8 working papers were prepared for other purposes but were included because of their relevance to the workshop agenda.

1.4. REVISION AND ADOPTION OF AGENDA

The final agenda listed in Appendix 2 was adopted by the participants during the opening session of SAW-8. Some slight modifications were necessary to accomodate speakers during the workshop.

2.0. MID-ATLANTIC FISHERY RESOURCES

2.1. Butterfish in the Gulf of Maine - Mid-Atlantic Area

Source Document: Waring, G.T. and E.D. Anderson. 1983. Status of the Northwestern Atlantic Butterfish Stock - 1983. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 83-91, 39 p.

Commercial Fishery

The USA catch of butterfish declined 56% from 4,508 mt in 1987 to 2,000 mt in 1988 (Table 2.1.1). In addition, the 1988 catch was the lowest observed since 1977 (1448 mt) and was equal to the average for 1965-1977, a period when the distant water fleet (DWF) catch accounted for a large share of the total butterfish catch. Since 1987, the DWF catches have been negligible because most of the DWF butterfish TALFF is tied directly to foreign squid allocations which have been non-existent.

Total landings (L), landings per unit effort (LPUE), and effort (f) declined 61%, 56%, and 13%, respectively, from 1987 levels during the January-June period, and 43%, 27%, and 21% below the corresponding July-December levels (Table 2.1.2). In addition, the 1988 LPUE indices are the lowest observed since 1981. Fishing effort (f) during July-December, the traditional domestic butterfish season, has been declining since 1982 (Table 2.1.2). Effort during the latter six months of 1988 (88.7 days fished) is 73% below the corresponding 1982 level (331.6). This decline in f was accompanied by an 81% decline in butterfish catch between the same two seasonal time periods.

Survey Abundance Indices

Indices of relative abundance and biomass (number and weight) from the NMFS, NEFC 1988 autumn bottom trawl survey increased 170% and 55%, respectively, from aberrantly low 1987 values (Table 2.1.3). Likewise, the recruitment index (number per tow at age 0) increased 260% (Table 2.1.3). The age 1+ index, however, declined 10%, and is the lowest index observed since

1982 (Table 2.1.3). Also, whereas the 1988 recruitment (282.3) is double the 20-year (1968-1987) average (141.1), the age 1+ (35.1), and biomass (7.3) indices are 22.3% and 5.8% below the 20-year averages (44.9, and 6.9). The decline in age 1+ abundance is attributed largely to decline in age 1 fish (Table 2.1.3). The abundance of age 2 fish (13.3) was 85% above the 1987 level and is the second highest on record (Table 2.1.3). The abundance of age 3 fish (0.2) was nearly equal to the 1987 level, and for the second consecutive year no age 4 fish were caught.

Indices of relative abundance (number and weight) for all regions combined from the Massachusetts 1988 inshore autumn bottom trawl survey reached were the highest observed during the 1978-88 time period (Table 2.1.4). These record high values follow record low 1987 indices. Overall, however, Massachusetts 1978-1988 indices do not exhibit the same yearly trends as seen in NEFC data (Figure 2.1.1). Indices of relative abundance from Connecticut surveys (Figure 2.1.1) follow yearly trends seen in the NEFC 1984-1988 data. In addition, the abundance of large butterfish was low for the second consecutive year (D. Simpson, pers. comm).

Indices of relative abundance (number) for three NEFC offshore (>27 m depth) strata sets (Waring 1986) from 1968 to 1988 were calculated to examine long-term trends by geographic region (Figure 2.1.2a). Abundance indices in each of the three regions during the 1968-1978 period, when foreign landings were relatively high, were generally lower than values observed in corresponding areas during 1979-1988 (Figure 2.1.2a). Furthermore, during the latter time period, Southern New England indices were always greater than those for Georges Bank; between 1968 and 1978, however, Georges Bank indices were greater than those for Southern New England about 50% of the time. Average bottom temperature for the three regions were similar in each of the two periods (Figure 2.1.2b). Although the sharp decline in butterfish abundance off Southern New England in 1987 has been attributed to cooler than normal bottom temperatures, there does not appear to be any direct relationships between recent increases in survey abundance indices and average bottom temperature. The 1987 mean bottom temperatures for the Southern New England and mid-Atlantic strata sets were the lowest observed since 1970 and the Georges Bank mean was the second lowest.

Total Mortality

Total instantaneous mortality (Z) rates between ages 0/1, 1/2, and 2/3 declined 13%, 39%, and 8%, respectively from 1986/87 to 1987/88 levels (Table 2.1.5). The mean Z's between ages 0/1 and 1/2 in recent years (1978/88) are below corresponding values for the previous 10-years (1968/77) (Table 2.1.5). While the Z between ages 2/3 is about one third higher in the recent time period.

Summary

The 1988 NEFC recruitment index is comparable to the high indices observed during the 1979-1981 and 1983-1985 periods, and is more than double, excluding 1971, recruitment indices observed during the 1968-1978 time period. This implies that since 1979, survival of pre-recruit sizes has increased.

The 1988 age 1+ index, however, is similar to the corresponding low post-1979 and high pre-1979 indices. Overall, this suggests that stock abundance is sufficient to support 1989 catches at levels equivalent to MSY (16,000 mt), although this may require areal and seasonal shifts in the distribution of fishing effort.

The record high 1988 Massachusetts butterfish indices followed record low 1987 levels, which were attributed to cooler than normal bottom temperatures. Butterfish are sensitive to cooling of coastal waters, as evidenced by their movement to shelf-edge waters during late autumn (Murawski and Waring 1979). However, a strong relationship between autumn temperature data and survey abundance indices has not been demonstrated.

The extremely low 1988 commercial catch is attributed to decreased availability of marketable size (Age 1+, $\geq$15 cm) butterfish on the traditional southern New England fishing grounds.

The decline in the mean Z between ages 1/2 fish since 1978 probably reflects the decline in total DWF fishing mortality. The DWF fishery on butterfish was conducted principally in winter, thus impacting on recruiting age 1 fish. The mean Z's between ages 0/1 for the two time periods are nearly identical which implies that current domestic fishing mortality rates are equivalent to historical DWF levels, assuming natural mortality, M=0.8, has remained constant over time. The slight decline in Z between ages 0/1 from 1987/88 may be attributable to a shift in the distribution of fishing effort by the domestic fleet.

Discussion

That the pattern of Z values over time is highly variable, suggests that the availability of various age groups is dependent on a number of factors including environmental variability, and that indices are affected occasionally by a single large tow. The NEFC survey, from which estimates of Z are derived, does not necessarily sample all habitats occupied by butterfish.

The 1987 NEFC survey values for age 0 fish was initially considered anomalously low due to unavailability of fish to the autumn survey; this was reconsidered with respect to the Z values associated with that year class. In the 1988 autumn survey, low abundance of age 1 fish from the 1987 cohort suggested that it was a poor year class.

Long term patterns in Z values, which are probably more robust than annual values, suggests either a shift in the fishery or a biological interaction such as a shift in predator pressure. It was noted that the decrease in Z values in recent years for younger age butterfish may be related to a decrease in fishing effort (on the smallest market categories). Furthermore, it was suggested that a linear model of age and year effects would not result necessarily in a more consistent interpretation of inter-annual variability found in Z values derived using survey data.

It was suggested that USA catches for butterfish have not reached the same levels recorded by the foreign fleets in the early 1970's due, in part, to the fishing practices employed by domestic fishermen. For example, the USA fleet does not fish southwest of Hudson Canyon during winter/spring or on Georges Bank in late summer-early autumn. Thus, they are not utilizing the same areas where foreign fleets succeeded in making high catches. Information is needed on current discard levels, particularly for the freezer trawler vessels which used mechanical graders to sort their catches. The catches of these vessels have not been sampled at sea in recent years.

Based on the change in fishing patterns since the completion of the last analytical assessment (1983), partial recruitment, overall F, and catch/landings relationships have probably changed markedly since the period of heavy foreign fishing. Thus it would be desirable to attempt a revised analytical assessment.

Table 2.1.1. Nominal catch (mt) of butterfish from Northwest Atlantic Fisheries Organization (NAFO) Subareas 5 and 6, 1965-1988.

Year	US	Foreign	Nominal Catch	Adjusted Nominal Catch[1]
1965	3,340	749	4,089	4,089
1966	2,615	3,865	6,480	6,480
1967	2,452	2,316	4,768	4,768
1968	1,804	5,437	7,241	7,241
1969	2,438	15,073	17,511	17,816
1970	1,869	9,028	10,897	14,319
1971	1,570	6,238	7,853	10,483
1972	819	5,671	6,490	13,040
1973	1,557	17,847	19,454	33,236
1974	2,528	10,337	12,865	17,993
1975	2,088	9,077	11,165	14,852
1976	1,528	10,353	11,881	16,249
1977	1,448	3,205	4,653	4,760
1978	3,676	1,326	5,002	5,375
1979	2,831	840	3,671	3,938
1980	5,356	879	6,235	6,748
1981	4,855	936	5,791	6,255
1982	9,060	631	9,691	10,483
1983	4,905	630	5,535	6,816
1984	11,972	429	12,401	16,854
1985	4,739	804	5,543	7,969
1986	4,418	164	4,582	6,166
1987	4,508	-	4,508	4,508
1988[2]	2,000	-	2,000	2,000

1 Adjusted to account for non-reported discards of countries not reporting butterfish from directed *Loligo* fishing operations (Murawski and Waring, 1979). The 1976-1986 adjusted catch incorporate estimated discards in US fishery.

2 Provisional

Table 2.1.2. International landings (L), USA LPUE (mt/day), and international effort (f) expressed as equivalent USA days fished.

	Jan. - June			Jul. - Dec.		
Year	L	LPUE	f	L	LPUE	f
1976	10164.7	2.20	4620.3	1716.3	3.69	465.1
1977	3182.4	7.66	415.5	1470.6	5.05	291.2
1978	1549.5	8.83	175.5	3452.5	8.64	399.6
1979	1562.4	7.64	204.5	2108.6	6.12	344.5
1980	1491.4	6.79	219.6	4743.6	13.05	363.5
1981	2090.2	14.16	147.6	3700.8	11.85	321.3
1982	2199.9	13.12	167.7	7490.8	22.59	331.6
1983	1467.6	12.79	115.5	4067.7	13.39	303.7
1984	6763.6	40.33	167.7	5637.4	20.91	269.6
1985	3523.5	16.07	219.3	2019.0	11.51	175.4
1986	1685.2	17.40	96.9	2896.8	17.06	169.8
1987	3113.4	20.41	152.5	1394.5	12.37	112.7
1988[1]	1202.7	9.03	133.2	798.1	9.00	88.7

1 Provisional

Table 2.1.3. Indices of relative abundance (stratified mean number per tow) for butterfish by age group, and mean weight per tow (kg) derived from NEFC autumn bottom trawl survey data, 1968-1988.

	Age							
Year	0	1	2	3	4	Total	Age 1 and Older	Weight (kg)
1968	41.28	50.59	1.64	0.10	0.	93.61	52.3	7.7
1969	39.48	18.82	2.12	0.16	0.	60.58	21.1	3.9
1970	26.43	11.24	0.86	0.10	0.	38.63	12.2	2.3
1971	208.85	8.76	0.70	0.24	0.	218.55	9.6	4.3
1972	73.20	8.34	0.31	0.05	0.	81.90	8.7	2.7
1973	119.10	27.73	1.50	0.07	0.	148.40	29.3	6.1
1974	82.13	15.96	1.74	0.37	0.	100.20	18.0	3.8
1975	26.34	17.54	1.71	0.15	0.	45.74	19.4	2.3
1976	110.63	26.50	2.12	0.33	0.	139.58	29.0	5.8
1977	47.73	32.78	6.22	0.24	0.	86.97	39.3	5.2
1978	134.96	7.96	10.18	1.05	0.	154.15	19.2	4.3
1979	231.51	73.01	4.85	0.18	0	309.55	78.1	12.1
1980	233.19	80.42	18.82	0.73	0.04	333.20	100.0	15.2
1981	234.55	47.14	12.88	0.29	0.01	294.87	60.3	7.0
1982	80.31	26.12	4.73	0.14	0.14	111.44	30.7	4.7
1983	358.77	78.49	10.70	3.25	0.07	451.28	92.5	12.8
1984	268.60	79.55	11.07	2.79	0.	362.01	93.4	11.4
1985	286.26	85.69	12.40	2.27	0.09	386.71	100.4	15.2
1986	140.16	29.75	12.19	1.96	0.33	184.39	44.3	6.8
1987	78.59	31.55	7.17	0.25	0.	117.56	39.0	4.7
1988	282.28	21.59	13.29	0.20	0.	317.36	35.1	7.3

Table 2.1.4. Butterfish autumn abundance indicies weight (kg/tow) and numbers per tow from 1978-1988 Massachusetts inshore bottom trawl surveys.

Year	Region 1	Region 2	Region 3	Region 4	Region 5	All Regions[1]
			KG/TOW			
1978	3.54	1.99	1.22	0.44	0.09	1.42
1979	2.63	0.68	0.56	0.62	0.07	0.91
1980	6.14	7.91	0.99	5.22	1.49	4.61
1981	2.33	2.37	0.38	5.76	0.02	2.43
1982	7.14	0.59	0.27	0.33	0.21	1.68
1983	5.28	1.13	1.90	1.60	0.57	2.06
1984	2.93	1.72	0.36	0.30	0.40	1.15
1985	2.02	1.42	0.60	2.03	7.48	2.77
1986	9.48	1.67	1.69	1.66	1.67	3.20
1987	1.15	0.73	0.01	0.01	0.01	0.39
1988	21.43	16.40	1.38	0.17	0.31	8.01
			NUMBERS/TOW			
1978	240.37	200.31	276.90	14.46	4.09	135.10
1979	204.04	62.91	132.60	11.93	1.46	76.11
1980	452.81	798.77	274.18	367.89	125.61	414.91
1981	160.99	143.85	92.37	114.51	5.20	104.86
1982	777.33	81.09	31.31	12.57	3.56	177.68
1983	499.39	162.42	206.89	52.59	27.06	181.12
1984	148.05	58.73	78.65	9.25	19.84	59.33
1985	217.68	116.74	153.23	72.88	163.24	140.42
1986	517.66	194.54	107.39	56.64	29.72	178.44
1987	25.56	17.58	4.12	0.47	0.07	9.50
1988	2275.76	1048.00	419.95	15.18	4.82	736.17

1 Region 1 (Buzzards Bay), Region 2 (Nantucket Sound), Region 3 (East of Cape Cod), Region 4 (Cape Cod Bay, Region 5 (Mass. Bay).

Table 2.1.5. Total mortality rates (Z) for butterfish derived from NEFC autumn abundance indices (Table 2.1.3), 1968-1988.

	AGE			
Year	0/1	1/2	2/3	3/4
1968/69	.78	3.17	2.33	-
1969/70	1.26	3.09	3.05	-
1970/71	1.10	2.78	1.28	-
1971/72	3.22	3.34	2.64	-
1972/73	.97	1.72	1.49	-
1973/74	2.01	2.77	1.40	-
1974/75	1.54	2.23	2.45	-
1975/76	.01	2.11	1.65	-
1976/77	1.22	1.45	2.18	-
1977/78	1.79	1.17	1.78	-
1978/79	.61	.50	4.03	-
1979/80	1.06	1.36	1.88	1.50
1980/81	1.60	1.83	4.17	4.29
1981/82	2.20	2.30	4.52	.73
1982/83	.02	.89	.38	.69
1983/84	1.51	1.96	1.34	-
1984/85	1.14	1.86	1.58	3.43
1985/86	2.26	1.95	1.84	1.93
1986/87	1.49	1.42	3.89	-
1987/88	1.29	0.86	3.57	-
68/77 MEAN	1.39	2.38	2.03	
78/88 MEAN	1.32	1.49	2.72	

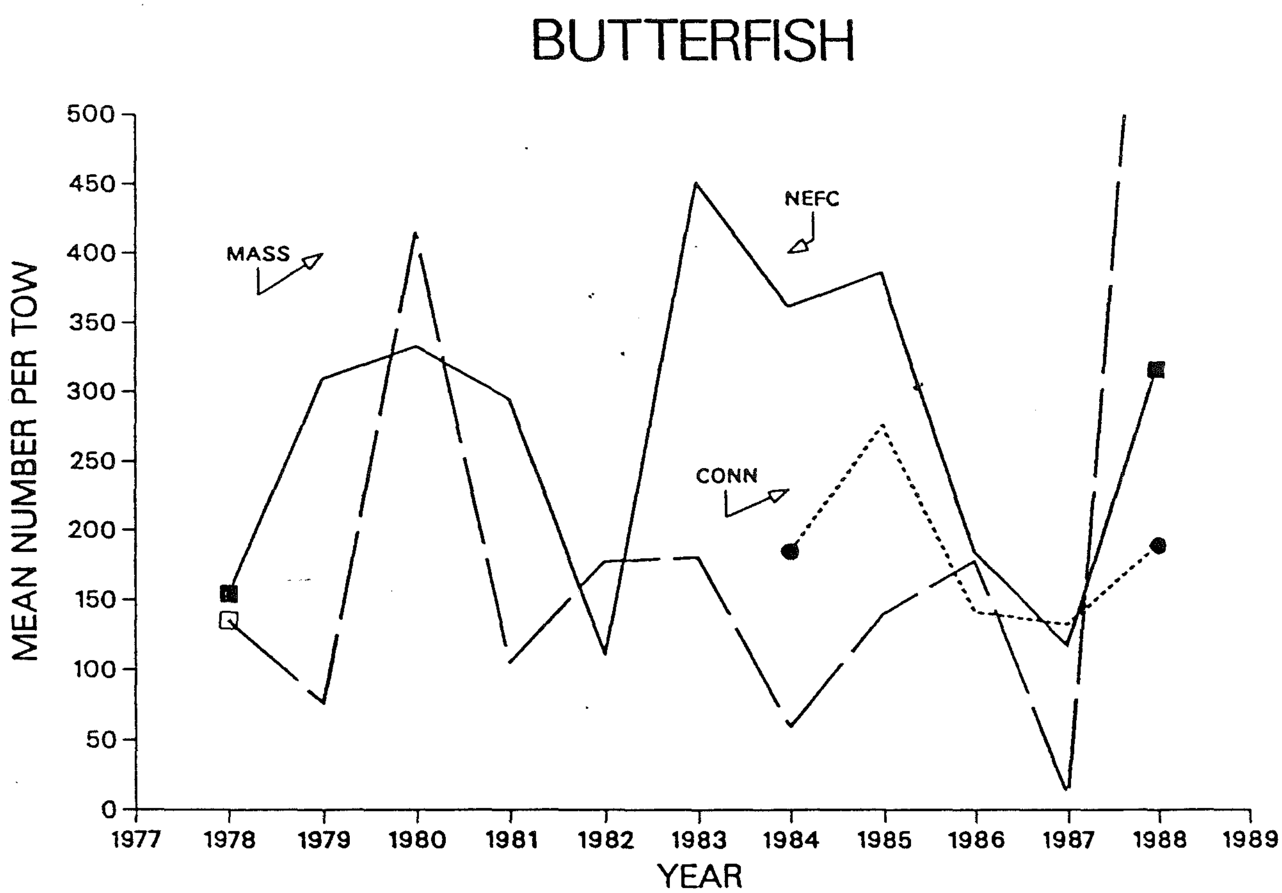


Figure 2.1.1 Butterfish abundance indices from NEFC (1978-88), MDMF (1978-88), and CDEP (1984-88) autumn bottom trawl surveys.

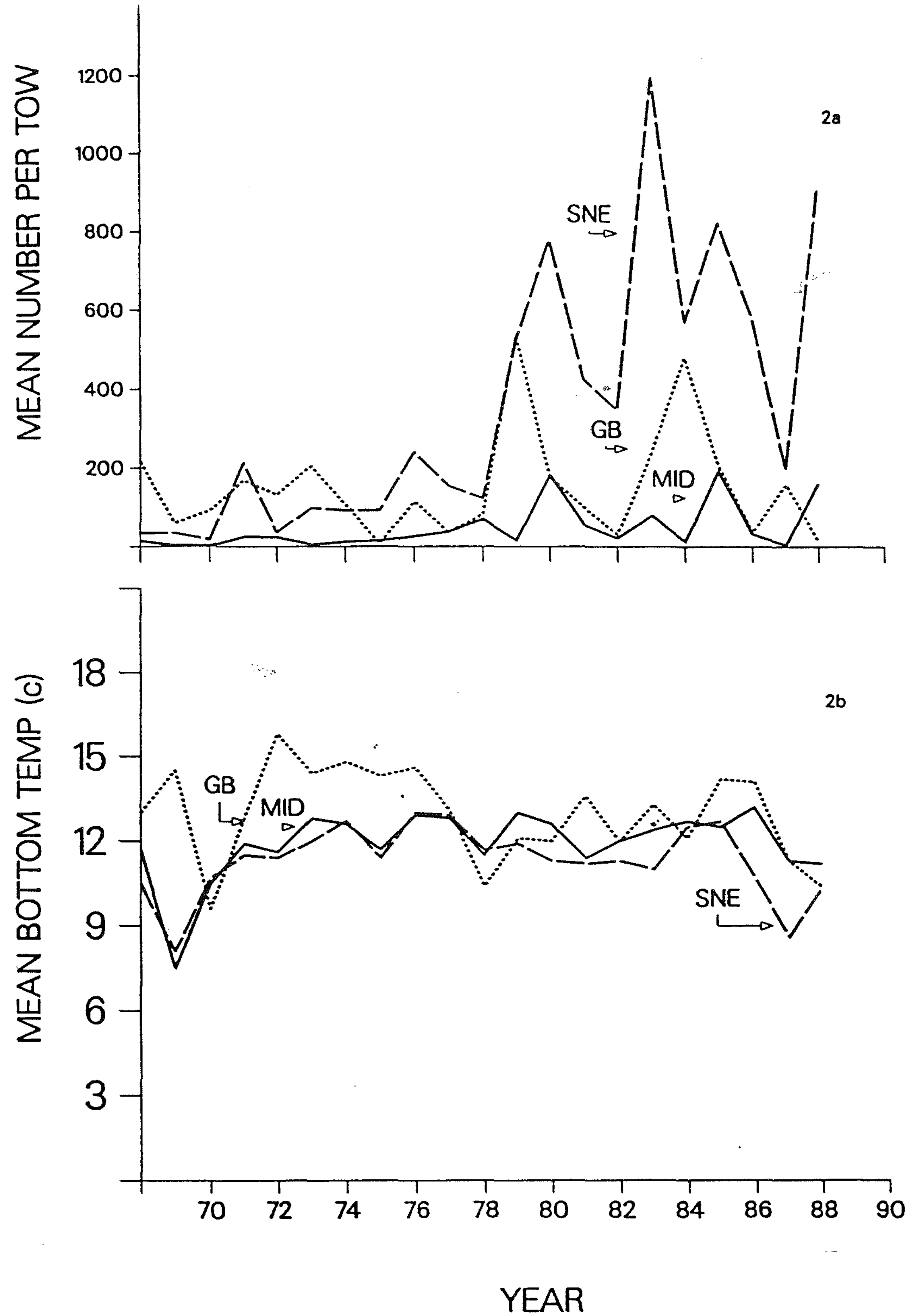


Figure 2.1.2 Butterfish abundance indices (2a) and mean bottom temperature (^{o}C) (2b) for selected NEFC autumn bottom trawl surveys, 1968-88.

2.2. Short-finned squid (Illex illecebrosus)

Source Document: Lange, A.M.T. 1984. Status of the Short-finned Squid (Illex illecebrosus) off the Northeastern USA, November 1984. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 84-38, 20p.

The Fishery

The total USA catch of short-finned squid (Illex illecebrosus) during 1988 was 1,966 mt (Table 2.2.1). The USA fishery directed at Illex was conducted entirely in Subarea 6 (Mid-Atlantic area, primarily Statistical Area (SA) 622, Figure 2.2.1) during 1988, with only 57 mt reported from Subarea 5 (primarily SA 537). The 1988 catch decreased 81% from the 1987 level (10,260 mt), and total catch was the lowest since 1981. Negligible catch (≤1 mt) was taken as bycatch in the joint venture mackerel fishery. Virtually all (96%) of the directed fishery landings were made during July-October (Figure 2.2.2), with 89% from the area south of Delaware Bay (SA 622-636). The fishery was again dominated by ton class 3 and 4 vessels (51-150 GRT and 151-500 GRT), as seen since 1982.

Length frequency data from the 1988 USA fishery in SAs 622-632 indicate presence of a single age class, with a single mode each month approximating the monthly mean. This mode ranged from about 15 cm during May, increasing to about 19 cm by September.

Catch (metric tons) per unit effort (days fished) indices from the USA directed fishery, defined as those trips where over 50% of the catch was Illex, are given in Figure 2.2.3, for 1982-88. This index is based on all otter trawl trips in SAs 622-636 (which has accounted for over 90% of landings in recent years), and reflects the relative availability of Illex to the directed fishery. CPUE in 1988 was about 50% above the 1982-87 mean, about 6% below the high 1987 level. This indicates that the dramatic decline in catch from recent levels is probably not due to reduced availability. In fact, effort directed at Illex was reduced greatly during 1988, probably due to market conditions.

Research vessel surveys

The 1988 NEFC autumn bottom trawl survey abundance index (stratified mean number per tow) for the Mid-Atlantic through Georges Bank strata was 20% below that for 1987 but was nearly twice the 1968-87 mean (Figure 2.2.4, Table 2.2.2). The pre-recruit (≤10 cm dorsal mantle length individuals) index was 57% below the 1987 index and 60% below the 1968-87 mean. Catch-per-tow indices for each of the three major strata sets were also examined separately (Figure 2.2.5). While the index was down significantly from the 1987 level in the Southern New England - Mid-Atlantic (SNE-MA) area, the value from Georges Bank was the second highest of the time series, and the Gulf of Maine value was the highest since 1980. Larger individuals are generally found in the more northern areas and the lower value in the SNE-MA area may be associated with lower abundance of pre-recruits.

No significant relationship has been found between research vessel catch-per-tow data for Illex and availability to the subsequent Illex fishery when data for all years are examined. However, highly significant results ($p<0.01$) were found for the relationship between SNE-MA mean numbers per tow for years with above average indices, and USA catches in the following year (although this relationship was influenced strongly by the 1981 index). Also, Illex abundance indices have held generally at either high or low levels for several years before exhibiting dramatic changes. Low abundance indices were seen during 1968-74, followed by high indices for 1975-81, and low indices from 1982 to 1986. Illex abundance appears to be exhibiting an increasing trend, given previous fluctuations.

Research survey and commercial fishery data have been used to evaluate the effects of environmental variability on the Illex population. However, results have been inconclusive. Stepwise regression analyses of mean catches-per-tow in weight (or number) for the autumn surveys (by area and overall) and average bottom temperatures from the autumn (Mid-Atlantic through Georges Bank strata) and spring (Mid-Atlantic strata) surveys, on USA annual catch and catch-per-unit-effort data were not significant.

Summary

Above average apparent abundance of adult Illex during the autumn 1988 NEFC research vessel survey suggests that current abundance would be adequate to provide catches during 1989 at the domestic annual harvest level (DAH) of 15,000 mt. This level is comparable to the average total landings from the fishery since the directed fishery began (1972-1988). In fact, the current stock size should support catches at a level similar to that seen during the previous period of high abundance (19,500 mt average during 1976-82). However, the ability of the fishery to take this level of catch is dependent on the availability of squid within the area of the fishery. This availability is associated with environmental and behavioral factors which are not yet fully understood. Also, the low level of catch during 1988 is attributed to market conditions which may persist during 1989.

Discussion

The increasing commercial catch-per-unit-effort values for Illex observed during a period of declining landings in recent years caused concern over potential sources of bias in the CPUE index. It was pointed out that a small number of vessels comprise most of the landings and have influenced the trends in CPUE for the whole time series.

With the apparent increases in Illex stock abundance in US waters, interest was voiced as to the changes in abundance seen over the entire shelf, e.g., including Nova Scotia and Newfoundland. No data were available at this time, but anecdotal information indicated that no changes in abundance have been seen in Nova Scotia, and that catches there remain low.

Concern was raised over the 1987 survey abundance index for Illex in light of the problems in interpreting indices for other species (specifically Loligo squid) during that year. Because the survey index was not in conflict with the CPUE data for Illex it is considered to be accurate.

Although the 1988 southern New England-Mid Atlantic survey index indicates a decline in abundance contrary to the commercial CPUE values for that area, the Georges Bank index increased dramatically. The aggregate survey index appears to be a better index of abundance than the individual area indices, because it can better account for variability in timing of migration across the area relative to variability in timing of the survey from year to year. Temperature appears to an important environmental factor influencing the migration timing, but the survey timing is not sensitive to inter-annual variation in temperature. It was suggested temperature effects be examined further.

Table 2.2.1. Annual short-finned squid landings (in metric tons) from the Northwest Atlantic (Cape Hatteras to Gulf of Maine) by USA and the distant-water-fleet (DWF), 1963-88.

Year	USA	DWF	Total
1963	810	0	810
1964	358	2	360
1965	444	78	522
1966	452	118	570
1967	707	285	992
1968	678	2,593	3,271
1969	562	975	1,537
1970	408	2,418	2,826
1971	455	159	614
1972	472	17,169	17,641
1973	530	18,625	19,155
1974	148	20,480	20,628
1975	107	17,819	17,926
1976	229	24,707	24,936
1977	1,024	23,771	24,795
1978	385	17,310	17,695
1979	1,780	15,742	17,522
1980	349	17,529	17,878
1981	631	14,723	15,354
1982	5,902	12,350	18,252
1983	9,944	1,776	11,720
1984	9,547	676	10,223
1985	4,997	1,053	6,050
1986	5,176	250	5,422
1987	10,260	0	10,260
1988	1,966	1	1,967

Table 2.2.2. Short-finned squid abundance and pre-recruit indices from NEFC autumn surveys, 1968-88.

Year	Mean Number per tow[1] Total	Pre-recruit	Pre-recruit[2] ratio
1968	2.3	0.6	0.26
1969	0.8	0.3	0.38
1970	3.4	0.2	0.06
1971	1.9	0.6	0.32
1972	3.5	1.8	0.51
1973	1.3	0.3	0.23
1974	3.0	2.1	0.70
1975	12.4	9.6	0.77
1976	28.7	0.6	0.02
1977	15.8	1.1	0.07
1978	28.4	5.1	0.18
1979	32.1	2.6	0.08
1980	17.0	0.7	0.04
1981	54.8	0.5	0.01
1982	4.3	1.0	0.23
1983	2.8	0.2	0.07
1984	6.4	0.4	0.06
1985	2.0	0.3	0.15
1986	3.2	0.5	0.16
1987	30.0	1.4	0.05
1988	24.0	0.6	0.03
1968-87 mean	13.6	1.5	0.11

1. Stratified mean number per tow of all size individuals (total) and of pre-recruits ($\leq$10 cm), Mid-Atlantic to Georges Bank.

2. Ratio of pre-recruits to total mean numbers per tow.

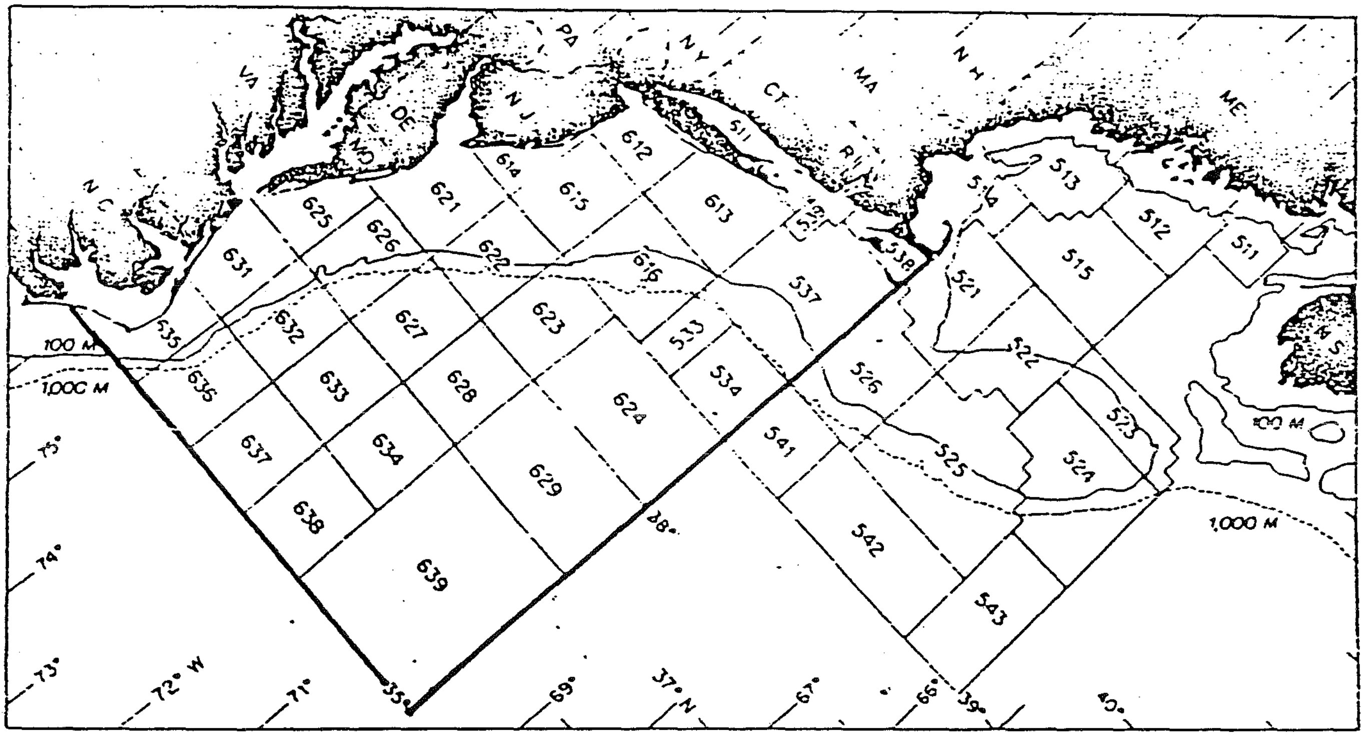


Figure 2.2.1 Statistical reporting areas for fishery data off the Northeastern USA.

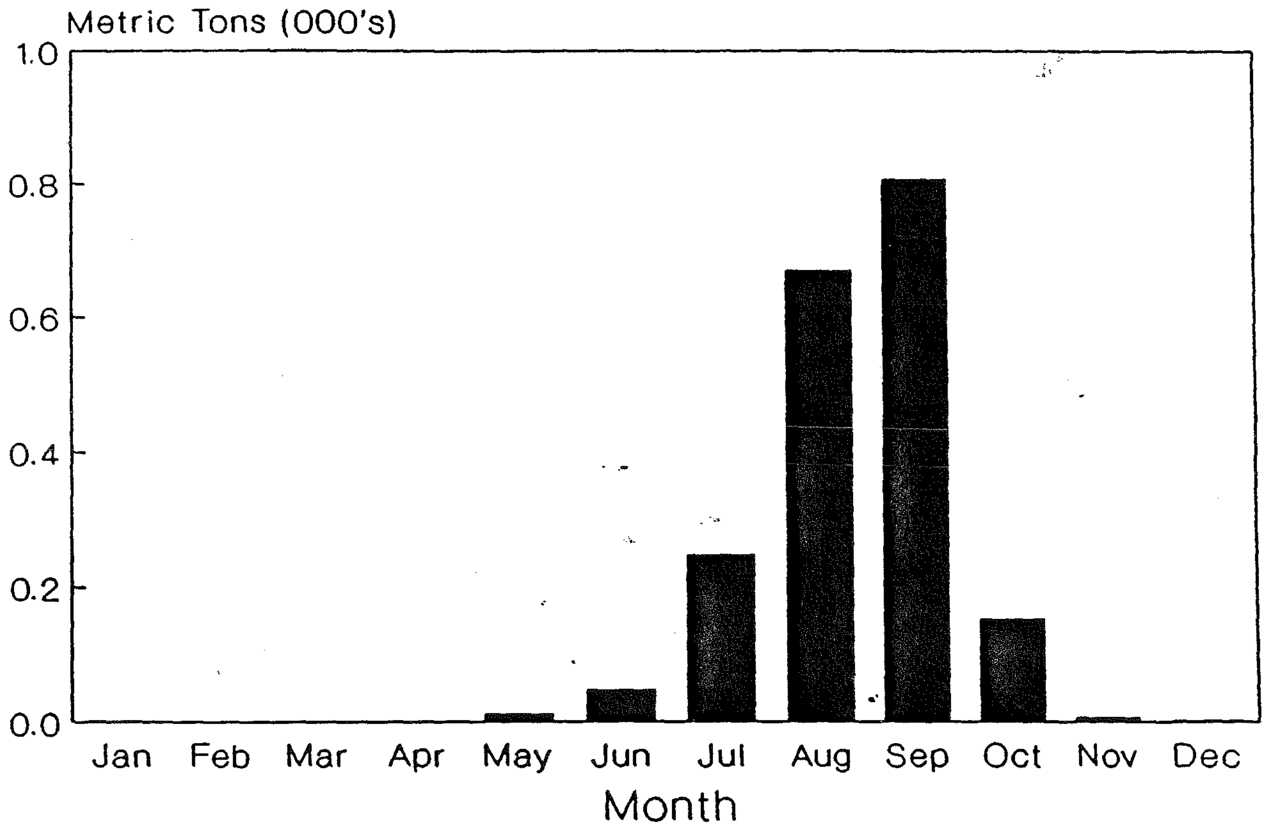


Figure 2.2.2 Monthly catches of short-finned squid in the USA domestic fishery during 1988.

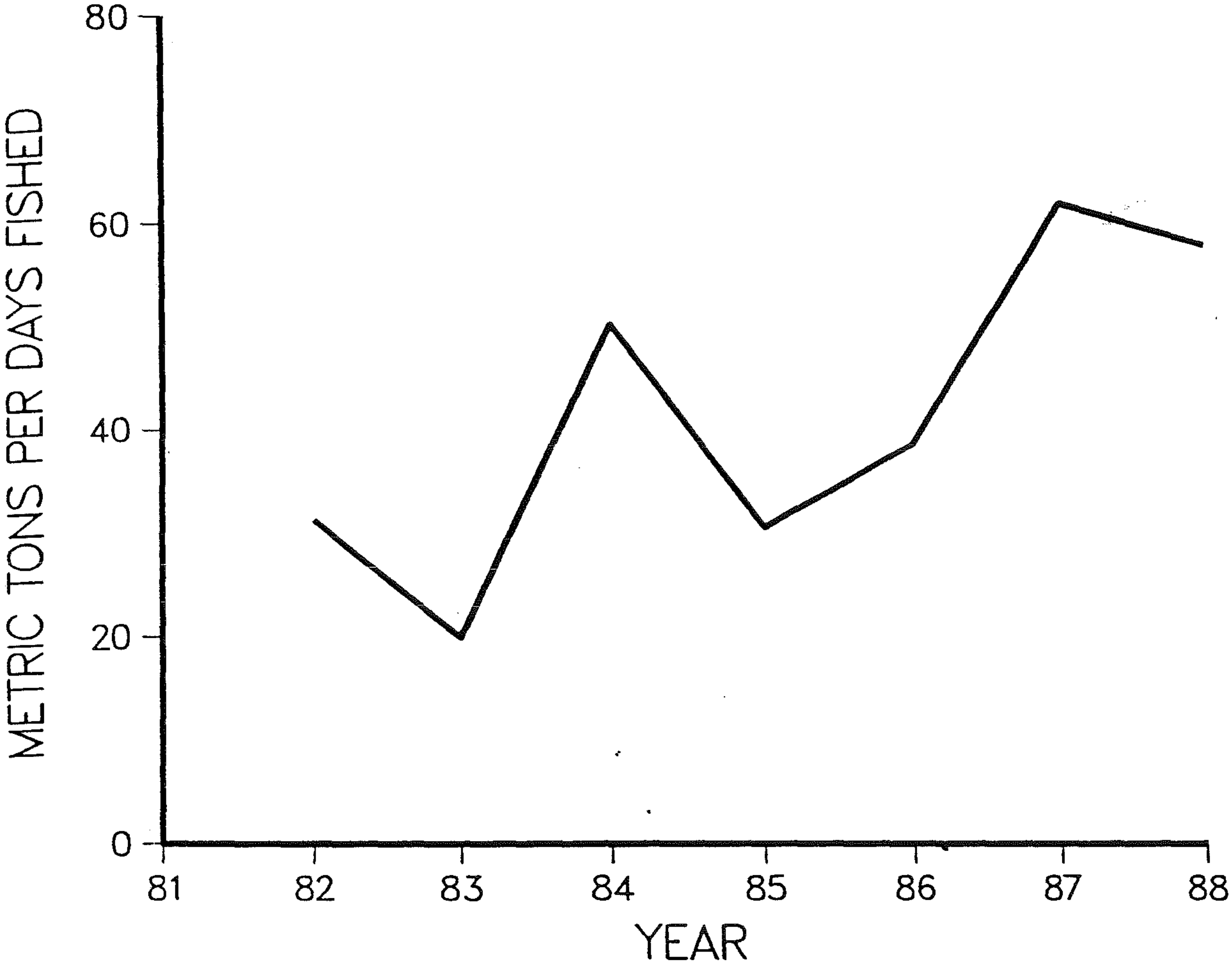


Figure 2.2.3 Catch-per-unit-effort (CPUE) of short-finned squid in the directed USA fishery (where the directed fishery id defined as all trips where squid accounted for over 50% of the total trip catch).

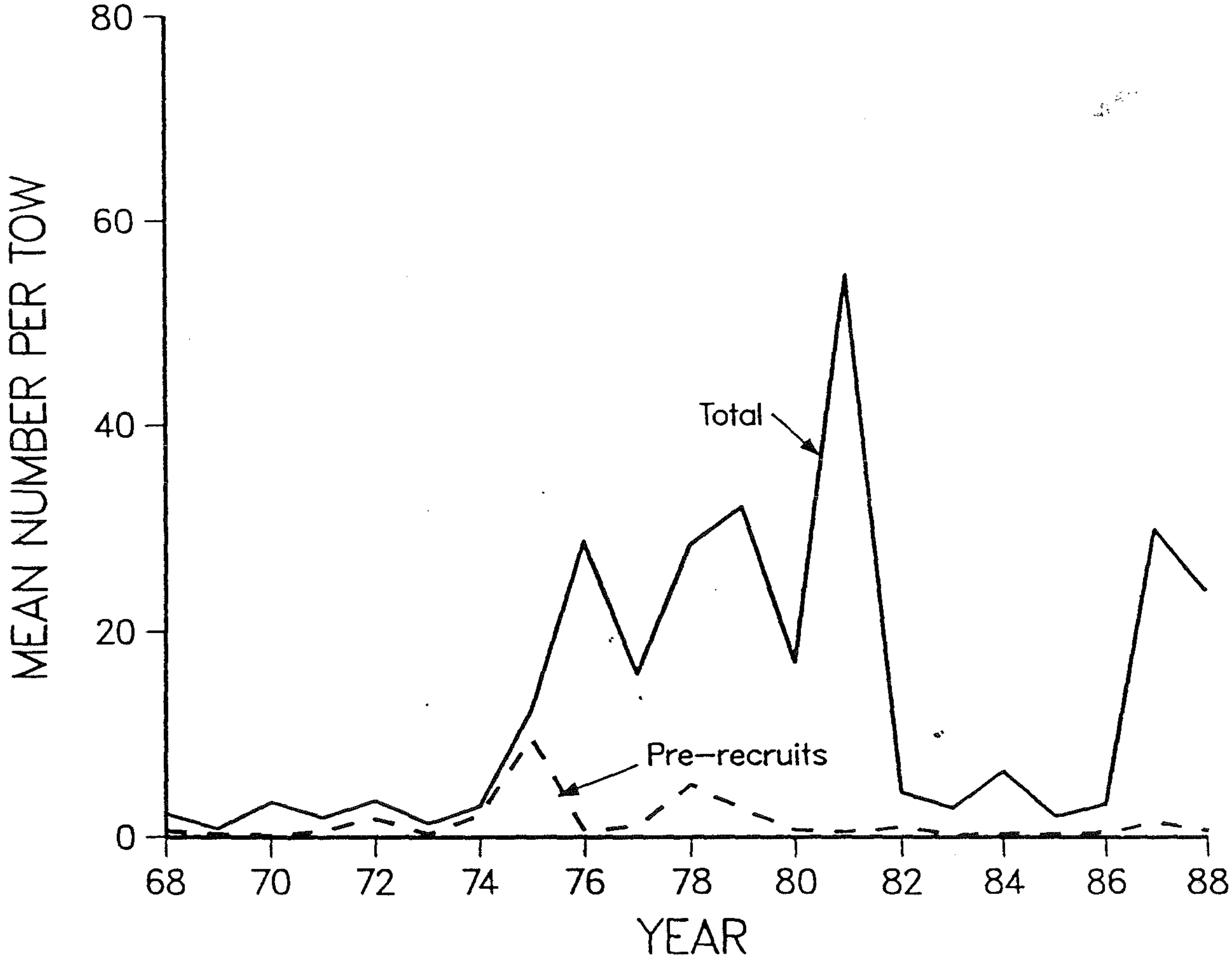


Figure 2.2.4 Total and pre-recruit (<10 cm dorsal mantle length) indices (mean catch in numbers, per tow) for the short-finned squid from the autumn NEFC bottom trawl survey.

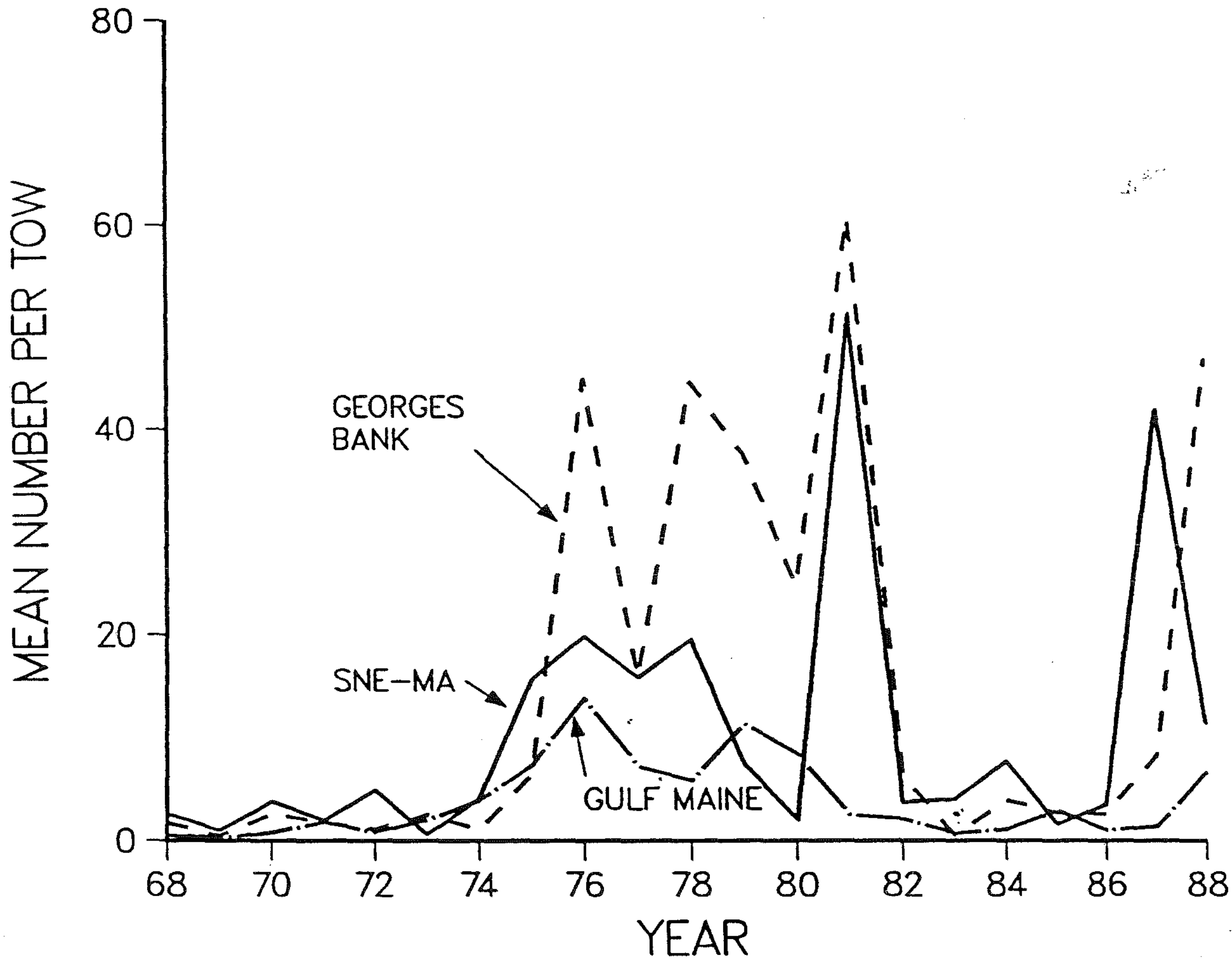


Figure 2.2.5 Stratified mean numbers-per-tow of short finned squid from the NEFC autumn bottom trawl surveys by area (Southern New England - Mid-Atlantic, Georges Bank, and Gulf of Maine.

2.3. Long-finned squid (*Loligo pealei*)

Source Document: Lange, A.M.T. 1984. An Assessment of the Long-finned Squid Resource off the Northeastern United States - Autumn 1984. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 84-37, 24p.

The Fishery

The USA *Loligo* catch in 1988 was taken primarily in Subarea 5 (55% or 10,541 mt), with 8,055 mt (42%) taken in Subarea 6 (the mid-Atlantic area primarily south of Long Island, to Hudson Canyon). An additional 474 mt was reported from unspecified areas and about 3 mt were reported as bycatch in mackerel joint venture fisheries. The total domestic harvest of 19,072 mt represented a 66% increase over the 1987 landings (Table 2.3.1). Domestic landings were distributed throughout the year with high catches during May-July, peaking in May (Figure 2.3.1). The fishery continued to be dominated by 50-150 GRT vessels, as has been the case since 1978. Most of the directed catch (defined as catch from those trips for which squid accounted for over 75% of the total) prior to 1984 was attributed to the inshore fishery in Vineyard and Nantucket Sounds (Statistical Area, SA 538, Figure 2.3.2). Since 1984, the directed catch in SA 537 (offshore, southern New England) has accounted for between 28% and 66% of the directed catch. Catches in SAs 611-616 (off New York and New Jersey), which had generally accounted for less than 20% of the US catch, have increased to account for 34% in 1986, 46% in 1987, and 32% in 1988. The distant-water-fleet (DWF) fishery (directed at mackeral) was allocated a small by-catch during 1988 and took only 3 mt.

Commercial Length Frequencies

Length frequency data from the 1988 USA fishery in the Southern New England and Mid-Atlantic areas indicate that the fishery was dominated by a single size class in most months. The bulk of the catch between January and September consisted of 12 cm to 25 cm individuals with significant numbers over 20 cm taken in most months. This is similar to the size distribution seen in past years.

Commercial Catch-per Effort

Catch-per-unit-effort (CPUE, metric tons per day fished) indices from the USA directed otter trawl fishery (as defined above) in areas 537-636, are given in Figure 2.3.3 for 1976-88. This index is based on all directed otter trawl trips in Subareas 5 and 6, and reflects the relative availability of *Loligo* to the directed fishery. The 1988 index reflects a 6.7% increase in CPUE over the 1987 index, and is the second highest since 1976.

Research Vessel Surveys

Minimum biomass (kg) and abundance (numbers) estimates, based on areal expansion of stratified mean weights and numbers per tow from the autumn NEFC bottom trawl surveys, are provided in Table 2.3.2. These estimates assume

100% catchability of *Loligo* during daytime, and account for off-bottom movements during the night. The 1988 biomass estimate represents the median of the time series, about 10% below the mean. The abundance estimate, however, was about 21% above the mean (1968-87).

The 1988 NEFC autumn bottom trawl survey abundance indices (stratified mean number per tow) for the Mid-Atlantic through Georges Bank strata were the fourth highest of the series (1967-87). Total abundance was 46% above the 1968-87 mean (Table 2.3.3, Figure 2.3.3), while the pre-recruit ($\leq$ 8 cm dorsal mantle length individuals) index was 39% above the 1968-87 mean.

An alternative index derived from the survey data (the proportion of zero tows (PZ)) was negatively correlated (p=0.015) with the subsequent availability of *Loligo* to the inshore fishery, and was shown to be independent of stock abundance (Lange 1987). The 1988 index (PZ=0.14) was the highest (indicating a higher proportion of tows which took no squid) since 1982, and similar to the 1987 index, but 30% below the 1976-1986 mean. If the relationship holds for the 1988 index, availability (CPUE) to the domestic fishery in 1989 should be above the historic average and comparable to that seen in 1988.

The State of Massachusetts research survey stratified mean number-per-tow index for *Loligo* for autumn 1988 was about 47% above the 1980-87 average (559.5 vs 381.1 squid per tow, Table 2.3.4). Catch rates in all areas except Nantucket Sound and Massachusetts Bay were well above average.

Prospects for 1989

Total abundance during the 1988 NEFC autumn survey based on daytime tows was 2.3 billion. Pre-recruits accounted for 77.4% of the total (1.75 billion). If 55% of the pre-recruits are from the spring cohort, and catchability is 45% (Lange 1984), 2.14 billion [1.75·(0.55/0.45)] recruits are estimated from that cohort. The autumn cohort is assumed to contribute additional recruits equivalent to about 18% (on average) of those from the spring cohort (0.39 billion). Total recruitment from the 1988 year class is therefore estimated to be 2.53 billion.

Table 2.3.5 contains estimates of potential yield of *Loligo* from the 1988 year class, assuming 2.53 billion recruits, for an offshore/inshore and an inshore fishery and a range of fishing mortality rates. The nature of the current fishery probably falls somewhere between these two models. Lange et al. (1984), assuming a moderate stock-recruitment relationship, found the highest equilibrium yield associated with an F of 0.70, while actual F levels have probably been around 0.4 or less. Yields, during 1989, from the 1988 year class at an F level 0.70 would be expected to range between 35,000 and 41,000 mt (between 29,000 and 33,000 mt at an F level of 0.4).

Environmental Considerations

Loligo migrate extensively, moving inshore in spring and summer and offshore to deep waters during autumn and winter. The timing and extent of these seasonal migrations are assumed to be related, at least in part, to temperature preferences of this species. Regression analysis indicates that about 77% of the variation in *Loligo* mean catch-per-tow (autumn surveys, Mid-Atlantic through Georges Bank areas, 1976-86) may be accounted for by changes in bottom temperature ($p \leq 0.001$). Lange and Waring (1988) found that in the Mid-Atlantic and southern New England areas, mean temperature of capture (mean temperature weighted by the catch in number) for large *Loligo* during autumn (1976-85) was 13.3 °C (s.d. 3.31) and for small (≤8 cm) *Loligo* 15.8 °C (s.d. 3.45). Mean temperature of capture for large *Loligo* during autumn 1988, 12.2 °C, was within 1 s.d. of of the expected, while small *Loligo* were taken in generally colder (10.8 °C) then expected waters.

The 1987 autumn survey indices were the lowest of the time series and it was theorized that a massive cold pool, present in the southern New England - Mid-Atlantic area during the time of that survey, may have reduced availability of *Loligo* to the survey trawl (NEFC 1988). Whatever the cause of the aberrant 1987 survey indices, availability to the 1988 fishery apparently was not affected.

Summary

Above average apparent abundance of both adults and pre-recruits during the autumn 1988 NEFC research vessel survey suggest that current abundance of *Loligo* is adequate to provide catches, during 1989, of between 29,000 and 33,000 mt, even at F levels below those expected to produce the highest equilibrium yield. In fact, catches of *Loligo* by the USA in its winter offshore fishery were over 3 times the above average level of 1988 for the first three months of the year, indicating reasonable availability of the stock, though the effort associated with these catches is not known. Over 40% of the domestic annual harvest (DAH) established in the 1989 Annual Specifications for the Fishery Management Plan (22,000 mt) was taken in the first three months of the fishery. If interest in the fishery continues it is likely that DAH will be reached before the end of the year.

Discussion

It was noted that *Loligo* catches in Massachusetts waters south of Cape Cod are an important part of the fishery. These catches are reported to be adversely influenced by the prevalence of Easterly winds during the time of the fishery, as occurred in 1987. These winds did not prevail in 1988 and catches were fairly high in that year. It was suggested that environmental interactions such as wind effects should be considered when determining CPUE indices, and that it may be useful to involve the Environmental Processes Division of NEFC in analysis of this possibility.

Judging from past landings patterns, the early 1989 landings suggest the potential for record catches. It was judged unlikely that catches would dramatically exceed previous years because of limitations in the structure of the market.

It was noted that larger processing trawlers have applied for permits to fish for *Loligo* in inshore Massachusetts and New York waters. The fishing power of these vessels has yet to be determined. The commercial CPUE will probably not be consistent over time as more larger vessels enter the fishery and it may be necessary to approach the computation of the index differently in the future.

It was noted the data on stock biomass and abundance in numbers were not always in agreement, suggesting that the mean weight fluctuated greatly over years. It was pointed out that factors for weighting night catches to equate to day catches differed for catch in numbers (factor 2.7) and weight (factor of 18), and that different numbers of day and night tows between years could account for this source of noise in the data. It was suggested day-night catch rates should be investigated further.

Table 2.3.1. Annual long-finned squid catches (in metric tons) from the Northwest Atlantic (Cape Hatteras to Gulf of Maine) by the USA[1] and the distant-water-fleet (DWF), 1963-88.

Year	USA	DWF	Total
1963	1,294	0	1,294
1964	576	2	578
1965	709	99	808
1966	772	226	948
1967	547	1,130	1,167
1968	1,084	2,327	3,411
1969	899	8,643	9,542
1970	653	16,732	17,385
1971	727	17,442	18,169
1972	725	29,009	29,734
1973	1,105	36,508	37,613
1974	2,274	32,576	34,850
1975	1,621	32,180	33,801
1976	3,602	21,682	25,284
1977	1,088	15,586	16,674
1978	1,291	9,355	10,646
1979	4,252	13,068	17,320
1980	3,996	19,750	23,746
1981	2,316	20,212	22,528
1982	5,464	15,805	21,269
1983	15,943	11,720	27,663
1984	11,592	11,031	22,623
1985	10,155	6,549	16,704
1986	13,292	4,598	17,890
1987	11,475	2	11,477
1988	19,072	3	19,075

[1] Includes joint venture catches made by USA catcher vessels.

Table 2.3.2. *Loligo pealei* minimum biomass (metric tons) and abundance (numbers, in millions) estimates[1] for the Mid-Atlantic to Gulf of Maine, from autumn NEFC bottom trawl surveys, 1968-88.

Year	Biomass	Abundance
1968	29,114	1,212
1969	48,055	2,393
1970	19,640	1,946
1971	14,050	1,106
1972	21,039	1,533
1973	44,252	3,092
1974	46,442	4,757
1975	48,636	7,789
1976	51,436	4,372
1977	27,421	3,157
1978	18,800	1,251
1979	19,333	2,114
1980	34,275	9,314
1981	24,345	3,411
1982	26,527	2,303
1983	62,363	4,460
1984	66,122	4,670
1985	55,612	4,865
1986	47,029	3,139
1987	8,363	689
1988	31,895	4,260

[1] From areal expansion of stratified mean weights (kg) and numbers per tow assuming 100% catchability during daytime. Nighttime catch data were expanded to account for diel differences in catch.

Table 2.3.3. Total and pre-recruit ($\leq$8 cm) stratified mean numbers per tow[1] of *Loligo pealei*) from the NEFC autumn bottom trawl surveys (Mid-Atlantic to Georges Bank), 1967-88.

Year	All sizes	Pre-recruits
1967	134.5	126.9
1968	176.5	159.9
1969	237.3	217.4
1970	85.6	79.3
1971	163.3	161.5
1972	271.4	258.5
1973	372.0	353.9
1974	251.7	233.3
1975	614.4	593.3
1976	410.9	302.5
1977	388.5	297.7
1978	144.2	93.4
1979	193.7	156.5
1980	364.1	279.8
1981	226.2	161.8
1982	310.4	256.6
1983	373.4	251.1
1984	299.8	152.2
1985	442.2	310.8
1986	453.0	360.4
1987	56.7	32.0
1988	413.7	320.0

1 Stratified mean number per tow of all sizes and of individuals $\leq$ 8 cm mantle length.

Table 2.3.4. Massachusetts State research vessel survey catch-per-tow indices by area, in numbers, 1980-88.

	Area				
Year	Buzzards Bay	Nantucket Sound	East of Cape Cod	Cape Cod Bay	Mass. Bay
1980	402.1	580.0	140.9	150.4	19.2
1981	379.9	365.6	301.3	216.5	186.3
1982	868.4	851.4	477.3	988.8	6.0
1983	476.9	438.5	90.9	695.8	244.4
1984	209.2	147.8	194.9	128.3	11.9
1985	445.5	1010.7	684.2	747.6	274.4
1986	919.5	359.8	610.7	103.7	29.3
1987	546.6	584.9	138.3	232.4	0.4
1988	1,229.4	349.9	642.3	596.7	19.7
Mean (1980-87)	531.0	542.3	329.8	407.9	96.5

Table 2.3.5. Estimated yield (in metric tons) of long-finned squid associated with various levels of fishing mortality and the 1988 recruitment level of 2.53 billion individuals for the offshore/inshore and inshore fisheries (assuming a moderate stock-recruitment relationship).

F	Offshore/Inshore	Inshore
0.27	22,500	24,900
0.41	29,400	33,300
0.55	33,800	38,600
0.70	35,300	41,500
0.93	32,600	46,600

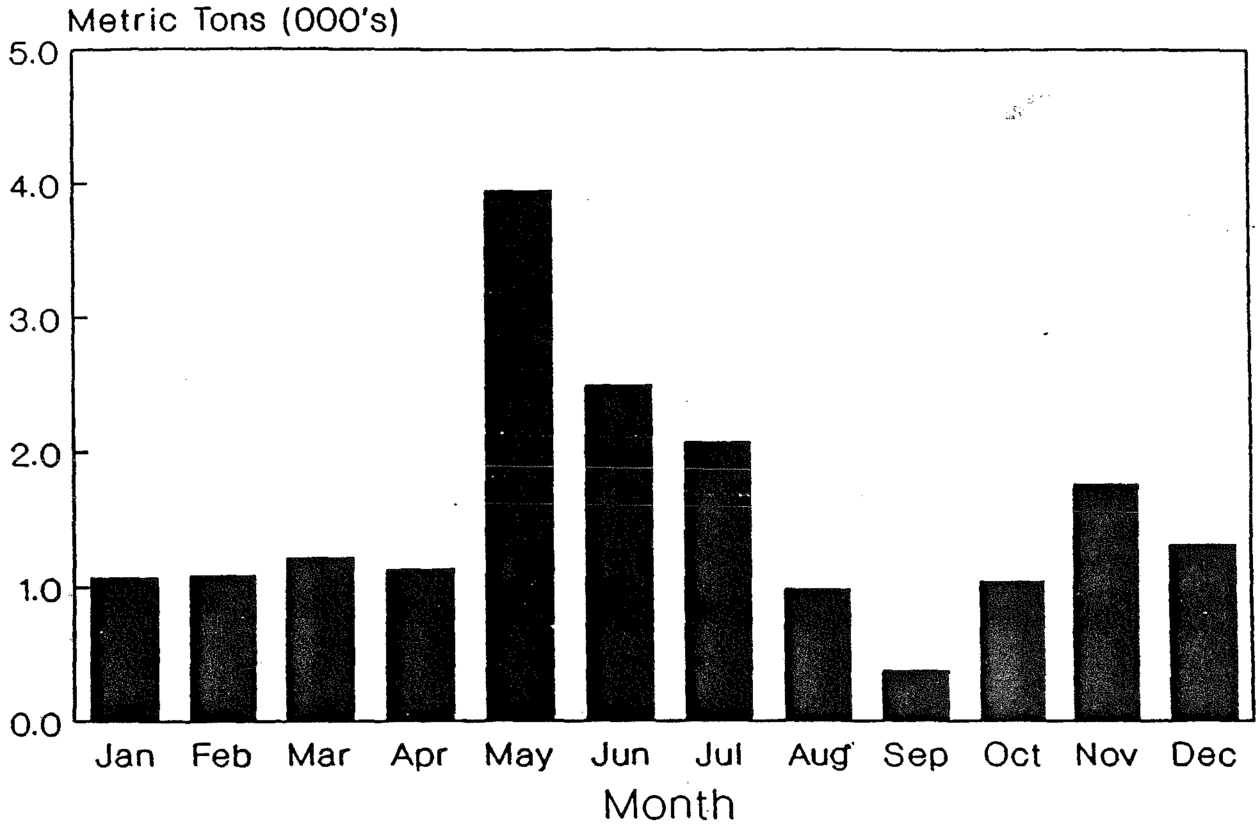


Figure 2.3.1. Monthly landings (metric tons) of long-finned squid in the USA fishery during 1988.

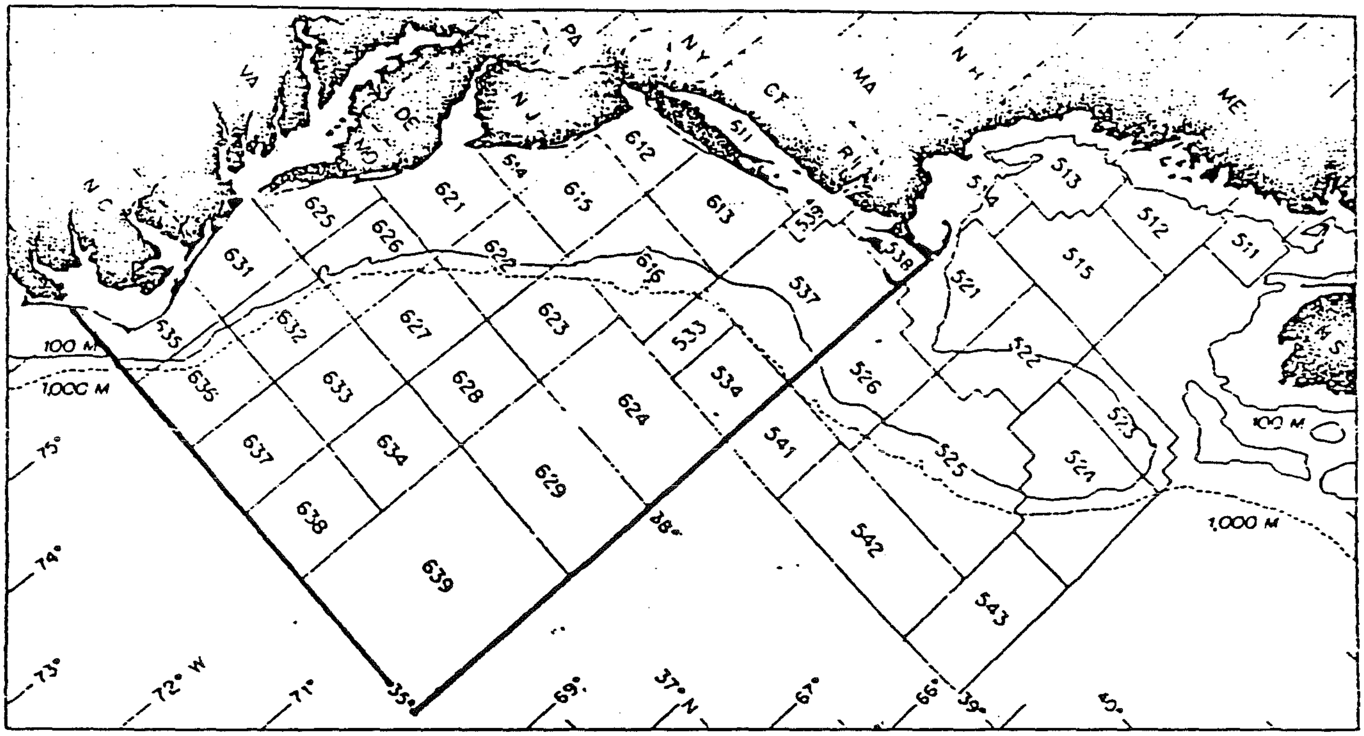


Figure 2.3.2 Statistical areas of the Northwest Atlantic used to report catch locations.

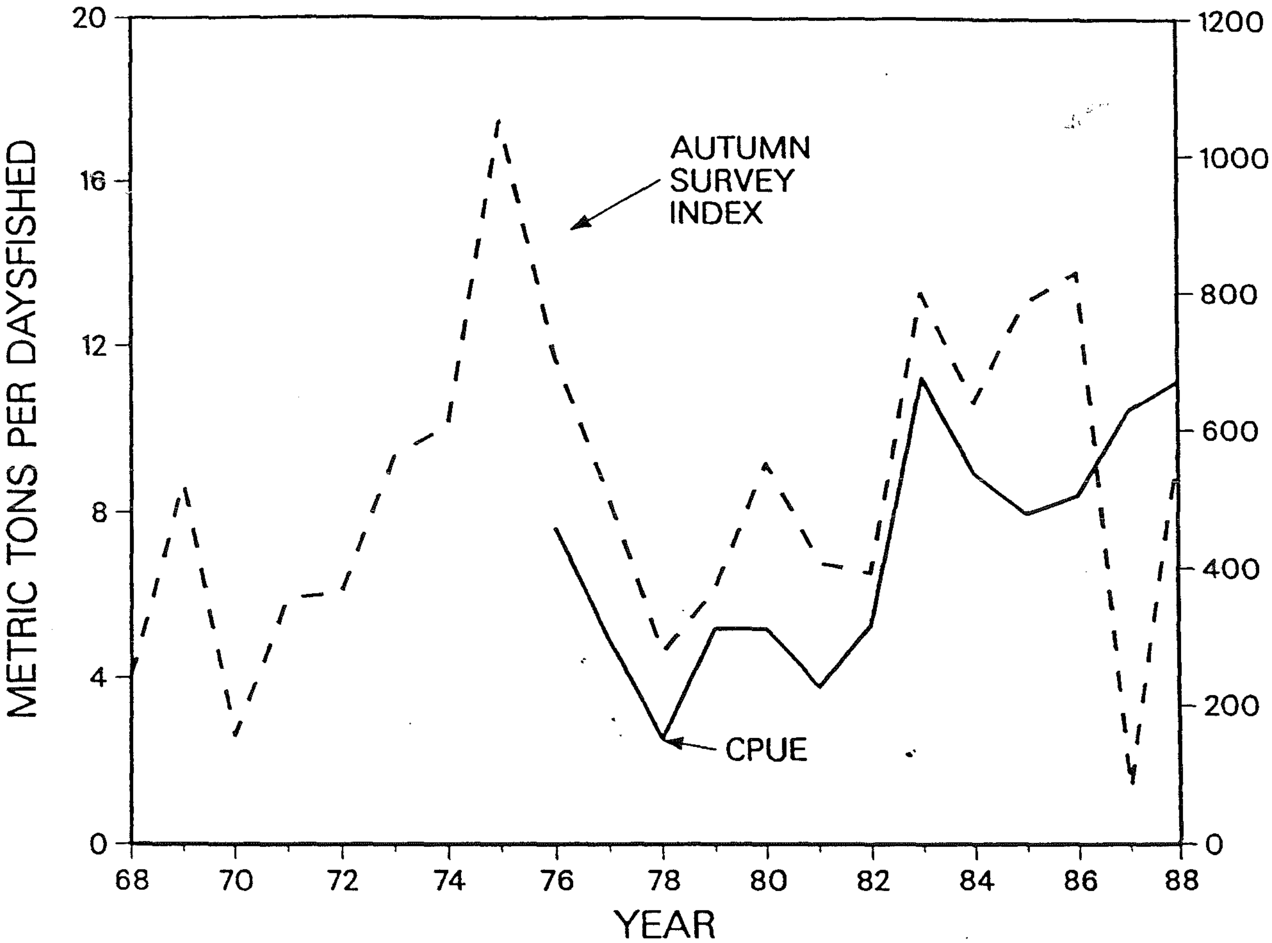


Figure 2.3.3 Commercial USA catch-per-unit-effort (CPUE) of long-finned squid in the directed fishery (otter trawl trips in all areas where squid comprised over 75% of the trip catch), and NEFC autumn bottom trawl survey stratified mean catch-per-tow (numbers) indices.

2.4. Mackerel Projection 1989

Source Document: Overholtz, W.J. and B. Parry. 1986. Update of the Status of the Northwest Atlantic Mackerel Stock for 1986. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 86-13, 15p.

Total stock biomass (ages 1 and older) of Atlantic mackerel from the Northwest Atlantic stock has increased steadily from an average of 485,000 mt in 1977-1981 to about 2.0 million mt at the beginning of 1988. Spawning stock biomass has also increased from about 600,000 mt in 1981 to 1.8 million mt in 1988. Stock rebuilding has occurred since the early 1980's because fishing mortality has been very low, averaging about 0.05 since 1980. Several large year classes (1981,1982,1984,1985) have also recruited to the fishable stock during this time period. The 1982 year class, the largest in the time series (6.2 billion fish), comprised a million mt of biomass in 1988. Given the current status of this stock and the low catches that are occurring at present, forecasts of $F_{0.1}$ catch and spawning stock size will be useful over the next several years, even if annual catch at age information is not available.

Data from the previous assessment (August 1988) were used to forecast mackerel catch and abundance for the coming year. A set of projected catches and spawning stock sizes under several assumptions of fishing mortality (F) including an estimate of $F_{0.1}$ catch for 1990 and corresponding spawning stock size for 1991 were completed (Table 2.4.1). In addition forecasts of catch, total stock size and spawning stock size for 1990-1993 under $F_{0.1}$ and arbitrary constant catch strategies are presented in Tables 2.4.2 and 2.4.3.

Discussion

A lengthy discussion ensued over the reliability and adequacy of the forecast given that no new catch at age data for 1988 had been used in the update. The low F that results from high stock levels and low catches makes it very difficult to tune the VPA. Even if 1988 catch at age data were input, short term implications of a new assessment would not change, because of high spawning stock biomass, high recruitment, and low F. NEFC is continuing to collect and archive data. The quality of the Canadian assessment is subject to the same limitations as the USA assessment without the 1988 data.

The discussion then focused on the pros and cons of performing a forecast instead of a new assessment for this fishery. There some was concern that the forcasting approach led to excessive apprehension in providing management advice, and that data from the forecast were inadequate to make management decisions (ie. setting the TALFF). In fact, the reported stock size was not reflected in recent catches by fisherman in the Hudson Canyon to Chincoteaque area. There were also concerns voiced an the assumption of year class strength.

It was pointed out that there could be problems if forecasts are made for the next 3 years based on an assumed year class strength. We should know how much of the catch and spawning stock biomass is made up of the assumed year classes. Density dependent problems could also have an effect on the next assessment.

In contrast, the forecast was supported since F continues to remain low, and results presented in the 1985 assessment have not changed. Foreign catches for 1989 equalled roughly 37,000 mt through April compared with 43,000 mt for the same period in 1988, and domestic catches have consistently increased over the last several years. Catch from the very large 1982 year class has averaged about 100 million fish annually since 1984, and year class strength was about 6.2 billion fish at age 1 for this cohort. The biomass of the 1982 year class was estimated to be about 1.0 million mt at the begining of 1988. Because of the high stock level, it seems inconsistent for the TALFF to be set so low. The inability of fisherman to locate mackerel may be due to changes in distribution or other factors, but are not likely due to declines in stock size.

Questions arose regarding the timing of a new assessment. Some felt it was warranted now given the concerns mentioned above, but this opinion was not shared by all participants. Criteria that may warrant a new assessment would be an increase in F (double or triple) or increased growth rates (indicating a decrease in population size). An increase in F would also provide a basis for tuning the VPA. Recent analyses suggest that year class size and adult biomass together determine growth. Growth rates, which seem to be a measure of stock status, could be monitored by tracking size at age over the next several years.

These issues were explored further during the workshop in an as hoc working group. (See Section 4.4).

Table 2.4.1. Projected catch of mackerel in 1990 in NAFO SA 2-6 and accompanying fishing mortality (F 3+) with spawning stock biomass (SSB) in 1991 along with percent change from 1990 SSB. These forecasts assume a 1989 catch of 75,000 mt and recruitment of 800 million fish for the 85-90 year classes at age 1 respectively.

F	CATCH 90 (000's mt)	SSB 91 (000's mt)	% change in SSB from 1990 (1,477)
0.05	77	1,483	+0.4
0.10	150	1,420	-3.9
0.15	220	1,361	-7.9
0.20	286	1,304	-11.7
0.25	350	1,249	-15.4
0.29*	399	1,208	-18.2
0.35	469	1,148	-22.3

*$F_{0.1}$

Table 2.4.2. Projected catch, total stock and spawning stock (mt) for 1990-93 under a $F_{0.1}$ management strategy. These forecasts assume a 1989 catch of 95,000 mt and recruitment of 800 million fish for the year classes at age 1.

Year	$F_{0.1}$ Catch 000's mt	Total Stock Biomass 000's mt	SSB 000's mt
90	399	1,886	1,477
91	315	1,570	1,208
92	279	1,289	1,050
93	215	1,159	877

Table 2.4.3. Projected catch, total stock and spawning stock (mt) for 1990-93 under an arbitrary sustained catch strategy. These forecasts assume a 1989 catch of 75,000 mt and recruitment of 800 million fish for the 85-92 year classes at age 1.

Year	Catch 000's mt	Total Stock Biomass 000's mt	SSB 000's mt
90	200	1,886	1,477
91	200	1,734	1,378
92	200	1,534	1,281
93	200	1,444	1,154

3.0. SPECIAL TOPICS

3.1. Recent Temperature Trends on the Northeast Continental Shelf

The Northeast Fisheries Center maintains four major temperature data bases:

1. Trawl Survey - these are surface and bottom temperature observations made at trawl stations during the spring and fall trawl surveys (1963 to present). The data are part of the survey data base and are available on the VAX computer.

2. MARMAP - these are from hydrographic casts which measured temperature and salinity through the water column at standard MARMAP station locations. The MARMAP program had over 180 standard stations on the continental shelf which were occupied 3-6 times per year from 1977 to 1987. Hydrographic observations were made on 49 cruises during this period. The data are in a system 1032 data base and in individual cruise files on the VAX computer.

3. SOOP XBT - this program makes monthly XBT transects across the shelf from ships of opportunity (SOOP). Historically, transects were made across the Gulf of Maine (1975-1985), across the shelf from Narragansett Bay (1974-1984), New York Harbor (1974-)and Chesapeake Bay (1974-1981). Presently only the New York transect is still being sampled. The data from this program are in a system 1032 data base on the VAX computer.

4. Satellite data - this AVHRR data is available through a cooperative agreement with the University of Rhode Island in Narragansett, RI. The digital satellite data (1978 to present) resides on the URI VAX computer. Weekly charts of surface temperature features (locations of the Gulf Stream, rings, and fronts) are prepared from the satellite data and provide a paper data base of these features.

The recent temperature trends on the northeast continental shelf have been determined by an analysis of the temperature data collected on the spring and fall trawl surveys for the period 1963 - 1987. To account for the different timing of the cruises in the different years, temperature anomalies were calculated by subtracting from each temperature observation the expected or mean temperature for the location and day of the year the observation was made. The reference mean temperature field was derived from the MARMAP temperature data base (Mountain 1989). An areal average of the temperature anomalies for each trawl survey was calculated for the Gulf of Maine, Georges Bank, the northern Middle Atlantic Bight and the southern Middle Atlantic Bight. The results are shown in the Figures 3.1.1a and 3.1.1b (these figures are part of a report in preparation). In general, the surface and bottom temperatures were relatively cold in the middle 1960's, warmed to reach a peak in the middle 1970's, decreased somewhat in the late 1970's and early 1980's, and have shown a slight warming again in the middle 1980's.

Comparison with the Boothbay Harbor surface water temperature time series (Figure 3.1.2) suggests that temperature variability since the early 1960's is relatively modest compared to the variability which occurred earlier in the century.

While the temperature changes may have been modest, other aspects of the physical environment have exhibited significant variability (Figure 3.1.3). The salinity of the waters on the shelf has shown interannual changes of about one PSU (practical salinity unit or part per thousand), which may have important dynamical implications - e.g., for mixing and circulation.

The volume of shelf water also has varied significantly over the last decade. The shelf region has two major water masses - the shelf water which is relatively cold, low in salinity and occupies most of the shelf region; and the slope water which is warm, salty and is found seaward of the shelf water over the outer shelf and the continental slope. Between these water masses is the shelf/slope front, a narrow region of strong gradients in temperature and salinity which marks the offshore oceanographic boundary of the shelf environment. This boundary moves seasonally, being further offshore in the spring and moving shoreward in the fall. The location of the boundary has varied interannually with significant changes in the volume of shelf water over the last decade. For example, there was about three times as much shelf water in the region south of New England in the fall of 1987 (about 1500 cubic kilometers) as in the fall of 1984 (about 500 cubic kilometers). The cold conditions over the outer shelf of the Middle Atlantic Bight in the summer and fall of 1987 was due in large part to this usually large volume of shelf water in the region. In essence, the "cold pool" shelf water, which in the fall is usually replaced over the outer shelf by slope water as the shelf/slope front moves shoreward, remained on the outer shelf during the fall of 1987. Determining the importance of these aspects of the physical environment for the living marine resources will require additional study.

Discussion

These data provide a means of examining anomalous distributions in catch data in relation to temperature and salinity (eg. haddock, butterfish, and squid in Southern New England waters in 1987). It was suggested that a salinity profile could be used to designate water masses as either shelf or slope water, and it was recommend that salinity profiles be obtained routinely on NEFC bottom trawl surveys (using the SCANMAR system if possible).

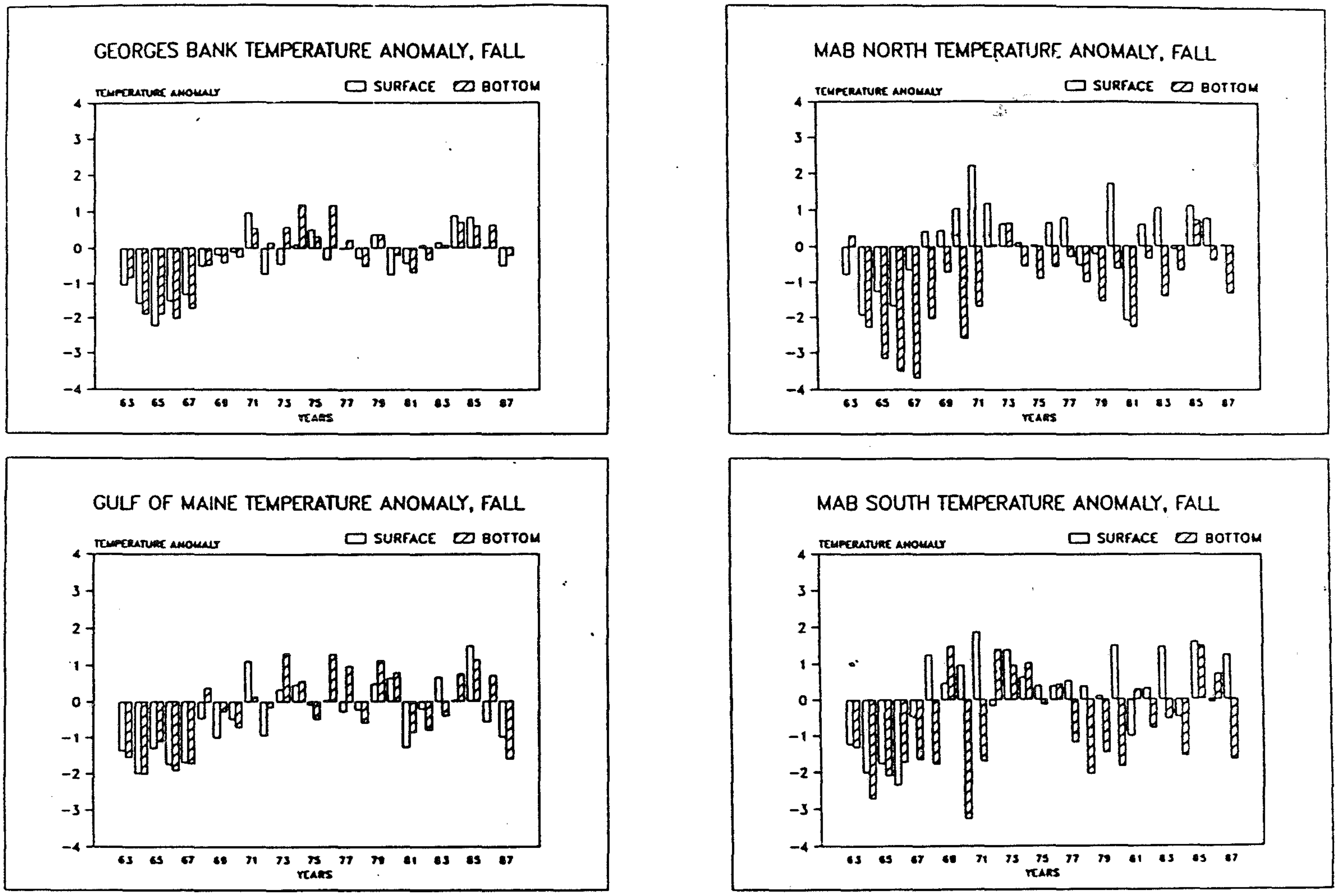


Figure 3.1.1a. Temperature anomalies in four regions of the continental shelf for the autumn bottom trawl surveys, 1963-1987.

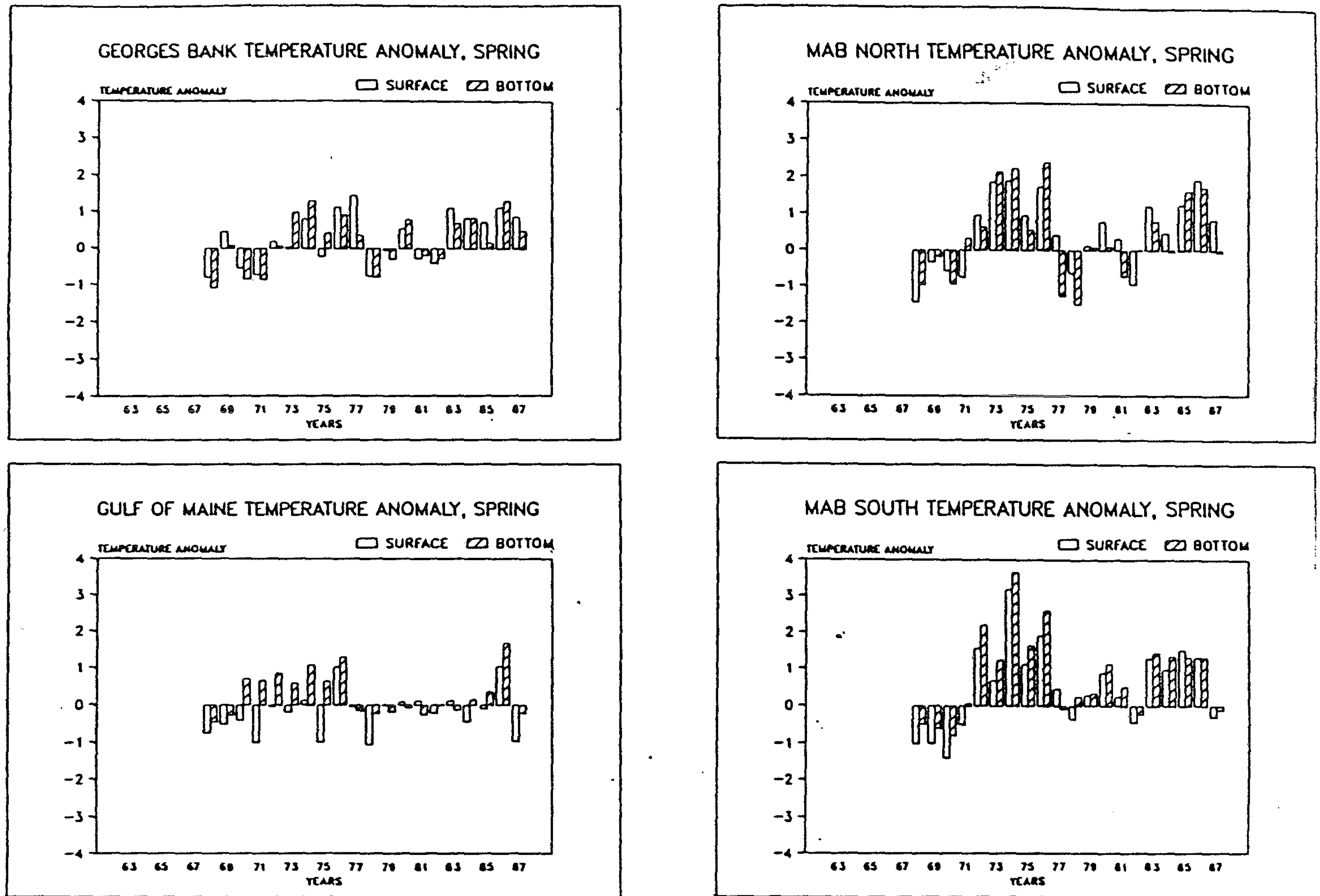


Figure 3.1.1b. Temperature anomalies in four regions of the continental shelf for the spring bottom trawl surveys, 1968-1987.

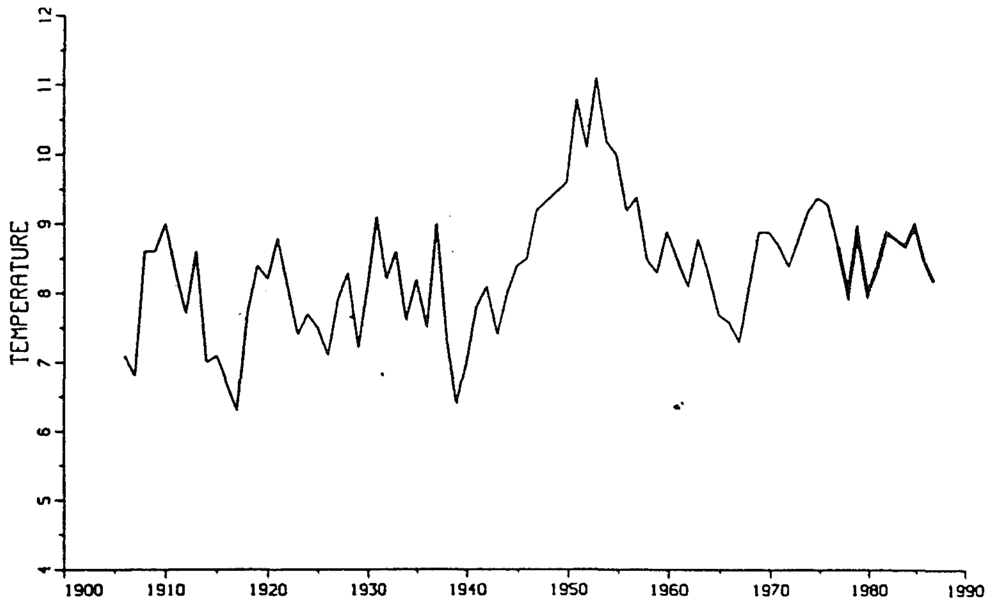


Figure 3.1.2. Annual average surface temperature at Boothbay Harbor, ME (From: Churchill 1985; data since 1985 from L. Churchill, Pers. Comm.)

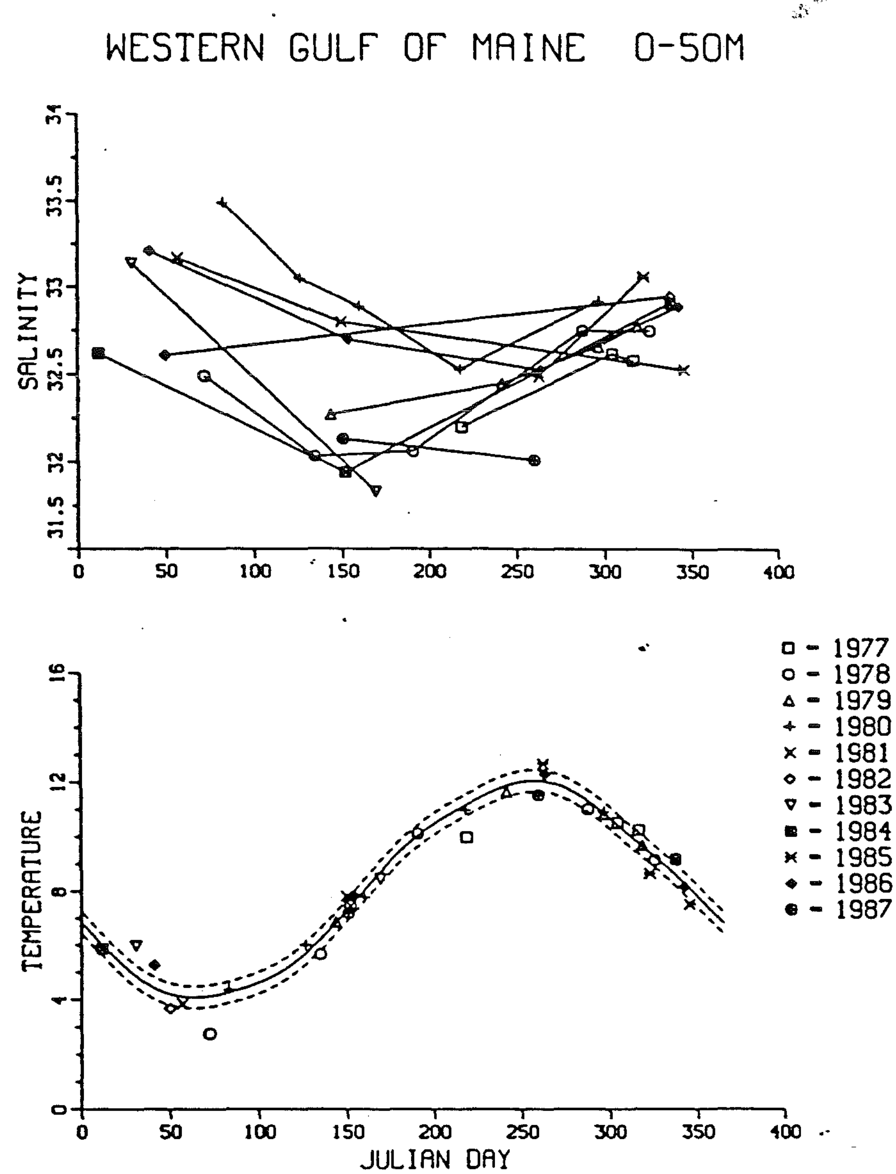


Figure 3.1.3. Average temperature and salinity of the upper layer (0-50m) of the western Gulf of Maine from all MARMAP cruises, 1977-1987.

3.2. Update on Status of SAFE Report Requirements

BACKGROUND

Proposed guidelines for implementation of the Magnuson Act were published in the Federal Register during 1988 and early 1989. Based on public comments, revised guidelines are expected to be published in final form by NOAA in July of this year. Contained in the proposed guidelines were requirements for a definition of overfishing and the publication of an annual stock assessment and fishery evaluation (SAFE) report for each stock under management. These requirements caused much consternation among participants at the last SAW.

The SAFE report is a document (or set of documents) that provides regional fishery management councils with a summary of the most recent understanding of the biological, social, and economic conditions (past, present, and future) of the fisheries being management under Federal regulation.

CURRENT STATUS

According to NMFS, Washington Office, the final guidelines will not change much in substance from the proposed guidelines; however, two changes are of direct interest to SAW participants.

In the proposed guidelines for SAFE reports, a number of topics were listed as types of information that should be contained in the report. This list was quite extensive and broad in scope. In the revised guidelines, this list will be moved to an appendix, and referenced as "suggested topics" -- not as a list of report requirements. The intent of the revised guidelines is not to disturb good, workable systems that are now in place, such as the Stock Assessment Workshops.

The other known change of importance to SAW participants is the schedule for arriving at acceptable definitions of overfishing for the managed stocks. The revised guidelines will require all new and existing fishery management plans to have a definition of overfishing acceptable to the Secretary within 18 months after publication of the final guidelines in the Federal Register. Within this time frame, the councils will have 90 days to submit a letter to the Secretary stating that the definition of overfishing in their new or existing plans is adequate as presently written. (The Secretary is given 90 days to respond to these letters.) Within 15 months after publication of the guidelines, a new definition of overfishing, or a revised definition for those not approved by the Secretary, must be submitted to the Secretary. This gives three months for review and approval before the 18-month deadline.

3.3. Age Sampling Requirements of the NEFC Bottom Trawl Survey.

The NEFC survey age sampling program is a case of double or two phase sampling. Double sampling is appropriate when the primary variable of interest is one that is difficult or expensive to measure, and is related to a more easily measured secondary variable. In double sampling, a large initial sample is selected and stratified on the basis of the easily measured variable. A random sample is then selected from each stratum, and the primary variable of interest is measured on the resulting stratified random sample. The purpose is to increase precision by taking advantage of the relationship between the primary and secondary variables. In the NEFC survey age sampling program, length is measured on the entire catch (or a subsample if the catch is large), and the catch is stratified using length as the stratification variable. The stratified random age sample is then selected according to the sampling plan that accompanies each cruise. The survey age sampling plans have not, to our knowledge, been previously examined from a statistical standpoint. The objective of the study is therefore to define shipboard sampling plans that minimizes the variance of the stratified proportion at age i ($Var(p_{sti})$) for a given cost, C^*_i, for each of five species-stocks.

Survey age data for Georges Bank Atlantic cod, (*Gadus morhua*), Gulf of Maine redfish, (*Sebastes fasciatus*), Georges Bank - Mid Atlantic butterfish, (*Peprilus triacanthus*), Georges Bank yellowtail flounder, (*Limanda ferruginea*) and Gulf of Maine - N. Georges Bank silver hake, (*Merluccius bilinearis*) were used in the analysis. These species were selected to represent a range of life history patterns. The survey data were restratified using from 3 to 6 length strata, the boundaries of which were selected using two different methods. Double sampling theory was then used to determine the number of fish to age from each length stratum for four of the species stocks. The method was not successful for redfish. Redfish is so slow growing and long-lived that the relationship between age and length was apparently not strong enough for stratification to be effective. New age sampling plans are presented for Gulf of Maine - N. Georges Bank silver hake and Georges Bank - Mid Atlantic butterfish using six length strata (Table 3.3.1). The plans are on a stock-area basis, not on a survey watch basis. New plans are not presented for Georges Bank yellowtail flounder and Georges Bank Atlantic cod at this time due to low stock levels. These sampling plans were determined by minimizing $Var(p_{sti})$ for a fixed C^*_i. However, the relationship between minimum $Var(p_{sti})$ and cost can be used to fix a target $Var(p_{sti})$ and determine a sampling plan for minimum cost.

Discussion

The brief discussion following this presentation primarily concerned the assumption that the large initial sample (pooled catches from the species/stock) used in the analysis was a simple random sample. A cluster sample is what is actually taken. If inter-cluster correlations are high, age sampling must be spread over the stock area to avoid biased results.

This problem may occur under the current per-watch sampling protocol used during NEFC bottom trawl surveys if a large catch of a particular species is encountered and heavily sampled at the beginning of a watch at the expense of very few samples being collected from other catches during the remainder of the watch. While from a statistical point of view, the optimal sample collection would occur throughout a watch, it was made clear that from a practical viewpoint, watch chiefs and chief scientists are not able to confidently predict future catches of individual species during a watch and if samples are not collected from catches that are on deck, there is no certainty that additional catches will be available for additional sampling later in a watch.

Table 3.3.1. Overall sampling plans for age determination for NEFC Autumn Bottom Trawl Survey, GB-MA butterfish and NGB-GM silver hake.

Length Strata boundaries (cm)	butterfish
0-9	0
10	0
11	18
12	24
13-14	75
15-20	199
sum	316
	silver hake
0-10	0
11-17	36
18-23	26
24-26	33
27-31	50
32-50	69
sum	214

3.4. Variability in Commercial Catch at Age and its Implications for Determining Optimal Age Sampling Requirements

Methods for calculating minimum estimates of variance of catch at age have been outlined by Southward (1976) and Gavaris and Gavaris (1983). Using these methods, variances of commercial catch at age were calculated for cod, haddock, pollock, summer flounder, winter flounder and yellowtail flounder for 1981-85 by stock area and sampling quarter. In addition, these variance estimates were partitioned into the components contributed by the age sample, length frequency sample, and two age-length interaction terms (C and D). Coefficients of variation (CV) associated with the catch at age of each species/stock within each sampling quarter were calculated and used as indices of precision. While acceptable levels of precision in catch-at-age matrices are as yet undefined, we assume that CV's of 20% or less are acceptable. Coefficients of variation corresponding to age sampling levels required to achieve CV's of 20% or less for the dominant age groups were determined for each species stock over the 1981-85 time series. The midpoint of the range of lowest age sample sizes which consistently produced CV's of 20% or less for the dominant age groups in each species stock within a sampling quarter were used to recommended optimal age sampling levels. Optimal quarterly sample sizes were expanded to recommend yearly age sampling requirements. Following the development of yearly sampling levels, appointment was made to market categories according to the percent composition each market category contributed to the total number of age samples over 1981-85. The Georges Bank cod species stock was used to illustrate this method to determine optimal age sampling requirements.

For the Georges Bank cod stock the proportion, variance, and CV's of the catch at age were calculated by quarter over 1981-85. These values for the year 1985 are presented in Figures 1-3, respectively and are representative of the results over the 1981-5 time series. The majority of the catch within all quarters was between ages 2-6 (Figure 1). Most of the variance associated with the catch-at-age matrices was contributed by the age sample (Figure 2) and total variance was proportional to sample size. The CV's at age were inversely related to the number of fish at that age in the age sample. The range of lowest age sample sizes which consistently produced CV's of 20% or less for the dominant age groups are presented in Figure 4. The midpoint of this range was a sample size of 291. Therefore, a quarterly age sample size of 300 was recommended and expanded to form an optimal annual age sample size of 1,200 (Table 3.4.1). When compared to the average total number of samples collected over the years 1981-5 this represents a reduction of 54% in age sampling. The distribution of the total number of age samples collected within each market category over the years 1981-85 was: scrod (24%), market (50%), and large-whale (26%). The optimal yearly sample size was then partitioned using this distribution to form the following recommended age sample sizes for each market category: scrod 300, market 600, large-whale 300 (Table 3.4.2).

For most species/stocks, age sample sizes of 300 or less per quarter yielded CV's of the catch at age of 20% or less for the dominant age groups. For some species/stocks reductions of up to 40% in age sampling from current levels would have minimal impact on the precision of their catch at age estimates. A strong relationship between year class strength and precision was observed in many cases. A significant relationship exists between the number of age samples collected at age and the corresponding CV at that age. A further development of this relationship could yield an explicit method for determining the number of age samples to collect to achieve a predetermined level of precision.

Discussion

The discussion following the presentation of preliminary results of the examination and potential reallocation of age sampling schemes for commercial catches revolved primarily around two topics. The first was the method used to derive variance estimates around catch at age. The method described indicated that variances in the age samples made up a very large proportion of the total catch at age variance, with variances of length frequency data adding little to the overall variance. There was some question whether this would actually be the case for some species and whether the addition of more length samples, a far more easily obtained variable, would be a reasonable approach to limiting the variance around catch at age.

Also discussed was the fact that market categories were not considered until after sample allocations by species/stock were made, and that the apportionment of samples to market categories were done based on the proportion of each category in the age samples in terms of numbers sampled. It was suggested that length data be separated by market categories at the beginning of the analysis, and that sample allocations be made on a market category rather than species/stock basis.

The use of historical catch and sampling protocols as a basis for developing new designs was also discussed in light of the imposition of minimum sizes; such as the 13" minimum size imposed on the summer flounder fishery. With these species, sampling schemes would have to take into account proportional changes in the length ranges in the smallest size categories after imposition of minimum sizes. It was suggested that analytical procedures such as estimating samples sizes from the variance equation could be employed.

Table 3.4.1. Recommended age sampling levels and average age sample sizes over the 1981-85 time series for the 10 species-stocks. The percent change in age sample sizes which would result if the optimal age sample sizes were collected is also indicated.

Species/Stock		Optimal Sampling Level	Average Sampling Level 1981-85	Change
Atlantic cod-Georges Bank		1,200	2,242	-46%
Gulf of Maine		1,200	1,042	+14%
Haddock-Georges Bank		1,000	1,335	-25%
Gulf of Maine		200	606	-66%
Pollock		1,200	1,781	-33%
Summer Flounder		1,000	1,739	-42%
Winter flounder-Georges Bank		800	502	+37%
Southern New England		800	1,206	-34%
Yellowtail-Georges Bank	(M)	600	829	-28%
	(F)	600	852	-30%
Southern New England	(M)	600	785	-24%
	(F)	600	879	-32%

Table 3.4.2. Allocation of optimal sampling level by market category.

Species/Stock	Market Category	%	Optimal Sampling Level
Atlantic cod-Georges Bank	Scrod	24	300
	Market	50	600
	Large, whale	26	300
Gulf of Maine	Scrod	32	400
	Market	42	500
	Large, whale	26	300
Haddock-Georges Bank	Scrod	34	400
	Large	61	600
Gulf of Maine	Scrod	34	100
	Large	66	100
Pollock	Small	13	150
	Medium	58	700
	Large	29	350
Summer Flounder	Small	29	300
	Medium	40	400
	Large	31	300
Winter flounder-Georges Bank	Pewee, Small	31	250
	Large, Lemon	69	550
Southern New England	Pewee, Small	41	350
	Large, Lemon	59	450
Yellowtail-Georges Bank (M)	Small	37	200
	Large	63	400
(F)	Small	37	200
	Large	63	400
Southern New England (M)	Small	72	450
	Large	28	150
(F)	Small	72	450
	Large	28	150

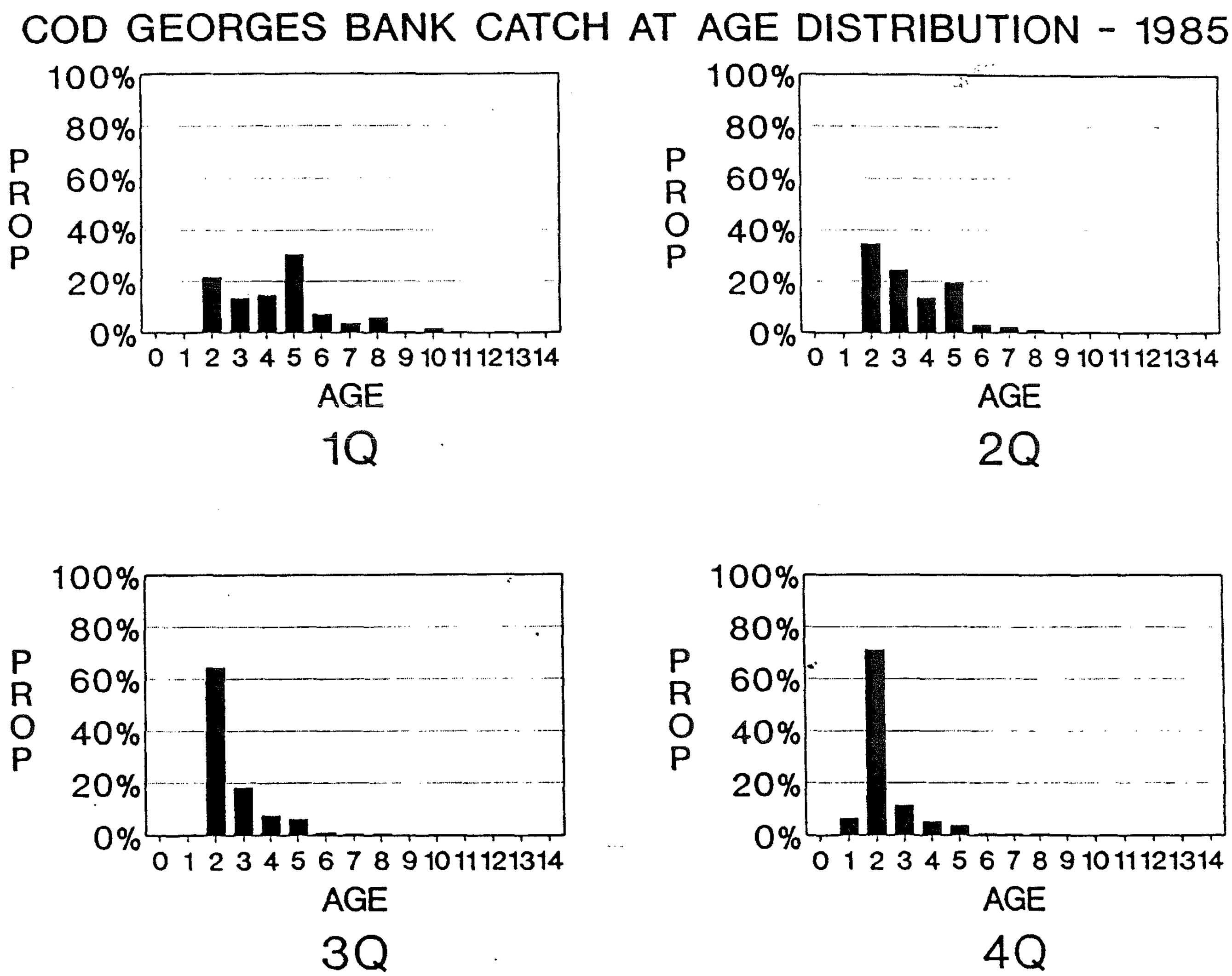


Figure 3.4.1. Georges Bank Atlantic cod: Proportion of catch at age by sampling quarter for 1985.

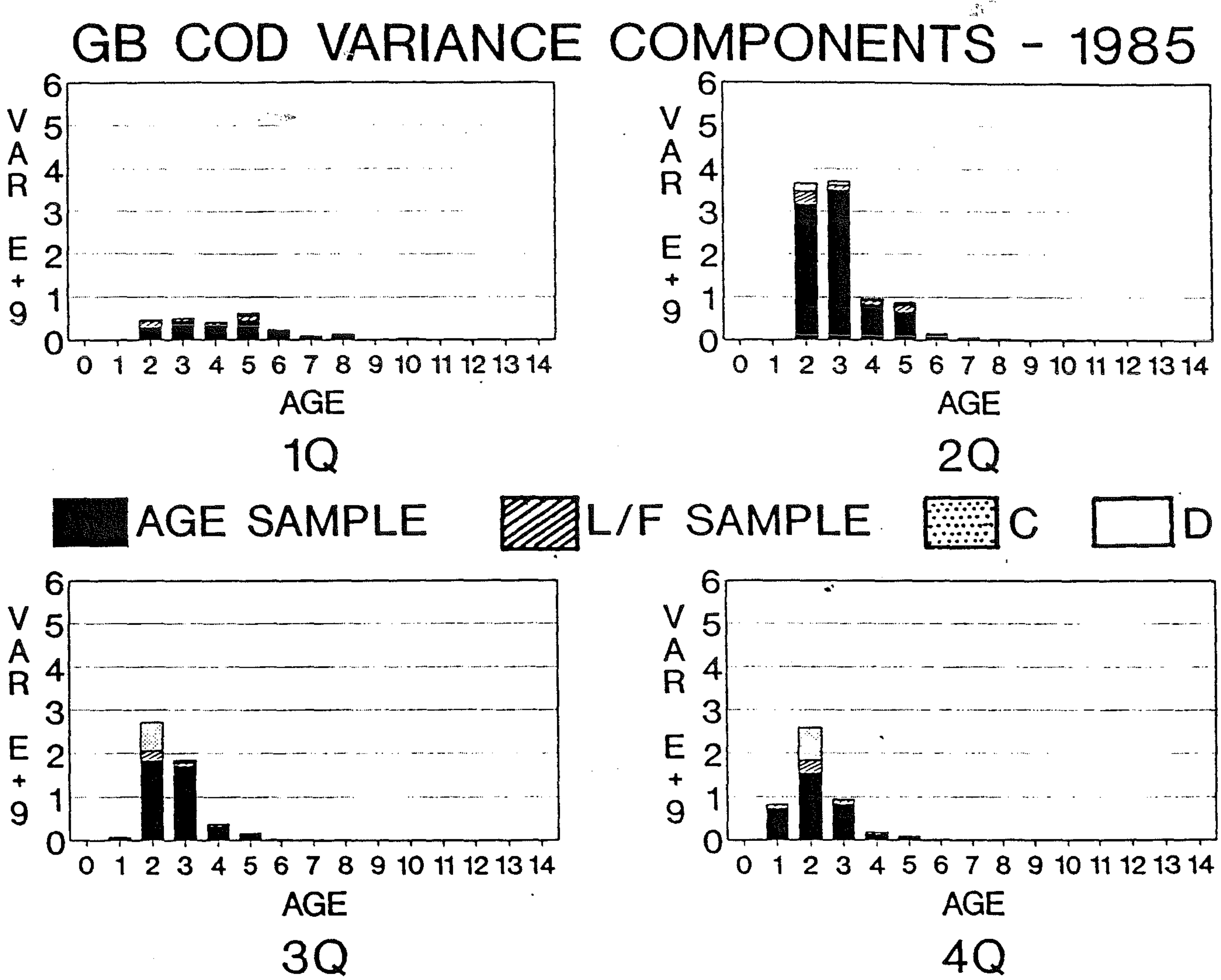


Figure 3.4.2. Georges Bank Atlantic cod: Total variance of catch at age by sampling quarter for 1985.

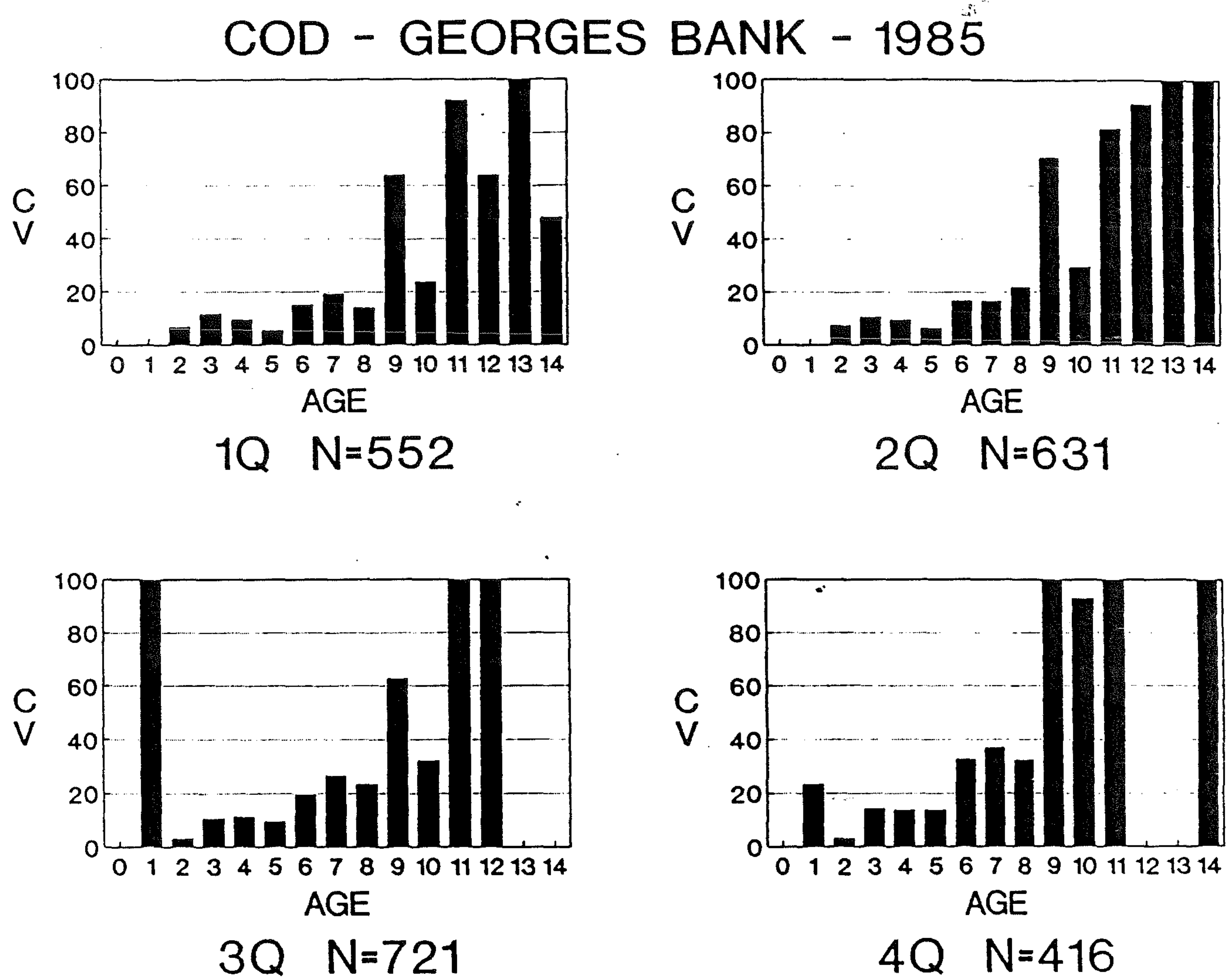
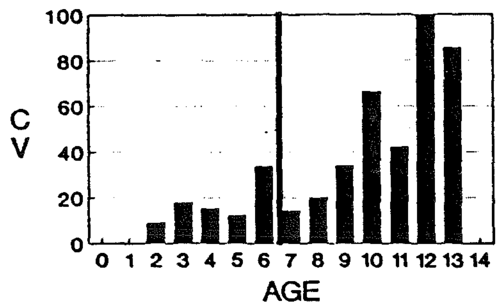
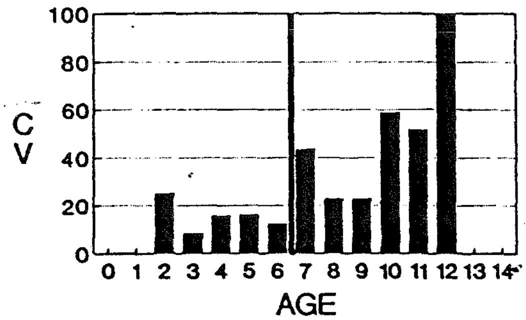


Figure 3.4.3. Georges Bank Atlantic cod: Coefficients of variation of the catch at age by sampling quarter for 1985. Age sample size for each quarter is indicated below each graph.

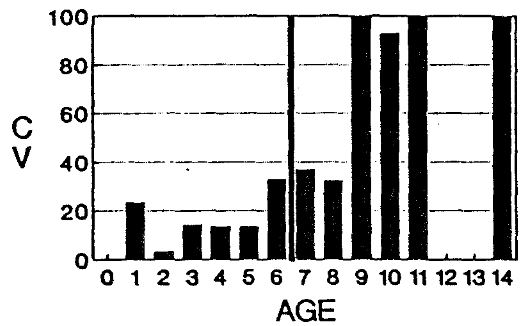
COD - GEORGES BANK - 1981-5
Low N with Good CV for Ages 2-6



1982 1Q N=242



1983 1Q N=291



1985 4Q N=416

Figure 3.4.4. Georges Bank Atlantic cod: Low age sample sizes which consistently produced coefficients of variation of 20% or less for the dominant age groups (ages 2-6).

3.5. Growth-Maturity Interactions and Effects on Spawning Stock Biomass per Recruit

The effect of changes in growth and maturation rates on spawning stock biomass per recruit (SSB/R) was evaluated using witch flounder as an example. Sensitivity analyses were performed by varying baseline estimates of k (Brody growth coefficient) and maturity at age by ± 5, 10, and 20%, and calculating a sensitivity index from resulting values of $\bar{S}$SB/R at F=0.2. At the 5% level of parameter change, the effect of growth on SSB/R was twice that of maturation (Table 3.5.1); however, the maturation effect assumed greater importance as the percentage of parameter change increased. Since observed changes in fish growth rates rarely exceed 20%, but changes in maturation rates can be much higher, the relative importance of maturation on SSB/R calculations and the resulting need for good maturity information is apparent.

The conventional belief has been that the maturation process for a given species/stock is genotypically or phenotypically determined, and that maturation is strictly a function of size or age. In this scenario, any observed change in maturation is directly related to a change in growth. However, there is increasing evidence that changes in maturation can occur in "real time", and that maturation may be the most plastic of the life history parameters. The interpretation of a recent study (Godo and Moksness 1987), in which offspring from 2 stocks of Norwegian cod with different growth and maturation rates grew and matured at identical rates in a controlled environment, is that maturation is determined (within physiological constraints) by the growth rate during the juvenile phase. With these concepts in mind, growth-maturity interactions routinely encountered (summarized in Table 3.5.2) were briefly reviewed.

Finally, growth-maturity interactions were examined in detail for two species with differing life histories, redfish and mackerel. The fast-growing 1978 year class of mackerel was contrasted with the slow-growing 1982 year class using traditional maturity analysis techniques; lower values of the median length of maturity (L_{50}) for the 1982 year class were related to a lower growth rate (Table 3.5.3). For redfish, a two factor logistic regression model was utilized to examine the interaction between growth and maturation of inshore and offshore groups; poorer growth rates of inshore fish resulted in earlier maturation of males.

Discussion

It was suggested that a higher value of F (0.6 or 0.8) may alter the sensitivity index of SSB/R with respect to changes in growth or maturation. The choice of F=0.2, however, corresponded to the best estimate of fishing mortality on witch flounder in 1980, when growth and maturation rates used for baseline runs were derived. Effects of changes in maturation on SSB/R were even greater in other studies reported to ICES.

Results for witch flounder may only be applicable to flatfish or other species with similar age ranges, since the age span employed in the analyses was large. For a species with shorter age ranges, maturation effects would not necessarily be the same. However, it was countered that, for a species with only a few ages, a change in median age at maturity from age 2 to age 3 is actually more significant than a one year change in a longer lived species.

In the comparison of growth and maturation for the two year classes of mackerel, it was noted that the interaction of growth and maturation is more complex than the scenarios presented, since the males and females of the 1982 year class were reacting differently to the change in growth rate. It was also pointed out that the use of survey data alone for the mackerel comparisons resulted in small samples size and possible misleading estimates of mean length at age.

A final suggestion was to concentrate on 3 or 4 species, by collecting age, maturity, and fecundity information in a coordinated study. Involvement of the Fisheries Ecology Division in reproductive studies may useful.

Table 3.5.1. Sensitivity of spawning stock biomass per recruit (SSB/R) estimates to changes in growth and maturation parameters for witch flounder from the Gulf of Maine - Georges Bank region at levels of M = 0.1 and F = 0.2.

Parameter	Percent Change	Sensitivity Index[1]
Growth	5	0.10
	10	0.18
	20	0.23
Maturation	5	0.05
	10	0.15
	20	0.34

1. calculated from the following expression:

$$\text{Sensitivity Index} = (SSB/R_{p+x} - SSB/R_{p-x}) \;/\; SSB/R_p$$

where:

x = the percent change in the parameter of interest.

Table 3.5.2. Growth - maturation interactions frequently observed for marine fishes (L_{50} and A_{50} represent median length and age at maturity, respectively), and interpretations as to possible mechanisms.

Change in Growth	Change in Maturation L_{50}	A_{50}	Interpretation
Increase	Increase	No change	Age drives maturation
Decrease	Decrease	No change	
Increase	No change	Decrease	Size drives maturation
Decrease	No change	Increase	
Increase	Increase	Increase	Life history optimization tactics
Decrease	Decrease	Decrease	
No change	Any change		Other factors involved (longevity, environment, exploitation)

Table 3.5.3. Comparison of growth and maturation rates between the 1978 and 1982 year classes of Atlantic mackerel (L_{50} and A_{50} represent median length and age at maturity, respectively).

	1978 Year Class		1982 Year Class	
	Male	Female	Male	Female
	Growth (mean length in cm)			
Age 1	19.8	20.3	21.7	22.5
2	30.3	30.2	25.3	25.2
3	34.4	34.4	29.8	30.0
4	36.7	37.4	32.0	32.6
5		38.0	33.5	33.9
6			35.2	34.3
	Maturation			
L_{50}	30.8	32.9	28.2	26.8
A_{50}	2.2	2.6	2.8	2.2

3.6. Summary of The Activities to Date of the Fleet Modeling Group (FMG)

The Fleet Modeling Group (FMG) is a joint working group from NEFC's Population Dynamics Branch and Fisheries Economics Investigation composed of individuals who have been conducting research and are interested in pursuing research topics that require detail information at the trip and/or vessel level of resolution.

The FMG began because several of its members had begun to pursue research topics which required examining the NEFC commercial catch and effort data bases in ways which have not been done as part of the traditional stock assessment process. The common approach used in analyses of the commercial data base is to initially collapse or aggregate the data into a number of strata (such as area, month gear type and vessels size). The summary statistics from such a collapse (e.g. total catch and effort within strata) form the basic data set used in the overall analysis. All information linking catch and effort to individual trips and trips to individual vessels is lost. The types of analyses that members of the FMG had begun to pursue required that all catch and effort data associated with an individual trip are linked together and that data from all trips from an individual vessel are also linked. In these approaches, the basic data set underlying the analyses is a time series of trips clustered by vessel.

The emphasis on individual trip and vessel data stems from the fact that trips and vessels are both the basic sampling unit from which data are collected and the basic operating unit in the fishery. In order to develop predictive models of the impact and possible response to various alternative management measures, one needs to understand how the fishery works at the vessel level. Moreover, in order to determine the variance component associated with any statistic generated from the commercial data base (such as CPUE), the analyses need to account for the basic sampling units (i.e. the trip and the vessel). An understanding of the variability and range associated with any statistics is often critical for predicting what the effect of an action may be. Table 3.6.1 summarizes some of the basic differences in the types of analyses and results that can be derived from an aggregated (or collapsed) data sets versus disaggregated data sets in a cross sectional and time series context. A few examples of general research topic in which individual trip and/or vessel information is critical are:

1) The modeling of the response to regulation in a single fishery when vessels can participate in alternative fisheries (e.g. how would effort regulations in the scallop fishery affect fishing effort in the otter trawl fishery?);

2) the effects of management actions (such as closed areas, limited entry, trip limits, individual transferable quotas, etc) on the catch and effort within a fishery;

3) defining effort and evaluating directedness in multi-species fisheries; and

4) standardizing catch per unit of effort statistics taking into account vessel and trip effects and estimating variances for cpue statistics.

The FMG was formed in November of 1988 after it became apparent that research topics being pursued both in the Population Dynamics branch and the Fisheries Economics Investigation required individual vessel/trip data and that similar problems were being encountered in preparing the data for these types of analyses. The group has four primary functions:

1) to evaluate the utility of the commercial data base for research requiring information on the overall activity of individual vessel and trips;

2) to coordinate and review studies involving individual vessel activity data;

3) to define software and data base requirements needed for producing data sets from which individual vessel/trip activity studies can be pursued; and

4) to provide a focal point for collaborative research for the development of bio-economic models.

Current research activities being pursued by the FMG are listed in Table 3.6.2. The first two topics are activities that the group has undertaken as a whole, while the latter five represent activities of individuals or groups of individuals within the FMG, and are not discussed further here.

The first activity in Table 3.6.2, developing data extraction and analysis procedures, is a major task given the structure of the NEFC commercial data bases. The development of a general and complete system will require software and data base support beyond that available in the FMG. However, the group has proceeded with the development of preliminary software. The work done to date is providing the group with a basis for defining what is needed for a general system, as well as important feedback on technical problems in the current commercial data bases. The identification of these technical problems may help to improve the overall data management and data collection processes.

As part of its function in evaluating the suitability of the commercial data bases for individual vessel analyses, the FMG has undertaken a descriptive study of the operating characteristic and performance of vessels within various fleet component (item 2 in Table 3.6.2). Examples of the types of information and analyses that are being generated in this study are provide in Figures 3.6.1 - 3.6.3 and Tables 3.6.3 - 3.6.5. These figures and tables provide results on class 4 vessels which fished in every year from 1982 to 1988. There were 180 class 4 vessels which fished in all 7 years, with the largest number of vessels (73) having used a mixture of otter trawl and scallop gears sometime over the course of these seven years (Table 3.6.3). However, very few of these vessels actually used both gears in all seven years (Figure 3.6.1). Comparison of the dollar value of the landings per day absent by vessels which only used otter trawl gear and vessels which only used scallop gear suggest that, in general, the daily revenue for an average scallop vessel is slightly higher than for an otter trawl vessel. However, the variance among otter trawl vessels tends to be much greater than among scallop vessels, so that the best otter trawl vessel tends to outperform the best scallop vessel (Figures 3.6.2 and 3.6.3). Relative vessel performance on a per day absent basis between years appears more variable for vessels which only use otter trawl gear than vessels which only use scallop gear (Tables 3.6.4 and 3.6.5).

These results illustrate the types of analyses the FMG has been conducting as part of its descriptive study, and they also demonstrate the types of results which can be obtained using data on individual vessel activity.

Discussion

It was recognized that information is not collected or readily available to address all questions concerning individual vessel activities. Particular concern was expressed about the lack of information on the vessel captain as a factor affecting individual vessel performance. Figures illustrating the proportion of vessels accounting for a given percentage of the revenue were not as "bowed" as expected, ie., that 10% of vessels might have been expected to account for an even greater percentage of the revenue than the figures indicate. Since class 4 vessels may account for more of the highliner activity, a more predominant "bowed" effect might be found for smaller vessels or if data were pooled over vessel classes. Focusing on individual ports and a range of vessel classes, and evaluating fishing effort instead of revenue may provide further insights into individual vessel performance.

It was noted that, by examining data from an individual vessel perspective, greater insights into the effects of possible management actions could be gained than from an examination of aggregate data. For example, results on the concentration of revenue would suggest that, if limits on overall effort were instituted, the least efficient vessels would likely be eliminated from the fleet. Thus, the reduction in overall nominal effort and fishing mortality might be less than anticipated.

The Fleet Modeling Group will review and coordinate individual efforts within the group, and continue studies to further characterize the fishing fleets.

Table 3.6.1. Comparison of the types of analyses that can be performed with aggregated and disaggregated data sets.

Data Structure	Types of Analyses: Cross Sectional	Time Series
Aggregate (data pooled by strata)	1) totals 2) means (weighted)	1) general trends 2) relationship between trends
Disaggregate (sampling design preserved)	1) means with variances 2) covariance across strata 3) relationships among variables 4) interaction effects 5) cluster description (e.g. vessel)	1) temporal covariances 2) interaction effects both temporal and across strata 3) dynamic responses and models 4) cluster effects and behavior

Table 3.6.2 Current research activity being conducted using individual vessel/trip data by the FMG and its individual members.

1) Data extraction and analysis procedures

   a) preliminary development of software
   b) definition of software needs and ways to implement
   c) evaluation of suitability of data for individual vessel analyses
   d) feedback on technical problems in data management and data collection

2) Descriptive summary of operating characteristics of vessels within various fleet components

3) Investigation of exist and entry

4) Investigation of directed effort and definition of multi- species effort in the otter trawl fishery (see report of 7th SAW)

5) Summary Statistics of Economic Trends

6) Economic analysis of the effect of ICJ line on scallop fishery

7) Analysis of the supply of effort and capital in an open access fishery (focused on scallop fishery)

Table 3.6.3 The composition by gear of class 4 vessels which fished every year from 1982 to 1988.

Number of Vessels	Description
33	only used otter trawl gear
24	only used scallop gear
17	only used clam gear
3	never used scallop, otter trawl or clam gear
73	used a mixture of scallop and otter trawl gear
30	used other mixtures of gears
180	Total

Table 3.6.4. Spearman's rank correlation coefficient for average dollar per day absent among class 4 vessels which fished every year from 1982-1988 and which only otter trawled (n=33).

	1982	1983	1984	1985	1986	1987	1988
1982	1.00						
1983	0.71	1.00					
1984	0.62	0.80	1.00				
1985	0.47	0.70	0.74	1.00			
1986	0.43	0.64	0.61	0.87	1.00		
1987	0.33	0.50	0.49	0.51	0.45	1.00	
1988	0.13	0.46	0.42	0.57	0.72	0.60	1.00

Table 3.6.5. Spearman's rank correlation coefficient for average dollar per day absent for class 4 vessels which fish every year from 1982-1988 and which only used scallop gear (n=24).

	1982	1983	1984	1985	1986	1987	1988
1982	1.00						
1983	0.69	1.00					
1984	0.63	0.86	1.00				
1985	0.67	0.60	0.63	1.00			
1986	0.39	0.65	0.61	0.73	1.00		
1987	0.50	0.63	0.57	0.62	0.67	1.00	
1988	0.52	0.70	0.62	0.41	0.51	0.73	1.00

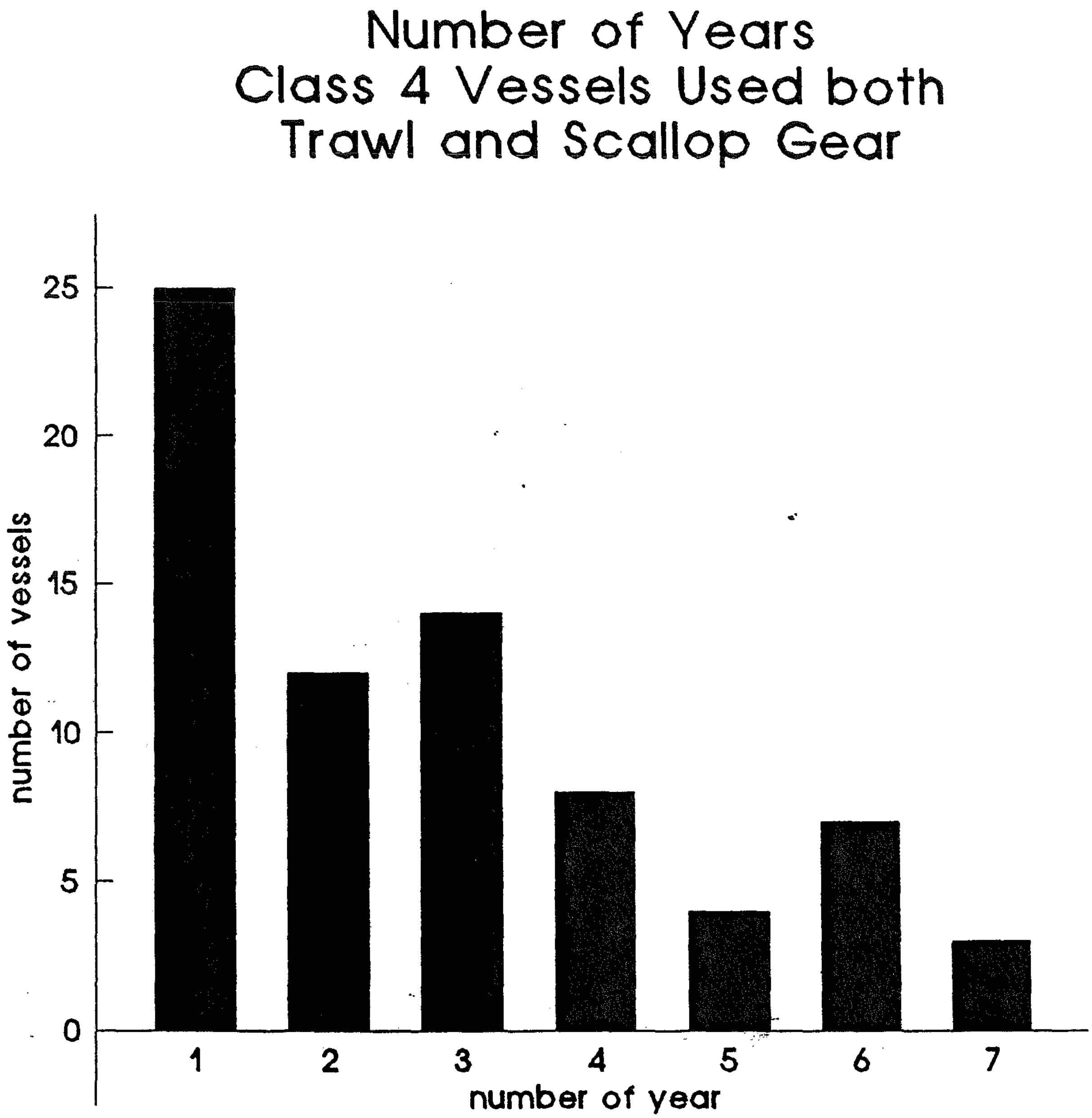


Figure 3.6.1. Number of years that tonnage class 4 vessels which fished every year between 1982 and 1988 used both scallop and otter trawl gear within any given year.

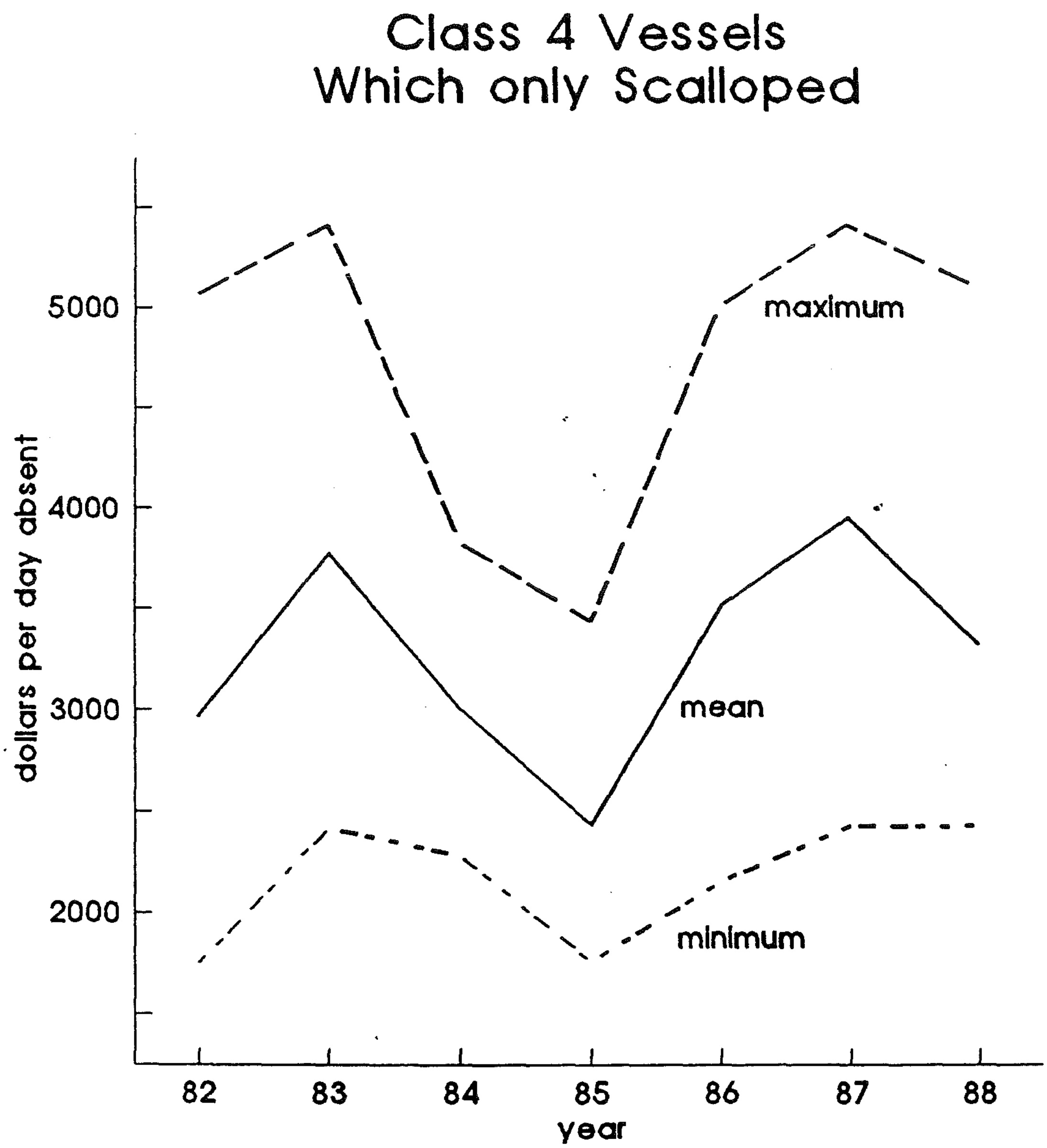


Figure 3.6.2. Average dollar per day absent for tonnage class 4 vessels which only used scallop gear and fished every year between 1982 and 1986.

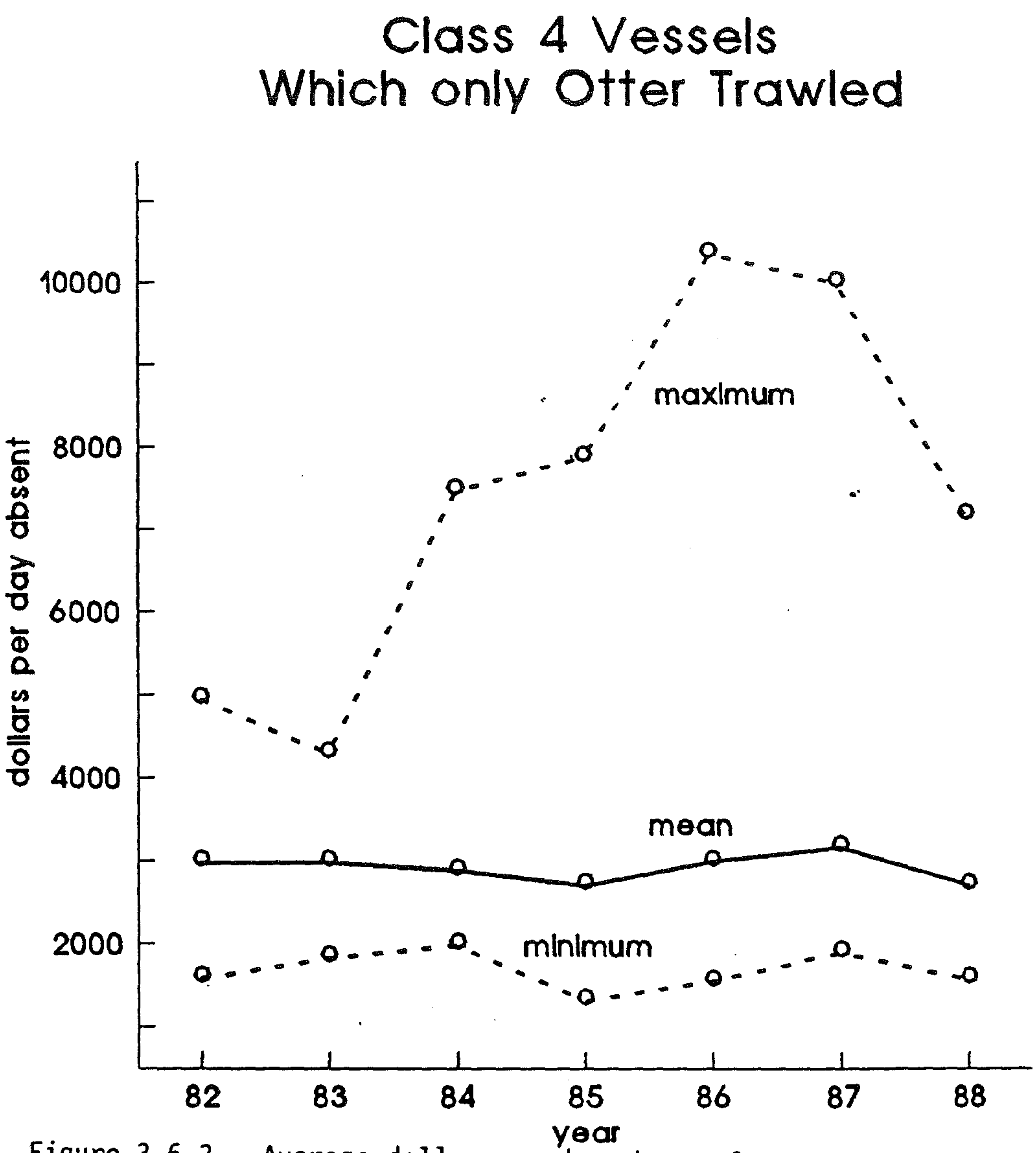


Figure 3.6.3. Average dollar per day absent for tonnage class 4 vessels which only used otter trawl gear and fished every year between 1982 and 1986.

3.8. Gillnet Fishery/Marine Mammal Interactions

Source Document: Gilbert, J. and K. Wynne. MS. Marine mammal interactions with New England gillnet fisheries. Woods Hole, MA: NMFS, NEFC. Contract Report. 30p.

Gillnet fishing in the Gulf of Maine has been identified as a cause of incidental mortality of marine mammals in recent years (see Polacheck 1989 and references therein for an overview). This has resulted in recent federal government action, as part of a national effort, of requiring sampling of up to 30% of gillnet fishing trips in this region for marine mammal mortalities (Federal Register, 1989). This sampling was required because the rate of taking of marine mammals is thought to exceed 1 per 20 days of operations.

Studies have been conducted by the University of Guelph and the University of Maine documenting the species, areas, seasons, and fisheries involved (Gilbert and Wynne MS 1988; Gaskin 1984). These studies suggest that the principal species taken by bottom-tending gillnets are harbor porpoise, harbor seals, grey seals, and white-sided dolphins. The University of Maine study suggests that the same species except grey seals are taken in the Cape Cod Bay surface gillnet fishery. That study noted some minor incidence of damage to the catch by harbor seals in this fishery.

The largest incidental mortality appears to occur with harbor porpoise. A single population of these animals is thought to inhabit both the Gulf of Maine and the Bay of Fundy region, with marked north-south seasonal movements. There are seasonal differences in the rates of kill, although the data are sketchy. The reproductive rate of small cetaceans is generally thought to be, at maximum, a few percent of population size annually.

The total incidental kill of harbor porpoise has been estimated to be between 280 and 800 animals, and estimates of total population size have ranged from 5,000 to 18,000 (see Polacheck 1989). Depending on the true values of incidental kill level and population size, the effect of the incidental mortality is either more significant (800 animals out of 5,000) or less significant (280 animals out of 18,000).

To assess the significance of the incidental mortality levels, more reliable estimates of incidental mortality are needed. This will be facilitated by the now-required sampling of the gillnet fishing trips. To design this sampling and to use the results to estimate total mortality will require study of the gillnet fleet and its fishing activity.

Two types of gillnet fishing occur in the Gulf of Maine, one using surface and the other using bottom-tending gillnets. Fishing is conducted by vessels less than 5 GRT (undertonnage), between 5 and 50 GRT (ton class 2), and between 50 and 150 GRT (ton class 3). The spatial distribution of gillnet fishing effort varies by surface and bottom-tending gillnets, and by vessel class. Surface tending gillnets are used in Cape Cod Bay, primarily for mackerel (Gilbert and Wynne MS 1988). Bottom-tending gillnets are used by ton class 2 vessels throughout the region. Fishing activity was distributed, in

1988 for example, further north in quarters 2-4 than in quarter 1 (Figure 3.8.1). Bottom-tending gillnets are used by ton class 3 vessels primarily in the central Gulf of Maine near shore in all seasons (Figure 3.8.2). Information on fishing activity by undertonnage vessels is not readily available, and what is available has not been tabulated here. There are difficulties with the resolution of the data for these smaller vessels. The amount of fishing effort associated with the fishing trips for all ton classes is not well measured because the amount of gear fished is not recorded consistently.

There are large seasonal differences in the number of days fished, the landings, and the dollar value of the landings for both ton class 2 and 3 vessels (Figure 3.8.3). The amount of fishing, landings, and dollar value are higher in the more recent years for both ton classes. The amount of fishing by ton class 2 vessels far exceeds that for ton class 3 vessels.

The amount of fishing by ton class 2 vessels using gillnets ranges from 20 to 50% of the fishing done by all ton class 2 vessels, tends to increase over the year, and has increased in recent years (Figure 3.8.4). The amount of fishing by ton class 3 vessels using gillnets is a small percent of the fishing done by all ton class 3 vessels (Figure 3.8.4), and also tends to increase over the year. The landings per day fished is lowest for both ton class 2 and 3 vessels early in the year, increasing from roughly 1 mt/day to 2 mt/day over the year (Figure 3.8.4).

The data presented here are not adequate as a basis for estimating incidental mortality of marine mammals in the gillnet fishery because of the seasonal changes in the fishery and the lack of information on undertonage vessels. In addition, information on the total number and distribution of individual vessels rather than trips will be needed. Further investigation of these data, and the collection of additional data will be required.

Discussion

Discussion initially centered around whether gillnet soak-time might be a viable alternative to days fished as a measure of effort for the Gulf of Maine gillnet fishery, since this measure might relate more closely to marine mammal kills. It was noted that there is some conflicting evidence relating gillnet soak-time to marine mammal entanglement. Some work suggests that marine mammals become entangled as the nets are deployed, while other studies indicate that the marine mammals become entangled on bottom tending nets which they may encounter. It was noted that much of the work dealing with marine mammal entanglement in general has been done on the U.S. west coast, and that workers in the Northeast will be drawing on the west coast experience for guidance.

It was noted that additional insight on the co-distribution of marine mammals and the gillnet fishery might be obtained by overlaying CETAP marine mammal observations and the observed distribution of gillnet effort. This exercise might help determine if there are some temporal and geographic components of the fishery that would require more intensive monitoring and regulation than others, although it was noted that harbor porpoise are often found outside of areas covered by CETAP.

Final discussion noted that in some regions harbor porpoise are commonly found in shallow water, and concern was expressed that an observation program based aboard large research vessels might not adequately sample animals in such areas. It was noted in response that harbor porpoise in the Gulf of Maine are widely distributed out to deep water, and may not be concentrated in shallow water.

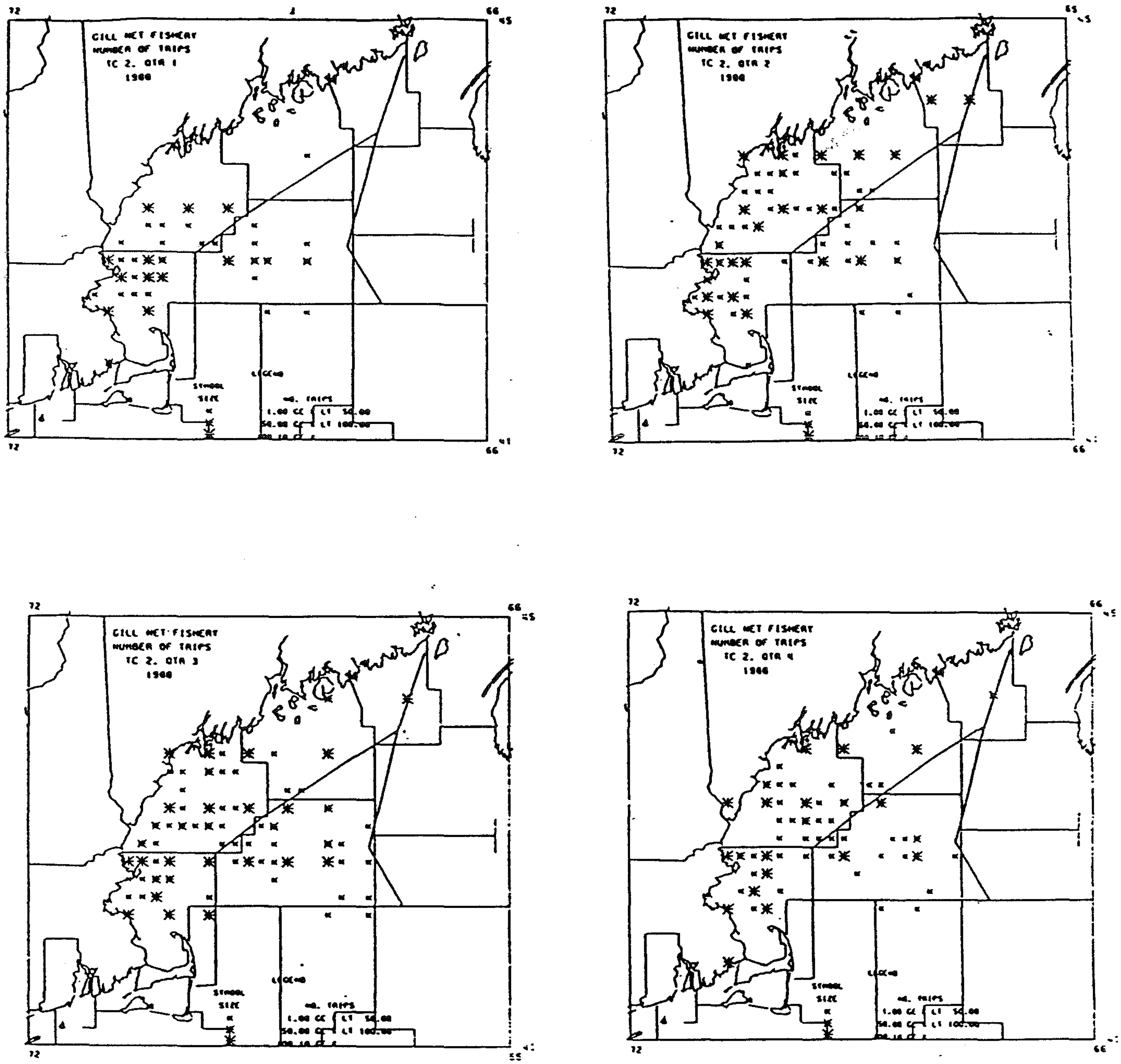


Figure 3.8.1. Number of gillnet fishing trips in 1988 by quarter of the year by 10 minute (interviewed trips) and 30 minute (uninterviewed trips) squares of latitude and longitude, for tonnage class 2 vessels.

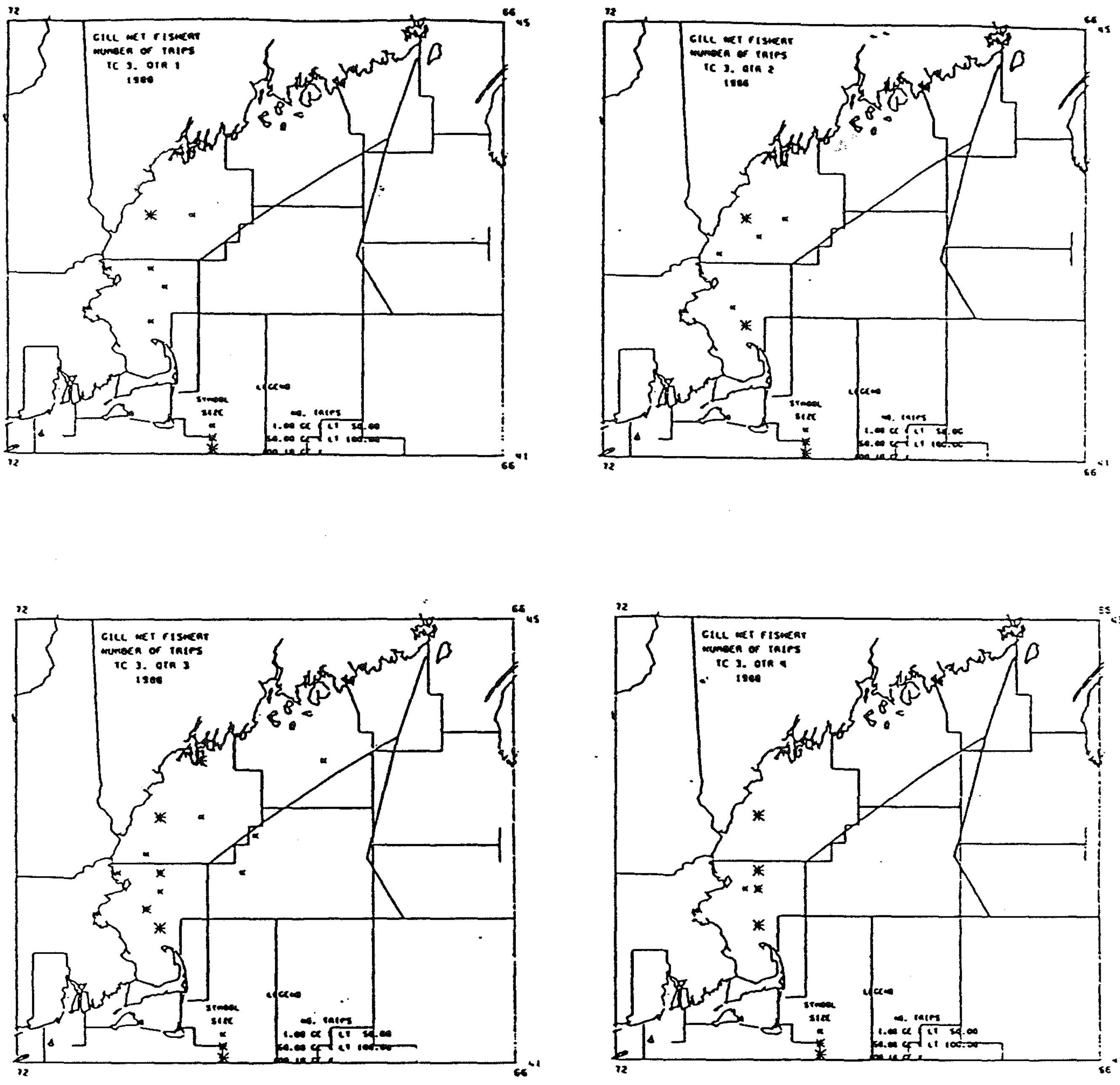


Figure 3.8.2. Number of gillnet fishing trips in 1988 by quarter of the year by 10 minute (interviewed trips) and 30 minute (uninterviewed trips) squares of latitude and longitude, for tonnage class 3 vessels.

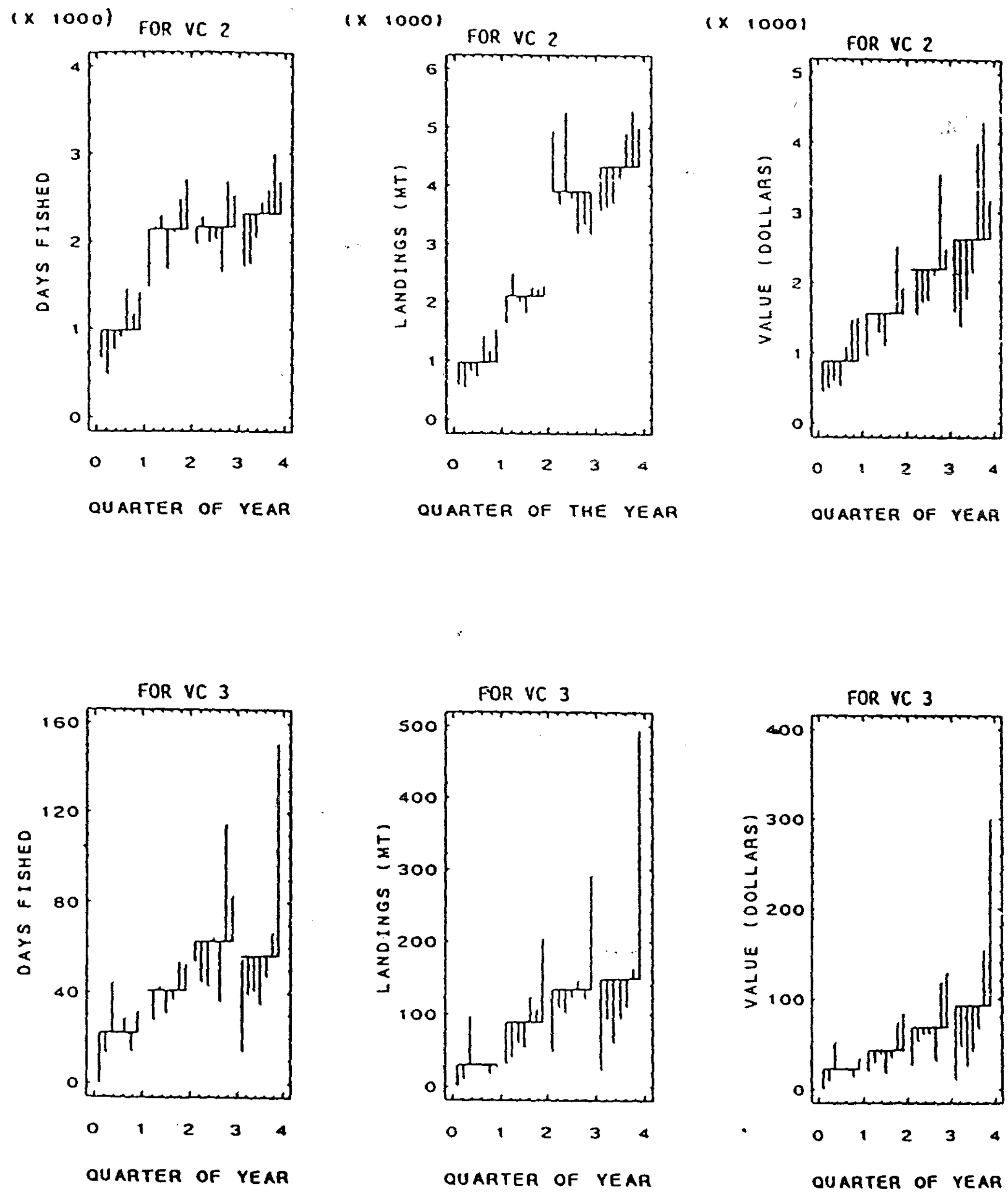


Figure 3.8.3. Days fished, tons landed, and dollar value ($1000's) of tonnage class 2 and 3 gillnet vessels by quarter over years 1982 to 1988. Horizontal bars represent mean values over all years for each quarter; vertical lines within each quarter represent levels of the variable for that quarter of each year of the seven years represented.

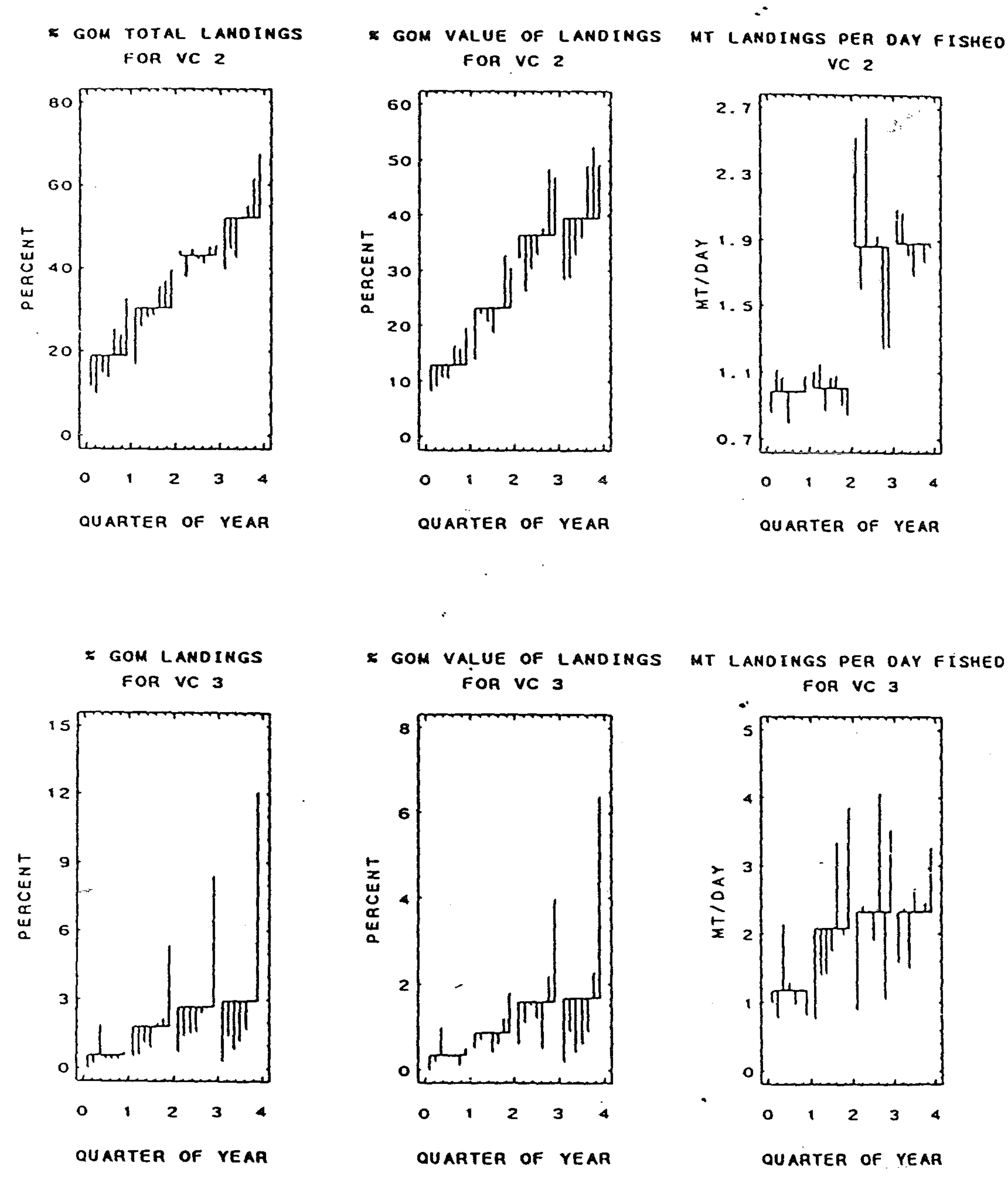


Figure 3.8.4. Percent of total landings and dollar values for tonnage class 2 and 3 vessels that were caught using gillnets, by quarter from 1982 to 1988. Landings per day fished are also illustrated by quarter.

3.9. Methods for Including Discards and Recreational Catch Data in Catch at Age Matrices

Source Documents:

Mayo, R.K., A.M. Lange, S.A. Murawski, M.P. Sissenwine and B.E. Brown. 1981. A procedure for estimating rates of escapement and discard, based on research vessel bottom trawl survey catches. ICES C.M. 1981/G:62.

NEFC. 1989. Report of the Seventh Stock Assessment Workshop. NMFS, NEFC, Woods Hole Lab. Ref. Doc. 89-04, p. 29-46.

Overholtz, W.J., S.H. Clark, and D.Y. White. 1983. A review of the status of the Georges Bank and Gulf of Maine haddock stocks for 1983. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No. 83-23, 31p.

Smolowitz, R.J. 1983. Mesh size and the New England groundfishery - applications and implications. NOAA Tech. Rep. NMFS SSRF-771. July 1983. 60p.

Report

In this session, examples from several species/stocks were presented to illustrate methods which have been or could be used to incorporate discards and recreational catch into catch-at-age matrices. Three general approaches to including discard estimates were discussed: (1) expansion of trip interview data, (2) estimation of total mortality from research surveys, and (3) combining mesh selectivity ogives with size/age composition data from commercial and survey catches. Inclusion of recreational catch relies on surveys of recreational fishermen. Two related approaches were discussed, one based on the NMFS Marine Recreational Fishery Statistics Survey (MRFSS), and the other on a special (species-specific) survey. The examples presented are summarized below.

Discards

1. Interviews and total mortality from survey - haddock example.

Estimates of discards of haddock from the Georges Bank stock were produced for the 1972, 1975, and 1978 year classes. Two methods were employed to estimate the number of fish discarded: (1) trip interviews, (2) total instantaneous mortality (Z) from research surveys.

Discards of haddock from the 1972 and 1975 year classes were estimated from trip interviews conducted by NEFC port agents. The ratio of total haddock trips to interviewed trips was used to calculate total discards from the interviewed trips with haddock discards. This method was used for the 1972 year class at age 2 (1974), the 1975 year class at age 2 (1977), and the 1975 year class at age 3 (1978).

Since similar trip interviews were not available for the 1978 year class another method based on survey total mortality was employed. Significant discarding of haddock of this year class at age 2 was reported by industry sources and from sea sampling trips. Spring and autumn data from NEFC research cruises were employed to obtain an average Z for this year class at age 2 which was used with estimated stock size at age 3 from VPA to estimate stock size and total catch at age 2. Discards were estimated by subtraction.

2. Mesh selectivity and size composition data - yellowtail flounder example.

Numbers of yellowtail flounder discarded were estimated by using the chronology of mesh size regulations in effect during the VPA time series in conjunction with size selection curves for yellowtail flounder (Smolowitz 1983) to estimate percent retention at length. Estimated lengths retained in commercial catches using the prescribed mesh size were then apportioned into numbers marketed or discarded using (1) percentages at length in the population as reflected by NEFC bottom trawl survey data, (2) cull points reflected by the mode of smallest sizes in length samples of yellowtail landed in the 'small' market category, and (3) age distribution through use of respective NEFC bottom trawl survey age-length keys.

Recreational Catch

1. MRFSS

Recreational catch data from the NMFS MRFSS have not yet been employed in catch-at-age matrices, however the SAW Summer Flounder Working Group has conducted a preliminary examination of the MRFSS intercept data for summer flounder to determine their adequacy for this purpose. Several important issues regarding use of the MRFSS data have been identified, including the following:

a. The intensity of length sampling varies geographically.
b. Appropriate methods are needed for converting length to age, given no age sampling in the MRFSS recreational survey.
c. MRFSS sampling protocol imposes a limit of 10 fish (per species) measured per intercept. The possible bias is unknown.
d. Adherence to sampling protocol varies somewhat among interviewers. The degree of bias is uncertain.
e. Methods are needed to estimate the size composition of released catch (Type B2).
f. Mortality rates of released fish (Type B2) are generally unknown, but must be accounted for.

Further discussion of these issues and possible solutions may be found in the Report of the Summer Flounder Working Group (see Section 4.1).

2. Special surveys - Bluefin tuna example

Small bluefin tuna (< 115 lbs) are fished recreationally between Cape Hatteras and Cape Cod. The fishery begins in May or June with the appearance of large schools in the coastal waters off North Carolina. The fishery progresses northward throughout the summer until the fall, when bluefin leave the coastal waters. Time and location of peak catches can vary considerably from year to year. Fishing success appears to be highly correlated with favorable water temperature, and the northward progression of favorable temperatures is highly variable.

Special surveys have been carried out annually since 1975 to estimate the number of bluefin tuna caught by the U.S. recreational fishery. Early surveys attempted to census the catch by following the fish through their seasonal progression northward, and interviewing anglers at the major fishing ports. During the late 1970's and early 1980's, overflights of traditional bluefin fishing grounds were added to the survey to estimate the sampling fraction of trips interviewed. Catches from interviews were then expanded to a total catch estimate. In the mid-1980's, the survey was revamped to handle all large pelagics more effectively. It is currently carried out in a fashion similar to the MRFSS. Effort estimates are made via telephone surveys. These estimates coupled with catch-effort and size data collected at major ports provide estimates of the catch at length for the recreational fishery.

Age-length keys are not developed from the survey sampling. However, modal progression is clear for at least the first two ages. Catch at length estimates are converted deterministically to catch at age using length bounds at age from the bluefin growth curve. The resulting catch at age estimates from the U.S. recreational fishery (largely ages 1-3) dominate the international catch-at-age matrix in recent years. Consequently, data obtained from the survey provide the only information available on the strength of recent year-classes in the western Atlantic.

Discussion

Discards - Haddock

The extent to which stock size changed when discards were included in the VPA was discussed. For strong year classes, estimates differed on the order of millions of fish; there probably was little effect on the long term average stock biomass, although estimates for individual years may be significantly higher. A problem may be that the fishery has always had large discards, so including discard estimates only for large year classes may be somewhat misleading. It was stated that recent larger year classes have proportionally higher discarding rates. Discards probably had relatively little effect on stock size in earlier years when total stock sizes were larger.

An analogous discard problem in pollock was mentioned where 2 year old fish seem to be missing in the 1988 catches. It is difficult to determine whether the absence of small fish in the landings was due to minimum size restrictions or mesh size regulations. Proper estimates cannot be made without sea sampling information on the actual catch.

Sea sampling data maybe used to characterize discard rates under variable strength year classes, but it must be kept in mind that regulation changes also affect discarding rates. Nevertheless, it is still critical to include non-yield biomass in yield per recruit estimates. Discards can also influence VPA estimates. If percent discarded is constant, then the trends in the VPA will be consistent, but if the percentage changes over time, the VPA trend will not be reliable.

Discards - Yellowtail

It was asked if consideration was given to differences between mesh size requirements of the management plan and actual sizes used. Only mesh sizes required under management regulations were used; estimates reflect official requirements and consideration of actual mesh sizes used is difficult due to lack of precise measurements. It was suggested that discard levels might be increased by a set percentage (5-20%) across the board as an exercise. It was mentioned, following a question on areas used, that landings from non-regulated mesh size areas (537-539) for the last three years under the interim management plan were included for Southern New England but regulated areas (526) usually comprised over half of the landings interviewed. Data also suggest that similar mesh sizes were used in other areas as well.

Recreational Catch

The discussion centered on the need to further examine details of the recreational surveys i.e. add request for age structures, etc. It was mentioned that ASMFC and MRFSS were both addressing various aspects of the problem.

Special Surveys - Bluefin tuna example

The data presented indicated fewer age 1's have been landed in recent years. A question was asked if this was a sampling problem or not. Considering the significant survey modifications in recent years, some sampling effect cannot be discounted. However, it is generally believed that bluefin migration patterns are size-specific, influenced by temperature and other oceanographic conditions. Recent conditions may have favored larger (older) fish being closer to shore. Efforts to encourage recreational fishermen to release younger fish and better adherence to the minimum size of 6.4 kg may have also contributed to the decline in the proportion of the age 1 landings. This potential increase in releases of age 1 fish is consistent with the increased landings of ages 2 and 3 fish in the most recent years.

3.10. ASMFC Recreational Subcommittee on Recreational Surveys

Report

The task of the subcommittee was to examine available marine recreational fisheries surveys and make recommendations concerning utility of the surveys and suggestions for improvements. Recommendations, which are detailed in a document prepared by the subcommittee, are summarized as follows:

- Define goals and develop a consensus on common marine recreational fisheries statistical needs.
- Supplement the NMFS Marine Recreational Fisheries Statistics Survey (MRFSS) database for important species.
- Consider special surveys (to fill data gaps) e.g. Mid-Atlantic Billfish Survey.
- Develop best techniques for survey design including data collection and analysis.
- Obtain more money for the MRFSS.
- Participate in program reviews of the MRFSS.
- States should actively participate in MRFSS efforts to improve the quality of the MRFSS.
- Support full funding of the 5-year USFWS hunting and fishing survey.
- Increase state money for recreational fisheries statistics programs.
- Develop special cooperative surveys to respond to unique needs for fisheries under shared state jurisdiction.
- States initiating long-term recreational data collection programs should attempt compatability with the MRFSS.
- Solve administrative problems preventing cooperative efforts between states and NMFS (e.g. difficulties involving sole-source contracts).
- ASMFC should consider a role as a coordinator for cooperative efforts.

In addition, several people have begun looking at the statistical design of the surveys. Subjects have included examination of alternative methods for estimating catch. The current practice of expansion using the arithmetic means of catch per trip may result in a biased estimate; geometric means or medians may produce better catch estimates.

Discussion

The bias created by using an arithmetic mean to estimate catch was questioned. It was stated that it is not a true bias, but the arithmetic mean may not be the most robust estimator given a preponderence of zero catches in the data. The implications of using the arithmetic mean to calculate the MRFSS catch estimates were addressed briefly.

4.0. WORKING GROUP REPORTS

4.1. Summer Flounder Working Group (WG 21)

Members: Wendy Gabriel (Chair, NEFC), Ray Conser (NEFC), Tom Hoff (MAFMC), Chris Moore (MAFMC), Anne Richards (NEFC), Rich Seagraves (Del. Div. Fish. and Wildl.), Gary Shepherd (NEFC), Mark Terceiro (NEFC)

4.1.1. Terms of Reference:

1. Identify proportion of total landings reflected by weighout system over time.

2. Compare trends in existing North Carolina data with other CPUE series.

3. Construction of the catch-at-age matrix for VPA.

4.1.2. Evaluation of MRFSS Data for Construction of Catch at Age Matrices

Use of MRFSS data in the construction of catch at age matrices is initially predicated on the assumption that landings data (by mode, area, month, etc.) are accurate and that data on weight per fish caught are accurate. The evaluation of this assumption was beyond the purview of the Working Group, but may be critical, as landings data are based on intercept samples that are evaluated here.

The Working Group felt that length frequency sampling intensity in the MRFSS was adequate to proceed. Target sampling intensity for commercial fisheries has been set at one sample of 100 lengths per 200 mt landed. Using that criterion, the MRFSS survey undersampled the landings somewhat. In the northern region (Maine to Connecticut), where the problem is worst (one "sample" per 31-1122 mt), the landings were lowest, however. In Mid-Atlantic states (New York to Virginia), where most of the landings occurred, sampling rates were fair (one "sample" per 170-544 mt); and in southern subregion (North Carolina), sampling intensity was excellent (one "sample" per 25-285 mt). The average sampling rate from 1979-1987 coastwide was one "sample" per 312 mt. Improvement in sampling could be obtained by increasing samples from the Mid-Atlantic private rental sector of the fishery in the third quarter.

The Working Group felt that the sampling protocol was generally unbiased by the restriction of length frequency samples to a maximum of ten fish. Less than 10% of the summer flounder intercept samples are affected by this limit. Unlike some fisheries (e.g., mackerel) where intercepted catches can reach 500 fish, it was felt that an accurate length-frequency characterization of the summer flounder intercept catches could be obtained by a 10-fish sample. Intercept samplers generally perform well. Overall, about 70% of the summer flounder available to be measured (given the 10 fish limit) were in fact measured.

Given the absence of age data in the MRFSS, the Working Group proposed to combine age-length keys from commercial, NMFS survey and state sources. Survey data provide age-length information on smaller fish landed recreationally but not landed commercially. Aggregating by subregion and semi-annual time periods provides good temporal, spatial and length-frequency range coverage. Quarterly age-length keys are not planned, because survey data collected in one quarter (which contains nearly no recreational catch) are to be applied to recreational catches in the second quarter. The Working Group would like to obtain any age-length information individual states may have available to augment and improve the present coverage. The Working Group was unable to evaluate how the numbers of fish aged per strata compare with those in other assessments, and whether the number of ages are adequate.

Treatment of discards in this fishery is especially problematic because the ratio of discards to landings has increased steadily from 1979-1987, to the point where more fish were released than landed in 1987. (The length frequency distribution of landed fish has likewise shifted through time, reflecting changes in landing regulations, changes in compliance, or other factors.) No length frequency information on discarded fish is available from the MRFSS. The Working Group strongly recommends the collection of at least a minimal amount of recreational sea sampling data to determine which assumption would be more accurate: 1) all discarded fish are age 0 or age 1, depending on size limits in effect and level of hooking mortality; or 2) all discarded fish survive. Length frequency sampling and notation of hook location, for example, would be useful for testing assumptions 1 and 2, respectively.

4.1.3. Comparison of General Canvas and Weighout Data

Because a significant portion of the commercial summer flounder fishery occurs in southern states, weighout data may not reflect fishery conditions coastwide over the entire period considered: weighout data reflected landings from Maine, Massachusetts and Rhode Island in 1976; New Jersey in 1978; New Hampshire in 1982; Virginia and Maryland initially in 1981 and totally in 1982; and New York in 1986. Data from North Carolina have not been included, as discussed below.

Percentage of General Canvas data reflected in weighout system ((WO/GC)*100.)

1976	44.40%
1977	26.76
1978	54.67
1979	41.97
1980	35.76
1981	62.54
1982	84.36
1983	89.17
1984	85.73
1985	84.31
1986	95.36
1987	92.69

The implication for CPUE analysis, as discussed in previous Working Group meetings, is that a single coastwide fishery index is possible only from 1986 on. Various subsets of the fishery are reflected starting at different years from 1976 on, and different CPUE analyses would be based on those subsets, as previously presented.

The implication for construction of a catch at age matrix appears more serious. Construction of a catch at age matrix extending back to 1976 presently requires the assumptions that length composition and age-length keys obtained from one component of the fishery be applied to the total catch over the range of the fishery, e.g., catch from Virginia would be characterized by length composition and age composition data from New England states. The difference between length and age samples from southern and northern states should be undertaken for years where coastwide sampling is available, to evaluate the effect of this assumption.

North Carolina Data

The Working Group has not examined any data that may be available on landings, effort and biological sampling of commercial catches for North Carolina.

Effects of Discard in Developing Commercial Catch at Age Matrices

No progress has been made on this topic, because of recent staff shortages. Future progress on this project is contingent on available personnel. The project entails evaluation of sea sampling data presently being collected. There is a critical need for sea sampling data on discards in the summer flounder fisheries to generate these estimates.

Discussion

The major point raised was a reiteration of exercising caution when extending biological statistics from one area, where they are available, to others, where the data and/or time series are not available. The working group expressed awareness of this concern in their report.

The possible need for accelerating resolution of data needs, e.g. discard information, hooking mortality rates, etc., was mentioned. This need was considered to be important enough that the work should be carried out in spite of personnel limitations, and a request was made that the SAW be a vehicle for pressing for this need. It was not determined that the SAW was the proper venue for such a push, but rather that the request should go through "normal" channels. The reason presented for such timely gathering of data was the worry that the stocks may be in worse shape than thought 6-12 months ago. This worry was based on reports that Virginia's recruitment indices for the past two years were poor and that there was a 50% decline in landings in the trawl fishery. Conflicting evidence from North Carolina, i.e. increasing recruitment indices for the past 2-3 years, was also mentioned.

4.2. Methods of Measuring Long-Term Potential Catch (WG 9)

Members: Brian Rothschild (Chair, CBL), Ray Conser (NEFC), Tom Hoff (MAFMC), Howard Russell (NEFMC), Vaughn Anthony (NEFC), Mike Fogarty (NEFC)

This Working Group met for two days (January 25-26) in Solomons, Maryland to address its terms of reference. A 26 page draft report was prepared but not circulated at the SAW. However, a brief report on progress was circulated as Working Paper #18.

4.2.1. Terms of Reference:

1. Review the classic definition of maximum sustainable yield (MSY) as well as the qualifications associated with the definition.

2. Consider alternatives to that definition and specify how these alternatives provide advice on either maximum yield, sustainable yield, or the desired combination of the two.

3. Review existing FMPs to determine how this problem has been handled under the FCMA.

4. Make recommendations on future research, noting any constraints in implementation.

4.2.2. Report

An expression of Maximum Sustainable Yield (MSY) or Long Term Potential Catch (LTPC) is useful as a means of assessing the potential consequences of management schemes, and so these concepts have become accepted starting points for communication among fishermen, administrators, and scientists. The Working Group is making progress in the development of alternatives to the classical definition of MSY. This effort is being undertaken because MSY often gives managers an incorrect impression of the potential of a fishery. Maximum catch is not sustainable; it changes with varying recruitment, and generally is calculated in a single species context. Sustainable yield implies equilibrium conditions which generally don't exist (consistent gear types, catchability, and selection patterns), and so the estimate of long term (30-40 years) equilibrium yields may not be appropriate given today's changing fishery practices and stock conditions.

As an alternative, LTPC is intended to be a realistic assessment of likely catches in the next 5-10 years, reflecting current conditions of exploitation pattern and the influence of competing fisheries. LTPC may not be sustained, and may not be maximum, because the catches are tied to existing conditions. However, the WG feels that LTPC can be used interchangeably with MSY for FMP purposes.

The Working Group identified four methods to be used in estimating MSY/LTPC, depending on the amount of fishery and biological data available:

1) Historical catch
   - use when only historical catch data are available
   - if catch constant, use average catch
   - if catch changing, may cap catch at recent level while better data are collected
2) Surplus production models
   - use when catch and effort data are available
   - employ standardized effort measures
   - non-equilibrium, delay-difference models preferred

3) Y/R and SSB/R
   - knowledge of stock and fishery characteristics required
   - can estimate $F_{0.1}$, F_{max}, Y/R, and SSB/R
   - requires knowledge of average recruitment level to estimate MSY/LTPC

4) Analytical assessment
   - requires data on stock and recruitment levels
   - calculate Y/R and SSB/R relationships
   - calculate either a) F_{med} or alternative F level, or b) S-R curve, R_{max}, F_{msy}, Y/R, and MSY/LTPC, depending on the nature of the S-R relationship

The Working Group noted that additional work is still needed to develop the concept of LTPC, including:

1) Use of surplus production models to estimate MSY/LTPC for cod, haddock, and mackerel -- compare with other methods

2) Examine use of F_{med} vs. other target F levels via simulation

3) Randomly generate S-R data from several known S-R relationships - then apply ICES methods and evaluate effectiveness

4) Via simulation modeling, evaluate the procedure of taking reciprocal of R/SSB from empirical data to obtain equilibrium SSB/R

<u>Discussion</u>

There was some debate over whether an F_{med} fishing level could be considered a conservative target. It was noted that in the fishery for Northeast Arctic cod, for which the S-R relationship is not well defined, the F_{med} strategy had resulted in continued stock declines. However, for cases in which the S-R data can be defined by a S-R relationship (e.g., Ricker or Beverton-Holt), then fishing at an F_{med} or $F_{r_{max}}$ (the F that produces the SSB that provide the maximum recruitment using the Ricker S-R curve) level may prove to be a reasonable strategy. If a stock-recruitment relationship is found, it should be used; if not, one should revert to the SSB/R approach.

4.3. Black Sea Bass and Scup Working Group Report (WG 22)

Members: Dave Keifer (MAFMC), Gary Shepherd (NEFC), Tom Hoff (MAFMC)

Terms of Reference: In support of MAFMC plans to expand the summer flounder FMP, the working group was asked to: 1) develop biological reference points over the geographic range, and 2) examine available fisheries statistics.

The Working Group will convene before SAW-9 and a report will be available at SAW 9. Anyone interested in participating should contact Dave Keifer, chair.

4.4. Mackerel Information Needs Ad Hoc Working Group Report

Members: Tom Hoff (MAFMC), Dave Keifer (MAFMC), Tim Smith (NEFC), Steve Murawski (NEFC), Bill Overholtz (NEFC)

4.4.1. Terms of Reference: To identify information needs to keep current on the status of mackerel.

4.4.2. Report

Individuals prepared separate lists of their perception of information needs, taking the terms of reference generally, not just as it relates to information needed to estimate quota limits under the FMP.

Two specific information needs were identified:

1. estimates of spawning stock size and $F_{0.1}$ catch levels annually to calculate ABC, as required under the Squid-Mackerel-Butterfish FMP.

2. other information for fishery monitoring.

These are described below:

1. Assessment advice for establishing annual quota levels must be updated annually, in a timely fashion. The technical information necessary includes an update to the VPA every 3 years, and projections of the existing VPA for years 2 and 3 to give management advice.

Two schemes for structuring the timing of the addition of new data to the analytic assessment were identified. First, if it is desired to update assessment advice in mid-year, to account for winter-spring catches of the current year, then data needs include:

1.1. foreign and JV length frequency sampling (computerized within 2-3 months of collection),

1.2. foreign and JV age/length keys (ageing completed by June-July),

1.3. commercial (Foreign, JV, USA) catch/effort (data computerized within 2-3 months of collection), and

1.4. R/V survey catch and ageing data completed from the spring survey by June-July.

Alternately, if the "leap-frog" model is used predicting 2 years ahead (i.e. to project 1989 catch and stock size during 1988, using the 1987 total catch data and the complete catch at age data through 1986), the same data as above is required except for the current-year data. In this approach the spring SAW would review the assessment of the status of mackerel, based on using data through the end of the previous year, predicting catch, F, and stock size for the following year.

Diagrammatically, this is:

year i	
year i+1	- Spring SAW uses data through year i - predicts catch, stock, etc. for year i+2
year i+2	

2. Use other data to monitor the fishery, specifically:

2.1. Catch and effort for foreign vessels by 3 digit area, through direct access to computerized observer logs for mackerel and for by-catch, by vessel, by Council staff on a near real time basis.

2.2. Same as 2.1. for U.S. vessels fishing in JVs.

2.3. Same as 2.1 for U.S. vessels landing mackerel from weighout data, with a time delay of a couple of months in getting weighout data on the computer.

2.4. Access to MRFSS data for mackerel.

2.5. Access to selected environmental data affecting spatial distribution of mackerel.

2.6 Data on growth rates of young fish, as a potential early indication of yearclass size.

It was noted that if the monitoring data under item 2 are found to be useful as indicators of relative stock size conditions, then perhaps more years can be allowed between VPA updates.

Recommendations

The working group participants felt that, given the current management system requiring in-year assessment update, both sets of data needs identified are not being properly met at present. The working group recommends that, contingent on the present fishery and stock conditions remaining constant, the analytic assessment should be updated every third year and presented at the appropriate SAWs, based on the "leap frog" procedure. The working group participants noted that there has been a decrease in availability of the data identified under item 2 above; NER staff are no longer entering these data on the computer. The working group recommended that the resources to computerize these data both historically and on a timely basis need to be made available in order to allow adequate near-real time monitoring of the mackerel fishery.

5.0. CHESAPEAKE BAY STOCK ASSESSMENT COMMITTEE REVIEW

5.1. Review of Chesapeake Bay Stock Assessment Program

Source Document: Anon. 1988a. Chesapeake Bay Program - Stock Assessment Plan. Chesapeake Executive Council, Annapolis, MD. 66p.

Improving stock assessments for Chesapeake Bay species is important if the commitment in the 1988 Chesapeake Stock Plan (Anon 1988a) of "restoring and protecting the Bay's living resources" is to be achieved. A coordinated plan for improving the stock assessment information was developed by the Chesapeake Bay Stock Assessment Committee (CBSAC), and agreed to by the several political bodies (Virginia, Maryland, Pennsylvania, US government) and by the Chesapeake Bay Commission. This plan is known as the Chesapeake Bay Stock Assessment Plan (CBSAP), and is comprehensive both in identifying the need for a bay-wide focus for assessment work and in identifying the approximately 100 people, 20 organizations, and three million dollars that are currently involved in stock assessment work in the Bay.

In response to a term of reference suggested during the Fall 1988 Stock Assessment Workshop, and given the comprehensive nature of CBSAP, a review of the stock assessment work in Chesapeake Bay has been structured broadly. The goal is to provide a comprehensive overview of the assessment work in that region that SAW participants might use to help evaluate the utility of specific programs toward meeting the goals of CBSAP. It is hoped that this review would result in a substantial discussion of the relationship of the specific projects to the overall CBSAP goals, rather than a detailed review of the specifics of individual projects.

Given the concerns about the limitations of existing time series of fishery independent and fishery dependent data raised in the preparation of a recent assessment of the status of yellow perch in the Bay (Anon. 1988b), this review was focused by design on projects relating to establishing such time series. Several other research projects are underway on the biology of Chesapeake Bay stocks, on recreational fishery statistics, and on developing new or improved assessment and survey methods. While review of several of these projects would also have been valuable, stock assessments in the bay appear to be critically dependent on the establishment of fishery independent and dependent data collection programs. It would be useful to review several of these other projects during a future SAW, but they appear to be of secondary importance at present.

The review was structured around the several sources of funds, especially but not exclusively those administered through federal grants. This structure was selected because CBSAP specifically tasked CBSAC to "continue its coordination role and begin to oversee the active development of baywide stock assessments" (Anon 1988a, p. ix), and because the issue of coordination of the several funding sources to achieve the goals of CBSAP has been raised recently among the several administrators of funding programs (Gabriel, personal communication).

To accomplish these goals, the Chair of CBSAC and the State Contacts for Virginia and Maryland were asked to participate in a panel discussion. The Chair of CBSAC, in the coordinating role identified on page ix of the CBSAP, described the several relevant research projects, identifying the funding source and amount, and the current status (completed, ongoing) (Table 5.1.1). These several projects were classified according to how they relate to the major features of the CBSAP as identified on pages ix-x of that document: Fishery Dependent, Fishery Independent, and Stock Assessment Implementation. Within each of these categories, the projects were also classified according to the tasks specified on pages ix and x in CBSAP.

The specifics of the several projects listed in Table 5.1.1 are described in Tables 5.1.2-5.1.4. These are included in their entirety because they are not readily available elsewhere. The structure of future funding directions by CBSAC is described in Table 5.1.5.

The State Contacts described how work within their state's programs relate to the goals of CBSAP in establishing long term fishery independent and fishery dependent data collection programs on a baywide basis.

Given the relatively general level of the review, and the fact that considerable technical expertise has been expended in developing CBSAP as a baywide undertaking, SAW participants undertook a discussion based on the presentations focused on how well the several funding sources were being used to meet the overall objectives of CBSAP. This discussion addressed the specific projects being funded in the several states, on the degree of coordination among the states for achieving data collection programs that are consistent across the Bay, and on identifying any gaps in coverage of critical topics.

Discussion

The discussion followed the organization of the program review and focused first on the fishery independent data collection programs of Virginia and Maryland. The fishery dependent data collection programs of the two states were also discussed. A lengthy discussion ensued on the multipurpose objectives and methodologies of the various programs, in the respective states. However, since specific results were not available, conclusive comments were generally precluded.

Fishery independent trawl data have been collected in Virginia continuously since 1954. However, the methodologies have varied significantly. Survey design (i.e. stratified rendom vs. simple random), area (i.e., all major rivers vs. target river) and net size (30 ft. vs. 20 ft.) have all changed during the past 35 years because of changes in funding and objectives of the sampling. The consistency of the trawl studies and the relative catchability were questioned. Significant work and analysis has occurred and is continuing on fishing power studies and escapement studies but the belief was that comparability could be developed so that the historical data base could be maintained.

Data from trawl surveys are used for a variety of other stock assessment projects (i.e. State requirements, EPA, Army Corp). Different objectives exist which have different precision requirements and thus, funding levels. CBSAC, in support of CBSAP, is intended to coordinate efforts between federal and state agencies and universities. Those efforts are funded from a variety of state and federal sources with only part of the total funds channeled through CBSAC.

Although significant changes have occurred over the time series and many ideas for improvement were suggested (i.e. expand to outside areas of North Carolina and DELMARVA coast), it was asserted that the Virginia trawl survey provides reliable estimates of recruitment for blue crabs, croaker, and summer flounder. It is hoped that indices can be developed for about 15 other species. Efforts to compare the Virginia and Maryland procedures through trawl equivalency coefficients are ongoing, and there is hope to be able to consolidate the two data sets. The SAW participants encouraged the improved cooperation between the two states and strongly urge the development of comparable methodologies. The Stock Assessment Workshop saw two major directions for these efforts: 1) establish a time series of data and then calibrate, and 2) calibrate ongoing surveys. However SAW participants realized that even if identical gear were used between the two states, a significant boat difference may preclude development of comparable data. Stratified random sampling began in Virgina in 1984 and in Maryland in 1989. State representatives reported significant progress in coordination within the past 4 months. Details of the Maryland sampling design should be available from CBL soon.

Several of the fisheries dependent data collection programs tie into the various NMFS data systems. Both Virginia and Maryland have used Wallop-Breoux monies to expand the MRFSS in the past and will continue in the future. A 200% expansion in MRFSS data collection effort in Virginia has reduced the coefficients of variation of the Virginia catch estimates. Maryland has a commercial finfish trip ticket fishery data collection program that appears to be decreasing in reliability due to conflicts between fishermen and Maryland DNR and from the use of the data by IRS to target violators. The NEMFIS system should improve commercial database quality in both states as that program evolves. Monthly input to the NEMFIS system by both states is anticipated. Biological sampling data, at least from Virginia, should be entered into NEMFIS in approximately three years.

Table 5.1.1. Summary of funded research related to Chesapeake Bay Stock Assessment Plan Foci. Completed research is designated C, ongoing research O. Numbers indicate programs funded by federal programs other than CBSAC proposals. Unnumbered items were funded by CBSAC (Table 5.1.2). Items designated as F-xx were funded by the U.S. Fish and Wildlife Service (Table 5.1.3). Items designated by a number only were funded by NMFS under the Grant-in-Aid program or the Anadromous Fish Conservation Act, (Table 5.1.4).

1A. Fishery Independent Programs

	Design Baywide trawl survey species, life stage	Augment Trawl survey for other juvenile populations	Effects of environment Program	Coordinate with Baywide Monitoring
1985	Pound net, trawl survey (VA) (C)	white,yellow perch Choptank River (MD (C)	white, yellow perch Choptank River (MD) (C)	
		Blue crab, juvenile weak fish, F areas (MD) (C)	Data files, time series analysis (VA) (C)	
		Several finfish (MD) (C)		
		Juvenile striped bass abundance (VA) (C)		
		blue crab spawning stock (VA) (C)		
		Anacostia, Potomac Survey (DC) (C)		
1986	Improve data management (VA) (C)	white, yellow perch Choptank River MD) (C)	Data files Time series (VA) (C)	
		Blue crab, juvenile weakfish, F. areas (MD) (C)		
		Recruitment index white perch (VA)(C)		
		Field sampling (VA)(C)		
		Anacostia, Potomac survey (DC)(C)		

1A. Fishery Independent Programs (continued)

	Design Baywide trawl survey species, life stages	Augment Trawl survey for other juvenile populations	Effects of environment Program	Coordinate with Baywide Monitoring
1987	Anacostia, Potomac survey (DC) (0)	Hydroacoustics assessment of Potomac (MD)(0)	Historical data evaluation in 2 tributaries (MD) (0)	
	Trawl survey (VA) (0)	Anacostia, Potomac survey (DC)(0)	Summer flounder recruitment (VA)(C)	
		Field study of blue crab population dynamics (MD)(0)		
1988	Trawl survey design (PA) (0)	Egg production and larval dynamics of striped bass	Oyster population dynamics (MD) (0)	
	Chesfish (MD) F-43)	white perch (MD)(6)	Finfish biological indicators (MD) (F-45)	
		Rappahannock striped bass (VA)(8)		
		Anadromous alosids (MD) (F-37)		
		Striped bass (MD) (F-42)		
		Yellow perch (MD) (F-46)		
		Juvenile striped bass Seine survey (VA)(F-87)		

1B. Fishery Dependent Programs

	Fisheries Statistics: catch, effort by gear, area	Fisheries Statistics: commercial trip tickets recreational survey, procedure & implementation	Fisheries Statistics: Biological characteristics of commercial, recreational catch
1985		Designs for harvest Estimate models (PA)(C)	Pound net, trawl survey (VA) (C)
1986	Standardize MD landings data base (MD) (C)	Designs for harvest estimate models (PA) (C)	Field study of blue crab population dynamics (MD) (0)
1987	Improve access to data base (MD) (0)		
	Field study of blue crab population (MD) (0)		
1988	Maryland Fishery Statistics (1)	Recreational fishery Statistics evaluation (VA) (0)	VMRC biological sampling (VA) (0)
	Commercial fisheries Statistics information	Improve fishery statistics (MD) (0)	Age error effects (VA) (0)
	Assessment of Commercial fishing effort in VA (VA)(3)	Estimation for short season recreational fisheries (blackdrum) (VA) (F-82)	Stock assessment information system fishery species (VA) (4)
	Study of Aiosa stock Composition and year-class strength in VA (VA) (7)		Study of Aiosa stock composition and year-class strength in VA (VA) (7)
	Catch and effort data collection for artificial reefs (VA (F-63)		Fisheries management studies (DC) (F-2)

1C. Stock Assessment Implementation

	Status of Stocks Analytic techniques Data management	Workgroups: finfish, oysters, blue crab data evaluation & sampling	Annual reports: status of stocks, fishing statistics assessment reports
1985	Information needs for management (MD) (C)	Blue crab, juvenile weakfish, F areas (MD) (C)	
	Stock id (VA) (C)		
	Data Files, time series analysis (V) (C)		
	Multivariate time series analysis (PA) (C)		
1986	Stock id (VA) (C)	Blue crab stock dynamics (MD) (C)	
	Data files time series (VA) (C)	Blue crab spawning stock (VA) (C)	
	Multiple time series regression models (PA) (C)		
1987	VMRC data Management (VA) (C)	Field study of blue crab population dynamics (MD) (0)	Status of Stocks knowledge (VA) (1)
		Analysis of white perch data sets (2 tributaries (PA) (C)	

1C. Stock Assessment Implementation (Continued)

	Status of Stocks Analytic techniques Data management	Workgroups: finfish, oysters, blue crab data evaluation & sampling	Annual reports: status of stocks, fishing statistics assessment reports
1988	Improve Fishery Statistics (MD) (0)	Oyster population dynamics (MD) (0)	
	Age error effects (VA) (0)	Blue crab tag-recapture (VA) (0)	
	Weakfish Stock id (MD) (F-101)	Oyster standing Stock, James River (VA) (0)	
	Weakfish, bluefish Summer floundr Stock id (VA) (F-60)	Study of Alosa stock Composition and year-class strength in Virginia (VA) (7)	
	Age determination methods, croaker, spot and weakfish (VA) (F-88)	Mark-recapture of striped bass, James River (VA) (9)	
		Summer flounder stock id, tagging (VA) (F-61)	
		Mark-recapture of striped bass, Rappahannock (VA) (F-77)	
		Age determination methods croaker, spot, weakfish (VA) (F-88)	

Table 5.1.2. Projects funded under the Chesapeake Bay Stock Assessment Committee.

FY 85

Maryland

Stock assessment, white and yellow perch 5/85-4/86 $44,000	Age, size composition in Choptank River; relative abundance and distribution of adults, juveniles; water quality in areas sampled; fyke and trawl nets in spring and summer; ageing methods.
Stock assessment, blue crab and weakfish 1/86-12/86 $105,000	Trawl sampling for blue crab and juvenile weakfish in 7 areas; periods and location of juvenile abundance and recruitment; sex ratios; weakfish juvenile index; length, scales, weight, sex; some fishery dependent sources.
Stock description, several finfish 7/85-6/86 $55,000	Length, weight, age, sex composition for white and channel catfish, bluefish, summer flounder, winter founder, black sea bass; ALKs up to age 4; ageing methods.
Information needs for management 1/86-12/86 $45,000	Striped bass age and growth differences between year classes in Potomac River not correlated with year class strength, based on back calculation; model structure developed for age-structured sequential fishery which needs sex-specific migratory data; decision support/expert system with objective of optimal allocation of fishing effort to maximize net present value, data sampling etc. driven by model requirements.

Virginia

Pound net, trawl survey 7/85-6/86 $100,000	Stratified random sampling of biological data from VA pound net fishery (age, size, growth, mortality, distribution); develop stratification scheme, cruise tracks, sample sizes for trawl survey (twice monthly).
Juvenile striped bass abundance 7/85-6/86 $22,000	Intercalibration of seine efficiency based on differences in seine size, net depth and deployment methods showed no significant difference in methods between MD and VA. Trawling was not an effective sampling method in the area.
Blue crab spawning stock 7/85-4/87 $53,000	Extent of spawning grounds, fecundity, distribution and abundance of eggs, reproductive potential.
Stock i.d. lab 7/85-6/86 $70,000	Develop capability for electrophoresis and mtDNA analysis within state.

Data files, time series analysis 9/85-8/86 $15,000	Assemble 30 year trawl survey data base for time series analysis of spot, summer flounder recruitment related to environmental fluctuation.

District of Columbia

Anacostia and Potomac River survey 7/85-12/86 $33,000	Anadromous fish survey (striped bass, American shad, hickory shad, alewife, blueback herring) using gillnets; length, weight, maturity at 14 sites.

Pennsylvania

Multivariate time series analysis; designs for harvest estimate models 7/85-6/88 $210,000	Categorical regression (with lags), transfer functions, resampling methods applied to striped bass, shad, oyster. Sources of bias, randomized response techniques for catch estimation, design for exploratory interviews.

FY 86

Maryland

Stock assessment, white and yellow perch 1/87-12/87 $110,000	Trawl and fyke net surveys of summer and spawning white and yellow perch; biological characteristics; ageing; age validation with oxytetracycline.
Stock assessment, blue crab, weakfish 5/86-4/87 $139,000	Potomac, Tangier Sound, Eastern Bay, Chester River, Pocomoke Sound, Patuxent River and Potomac tributaries.
Maryland fishery statistics 9/86-8/87 $58,000	Standardize Maryland landings data base, biological data, data access.
Blue crab stock dynamics 5/86-12/87 $105,000	Stock-recruitment relationship from CPUE data; Seasonal CPUE patterns from analysis of statistics and field observations of commercial fishery; ARIMA time series for small scale spatial distribution.

Virginia

Improve data management, pound net and trawl survey 7/86-6/87 $100,000	Computerization of measurement system; programs for random station selections, data auditing, formatting; validation and documentation; data summary programs.

Recruitment index, white perch 7/86-12/87 $34,000	Compare VA trawl survey data to seine survey and landings data. (Relationship poor).
Operate stock i.d. lab 7/86-12/87 $77,000	Stock identification of striped bass stocks; blue crab populations in Delaware Bay, Chesapeake and North Carolina; oyster stocks in Chesapeake Bay.
Blue crab spawning stock 9/86-4/88 $67,000	Sampling methodology for population size estimates; estimate population size, distribution and relationship to environmental factors.
Data files, time series 7/86-6/87 $30,000	Continue VIMS survey index work; life history model for spot; juvenile index trends for summer flounder, croaker, spot; climate trends.
Field sampling 7/86-6/87 $9,000	Juvenile monitoring, fall/winter on Virginia eastern shore.

District of Columbia

Anacostia and Potomac River survey 1/87-6/88 $54,000	Continue survey; electrofish for seasonal distribution of adult and juvenile striped bass; age composition; compare gear types for capturing juveniles.

Pennsylvania

Multiple time series regression methods, designs for harvest estimate models 9/86-8/87 $95,00	Evaluate fluctuations in stock size variables related to habitat quality, anthropogenic, environmental variables. Evaluation of Maryland interview/license survey and crab catch survey; calibration of crabbing operation in Virginia.

FY 87

Maryland

Hydroacoustics survey of Potomac 4/88-6/88 $20,000	Cooperative with District of Columbia; dual beam echo integration ground-truthed with D.C. survey.
Improved access to data base 4/88-3/89 $75,000	Continue contract for data access; add five microcomputer workstations.

Field study of blue crab population dynamics 3/88-1/90 $242,500	Estimate total effort, C/f and length frequency in pot fishery by sampling at processors, by observers and by aerial survey. Winter dredge survey to estimate overwintering Z and recruitment next year (expand to Baywide estimate). Tag by sex to show distribution, F, by various fisheries, M, and growth.
Historical data evaluation and collection, two tributaries 6/88-6/89 $110,00	Assemble 45 time series of hydrographic and contaminant conditions, 1930-1985, monthly or annually. Evaluate relationship of stock abundance from 5-10 fisheries to time series (recruitment success).

Virginia

VMRC data management 7/87-6/88 $53,000	Compilation of historical data on microcomputer data base; data sources and specificity documented; audit and data summary programs written.
Trawl survey 7/87-12/88 $242,000	Evaluate sources of variation in trawl catches, species composition, time/space distribution, gear comparisons, data analysis and management.
Summer flounder recruitment 7/87-12/88 $14,000	Location and timing of recruitment, preferred substrate for juveniles, time/space distribution of YOY recruitment, shifts in diet with shifts in size.
Status of stocks knowledge 7/87-12/88 $23,000	Summarize existing information on species in bibliography.

District of Columbia

Anacostia and Potomac River survey 7/87-12/88 $80,000	Trawl survey in cooperation with MD hydroacoustic survey.

Pennsylvania

Analysis of white perch data sets 8/87-6/88 $50,000	Partition white perch mortality due to environment and anthropogenic factors. Data not adequate.

FY 88

Maryland

Improve fishery statistics 9/88-3/91 $85,000	Purchase image analysis system to read handprinting.
Oyster population dynamics 9/88-3/91 $220,000	Evaluation of effect of temperature, salinity, current direction and speed affects recruitment, growth, mortality; optimal densities of shell and seed for planting success; evaluate existing oyster management strategies.

Virginia

VMRC biological sampling 7/88-7/89 $37,000	Pilot program to characterize harvest by region; length, weight, sex, maturity, fecundity; electronic measuring boards; computers.
Recreational fishery statistical evaluation 9/88-7/89 $122,000	Define data needs to assess recreational fisheries, how closely NMFS survey meets needs and how survey may be altered; design new survey for material not being collected.
Age-error effects 10/88-1/90 $74,000	Evaluation of adequacy of existing growth and age-structure data; effects of errors on application of standard models. Striped bass example.
Blue crab tag-recapture 10/88-10/90 $164,000	Tag-recapture study to determine length of time to produce brood, rate of brood production, time spent on spawning grounds. Fishery dependent study of time on grounds, exploitation rates.
Oyster standing stock, James River 8/88-7/89 $22,000	Application of DeLury-type estimator to estimate abundance of naturally-occurring oyster stock.

Pennsylvania

Trawl survey design 8/88-6/89 $75,000	Formulate pilot Bay-wide survey design, based on existing survey data.

Table 5.1.3. Chesapeake Bay project descriptions funded by U.S. Fish and Wildlife Service.

REVIEW OF CHESAPEAKE BAY FEDERAL AID FISHERIES PROJECTS

MARYLAND PROJECTS

F-37-R-11 Investigation of Anadromous Alosids in Chesapeake Bay. Federal Cost $178,686, tenth year, Project Leader: Dale Weinrich. Description: Original project was to investigate the collapse of the Atlantic shad population in the upper bay. Provided basis for moratorium on shad fishing. Has been expanded to evaluate population status of all alosids in the upper bay. Estimates adult shad populations in the Susquehanna River and is developing a juvenile index of all alosids.

F-42-R-2 Investigation of Striped Bass in Chesapeake Bay. Federal Cost $272,126, new project. Project leader: Robert Early. Description: All of Maryland's Striped bass work is now in this project. This project determines the characterstics of the resident/premigratory bass population; characterstics of the spawning population in the bay and tributaries; determines fecundity of spawning females; determines hatchery contribution and determines the striped bass recruitment index.

F-43-R-2 CHESFISH. Federal Cost $251,748, new project. Project leader: Brian Rothschild (CBL). Description: This project was originally submitted through the Chesapeake Bay Stock Assessment Committee (CBSAC) along with a similar project by VIMS to the Northeast Fisheries Center (NMFS). The NFC could only partially fund these projects and Maryland submitted the project to us to be funded with D-J monies. The objective of the project, along with the VIMS project, is to provide a base of fisheries independent trawl data for Chesapeake Bay.

F-45-R-1 Finfish Biological Indicators. Federal Cost $255,955, new project. Project leader: Eric May. Description: Project will provide laboratory facilities and a quick response team to investigate and evaluate fish kills; will attempt to evaluate habitat degradation based on the immunological response of finfish.

F-46-R-1 Investigation of Yellow Perch Stocks in Maryland. Federal Cost $106,872, new project. Project leaders: Bill Eaton, Harley Speir. Descripton: This project will investigate yellow perch populations and spawning success in several tidal streams.

F-101-R-1 Coastwide Weakfish Stock Identification Program. Federal Cost $6,502, new project. Project leaders: B.W. Meehan, H.M. Austin VIMS. Description: Cooperative project with the states of MA, NY, NJ, DE, and NC. The ASMFC will coordinate, provide administrative supporc and contract with VIMS for the work.

VIRGINIA PROJECTS

F-60-R-2 Stock Identification of Mid-Atlantic Weakfish, Bluefish and Summer Flounder Using Electrophoresis. Federal Cost $107,430. Project leaders: Herbert Austin, Mark Chittenden, Brian Meehan, VIMS. Description: Determine the stock composition of the three species in Virginia's coastal and Chesapeake Bay waters.

F-61-R-3 Stock Identification of Summer Flounder in the Southern Mid-Atlantic Bight-Tagging Studies. Federal Cost $106,800. Project leader: J.A. Musick, VIMS. Description: Tagging will be used to obtain information on stock composition and migratory patterns of summer flounder.

F-63-R-2 Development and Implementation of a Catch and Effort Data Collection System for Monitoring Virginia's Artificial Reefs. Federal Cost $22,671. Project leader: Jon A. Lucy, VIMS. Description: Fishermen will be contacted to determine fishing success rates for artificial reef sites.

F-77-R-2 A Mark-Recapture Study of Striped Bass in the Rappahannock River, Virginia. Federal Cost $98,778, new project. Project leader: Joseph Loesch, VIMS. Description: This a mark-recapture study of adult striped bass in the Rappahannock River and is coordinated with an identical study in the James River funded by NMFS. Maryland, New York, Rhode Island and possibly the District of Columbia will be tagging adult striped bass using the same tag. All tags are returned to Charlie Wooley who will evaluate all tag return data.

F-82-R-2 Assessment and Development of Biological Estimation Procedures for Short Season Recreational Fisheries: The Virginia Black Drum Fishery. Federal Cost $54,260, new project. Project leader: Cynthia Jones, ODU. Description: Standard creel survey of the black drum fishery in Chesapeake Bay.

F-87-R-1 Estimation of Juvenile Striped Bass Relative Abundance in the Virginia Portion of Chesapeake Bay. Federal Cost $47,849, new project. Project leader: James Colvocoresses, VIMS. Description: This project will continue the beach seine surveys in the James, York and Rappahannock Rivers to determine relative annual year class strength.

F-88-R-1 Development of Age Determine Methods, Life History-Population Dynamics Information, and Evaluation of Growth Overfishing Potential for Important Recreational Fishes. Federal Cost $146,262, new project. Project leaders: Cynthia M. Jones, ODU and Mark E. Chittenden, Jr., VIMS. Description: This project will develop and validate methods of age determination needed for population models for Atlantic croaker, spot and weakfish.

F-89-R-1 Anadromous Striped Bass Restoration. Federal Cost $74,841, new project. Project leader: Dean Fowler, VDGIF. Description: This project consists of obtaining striped bass spawning adults from the Pamunkey and Mattaponi Rivers, raising the young until Phase II, then tagging and releasing them back into the Pamunkey and Mattaponi Rivers. The objective is to evaluate the restoration of striped bass to specific spawning rivers.

DISTRICT OF COLUMBIA PROJECTS

F-2-R-5 Fisheries Management Studies. Federal Cost $210,751. Project leader: C. Coopwood. Description: Project consists of three studies; a fisheries survey of the Potomac and Anacostia Rivers, a creel survey and an artificial reef study.

F-5-D-1 Anacostia River Boating Access Development. Federal Cost $262,500. Project leader: None listed. Description: Construct a boat ramp on the Anacostia River with parking and comfort station facilities.

FEDERAL AID DEVELOPMENT PROJECTS
CHESAPEAKE BAY AND TIDAL PORTIONS OF ITS TRIBUTARIES

Maryland	F-41-D-2	$74,269	Maryland Sport Fishing Access. Currently requesting approval to construct fish cleaning stations adjacent to Choptank River fishing piers.
		$170,026	Currently requesting approval for a parking lot and visitor comfort station at Point Lookout State Park to accommodate boaters and pier fishermen. Segment 1 of this project was conditionally approved but the funds reverted. The original conditions must be met before this segment can be approved.
	WEP-100-5	$1,922,250	Wildlife Comprehensive Planning. Includes maintenance and operations of wildlife management areas. The following are adjacent to the Bay and its tributaries. Cedar Island WMA Pocomoke Sound WMA Fairmount WMA Deal Island WMA South Marsh Island WMA Fishing Bay WMA Taylors Island WMA Bowen WMA The Elms WMA
Virginia	F-81-D-1	$657,647	Osborne Pike Landing. Construct a major boating and fishing access area on the James River south of Richmond.
	W-48-D-30	$1,512,451	Wildlife Habitat Development. Includes operations and maintenance on wildlife management areas. The following are adjacent to the Bay and its tributaries: Saxis WMA Mockhorn Island WMA Chickahominy WMA Hog Island WMA Ragged Island WMA

Table 5.1.4. Chesapeake Bay projects funded by National Marine Fisheries Service.

CHESAPEAKE BAY FISHERIES RESEARCH
NMFS GRANT-IN-AID PROGRAM -- FY 1989

Interjurisdictional Fisheries Act of 1986

A. **General Provisions:**

1. **State:** Maryland
   Title: Maryland Fisheries Statistics
   Current Project Segment: 7/5/89 - 7/4/90
   Federal Share: $84,027
   State Share: $84,027
   Project Species: Maryland's commercial and charter boat fisheries, including American shad, alewife, blueback herring, white perch, weakfish, yellow perch, blue crabs, oysters, and soft clams.
   Study Description: A comprehensive computerized catch reporting and monitoring system which focuses on harvest and economic value associated with Maryland's commercial fisheries.

2. **State:** Virginia
   Title: Commercial Fisheries Statistics Information Systems
   Current Project Segment: 7/1/89 - 6/30/90
   Federal Share: $170,650
   State Share: $ 56,883
   Project Species: Virginia's commercial fisheries including oysters, surf clams, hard clams, blue crabs, alewives, bluefish, summer flounder, mackerel, and sea bass.
   Study Description: To collect, compile, and process information pertaining to Virginia's commercial finfish and shellfish catch statistics and harvestor employment. Information is gathered through both mandatory and voluntary reporting by harvestors, seafood dealers, and processors.

   In addition, biological samples are collected to determine population parameters of selected interjurisdictional fish species. Analysis of this data provides information necessary for determining effects of management decisions and developing fishery management plans.

3. **State:** Virginia
   Title: The Assessment of Commercial Fishing Effort in Virginia
   Current Project Segment: 10/1/88-6/30/89
   Federal Share: $26,600
   State Share: $ 8,868
   Project Species: Striped bass, American shad, and river herring.
   Study Description: To collect effort data for the pound net and gillnet commercial fisheries on the James, York, and Rappahannock Rivers. Data collected directly address research concerns stated in the Interstate Management Plans for these species and provide timely information needed for the formulation of state management strategies for striped bass and shad/river herring.

4. **State:** Virginia
   Title: Stock Assessment Information System for Interjurisdictional Fishery Species
   Current Project Segment: 7/1/88 - 6/30/89
   Federal Share: $27,630
   State Share: $ 9,210
   Project Species: Striped bass, alewives, bluefish, summer flounder
   Study Description: Determine through biological sampling the population parameters of selected interjurisdictional fish species. Analysis of this data provides information necessary for determining effects of fisheries management decisions and developing fishery management plans.

B. **Resource Disaster Provisions:**

5. **State:** Maryland
   Title: Development of Chesapeake Bay Oyster Management Strategy
   Current Project Segment: 5/1/89 - 4/30/90
   Federal Share: $502,170
   State Share: $ -0-
   Project Species: American Oyster
   Study Description: To restore the American oyster population in Chesapeake Bay that has been severely damaged by the disease organism MSX. Project activities include planting of

oyster shells on natural oyster bars which will provide new substrate for spat set; and planting of seed oysters to supplement natural spat set.

The Anadromous Fish Conservation Act of 1965

A. **General Provisions:**

6. **State:** Maryland
   Title: Egg Production and Larval Dynamics of Striped Bass and White Perch in the Potomac River and Upper Chesapeake Bay
   Current Project Segment: 4/1/88 - 3/31/89
   Federal Share: $40,000
   State Share: $65,743
   Project Species: Striped bass and white perch
   Study Description: Conduct field investigations into striped bass and white perch comparative egg/larval survival, and ascertain how adult female size/age affects egg quality and subsequent mortality levels. Study results will aid in population assessments and management of these anadromous fish resources within Chesapeake Bay.

7. **State:** Virginia
   Title: Study of Alosa Stock Composition and Year-Class Strength in Virginia
   Current Project Segment: 2/1/88 - 1/28/89
   Federal Share: $48,000
   State Share: $48,000
   Project Species: American shad, blueback herring and alewife
   Study Description: To define the current status of commercial alosid populations in Virginia's coastal waters through biological sampling, aerial and log book surveys. Fishing effort, landings, and catch per unit of effort will be determined for the pound net and stake gillnet fisheries.

B. **Emergency Striped Bass Study Provisions:**

8. **State:** Virginia
   Title: Striped Bass Research, Virginia: Characterization of the Striped Bass Population in the Rappahannock River
   Current Project Segment: 7/1/88 - 6/30/89
   Federal Share: $60,000
   State Share: $20,000
   Project Species: Striped Bass
   Study Description: To characterize, through field sampling, the adult striped bass population in Virginia's Rappahannock River by sex, age, length, and weight during Fall and Spring 1988 and 1989, respectively.

9. **State:** Virginia
   Title: A Mark-Recapture Study of Striped Bass in the James River, Virginia
   Current Project Segment: 2/1/88 - 1/31/89
   Federal Share: $50,000
   State Share: $14,609
   Project Species: Striped Bass
   Study Description: Tag and release of striped bass in the James River will be conducted to evaluate migratory behavior and fishery exploitation rates. Age and growth investigations will be conducted via collection of scale samples and length measurements. Results will contribute to research needs identified in the Interstate Fishery Management Plan for the Striped Bass.

Table 5.1.5. Portion of the request for proposals (RFP) by CBSAC for 1989 funds.

CHESAPEAKE BAY STOCK ASSESSMENT COMMITTEE
Request for Proposals
Fiscal Year 1989

INTRODUCTION

The Chesapeake Bay Stock Assessment Committee was established in 1985. Terms of reference (Attachment A) and a description of the Committee's past and anticipated activities are presented in the Chesapeake Bay Stock Assessment Plan. (Copies of the Stock Assessment Plan are available from the Chesapeake Bay Liaison Office, 410 Severn Ave., Annapolis MD 21403, Tel. (301)-266-6873.) Among its other activities, the Committee annually recommends fisheries statistics and stock assessment research projects to be funded through Cooperative Agreements. Consistent with its origins, the Committee is most interested in proposals that address fisheries assessment problems on a Bay-wide basis, and that are based on cooperative joint interstate and interinstitution efforts. Consequently, proposals related to transboundary fishery problems [e.g., related to stocks and/or fisheries that extend across Chesapeake state borders] that do not address the subject Bay-wide or proposals that are not consistent with the Chesapeake Bay Stock Assessment Plan will be unacceptable.

FY 89 SPECIFICATION/WORK STATEMENT

1. Improving fishery statistics: Fishery-dependent data collection needs

Objective: **Complete a systematic and critical review of all state fishery statistical sampling (and data collection systems) for Chesapeake Bay, recreational and commercial, existing and proposed, with respect to adequacy of systems for Bay-wide analytic assessment needs.**

Review should be consistent with the implementation of trip ticket systems for commercial fishery data collection. Aspects of systems to be reviewed should include but not be restricted to content, design, sampling, and collection procedures, standardization, and comparability of component observations and associated data bases over time and between states. Evaluations and analyses should especially address size and age distribution components of sampling systems; and should also address discard and any multispecies attributes of catches (e.g., by-catch, catch composition). Catch and effort (including the linkage of catch and effort) may also be addressed from a historical perspective. Adequacy of coverage in terms of time, space and gear types in the fishery should be addressed. Precision and accuracy of existing estimates should be evaluated to the extent possible. Review should include qualitative and quantitative recommendations for modification and/or augmentation of existing and proposed systems, as necessary to meet Bay-wide analytical assessment needs.

2. Improving fishery statistics: Fishery data base needs

Objective: Cooperatively develop a single Bay-wide data base (among agencies and institutions of Maryland, Virginia, District of Columbia and the National Marine Fisheries Service) for each transboundary species important to Chesapeake Bay fisheries.

Resulting data bases should enable other assessment investigators access to documented data sets which are standardized, and Bay-wide whenever possible. Provisions for exchange, installation, and initial maintenance of long-term data sets (e.g., commercial, recreational time series, fisheries-independent surveys and others: see Living Resources Workplan, February 1989, Living Resources Subcommittee, available from B. Gillelan, 202-673-5243), initial updating of long-term data sets, protocol for future exchange and maintenance of planned new data sets, and data set documentation and standardization should be included. Proposals which develop multispecies data sets will be given priority. Resulting data bases should be installed at Chesapeake Bay Computer Center, with copies available to assessment investigators. Commercial fishery statistics should be standardized to Northeast Marine Fisheries Information System (NEMFIS) format and documentation should follow Chesapeake Bay Program submission guidelines.

3. Stock assessment research needs

Objective: Develop basic stock assessments for major Chesapeake Bay fishery resources.

Provisions for the collation and analysis of Bay-wide biological and fishery data sufficient to support water quality and fishery management plans should be included. Proposals for stock assessments over the Bay-wide range of the species will be given special consideration. Assessment analyses should be limited in sophistication only by the extent of available data. To the extent data are available, biologically and environmentally induced effects on life-history parameters should be incorporated as extensions of existing assessment models or development of new ones. (Consistent with the Chesapeake Bay Stock Assessment Plan, assessments should ultimately partition effects of fishing mortality, natural mortality, and contaminants on variation and trends on abundance and yield.) Adequacy of existing data for stock assessment purposes should be reviewed. Highest priority will be given to proposals for assessments of species for which Fishery Management Plans are in place or scheduled for the upcoming year (blue crab, American oyster, American shad, striped bass, bluefish, weakfish and spotted sea trout). Proposals are also especially solicited for assessments of species for which Fishery Management Plans are anticipated in the following years (American eel, croaker, spot, red drum, summer flounder, river herring).

4. Other research needs: survey design and evaluation

a. Objective: Design a Bay-wide survey, data management and reporting system to monitor juvenile and adult blue crab abundance; and incorporate results into Bay-wide trawl survey. Develop recruitment indices and improve estimates of life history parameters.

b. Objective: Evaluate juvenile seine surveys in terms of suitability for use as recruitment indices, indicators of abundance trends and survey performance (accuracy and precision within and among years) for all species captured. Report analytic results and recommend qualitative and quantitative improvements in design and analysis.

c. Objective: Develop sampling methodology to obtain abundance indices for species and life stages not represented in trawl or seine surveys (e.g., alosids).

d. Objective: Design survey, data management and reporting system to monitor (with associated variance estimates) annual recruitment, abundance and biomass of hard clam. Implement pilot surveys, as feasible.

e. Objective: Design compatible, standardized monitoring program between Maryland and Virginia to derive indices of oyster recruitment (initial spring and surviving fall spatfall); to survey seed, small and market oysters and their predators. Implement pilot studies, as feasible.

f. Objective: Evaluate soft clam surveys (including, e.g., Maryland Chesapeake Bay Longterm Benthic Monitoring Program data, Maryland Soft Clam Survey) to determine adequacy of sampling program for tracking trends in abundance (including accuracy and precision within and among years). Develop standard data management and reporting system. Implement pilot surveys as feasible.

These needs are listed in order of priority. Projects which address these research needs for species for which Fishery Management Plans are in place or scheduled for the upcoming year (blue crab, American oyster, American shad, striped bass, bluefish, weakfish and spotted sea trout) or are anticipated in following years (American eel, croaker, spot, red drum, summer flounder, river herring) are encouraged. Other proposals for innovative research beyond the needs listed here may be submitted, although their consideration cannot be guaranteed.

All proposals involving the collection of new data must contain adequate provisions for the documentation and transfer of copies of data (via magnetic tape) to Grants Officer's Technical Monitor in format to be approved by GOTM. Provision should also be made for a relatively non-technical extended abstract (not to exceed five pages) to be included in the final report.

6.0. TERMS OF REFERENCE FOR SAW-9

6.1. Revised and Updated Assessments

6.1.1 Revised Pollock Assessment
6.1.2 Updated Surf Clam Assessment
6.1.3 Updated Ocean Quahog Assessment
6.1.4 Report of CAFSAC Georges Bank Haddock and Cod Assessments
6.1.5 Report of CAFSAC Mackerel Assessment
6.1.6 Review of Blue Crab Assessments and related research

6.2. Working Group Reports

6.2.1 Report of the Summer Flounder Working Group (WG 21)
6.2.2 Report of the Black Sea Bass/Scup Working Group (WG 22)
6.2.3 Report of the Long-Term Potential Catch Working Group (WG 9)

6.3. Special Topics

6.3.1 NMFS and State Commercial landings data bases.
- Review of various sources of landings data, including weighouts and canvasses
- Review of Resource Statistics and Economics Branch procedures
- Review of domestic commercial sea sampling program

6.3.2 Biological Interactions in the pelagic ecosystem
6.3.3 Technical Interactions in the Gulf of Maine

6.4. Timing of the Fall 1989 Stock Assessment Workshop (SAW-9)

The next SAW was tentatively scheduled to take place during the third or fourth week of November, 1989.

6.5. An appraisal of the format, content, and objectives of future Stock Assessment Workshops

At the request of the participants, the Chair prepared an evaluation of several alternate formats for future workshops. The following reflects the Chair's presentation and the discussion which ensued.

Recent Stock Assessment Workshops have evolved from the original concept of stock assessment review sessions to include an increasing number of ancillary research topics. SAW-8 included reviews and discussions of 4 stock assessments, 3 working group reports, and 10 sessions devoted to ongoing research and data collection programs. The 3-day schedule left little time for in-depth discussions on any one topic.

Several modifications to the present format were proposed to allow for more detailed review and discussion of priority issues, including:

1. Alternate workshops between research topics and stock assessments. Under this proposal, one workshop would concentrate on a single assessment conducted by several members in a working group format during the week immediately prior to the full SAW meeting. The working group would conduct a hands-on assessment and the results reviewed in a plenary session by all participants. A less than favorable review would likely require that the working group reconvene and revise the assessment for a second review. The working group would be comprised of a range of interested individuals from several institutions. An expanded version of this proposal would encompass several working groups meeting concurrently and presenting their results for review.

The other semi-annual workshop would be devoted to research topics, and data and methodology issues arising out of the assessment review. It was noted that this format may not necessarily fulfill annual SAFE reporting requirements since not all stocks could be reviewed by the SAW in a given year.

2. Propose that all working groups meet separately from the SAW and conduct their assessments during week-long intensive hands-on sessions. The SAW would then meet to review the working group reports. Under this concept the SAW becomes a review body apart from the working groups.

3. Assessments would be conducted during a week-long SAW session with all participants actively engaged in one or more analyses leading up to the assessment. This would encourage members with expertise in various methodologies to participate in the hands-on assessment for species with which they are not usually associated. This approach would encourage the dissemination of ideas and techniques among all participants.

4. The SAW remains in its present format, but the review of working papers and drafts would be distributed among several ad-hoc working groups which would provide a summary report suitable for review at a plenary session. Working papers would be prepared and distributed to WG members well in advance of the Plenary SAW session.

5. The present 3-day format is too short to satisfy any of the proposed assessment formats and should be increased to one full week.

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8.0. APPENDICES

8.1. Appendix 1: List of Working Papers

WP# 1 - Status of Butterfish in the Gulf of Maine-Mid-Atlantic Area, April 1989 - Gordon Waring

WP# 2 - Assessment update for short-finned squid (Illex illecebrosus) - Anne Lange

WP# 3 - Assessment update for long-finned squid (Loligo pealei), spring 1989 - Anne Lange

WP# 4 - Mackerel assessment 1989 - Bill Overholtz

WP# 5 - Gillnet fishery/marine mammal interaction - Tim Smith

WP# 6 - Update on status of SAFE report requirements - John Boreman

WP# 7 - Stock Assessment Plan - Chesapeake Bay Program

WP# 8 - A study of the age sampling requirements of the NEFC bottom trawl survey - Janice Forrester

WP# 9 - An examination of variability in catch at age and its implications for determining optimal age sampling requirements. - Scott Mosely

WP# 10 - Growth-maturity interactions and effect on spawning stock biomass per recruit. - Jay Burnett

WP# 11 - A summary of the activities to date of the fleet modeling group (FMG) - Tom Polacheck

WP# 12 - Individual vessel behavior in the scallop fleet - William Emerson

WP# 13 - ASMFC Recreational fishery

WP# 14 - Methods for including discards and recreational catch data in catch at age matrices - Anne Richards

WP# 15 - Black sea bass/scup working group - Dave Keiffer

WP# 16 - Summer flounder working group - Wendy Gabriel

WP# 17 - Review of Chesapeake Bay Stock Assessment Program - Tim Smith

WP# 18 - Long-term yield working group

8.2 Appendix 2: Agenda

Spring 1989 Stock Assessment Workshop (SAW 8)

Chair: Ralph K. Mayo

AGENDA

Monday, April 24, 1989 - **NEFC Aquarium Conference Room**

1:15 - 1:30	Opening Remarks and Announcements

Session Chair: Steve Murawski

1:30 - 2:30	Illex and Loligo squid assessment update - Anne Lange
2:30 - 3:15	Butterfish assessment update - Gordon Waring
3:15 - 3:30	Break
3:30 - 4:00	Mackerel assessment update - Bill Overholtz
4:00 - 4:30	Temperature trends in the Northwest Atlantic - Dave Mountain
4:30 - 5:00	Update of SAFE requirements - John Boreman

Tuesday, April 25, 1989 - **MBL Candlehouse Conference Facility**

Session Chair: Steve Clark

9:00 - 10:30	Report on age sampling requirements - Janice Forrester and Scott Moseley
10:30 - 11:00	Growth-maturity interactions and effect on SSB/R - Jay Burnett
11:00 - 12:00	Review of fishing vessel fleet characteristics - William Emerson and Tom Polacheck
12:00 - 1:15	Lunch

Session Chair: Ralph Mayo

1:15 - 2:45	Review draft reports for Loligo and Illex squid, butterfish, mackerel, temperature trends, and SAFE requirements
2:45 - 3:00	Break
3:00 - 4:00	Report by ASMFC Recreational Subcommittee on recreational surveys - Eric Smith
4:00 - 5:00	Review of methods for inclusion of discards and recreational data in catch-at-age matrices - Anne Richards

Wednesday, April 26, 1989 - **NEFC Aquarium Conference Room**

Session Chair: Fred Serchuk

9:00 - 9:30	Black sea bass and scup Working Group (WG 22) report - Dave Keifer
9:30 - 10:15	Summer flounder Working Group (WG 21) report - Wendy Gabriel
10:15 - 10:30	Break
10:30 - 11:00	Bottom-tending gillnet fishery/marine mammal interactions - Tim Smith
11:00 - 11:45	Long term potential yield Working Group (WG 9) report - Brian Rothschild
11:45 - 1:00	Lunch

Session Chair: Tim Smith

1:00 - 3:30	Review of CBSAC assessment research program
3:30 - 3:45	Break
3:45 - 5:00	Review draft session reports Discuss terms of reference for next SAW
6:00 - 8:00	Reception

Thursday, April 27, 1989 - **MBL Candlehouse Conference Facility**

Session Chair: Ralph Mayo

9:00 - 12:00	Review Working Group and remaining draft session reports, and finalize workshop report
12:00	Adjourn

8.3 Appendix 3: Participants

NMFS, NEFC, Woods Hole

R. Mayo
S. Murawski
G. Waring
W. Overholtz
S. Clark
T. Polacheck
A. Richards
L. O'Brien
H. Mustafa
M. McBride
T. Morrissey
S. Chang
F. Almeida
K. Foster
F. Serchuk
G. Shepherd
K. Friedland
A. Lange
V. Anthony
J. Idoine
M. Terceiro
T. Smith
C. Esteves
H. Stern
J. Forrester
N. Shepherd
N. Munroe
D. Hansford
W. Emerson
G. Power
R. Conser
B. Pollard

NMFS, SEFC, Beaufort, NC

D. Vaughn

NMFS, Pascagoula, MS

C. Gledhill

NMFS, Gloucester, MA

P. Colosi

MAFMC

C. Johnson
C. Moore
D. Keifer
T. Hoff
W. Hader
J. Mason

NEFMC

H. Russell
C. Kellogg
B. Austin

NC Div. Marine Fisheries

J. Hawkins
R. Monaghan

RI Fish & Wildlife

T. Lynch

VA Marine Resource Commission

E. Barth
R. O'Reilly

MA Division of Marine Fisheries

A. Howe
T. Currier
D. Witherell
S. Correia
D. Pierre

Old Dominion University, Norfolk, VA

M. Prager

CT D.E.P. Marine Fisheries

P. Howell
D. Simpson

NY D.E.C.

J. Mason

Del. Div. Fish. and. Wildl.

R. Seagraves

Virginia Instiitute of Marine Science

J. Musick

MD Dept. Nat. Res.

P. Jones

NOAA Estuarine Prog. Office

B. Gillelan