Fisheries and Oceans Pêches et Océans

Canadian Stock Assessment Secretariat
Research Document 98/144

Secrétariat canadien pour l'évaluation des stocks
Document de recherche 98/144

The 1998 Assessment of Pollock (Pollahius virens) in NAFO Divisions 4VWX and Subdivision 5Zc

by

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ISSN 1480-4883
Ottawa, 1998
Canada

Abstract

For the first time in this stock assessment, the assessment employs information from the current year. Thus, new information is presented here from 1997 and 1998 (current up until the end of August). This updates the assessment presented last year that contained information from the previous year only.

Landings of pollock in the management unit 4VWX5Zc were 11,936 t in 1997, compared with a TAC of 15,000 t. With the exception of the large mobile gear sector, most sectors were able to catch close to their allocations. In contrast, landings for the partial year 1998 were 10,353 t against a quota of 20,000. Most fishermen reported a less positive fishery in 1998 than that experienced in 1997, with exception of those fishing on Georges Bank and some parts of western 4X. The geographic scope of the fishery become increasingly constricted, with a growing proportion of landings coming from western 4X.

The stock status evaluation was based on an analytical assessment employing landings statistics, sampling for size and age composition of the commercial catch and trends in commercial fishery catch rate. Because of a severe retrospective pattern in the population model, there is considerable uncertainty in the population model. Without adjustment for the retrospective pattern, the $F_{0.1}$ yield in 1999 is about 12,500 t (assumes total 1998 removals of 15,000 t). The 1999 yield that reflects the average retrospective pattern in $F_{0.1}$ catch calculated from 1995 to 1997 could be as low as 5000 t.

Résumé

Pour la première fois, des renseignements ayant trait à l'année en cours ont été utilisés pour l'évaluation de ce stock. De nouveaux renseignements sont donc présentés pour 1997 et 1998 (jusqu'à la fin d'août). Cela met à jour l'évaluation de l'an dernier dont les renseignements étaient limités à ceux de l'année précédente.

Les débarquements de goberge de l'unité de gestion 4VWX5Zc ont atteint 11 936 t en 1997, cela pour un TAC de 15 000 t. À l'exception du secteur à gros engins mobiles, la plupart des secteurs ont pratiquement atteint leur allocation. Au contraire, les débarquements obtenus pour l'année partielle de 1998 ne se sont élevés qu'à 10 353 t, pour un quota de 20 000 t. Si l'on fait exception du banc Georges et de certaines zones de l'ouest de la 4X, la plupart des pêcheurs ont signalé une pêche moins favorable qu'en 1997. L'aire de pêche devient de plus en plus restreinte et une plus grande proportion des débarquements provient de l'ouest de 4X.

L'évaluation de l'état du stock repose sur une analyse fondée sur les statistiques des débarquements, l'échantillonnage des prises commerciales pour la détermination de la composition par tailles et âges et l'allure du taux de capture de la pêche commerciale. L'existence d'un important effet rétrospectif au sein du modèle de population rend très incertains les résultats obtenus. En l'absence de corrections, le rendement au niveau $F_{0.1}$ de 1999 est de 12 500 t environ (en supposant une récolte totale de 15 000 t en 1998). Le rendement de 1999 qui reflète l'effet rétrospectif moyen sur les prises au niveau $F_{0.1}$ calculées de 1995 à 1997 pourrait donc être aussi faible que 5 000 t.

Introduction

Management Unit

The management unit for the pollock resource in Maritime waters includes NAFO Divs. 4VWX and Subdiv. 5Zc. The convention for the Canadian management unit was established following a review in 1989 (Annand et al. 1989), which involved examination of results of egg and larval surveys, meristic and morphometric studies, and tagging work. Prior to this, the convention for the management unit was NAFO Divs. 4VWX and Subarea 5.

History and Description of the Fishery

Landings and TACs since 1974 are shown on Fig. 1 and Table 1. Landings from 1974 to 1980 averaged about 28,000, rose through the early 1980s to 45000 in 1987. Since then, landings have sharply decreased. The TAC rarely constrained overall fishery landings, although for a period of five consecutive years in the late 1980s, the TAC was either met or exceeded. The 1997 total allowable catch (TAC) for 4VWX5Zc pollock was 15,000 t. With the exception of the large mobile gear sector, most sectors were able to catch close to their allocations. In contrast, landings for the partial year 1998 were 10,353 t against a quota of 20,000 (Fig. 1, Tables 1,2).

The 1997 and 1998 landings continue the recent trend of comparatively small contributions to total landings in the eastern portion (4VW) of the management unit (Table 3, Fig. 2). However, management measures have had considerable impact on the fishery in the 4VW component in recent years. For example, the cod management unit in 4VsW has been closed since September 1993, thus restricting opportunities for pollock fishing on the eastern Shelf. Further dissagregation of landings by NAFO Subdivision (Fig. 3) indicate that landings in 4X have declined since 1991. While landings from 4V were significant through the late 1980s', they have dropped markedly until 1993, when they recovered slightly. Landings from 5Zc (Georges Bank) have peaked in 1993, but declined thereafter. Examining the pattern of landings within 4X5 at a finer level of resolution, that of unit area, reveals that the fishery has become increasingly concentrated in a few unit areas in the western portion of 4X (4Xp, 4Xq), whereas in 1993 and 1994 more unit areas contributed to overall removals (Figs. 4 and 5).

The spatial distribution of the pollock fisheries is further summarized in Figs 6 to 7, which show the monthly distribution of 1997 landings of TC 1-3 and 4+ trawlers, respectively. The smaller trawlers largely fish in 4X, with key areas being German Bank, Georges Bank and the lower Bay of Fundy. The larger trawlers are more generally distributed throughout the management unit, with significant landings made from the edge of the Scotian Shelf in 4Vn and 4Vs and Georges Bank. To assess recent changes in the fishery distribution, we also show comparable information for the 1991 fishery (Figs. 8,9). A difference which is apparent in the comparison of the fishery distribution of small mobile gear is that the October/November fishery apparent in 4VW is no longer pursued. For large mobile gear, the fishery that was evident on the Shelf edge in 1991 was not present in 1997.

Table 4 shows landings information aggregated into trimester and gear categories[1]. A variety of fishing gear is used, including primarily mobile gear (otter trawls) and fixed gear (gill nets, handlines and longlines). As indicated in Fig. 10, there have been significant changes in the relative importance of gear types over time. The relative contribution of larger draggers has been much diminished, whereas the contribution of smaller draggers and fixed gear has been steadily increasing.

The monthly distribution of landings by gear sector over the past ten years is shown on Table 5. A change in fishing behaviour is noted for the smaller trawlers in the early 1990s, with a reduction in the proportion of landings taken in the first few months of the year compared with 1987 and 1988 for example. The fixed gear component of the fishery has also been late starting relative to previous years, but removals during the first quarter are usually small.

A recent development of note in the domestic fishery has been the expansion of the redfish fishery on the Scotian Shelf in 1996. This fishery uses smaller mesh size (90-100 mm) than the rest of the domestic otter trawl fishery . Landings of pollock in the redfish fishery in 1997 were 358 t.

Landings of pollock in the foreign silver hake fishery decreased from 1996 (135 t) to 1997 (64), exclusively by Cuba. Foreign landings to date in 1998 are 10 t (9 t Cuba, 1 t Russia).

During consultations with industry in September and October of 1998, fishermen reported mixed experiences with the pollock fishery this year (Table 6). In general, fishing was considered poor throughout much of the management unit. Notable exceptions to this were Georges Bank and parts of western 4X where good fishing was reported. Other consistent observations were that fish were found in unexpected areas, but not in some traditional fishing areas. Comments on fish size were variable, but in general it was noted that there were few large pollock.

Catch at Length and Age

Results of age determination testing done in 1998 are summarized in Appendix I. The performance of the age reader was considered acceptable in all tests. Overall, there has been a slight decline in mean commercial fishery weights at age through the late 1980s and early 1990s but the decline appears to have stabilized by the mid 1990s (Fig. 11). At the oldest ages in 1996 and 1997, there were some anomously high weights calculated, but those appear related to a very small sample size of such fish in recent years.

The catch at age was developed using the approach established in Neilson and Perley (1994), and two years of catch at age were appended to the catch at age presented last year. In general, sampling levels seemed adequate for the construction of the catch at age. Fig. 12 summarizes the components of the 1997 catch at age disaggregated by area, gear and trimester in

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[1] Mobile gear included bottom otter trawls (side and stern), midwater trawls (side and stern), bottom pair trawl, midwater pair trawl, shrimp trawl, and Danish and Scottish Seine. Fixed gear included gillnet (set or fixed), longline, jigger, troller lines, mechanized squid jigger, handline (baited),trap, pot, weir and miscellaneous.

relation to the landings for that combination. In general, it appears that the sampling covered the fishery components well. However, when the most significant component (4X) is disaggregated further, it can be seen that only one sample was available for the Bay of Fundy (4Xrs), repeating a problem seen last year (Fig. 12). Sampling was also generally good in 1998, and improved in the Bay of Fundy (Fig. 13). The number of age determinations made in 1997 and 1998 are summarized in Table 7.

Supplemental 'B' landings accounted for 3 t in 1997, and all came from 4X5. For the purposes of constructing the catch at age, it was assumed that the supplemental 'B' landings could be attributed to the small mobile gear category (OTB TC 1-3).

Landings from the vessels participating in the small mesh gear silver hake fishery were attributed to the foreign small mesh gear fishery for the purpose of constructing the catch at age. An age-length key derived in combination from the 1998 survey and commercial samples was applied to the length-frequency samples available from the Observer Program.

Landings of pollock from redfish directed trips were also treated separately in the construction of the catch at age.

As in the past assessment, length-weight parameters were calculated as the average *a* and *b* parameter values over the past five years. Since we do not have recent spring or fall surveys, we used the summer values for the 1st and 3rd trimesters as well.

The resulting catch at age and weight at age appear in Tables 8 and 9, respectively. The 1997 catch composition is shown in Fig. 14, both with respect to the predicted age composition and the ten-year average age composition. The 1997 age distribution continues the trend seen last year of considerably fewer older fish were observed than predicted. The relatively strong 1992 year class is close to predicted value and contributes the greatest proportion to overall removals (Table 10). The 1993 year class also was stronger than predicted. Compared with the 10 year mean age composition, the 1997 distribution covers younger ages.

The 1998 catch at age is summarized in Fig. 15. Both the 1992 and 1993 year classes appear in higher proportion than the long term mean, but again few fish were observed at ages 7+.

The low numbers of age 7+ fish were noted in the previous assessment and several possible causes discussed. In summary, it is possible to identify some aspects of the recent fishery which could have contributed to the difference between observed and expected age composition, but it is unknown whether these factors fully account for the deviations.

Distribution and Abundance

Research Surveys

The overall trend in catch per tow is shown in Fig. 16. Regarding abundance trends from the survey, results for pollock are considered typically highly variable. As noted in previous assessments, it is difficult to track cohorts from year to year, as the survey shows pronounced interannual variation (Fig. 17). Given such observations, we elected not to use the survey as an index of abundance.

Age by age distribution plots for 5 year blocks of summer surveys are presented in Figs. 18a-c. There appears to be a comparative absence of fish of age 8+ in the 1993 to 1997 period compared with the two earlier time periods. Survey length composition information shows a trend of decreasing size during the period 1988 to 1997 (Fig. 19). The 1998 survey length composition information is shown on Fig. 20.

This year, we also investigated pollock catches in the spring survey conducted on the Eastern Scotian Shelf. The size composition of the spring survey catches is shown on Fig. 21 from 1990 to 1997 along with the pollock catches from the corresponding strata of the summer survey for the same years. This comparison was attempted to determine if discrete year classes could be identified and tracked through use of the two surveys combined. However, catches of pollock in the spring survey proved erratic from year to year and no coherent signal was identified using this approach.

Industry Survey

A collaborative survey with ITQ mobile gear operators has been ongoing for the past four years. While the survey was not used in the assessment as an index of abundance, it provides important information on distribution, size composition and the catch rates can be compared qualitatively. The distribution of catches over the four years of the survey is shown on Fig. 22. It can be seen that the catches of pollock in 1998 were smaller than the previous years, particularly in the Bay of Fundy. Skippers participating in the survey indicated that some stations in the fixed station design could not be occupied in 1998 due to the presence of fixed gear. This affected about six stations in 1998, and some were considered good pollock grounds. A striking contrast in the size composition of the catch was also noted, with the catch in 1998 being considerably smaller in length than that of previous years (Fig. 23). There was also a marked decline in mean catch per tow (Fig. 24) from 1997 to 1998.

Commercial Catch Rates

As reported in the previous stock assessment, a standardized catch rate series was developed for mobile gear. Catch and effort data from the International Observer Program (IOP) were included[2] for tonnage classes 4+. For the smaller tonnage classes, data from ZIFF were used. The data for 1989 were omitted from the analyses for TC 1-3 since this was the year when a combined

[2] Four ORACLE IOP tables were used to generate catch rate data: TRIVES, GEA,CAT and SETNO tables. To extract the appropriate data, these tables were linked to each other by the trip number which is the key field for all tables. Gear is then keyed to set number by the gear code and set number is keyed to the catch by the set number, yielding an output file file with pollock dat selected for area, gear type, tonnage class, main species caught (MSPEC= pollock)

cod-haddock-pollock quota was attempted for areas 4X5 (Mohn et al. 1990), and anomolously high pollock catch rates were observed.

We selected trips which had directed pollock catches (when pollock landings were equal to or greater than 50% of the total landings by weight) and where effort and catch are both greater than zero and grouped to the sub-trip level from 1982 to 1996. Factors in the catch rate standardization included vessel, year, month, tonnage class, NAFO unit area and mesh type (square vs diamond). In instances prior to and including 1993 where the mesh type field was blank, it was assumed to be diamond. In 1994, all such records were deleted. In 1995, if the mesh type field was blank, it was assumed to be square mesh. We included NAFO unit areas 4Vn, 4Vs, 4Wg, 4Wh, 4Wk, 4Wl, 4Xm, 4Xo, 4Xp, 4Xq, 4Xr, 4Xs and 5Zj only in the analyses, as other areas did not have sufficient data to warrant inclusion. Even though area 5Yb was consider to have sufficient data, we excluded it, since there is thought to be landings incorrectly attributed to that area.

In the initial analyses, all main effects were found to be significant and gave patterns in catch rates rates which were expected and intuitive (ie. increasing catch rate with increasing tonnage class, seasonal patterns in catch rates which were consistent with previously published results (Hanke 1993). Two tonnage classes had relatively few observations of catch and effort (TC 1 and 6), and they were omitted from the final run. Also, catch rates during the May through October period were judged sufficiently similar to be combined into one level for the analysis of seasonal effects on catch rates. The results of the multiplicative analyses is shown in Appendix II. As with previous analyses of catch rates for this resource, the amount of variation in observed catch rate explained by the model was comparatively low (17%). We examined the impacts of including terms in the model which attempted to account for possible interaction between TC and area, and TC and month, but such terms did not appreciably increase the overall fit of the model. We therefore elected to retain the main effects model only.

To move the assessment to one which employs fishery information during the current year, we established that the index of abundance obtained using information throughout the year was comparable to that obtained when only two trimesters are available. The two time series are shown on Fig. 25, and track each other well. The catch rate series used in this year's assessment therefore contained catch and effort information throughout the whole year until 1998 and the first two trimesters of 1998. The highest catch rate observed was in 1986, and was supported by the very strong 1979 year class. The two new data points added this year were lower than the 1996 value added during the last assessment. Fig. 26 shows the series, with variation around each point.

To obtain the age-disaggregated catch rates, we first constructed the catch at age for otter trawlers using the the same method of aggregation was used as was done for the Canadian catch at age. The OTB TC 1-3 and OTB TC4+ were aggregated by area and by trimester and then combined to create one catch at age table. The age-disaggregated catch rates shown in Table 11 were obtained by dividing the catch at age by standardized effort.

Sequential Population Analyses:

Estimation of Stock Parameters

The adaptive framework of Gavaris (1988) was used to calibrate the sequential population analysis with the commercial catch rate data shown in Table 11, using the following model formulation:

$C_{a,y}$ = catch	a= 2 to 12, y = 1974 to 1998.67 (first two trimesters of 1998)
$I_{a,y}$ = OTB catch rates	a= 3 to 9, y = 1982 to 1998

where a is age, and y is year. The model provided estimates of the abundances of ages 4 to 12.

The OTB catch rate index was considered a midyear index and compared with midyear population abundance. The statistical error in the survey size sample data was assumed to be independent and identically distributed and the error in the catch at age was assumed negligible. Natural mortality , M, was assumed constant at all ages and equal to 0.2. The fishing mortality rate, F, for the oldest age (12) was taken as the arithmetic average of ages 7, 8, 9 and 10.

Based on a yield per recruit analysis documented in Neilson and Perley (1996), the $F_{0.1}$ fishing mortality was taken to be 0.30. The partial recruitment vector used for catch and population projections is shown below, and is the same as used last year.

Age	Partial Recruitment
2	0.01
3	0.10
4	0.40
5	0.80
6	0.90
7	1.00
8	1.00
9	1.00
10	1.00
11	1.00
12	1.00

Assessment Results

The initial ADAPT run displayed time trends in residuals, with ages 5, 6 and 7 being noteworthy in 1994, 1995 and 1996 (Fig. 27, Appendix 3). To assess the stability of the estimates of year-class as more data become available, we completed a retrospective analysis for ages 4, 5

and 6 (Fig. 28). A pattern of declining trends of estimates with additional data is apparent for many yearclasses, particularly the larger ones.

Should the retrospective pattern persist and influence the beginning of year 1999 population biomass estimate to the extent that it did in 1994 to 1996, population biomass could be reduced from the current estimate of 40,527 t to as little as 17,970 t, and the recent increase in biomass becomes much less obvious (Fig. 29).

The exploitation rate at age 5+ that reflects the population abundance trends shown above shows considerable divergence with the adjusted (to reflect the retrospective pattern) and unadjusted scenarios (Fig. 30). The unadjusted exploitation rates peak in 1991-1994, then decline to the target level in 1997 and 1998 (the actual value is contingent on the final removals in 1998). With analyses adjusted for the retrospective, the decline in exploitation rate is much less obvious during the same period. However, the observation that exploitation rates remained high throughout the recent past is inconsistent with the substantial decline in mobile gear effort from 1991 until 1996.

Recruitment after the strong 1979 year-class remained close to the long-term average of 28 million fish for nine years. Recent (1992-1995) year-classes has averaged about 18 million fish (unadjusted for the retrospective pattern). Even though there is little relationship between stock and recruitment for this groundfish resource, the 1999 adult biomass is at levels normally associated with poor recruitment, particularly after the retrospective adjustment (Fig. 31).

Exploratory analyses were conducted that allowed the relationship between the index and the population to vary. The relationship is referred to as the catchability of the index gear, in this case the trawler. While further work is required, the preliminary analyses indicated that the assumption of constant catchability in the standard assessment approach has not been met, and this may be contributing to the retrospective pattern described earlier.

Prognosis

In the past assessments, abundance at age 2 and 3 for the terminal year of the VPA was set at 28,000,000 and 22,924,00 respectively, which reflected long term mean values for those ages. More recently, however, these values were not achieved. To better reflect recent recruitment, we calculated the mean numbers at age 2 from 1987 to 1996 of the previous assessment (19,000,000) and decremented that value by natural mortality to set the numbers at age 3 (15,600,000). Average weights at age used for the projection are from the fishery and those observed during the period 1992-1996, a period of stability in the weight at age data (Fig. 11). These average weights at age were then converted to beginning of year weights at age for calculation of beginning of year biomasses.

Without adjustment for the retrospective pattern, the $F_{0.1}$ yield in 1999 is about 12,500 t (assumes total 1998 removals of 15,000 t). The 1999 yield that reflects the average retrospective pattern in $F_{0.1}$ catch calculated from 1995 to 1997 could be as low as 5000 t.

Management Issues

Given the difficulties in determining recent population status, a very cautious approach to harvesting is required. Danger signals and sources of uncertainty include the continued geographic constriction of the fishery in Div. 4X and the absence of larger and older fish in the fishery and the survey. These factors and two consecutive years of catch rate declines have led to a markedly different interpretation of stock status than that presented in the last assessment. Given the negative indicators for this resource, fishing at a level less than $F_{0.1}$ should be considered to allow the stock to rebuild.

Acknowledgements

We thank the many members of the fishing industry who took time to participate in the process of stock assessment this year. The Gulf of Maine Section, through their review of the preliminary analyses, contributed to this document. Heath Stone assisted with further probing of the commercial fishery catch rate series. Finally, we thank both the MFD port samplers (G. Donaldson, A. Williams, and J. Fennell) and those in the fishery that contributed sampling information.

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Table 1. Pollock landings[1] (t round fresh) by country for NAFO Divs. 4VWX and Subdiv. 5Zc
(Source: Neilson and Perley, DFO ZIFF & IOP Data)

	Canada	Japan	France[2]	Fed. Rep. Germany	German Dem. Rep.	Cuba	USSR (Russia)	USA	Spain	Other	Total
1974	24975	40		149			2301	435	1500	61	29461
1975	26548			236	95		2004	403	708	124	30118
1976	23565			994	24		1466	443	303	385	27180
1977	24653	1		368			182	325		53	25582
1978	26801	110	33			141	502	451			28038
1979	29967	19	23			50	1025	391		7	31482
1980	35986	81	99			32	950	443			37591
1981	40270	15	90				358	918			41651
1982	38029	3	44			84	297	840			39297
1983	32749	6	22			261	226	1324			34588
1984	33465	1	46			123	97	1691		1	35424
1985	43300	17	77			66	336				43796
1986	43249	51	77			387	564			4	44332
1987	45330	82	28			343	314				46097
1988	41831	1				225	1054				43111
1989	41112	1				99	1782				42994
1990	36178					261	1040				37479
1991	37931	38				459	1177				39605
1992	32002	72	9			1015	1006				34104
1993	20253					644	176				21073
1994	15240					10					15250
1995	9781					58					9839
1996	9145					129	6				9280
1997	11872					64					11936
1998	10343					9	1				10353

[1] Data from 1996 to 1998 are provisional.

[2] Includes mainland France and St. Pierre and Miquelon

[3] 1998 Data from January 1 to August 31

Table 2.. Pollock landings[1] (t round fresh) by country for NAFO Divs. 4VWX and Subdiv. 5Zc (Source: Neilson and Perley, DFO ZIFF & IOP Data)

1997

Gear Sector	Quota	Catch	% of Quota
Fixed <45'	4195	3954	94
Fixed 45-64'	119	115	97
Mobile <65' (ITQ)	3405	3134	92
Mobile <65' (Generalists)	33	33	100
Mobile 65'-100'	1373	1304	95
Vessels >100'	5875	3338	57
Totals	15000	11878	

Source: DFO Preliminary Final Quota Report, December 1997

1998(to Sept. 15)

Gear Sector	Quota	Catch	% of Quota
Fixed <45'	5613	3153	56
Fixed 45-64'	147	62	42
Mobile <65' (ITQ)	4550	3103	68
Mobile <65' (Generalists)	26	7	27
Mobile 65'-100'	1121	946	84
Vessels >100'	8543	3417	40
Totals	20000	10688	

Table 3. Pollock landings (t) by season and country for NAFO divs. 4VWX and Subdiv 5Zc.

Canada (Maritimes & Newfoundland)

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1974	713	1257	807	2777	1643	11738	8817	22198
1975	1223	1005	1854	4082	1836	9866	10764	22466
1976	425	845	1186	2456	2078	12167	6864	21109
1977	931	1428	4748	7107	6010	5880	5656	17546
1978	3875	2696	510	7081	5835	7484	6401	19720
1979	1406	5477	1927	8810	4558	10023	6576	21157
1980	2493	4301	3633	10427	6353	13188	6018	25559
1981	4056	2437	11055	17548	5792	7170	9760	22722
1982	3030	4082	4774	11886	3096	14664	8383	26143
1983	2029	7099	1644	10772	4879	14212	2886	21977
1984	2288	4744	4217	11249	2820	13900	5496	22216
1985	3861	5031	5959	14851	6589	15673	6187	28449
1986	5522	8157	4534	18213	5859	14091	5086	25036
1987	6177	5521	4780	16478	5766	16496	6590	28852
1988	4744	5807	4397	14948	3761	15710	7412	26883
1989	4050	7538	4302	15890	6743	12471	6008	25222
1990	4752	4529	2913	12194	3126	13839	7019	23984
1991	4711	2144	3896	10751	6781	13746	6653	27180
1992	3153	2369	2586	8108	4566	13814	5514	23894
1993	809	1215	391	2415	4285	9433	4121	17839
1994	752	974	427	2152	1789	7923	3376	13088
1995	427	654	620	1701	1131	4271	2678	8080
1996	657	538	262	1457	1161	3952	2576	7689
1997	408	357	220	985	2184	5638	3066	10888
1998	181	301		482	3578	6283		9861

USSR

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1974	194	903	628	1725	11	512	53	576
1975	471	981	221	1673	58	149	124	331
1976	555	488	291	1334	10	58	64	132
1977	17	82		99	39	44		83
1978	9	459	8	476		26		26
1979	4	928		932	6	87		93
1980	122	715		837		113		113
1981	45	311		356	2			2
1982		297		297				0
1983	16	204		220		6		6
1984		97		97				0
1985		336		336				0
1986		564		564				0
1987		314		314				0
1988	96	958		1054				0
1989	605	1177		1782				0
1990	342	698		1040				0
1991	151	640	2	793		384		384
1992	519	350		869	2	135		137
1993	21	125		146		30		30
1994								
1995								
1996	6							
1997								
1998		1		1				

Table 3.(cont.) Pollock landings (t) by season and country for NAFO divs. 4VWX and Subdiv 5Zc.

Other Foreign Countries

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1974	176	196	173	545	746	605	289	1640
1975	421	57	263	741	145	253	427	825
1976	254	318	162	734	288	237	888	1413
1977	10	194	19	223	168	304	52	524
1978	36	153	95	284	200	111	140	451
1979	22	22	54	98	118	136	138	392
1980	101	38	1	140	272	128	115	515
1981	90			90	410	269	254	933
1982	23	106		129	365	221	256	842
1983	18	268		286	358	497	472	1327
1984	87	83	1	171	387	528	776	1691
1985	82	70	8	160				0
1986	204	291	24	519				0
1987	110	311	32	453				0
1988	4	222		226				0
1989	99	1		100				0
1990	153	108		261				0
1991	209	169		378		118		118
1992	259	361		620	12	464		476
1993	33	213		246	4	343		347
1994		9		9		1		1
1995	11	43		54	1	3		4
1996	11	111		122			8	8
1997	17	29		46		18		18
1998	2	7		9				

Table 4. Nominal landings of pollock in NAFO Divs. 4VWX and Subdiv. 5Zc for Canada(Maritimes,Quebec and Newfoundland)

Otter Trawlers -- Tonnage Classes 4+

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970	1523	212	138	1873	686	1865	1581	4132
1971	629	63	208	900	919	3473	2073	6465
1972	417	90	545	1052	1461	5800	4138	11399
1973	726	276	2173	3175	3259	4227	3239	10725
1974	707	1113	628	2448	1057	6350	5964	13371
1975	1222	926	1776	3924	1042	5699	5361	12102
1976	424	737	1081	2242	877	5418	2746	9041
1977	912	1358	4545	6815	4846	1522	2661	9029
1978	3558	2107	377	6042	4676	3383	2411	10470
1979	1368	5194	1715	8277	3487	3421	1004	7912
1980	2448	3949	3412	9809	4321	3409	2411	10141
1981	3980	1382	9017	14379	4280	558	4956	9794
1982	2919	3084	4123	10126	1628	3917	3665	9210
1983	1879	6144	1032	9055	2890	2652	396	5938
1984	2155	3416	3559	9130	729	1633	564	2926
1985	3628	4339	5502	13469	581	835	879	2295
1986	4861	6499	3957	15317	1326	939	235	2500
1987	5609	4178	3998	13785	2435	2518	2408	7361
1988	3951	3588	4244	11783	755	3301	2951	7007
1989	3006	4933	3669	11608	1498	2489	2596	6583
1990	4154	2832	1836	8822	1654	1835	1268	4757
1991	4172	1393	2352	7917	1580	2638	1401	5619
1992	2794	1499	1025	5318	1306	2275	1288	4869
1993	718	311	224	1253	2629	651	1457	4737
1994	701	458	174	1333	177	757	860	1794
1995	381	463	417	1261	215	400	391	1006
1996	486	157	198	841	437	754	930	2121
1997	353	0	70	423	638	368	728	1734
1998	125	88		213	824	251		1075

Otter Trawlers -- Tonnage Classes 1 - 3

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970	8			8	336	2042	483	2861
1971	4			4	245	1708	717	2670
1972		9	1	10	537	2035	902	3474
1973			2	2	1922	6762	618	9302
1974		39	40	79	562	3398	591	4551
1975				0	745	2610	836	4191
1976				0	1039	2844	715	4598
1977		2		2	896	2224	808	3928
1978	9	23	2	34	955	2187	961	4103
1979		8	2	10	869	4043	1170	6082
1980	2	137	18	157	1523	4033	823	6379
1981	32	302	44	378	957	3178	1547	5682
1982	58	220	93	371	713	4775	1734	7222
1983	84	155	23	262	1403	6829	855	9087
1984	119	598	252	969	1847	8492	3015	13354
1985	197	151	89	437	5408	8564	1386	15358
1986	379	804	44	1227	3797	4801	594	9192
1987	504	311	73	888	2747	5859	483	9089
1988	556	708	13	1277	2739	6196	244	9179
1989	934	1296	60	2290	4533	2366	48	6947
1990	403	594	492	1489	533	3985	1996	6514
1991	319	80	642	1041	4379	5151	2049	11579
1992	236	149	997	1382	2645	6409	1378	10432
1993	29	100	8	137	1367	4290	1132	6789
1994	28	72	17	117	1378	2823	1079	5280
1995	39	26	8	73	701	2016	814	3531
1996	46	39	12	97	719	1439	1145	3303
1997	35	64	70	169	1424	2712	1320	5456
1998	22	11		33	2705	3248		5953

Table 4.(Cont.) Nominal landings of pollock in NAFO Divs. 4VWX and Subdiv. 5Zc for Canada(Maritimes,Quebec and Newfoundland)

GILLNET, LONGLINE and MISCELLANEOUS Gears – all tonnage classes

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970		46	224	270	53	893	663	1609
1971		118	72	190	5	979	544	1528
1972		137	170	307	8	927	845	1780
1973	6	101	139	246	9	2196	1335	3540
1974	6	105	139	250	24	1990	2262	4276
1975	1	79	78	158	49	1557	4567	6173
1976	1	108	105	214	162	3908	3403	7473
1977	19	68	203	290	268	2134	2188	4590
1978	308	566	131	1005	204	1914	3029	5147
1979	38	275	210	523	202	2559	4402	7163
1980	43	215	203	461	509	5746	2784	9039
1981	44	753	1994	2791	555	3434	3257	7246
1982	53	778	558	1389	755	5972	2984	9711
1983	66	800	589	1455	586	4731	1635	6952
1984	14	730	406	1150	244	3775	1917	5936
1985	36	541	368	945	600	6274	3922	10796
1986	264	732	403	1399	716	8422	4202	13340
1987	69	1022	709	1800	589	8100	3696	12385
1988	80	1339	340	1759	260	6223	4230	10713
1989	110	1309	573	1992	712	7616	3364	11692
1990	196	1104	584	1884	939	8018	3755	12712
1991	221	671	902	1794	822	5958	3202	9982
1992	123	722	564	1409	616	5130	2849	8595
1993	62	804	159	1025	289	4492	1532	6313
1994	23	443	237	703	234	4343	1436	6013
1995	7	164	194	365	216	1855	1472	3543
1996	125	343	51	519	6	1758	501	2265
1997	20	293	80	393	123	2558	1018	3699
1998	33	201		234	48	2785		2833

Table 5. Nominal monthly landings of pollock in NAFO Divs. 4VWX and 5Zc for Canada(Maritimes, Quebec and Newfoundland)

Sum of Pok_wt		Gear	TC				
		GN	LL	Misc	OTB		Grand Tota
Year	Month	Fixed Gear	Fixed Gear	All	Large Mob	Small Mobile	
1987	1	183	25	1	1781	1214	3204
	2	100	8	0	1906	897	2911
	3	164	10	17	2144	962	3297
	4	109	52	0	2201	169	2531
	5	284	283	54	1015	3810	5446
	6	972	852	46	2171	2121	6162
	7	1864	1084	2	2000	152	5102
	8	2955	755	0	1502	95	5307
	9	2047	436	37	829	373	3722
	10	1000	277	11	3367	105	4760
	11	376	49	2	1181	53	1661
	12	176	45	0	993	13	1227
1987 Total		10230	3876	170	21090	9964	45330
1988	1	57	20	4	970	1164	2143
	2	40	18	27	939	640	1398
	3	46	3	3	1728	526	2206
	4	49	22	46	1200	1003	2249
	5	133	338	78	1016	1557	2980
	6	885	624	180	3038	1838	6131
	7	1882	690	23	1996	3279	8214
	8	2143	550	19	1010	238	3770
	9	2088	318	0	2095	150	4519
	10	1414	184	11	1637	54	3327
	11	444	42	1	866	37	1047
	12	52	8	0	2395	13	2945
1988 Total		9233	2817	392	18890	10499	41831
1989	1	7	9	51	899	735	1702
	2	1	16	53	1056	1756	2882
	3	182	5	29	1476	1117	2809
	4	385	15	67	1058	1887	3413
	5	546	263	14	1191	1292	3305
	6	1233	514	27	1794	2243	5810
	7	2494	577	17	2529	101	5718
	8	2706	532	5	1847	33	5123
	9	1962	433	5	1662	16	4078
	10	801	218	2	1175	58	2254
	11	395	69	0	2422	4	2891
	12	55	19	2	774	30	880
1989 Total		10768	2670	271	17881	9272	40864
1990	1	55	17	8	837	342	1260
	2	45	13	20	1349	357	1784
	3	491	38	13	2690	157	3389
	4	321	82	32	959	157	1550
	5	717	209	47	896	424	2292
	6	1202	626	14	1334	1163	4339
	7	2440	728	74	1349	2094	6685
	8	2272	777	5	1105	897	5056
	9	2060	493	28	992	478	4051
	10	976	253	32	759	843	2863
	11	333	38	13	407	836	1627
	12	82	10	29	993	338	1452
1990 Total		10993	3285	314	13668	8088	36348

Table 5.(Cont.) Nominal monthly landings of pollock in NAFO Divs. 4VWX and 5Zc for Canada(Maritimes, Quebec and Newfoundland)

		GN	LL	Misc	OTB		Grand Tota
1991	1	39	46	82	1030	766	1965
	2	66	17	60	1617	1074	2834
	3	249	4	1	1337	647	2237
	4	394	20	64	1800	2211	4489
	5	501	138	8	1710	1270	3627
	6	860	535	10	869	1833	4107
	7	1457	918	1	698	1560	4634
	8	1474	725	1	754	568	3522
	9	1430	457	36	193	781	2897
	10	1161	326	7	448	728	2670
	11	460	55	14	1463	827	2819
	12	148	11	0	1649	355	2163
1991 Total		8238	3253	284	13569	12620	37964
1992	1	80	23	6	1268	604	1982
	2	114	21	12	1012	455	1615
	3	96	10	0	768	738	1612
	4	337	33	5	1059	1082	2517
	5	369	109	39	1488	2657	4662
	6	588	635	3	1208	1084	3518
	7	1168	996	0	644	1600	4408
	8	1094	848	3	434	1215	3594
	9	1093	642	0	195	556	2486
	10	661	423	20	807	507	2418
	11	353	102		1091	783	2329
	12	89	28	1	220	529	866
1992 Total		6044	3870	89	10193	11813	32009
1993	1	4	4	0	1144	167	1319
	2	59	11	0	867	78	1015
	3	102	13	1	858	407	1381
	4	117	30	10	482	744	1382
	5	305	123	21	243	1048	1740
	6	829	589	13	624	1262	3317
	7	953	952	5	20	1429	3359
	8	752	753	2	75	660	2243
	9	603	448		89	381	1521
	10	305	236	0	42	148	731
	11	8	74	0	863	338	1282
	12	0	17	1	686	274	977
1993 Total		4037	3250	53	5993	6936	20267
1994	1	0	8	0	495	83	585
	2	7	5	32	242	371	657
	3	5	2	14	65	413	500
	4	136	47	2	76	539	800
	5	201	127	5	93	529	955
	6	632	765	167	263	698	2525
	7	821	918	9	602	1219	3568
	8	622	528	11	253	454	1868
	9	526	440	14	18	276	1274
	10	252	256	1	328	313	1149
	11	53	130	3	284	286	756
	12	8	16	0	387	238	650
1994 Total		3264	3242	256	3105	5420	15288

Table 5.(Cont.) Nominal monthly landings of pollock in NAFO Divs. 4VWX and 5Zc for Canada(Maritimes, Quebec and Newfoundland)

		GN	LL	Misc	OTB		Grand Tota
1995	1		12	0	283	91	387
	2		0	0	224	119	343
	3		1		49	180	229
	4	201	8	1	40	350	599
	5	15	60	0	121	232	428
	6	744	148	2	265	940	2099
	7	640	287	4	348	600	1880
	8	56	62	1	129	270	519
	9	1298	122	0	87	248	1756
	10	133	53	0	105	250	541
	11	41	11	0	423	231	706
	12	5	3	0	194	92	294
1995 Total		3133	768	8	2268	3605	9781
1996	1		2	5	200	168	375
	2		0	101	95	155	352
	3			5	338	211	554
	4	0	18	0	289	230	537
	5	161	64	35	158	335	754
	6	171	227	3	231	385	1018
	7	484	269	0	399	415	1567
	8	490	197	0	122	343	1151
	9	159	83	0	138	284	664
	10	117	68	3	190	325	701
	11	52	16	0	287	322	677
	12	44	10	0	515	227	795
1996 Total		1678	954	152	2962	3399	9145
1997	1		1		234	68	304
	2		6	0	311	383	700
	3		2	1	313	316	633
	4	117	15	0	132	691	955
	5	152	28	0	116	490	787
	6	454	265	0	90	783	1592
	7	598	424	0	81	940	2043
	8	654	275		81	563	1573
	9	490	112		162	600	1366
	10	319	71		155	238	784
	11	83	8		277	264	632
	12	11	3	0	203	288	505
1997 Total		2879	1212	1	2157	5624	11872
1998	1		2		124	291	417
	2		2	0	184	644	830
	3	0	1		275	1012	1288
	4	73	5		366	780	1223
	5	173	12		154	718	1057
	6	586	161	20	95	1117	1979
	7	1069	221	0	68	1002	2360
	8	554	189	0	23	422	1188
1998 Total		2454	593	21	1289	5986	10343

Table 6. Summary of fishermen's views on the status of the pollock fishery in 1998, organized by gear sector.

Sector	Area Fished	Comments
Mobile <65' (3 skippers, one representative	Primarily Western 4X	Gear conflicts keeping them off some of the best pollock grounds. The Gravelly, formerly a good pollock area, not productive. Predicting difficulty in catching their quota in 1998. Mostly large fish seen.
Mobile <65' (one skipper)	Western 4X	Generally good fishing, but pollock not found in traditional areas.
Mobile >100' (one skipper, one fleet manager)	Throughout Management Unit	Different spatial pattern to fishery noted, but coverage of the management unit by their vessels was not complete. An example is the absence of fish on Seal Island Grounds, a good traditional place to catch pollock. Large fish seen in 1998, a surprise given what was caught in 1997. Continued caution in the exploitation of the resource was advised.
Handline (three skippers)	Eastern 4X (inshore)	Much poorer year in 1998 than last year. Fish are very small. Lots of harbour pollock around.
Handline (two skippers)	Western 4X (one goes to Georges as well)	Generally thought fishing was about the same as last year, but noted different spatial pattern. No fish on German Bank. Good range of sizes noted, but few big "blister" pollock. Good fishing noted on Georges.
Handline	Eastern Bay of Fundy	Very poor fishery, unlike last year.
Gillnet (one skipper)	4W	Fishery was about the same as last year, but expected better given strong fishery last 2-3 years. Fishery started strong in July/August but declined thereafter. Emerald Basin, a notable area for pollock fishing in the past, was not productive this year. Good size range of fish, generally in excellent condition early in the year, but declined by latter half of summer. Abundance of small (14" fish) noted in the water.
Gillnet (two skippers)	Eastern 4X	Generally poor fishing, small fish. Lots of small fish not retained by gillnet.
Gillnet (one skipper)	Western 4X	Generally very good fishing, but pollock found in non-traditional areas. Good areas have included Crowell Basin, Truxton Swell. Acknowledges that fishing in eastern 4X has been extremely poor.

Table. 7 Number of age determinations used in the stock assessment by trimester and area, 1997 and 1998. The number in the bracket refers to ages inferred from examination of age-length keys where no matching ages were available for fish of a given length.

1997

	Trimester 1	**Trimester 2**	**Trimester 3**
4VW	57(6)	45(16)	38(6)
4X5	408(2)	579(2)	387(9)

1998

	Trimester 1	**Trimester 2**	**Trimester 3**
4VW	55(9)	73(1)	
4X5	318(0)	286(12)	

Table 8. Catch at age (numbers in thousands)

Total Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	8	-	10	-	1
2	197	175	178	36	23	98	171	171	134	56
3	5603	1058	1361	1476	835	2763	291	291	4018	1999
4	2662	4023	1974	2873	3119	5786	1864	1864	1589	9514
5	2356	2090	3649	1785	3084	3482	5306	5306	563	1256
6	1088	1904	1089	2181	1276	1705	3169	3169	1873	238
7	317	835	1089	732	1167	528	1075	1075	2295	524
8	164	196	207	417	257	249	277	277	1069	835
9	80	55	36	108	143	47	168	168	389	428
10	83	57	14	19	17	15	32	32	172	163
11	74	35	18	25	19	14	9	9	87	50
12	40	31	49	80	18	-	2	2	22	58

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	1	1	1	-	1	-	8	-	-	-
2	87	19	59	15	11	61	49	329	53	58
3	803	459	705	411	648	670	803	1763	2895	923
4	3493	2028	2889	1986	2563	4104	1777	3054	5265	3784
5	7155	3830	3550	4326	3170	3832	3598	2890	3168	2954
6	639	5022	3440	3577	3158	2424	2727	3486	1933	1337
7	92	1162	2790	2587	1884	2170	1563	1607	1058	506
8	217	150	342	1744	1156	970	986	803	435	275
9	210	179	94	247	1006	702	641	402	308	101
10	92	233	109	44	53	434	308	291	169	37
11	18	126	150	48	20	31	120	142	67	21
12	23	41	68	47	32	14	47	88	54	13

	1994	1995	1996	1997	1998
1	-	-	-		
2	50	32	95	8	2
3	273	467	430	241	175
4	693	795	1366	1183	951
5	2184	1256	1117	2043	1477
6	1396	1236	793	1053	1206
7	709	401	446	299	283
8	338	96	84	61	56
9	172	37	21	4	9
10	44	17	4	0	3
11	18	5	1	1	0
12	7	1	1	0	0

Table 8(Cont) Catch at age (number in thousands)

Canadian Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	-	-	-	-	-
2	185	167	126	36	23	8	128	42	132	54
3	4784	986	1207	1433	786	98	244	1333	3516	1857
4	2364	3567	1738	2855	3070	2752	1733	672	1584	9309
5	2125	1852	3170	1760	3022	5582	5035	2043	563	1248
6	954	1660	939	2128	1222	3341	3113	4019	1872	237
7	273	795	1001	710	1142	1645	1047	2432	2294	523
8	144	132	194	395	246	495	269	712	1067	833
9	64	45	35	90	134	248	165	207	389	428
10	51	56	12	19	17	47	32	148	172	163
11	33	34	16	25	19	15	9	31	87	50
12	10	30	42	80	18	14	2	24	22	58

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	-	-	-	-	-	-	-	-	-	-	-
2	22	6	3	13	11	34	4	45	24	56	50
3	720	443	387	372	583	580	595	1024	2008	901	272
4	3491	2017	2695	1958	2387	3424	1578	2571	4508	3521	691
5	7152	3796	3507	4277	3115	3652	3276	2774	3041	2824	2179
6	639	5017	3420	3528	3113	2381	2662	3427	1853	1282	1395
7	91	1159	2775	2555	1808	2104	1543	1592	1036	498	709
8	215	145	341	1680	1121	931	970	793	427	271	338
9	207	174	94	245	992	677	631	390	306	100	172
10	148	224	105	40	53	414	308	288	167	37	44
11	31	119	144	44	18	28	118	138	66	21	18
12	24	39	65	44	28	10	41	87	53	13	7

	1995	1996	1997	1998	1988-1997
1					-
2	23	20	6	2	22
3	407	265	216	172	596
4	781	1271	1152	943	1868
5	1251	1067	2030	1474	2086
6	1235	769	1052	1206	1611
7	401	437	299	283	929
8	96	83	61	56	485
9	37	21	4	9	327
10	17	4	0	3	131
11	5	1	1	0	41
12	1	1	0	0	24

Table 8(cont) Catch at age (numbers in thousands)

Foreign Catch at Age

	1974	1975	1976	1977-1993
1	-	-	-	-
2	12	8	17	-
3	291	67	121	-
4	162	228	160	-
5	152	87	237	-
6	77	78	64	-
7	20	23	42	-
8	9	4	14	-
9	5	2	2	-
10	3	1	2	-
11	3	1	2	-
12	1	1	8	-

Small Mesh Gear Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	-	-	10	-	-
2	-	-	35	-	-	-	43	829	2	2
3	528	6	33	43	49	11	47	1	502	142
4	136	229	77	18	49	104	131	1	5	205
5	79	151	242	25	62	141	271	1	-	8
6	57	166	86	53	54	60	56	-	1	1
7	24	17	46	22	25	33	28	-	1	1
8	10	60	-	22	11	1	8	1	2	2
9	10	9	-	18	9	-	3	1	-	-
10	29	-	-	-	-	-	-	-	-	-
11	38	-	-	-	-	-	-	-	-	-
12	29	-	-	-	-	-	-	-	-	-

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	1	1	1	-	1	-	8	-	-	-
2	65	13	56	2	-	27	45	284	29	2
3	83	16	318	39	65	90	208	739	887	22
4	2	11	194	28	176	680	199	483	757	263
5	3	34	43	49	55	180	322	116	127	130
6	-	5	20	49	45	43	65	59	80	55
7	1	3	15	32	76	66	20	15	22	8
8	2	5	1	64	35	39	16	10	8	4
9	3	5	-	2	14	25	10	12	2	1
10	-	9	4	4	-	20	-	3	2	-
11	0	7	6	4	2	3	2	4	1	-
12	2	2	3	3	4	4	6	1	1	-

	1994	1995	1996	1997	1998
1	-				
2	-	9	75	2	
3	1	60	165	25	2
4	2	14	95	31	7
5	5	5	50	13	3
6	1	1	24	1	
7	-		9		
8	-		1		
9	-				
10	-				
11	-				
12	-				

Table 9 (cont) Mean weight at age(kg) for pollock in 4VWX5Zc.

Total Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	0.19	-	-	-	0.63
2	0.82	0.86	0.59	0.79	1.14	0.77	1.03	0.68	0.76	0.83
3	1.38	1.26	1.21	1.10	1.23	1.18	1.68	1.74	1.19	1.25
4	1.94	1.95	1.92	1.52	1.80	1.55	2.08	2.54	2.69	1.66
5	3.00	3.06	2.81	2.48	2.60	2.62	2.77	2.91	3.51	3.12
6	4.09	3.81	3.71	3.50	3.90	3.40	3.46	3.34	4.18	4.12
7	5.08	5.06	4.67	4.52	4.59	4.34	4.12	4.32	4.45	4.83
8	6.16	6.52	5.64	5.47	6.02	5.55	5.58	5.93	5.19	5.08
9	6.68	7.49	7.02	6.62	6.91	6.61	6.50	6.90	6.12	5.84
10	7.39	7.49	7.80	7.25	7.37	7.14	9.07	7.77	7.64	6.48
11	8.58	8.22	8.76	10.02	8.38	8.79	8.40	7.54	8.00	8.00
12	10.03	9.59	9.11	11.30	10.03	-	11.65	9.22	8.65	8.72

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.36	0.00	0.00	0.00	0.00	0.00	0.25	0.14	0.00	0.00
2	0.73	0.59	0.35	0.92	1.19	0.60	0.48	0.53	0.75	0.97
3	1.64	1.58	1.18	1.44	1.31	1.23	1.30	1.09	1.08	1.19
4	2.36	2.22	2.12	2.04	1.96	1.71	2.04	1.93	1.62	1.54
5	2.67	3.02	2.73	2.60	2.71	2.43	2.56	2.63	2.41	2.17
6	3.84	3.39	3.48	3.07	3.29	3.16	2.96	3.07	3.03	2.95
7	5.41	3.72	3.85	3.70	3.60	3.69	3.78	3.42	3.49	3.33
8	5.97	4.85	4.41	4.05	4.39	4.03	4.21	4.16	4.18	3.88
9	5.90	6.61	6.00	4.45	4.61	4.68	4.97	4.63	4.96	4.70
10	6.32	6.55	6.60	6.25	5.74	4.79	5.24	5.00	5.60	5.35
11	7.69	7.25	6.76	6.48	7.53	6.41	6.06	5.77	5.88	5.97
12	8.53	8.81	6.69	7.17	8.51	7.25	7.10	5.90	6.43	6.81

1	1994	1995	1996	1997	1998
2	-			0.10	
3	0.87	0.61	0.38	0.81	0.85
4	1.28	1.07	1.02	1.21	1.08
5	1.54	1.65	1.66	1.80	1.65
6	1.90	2.08	2.12	2.34	2.25
7	3.06	2.58	2.68	3.12	3.05
8	3.78	3.64	3.18	3.70	4.19
9	4.18	4.35	4.56	4.91	4.83
10	4.74	4.66	4.94	7.57	6.64
11	5.59	4.88	7.44	8.88	5.41
12	6.00	5.51	9.64	6.92	14.21
	6.18	7.57	6.83	11.75	12.88

Table 9 (cont) Mean weight at age(kg) for pollock in 4VWX5Zc.

Canadian Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	0.19	-	-	-	-
2	0.83	0.86	0.63	0.79	1.14	0.77	1.12	1.01	0.76	0.84
3	1.43	1.27	1.23	1.11	1.26	1.18	1.77	1.74	1.24	1.25
4	1.98	1.99	1.94	1.52	1.81	1.54	2.10	2.54	2.70	1.67
5	3.02	3.10	2.80	2.48	2.59	2.63	2.80	2.91	3.51	3.13
6	4.05	3.87	3.73	3.49	3.88	3.38	3.47	3.34	4.18	4.11
7	5.03	5.07	4.65	4.50	4.59	4.33	4.14	4.32	4.45	4.83
8	6.06	6.51	5.62	5.45	6.00	5.54	5.56	5.93	5.19	5.08
9	6.62	7.47	7.04	6.55	6.84	6.61	6.51	6.90	6.12	5.84
10	7.22	7.69	7.71	7.25	7.37	7.14	9.07	7.77	7.64	6.48
11	8.12	8.47	8.67	10.02	8.38	8.79	8.40	7.54	8.00	8.00
12	9.37	9.89	9.19	11.30	10.03	-	11.65	9.22	8.65	8.72

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	-					-		-	-	-
2	1.46	1.08	0.91	1.01	1.19	0.75	0.82	0.88	1.10	0.99
3	1.68	1.61	1.43	1.51	1.40	1.26	1.45	1.30	1.26	1.20
4	2.36	2.22	2.15	2.05	2.01	1.82	2.06	2.06	1.69	1.56
5	2.67	3.03	2.73	2.60	2.72	2.45	2.55	2.67	2.43	2.19
6	3.84	3.39	3.48	3.07	3.30	3.17	2.97	3.08	3.06	2.97
7	5.41	3.72	3.86	3.71	3.61	3.71	3.78	3.42	3.51	3.33
8	5.97	4.87	4.42	4.07	4.39	4.05	4.22	4.16	4.20	3.88
9	5.90	6.64	6.00	4.44	4.62	4.71	4.98	4.63	4.96	4.70
10	6.34	6.60	6.62	6.31	5.74	4.81	5.24	4.99	5.61	5.35
11	7.69	7.33	6.79	6.63	8.36	6.64	6.05	5.77	5.88	5.97
12	8.76	8.93	7.00	7.26	8.72	7.25	7.19	5.87	6.42	6.81

	1994	1995	1996	1997	1998
1	-				
2	0.87	0.73	1.02	0.98	0.85
3	1.29	1.14	1.34	1.28	1.09
4	1.54	1.66	1.69	1.83	1.66
5	1.90	2.09	2.14	2.34	2.26
6	3.07	2.58	2.69	3.12	3.05
7	3.78	3.64	3.20	3.70	4.19
8	4.18	4.35	4.58	4.91	4.83
9	4.74	4.66	4.96	7.57	6.64
10	5.59	4.88	7.44	8.88	5.41
11	6.00	5.51	9.64	6.92	14.21
12	6.18	7.57	6.83	11.75	12.88

Table 9(cont) Mean weight at age(kg) for pollock in 4VWX5Zc.

Foreign Fishery Weight at Age

	1974	1975	1976	1977-93
1	-	-	-	-
2	0.59	0.84	0.63	-
3	1.24	1.13	1.04	-
4	1.81	1.68	1.88	-
5	2.89	2.32	2.83	-
6	3.97	3.25	3.52	-
7	5.23	4.33	4.83	-
8	6.70	5.13	5.90	-
9	6.72	5.13	6.70	-
10	7.00	-	8.26	-
11	8.43	-	9.46	-
12	13.00	-	8.68	-

Small Mesh Gear Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	0.77	0.66	0.62	0.43
3	1.02	1.11	0.92	0.74	0.83	1.23	1.25	1.52	0.84	1.15
4	1.47	1.74	1.45	1.65	1.66	1.81	1.86	1.74	2.15	1.28
5	2.71	3.04	2.91	2.80	2.88	2.49	2.19	2.96	-	2.52
6	4.90	3.47	3.68	3.90	4.32	3.93	2.72	3.63	3.54	4.38
7	5.50	5.62	5.13	4.99	4.45	4.48	3.14	4.28	4.97	4.62
8	7.01	6.64	-	5.90	6.45	5.98	6.32	5.41	6.30	4.35
9	7.01	8.00	-	6.92	8.01	-	6.37	7.36	8.82	5.03
10	7.73	-	-	-	-	-	-	8.87	7.43	7.08
11	8.99	-	-	-	-	-	-	-	-	7.61
12	10.20	-	-	-	-	-	-	-	8.50	8.39

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.36	-	-	-	-	-	0.25	0.14	-	-
2	0.48	0.37	0.32	0.32	0.26	0.42	0.45	0.47	0.46	0.50
3	1.29	0.62	0.87	0.79	0.50	1.08	0.86	0.79	0.70	1.00
4	2.50	1.39	1.68	1.40	1.22	1.19	1.85	1.29	1.23	1.35
5	2.82	2.35	2.48	1.92	2.39	2.04	2.59	1.85	1.90	1.93
6	3.77	2.92	3.24	2.65	2.70	2.82	2.80	2.69	2.16	2.59
7	4.97	3.04	3.20	2.94	3.36	3.08	3.68	3.40	2.77	3.35
8	5.60	4.29	3.85	3.61	4.33	3.69	3.77	3.89	3.46	3.95
9	5.87	5.40	-	4.78	4.30	3.99	4.32	4.54	4.31	5.10
10	5.96	5.35	6.14	5.74	-	4.45	5.74	6.02	4.60	6.10
11	7.25	5.94	6.04	4.84	-	4.19	6.12	5.86	5.85	6.80
12	6.19	6.46	-	5.96	7.04	7.24	6.45	8.25	6.80	7.80

	1994	1995	1996	1997	1998
1				0.10	
2	0.36	0.29	0.21	0.27	0.12
3	0.60	0.58	0.51	0.59	0.45
4	0.76	0.80	1.26	0.91	0.73
5	1.24	1.22	1.79	1.38	1.013
6	1.67	1.94	2.17	1.93	1.95
7	-		2.29	2.26	1.9
8	-		2.83	4.10	
9	-		3.08		
10	-				
11	-				
12	-				

Table 10. Proportional Catch at Age for pollock in 4VWX5Zc.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.00	0.01
2	1.56	1.67	1.84	0.37	0.23	0.67	1.38	1.38	1.10	0.37
3	44.24	10.12	14.08	15.17	8.39	18.80	2.35	2.35	32.90	13.22
4	21.02	38.46	20.43	29.52	31.32	39.37	15.08	15.06	13.01	62.91
5	18.60	19.98	37.76	18.34	30.97	23.70	42.91	42.88	4.61	8.31
6	8.59	18.20	11.27	22.41	12.81	11.60	25.63	25.61	15.34	1.57
7	2.50	7.98	11.27	7.52	11.72	3.59	8.69	8.69	18.79	3.47
8	1.30	1.87	2.14	4.28	2.58	1.69	2.24	2.24	8.75	5.52
9	0.63	0.53	0.37	1.11	1.44	0.32	1.36	1.36	3.19	2.83
10	0.66	0.54	0.14	0.20	0.17	0.10	0.26	0.26	1.41	1.08
11	0.58	0.33	0.19	0.26	0.19	0.10	0.07	0.07	0.71	0.33
12	0.32	0.30	0.51	0.82	0.18	0.00	0.02	0.02	0.18	0.38

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.01	0.01	0.01	0.00	0.01	0.00	0.06	0.00	0.00	0.00
2	0.68	0.14	0.42	0.10	0.08	0.40	0.39	2.21	0.34	0.58
3	6.26	3.46	4.97	2.73	4.73	4.35	6.36	11.87	18.79	9.22
4	27.23	15.31	20.35	13.21	18.71	26.63	14.07	20.56	34.18	37.81
5	55.77	28.91	25.01	28.78	23.14	24.86	28.49	19.45	20.56	29.51
6	4.98	37.90	24.23	23.80	23.05	15.73	21.60	23.47	12.55	13.36
7	0.72	8.77	19.65	17.21	13.75	14.08	12.38	10.82	6.87	5.06
8	1.69	1.13	2.41	11.60	8.44	6.29	7.81	5.41	2.82	2.75
9	1.64	1.35	0.66	1.64	7.34	4.55	5.08	2.71	2.00	1.01
10	0.72	1.76	0.77	0.29	0.39	2.82	2.44	1.96	1.10	0.37
11	0.14	0.95	1.06	0.32	0.15	0.20	0.95	0.96	0.43	0.21
12	0.18	0.31	0.48	0.31	0.23	0.09	0.37	0.59	0.35	0.13

	1994	1995	1996	1997	1998
1	0.00	0.00	0.00		
2	0.85	0.74	2.18	0.16	0.04
3	4.64	10.75	9.87	4.93	4.20
4	11.78	18.31	31.34	24.17	22.85
5	37.12	28.92	25.63	41.75	35.50
6	23.73	28.46	18.20	21.52	28.98
7	12.05	9.23	10.23	6.11	6.79
8	5.74	2.21	1.93	1.25	1.35
9	2.92	0.85	0.48	0.09	0.21
10	0.75	0.39	0.09	0.01	0.06
11	0.31	0.12	0.02	0.02	0.00
12	0.12	0.02	0.02	0.00	0.00

Table 11. Age disaggegated catch rates for pollock caught in the otter trawl fishery, 4VWX5Zc. Grey cells signify noteworthy cohorts, including the 1979 and 1992 yearclasses.

	3	4	5	6	7	8	9
1982.5	0.1294	0.0509	0.0163	0.0471	0.0542	0.0244	0.0096
1983.5	0.0880	0.4148	0.0378	0.0053	0.0149	0.0263	0.0137
1984.5	0.0298	0.1300	0.2692	0.0205	0.0026	0.0063	0.0065
1985.5	0.0190	0.0786	0.1349	0.1836	0.0432	0.0050	0.0051
1986.5	0.0192	0.1146	0.1519	0.1438	0.1209	0.0150	0.0033
1987.5	0.0159	0.0746	0.1452	0.1167	0.0763	0.0505	0.0079
1988.5	0.0201	0.0709	0.0858	0.0853	0.0495	0.0283	0.0246
1989.5	0.0226	0.1196	0.1105	0.0639	0.0549	0.0245	0.0170
1990.5	0.0242	0.0572	0.1010	0.0767	0.0392	0.0265	0.0147
1991.5	0.0248	0.0585	0.0553	0.0644	0.0291	0.0136	0.0069
1992.5	0.0551	0.1182	0.0659	0.0347	0.0183	0.0073	0.0053
1993.5	0.0330	0.1318	0.1001	0.0359	0.0131	0.0076	0.0026
1994.5	0.0153	0.0357	0.1104	0.0580	0.0213	0.0074	0.0028
1995.5	0.0413	0.0697	0.0979	0.0862	0.0188	0.0041	0.0020
1996.5	0.0307	0.1386	0.1003	0.0604	0.0311	0.0046	0.0009
1997.5	0.0144	0.0767	0.1266	0.0502	0.0123	0.0017	0.0002
1998.5	0.0124	0.0684	0.0987	0.0676	0.0111	0.0019	0.0004

Table 12a. Estimated beginning of year population numbers (000s), bias adjusted, pollock in 4VWX5Zc. ALL DATA INCLUDED.

	2	3	4	5	6	7	8	9	10	11	12
1974	17249	28114	10221	8430	2958	828	422	504	347	175	134
1975	26403	13944	17977	5977	4787	1447	394	199	340	209	77
1976	37806	21459	10462	11101	3021	2215	443	148	113	227	140
1977	44940	30792	16341	6789	5817	1498	842	178	89	80	170
1978	20138	36761	23878	10793	3955	2809	573	318	50	55	43
1979	5146	16467	29344	16740	6068	2094	1256	240	132	25	28
1980	15650	4125	10994	18819	10573	3437	1240	805	154	95	8
1981	71795	12659	3115	7323	10644	5813	1850	766	508	97	70
1982	42809	57994	9162	1945	4161	5116	2584	876	440	283	52
1983	34441	34928	43856	6071	1087	1733	2138	1160	370	207	154
1984	34683	28148	26793	27351	3841	676	949	1003	566	157	124
1985	25676	28318	22320	18789	15966	2569	471	582	632	381	112
1986	26122	21005	22770	16446	11938	8567	1065	251	316	309	199
1987	28370	21333	16561	16039	10272	6686	4512	566	121	161	119
1988	17752	23214	17095	11769	9247	5204	3158	2133	242	60	89
1989	18567	14524	18421	11688	6789	4740	2573	1550	848	151	31
1990	21902	15147	11286	11391	6133	3386	1943	1238	642	308	96
1991	19534	17888	11676	7640	6099	2585	1377	712	443	251	145
1992	8791	15696	13056	6816	3668	1894	691	414	225	105	79
1993	10170	7150	10245	5979	2752	1281	609	180	67	35	26
1994	21950	8274	5022	4999	2260	1060	596	253	57	22	10
1995	18428	17926	6528	3487	2141	612	241	187	55	8	2
1996	12584	15059	14255	4628	1730	654	146	111	120	30	2
1997	18948	10217	11941	10439	2785	708	141	45	72	95	24
1998	19097	15508	8180	8774	6780	1366	320	63	33	59	77
1998.67	16700	13400	6266	6295	4805	931	228	47	26	52	67

Table 12b. Estimated beginning of year population numbers (000s), bias adjusted, pollock in 4VWX5Zc. CPUE INDICES 5,6,7 OMITTED IN SCENARIO.

	2	3	4	5	6	7	8	9	10	11	12
1974	17249	28114	10221	8430	2958	806	422	500	343	173	132
1975	26403	13944	17977	5977	4787	1447	376	199	338	206	75
1976	37806	21459	10462	11101	3021	2215	443	133	113	225	137
1977	44940	30792	16341	6789	5817	1498	842	178	77	80	168
1978	20137	36761	23878	10793	3955	2809	573	318	50	46	43
1979	5146	16466	29343	16740	6068	2094	1256	240	132	25	20
1980	15650	4125	10994	18819	10573	3437	1240	805	154	95	8
1981	71792	12658	3115	7323	10644	5813	1850	766	508	97	70
1982	42803	57992	9161	1945	4160	5116	2584	876	440	283	52
1983	34434	34923	43855	6070	1087	1733	2138	1160	370	207	154
1984	34676	28142	26789	27350	3840	676	949	1003	566	157	124
1985	25669	28311	22315	18786	15965	2569	470	582	632	381	112
1986	26119	20999	22765	16442	11935	8566	1065	251	316	309	199
1987	28181	21331	16556	16035	10269	6684	4511	565	121	161	119
1988	17635	23059	17093	11765	9243	5202	3156	2133	242	60	89
1989	18466	14428	18294	11686	6785	4737	2571	1549	848	151	31
1990	21838	15064	11208	11288	6132	3384	1940	1236	641	307	95
1991	19420	17835	11609	7576	6015	2584	1375	710	441	250	144
1992	8460	15603	13013	6761	3616	1826	690	412	224	104	78
1993	10507	6879	10169	5943	2707	1239	555	179	66	34	25
1994	24778	8550	4800	4937	2232	1024	562	209	57	21	9
1995	20055	20241	6754	3306	2090	589	212	160	21	8	2
1996	13044	16391	16150	4813	1582	614	128	88	97	2	2
1997	18948	10594	13031	11991	2936	588	109	30	53	76	1
1998	19097	15508	8488	9666	8050	1489	223	37	21	43	61
1998.67	16700	13400	6536	7076	5915	1038	143	24	16	38	54

Table 13a. Estimated fishing mortality, bias adjusted, pollock in 4VWX5Zc. ALL DATA INCLUDED.

	2	3	4	5	6	7	8	9	10	11	12
1974	0.013	0.247	0.337	0.366	0.515	0.542	0.553	0.192	0.305	0.622	0.398
1975	0.007	0.087	0.282	0.482	0.570	0.984	0.781	0.361	0.203	0.203	0.582
1976	0.005	0.072	0.232	0.446	0.502	0.767	0.713	0.311	0.146	0.091	0.484
1977	0.001	0.054	0.215	0.340	0.528	0.761	0.775	1.075	0.268	0.417	0.720
1978	0.001	0.025	0.155	0.376	0.436	0.605	0.672	0.675	0.470	0.470	0.605
1979	0.021	0.204	0.244	0.259	0.368	0.324	0.246	0.243	0.133	0.913	0.000
1980	0.012	0.081	0.206	0.370	0.398	0.420	0.281	0.261	0.259	0.110	0.305
1981	0.013	0.123	0.271	0.365	0.533	0.611	0.547	0.354	0.385	0.430	0.474
1982	0.003	0.079	0.212	0.382	0.676	0.672	0.601	0.663	0.557	0.411	0.623
1983	0.002	0.065	0.272	0.258	0.275	0.403	0.557	0.517	0.656	0.309	0.533
1984	0.003	0.032	0.155	0.338	0.202	0.162	0.289	0.261	0.197	0.135	0.227
1985	0.001	0.018	0.105	0.254	0.423	0.680	0.430	0.411	0.516	0.450	0.509
1986	0.002	0.038	0.150	0.271	0.380	0.441	0.433	0.528	0.475	0.752	0.469
1987	0.001	0.021	0.142	0.351	0.480	0.550	0.549	0.648	0.507	0.396	0.563
1988	0.001	0.031	0.180	0.350	0.468	0.504	0.512	0.722	0.275	0.457	0.503
1989	0.004	0.052	0.281	0.445	0.496	0.692	0.531	0.681	0.814	0.256	0.680
1990	0.002	0.060	0.190	0.425	0.664	0.700	0.804	0.829	0.740	0.556	0.768
1991	0.019	0.115	0.338	0.534	0.969	1.120	1.003	0.951	1.241	0.954	1.079
1992	0.007	0.227	0.581	0.707	0.852	0.934	1.146	1.614	1.647	1.180	1.335
1993	0.006	0.153	0.518	0.773	0.754	0.565	0.678	0.942	0.907	1.028	0.771
1994	0.003	0.037	0.165	0.648	1.107	1.282	0.957	1.322	1.731	1.997	1.301
1995	0.002	0.029	0.144	0.501	0.986	1.234	0.572	0.245	0.411	1.054	0.582
1996	0.008	0.032	0.112	0.308	0.693	1.333	0.982	0.233	0.037	0.037	0.616
1997	0.000	0.022	0.108	0.232	0.513	0.593	0.609	0.104	0.000	0.012	0.000
1998	0.000	0.018	0.198	0.296	0.314	0.373	0.308	0.248	0.152	0.000	0.000

Table 13b. Estimated fishing mortality, bias adjusted, pollock in 4VWX5Zc. CPUE INDICES 5,6,7 OMITTED IN SCENARIO.

	2	3	4	5	6	7	8	9	10	11	12
1974	0.013	0.247	0.337	0.366	0.515	0.562	0.553	0.193	0.309	0.630	0.404
1975	0.007	0.087	0.282	0.482	0.570	0.984	0.838	0.361	0.205	0.206	0.597
1976	0.005	0.072	0.232	0.446	0.502	0.767	0.713	0.352	0.146	0.092	0.494
1977	0.001	0.054	0.215	0.340	0.528	0.761	0.775	1.075	0.317	0.417	0.732
1978	0.001	0.025	0.155	0.376	0.436	0.605	0.672	0.675	0.470	0.605	0.605
1979	0.021	0.204	0.244	0.259	0.368	0.324	0.246	0.243	0.133	0.913	0.000
1980	0.012	0.081	0.206	0.370	0.398	0.420	0.281	0.261	0.259	0.110	0.305
1981	0.013	0.123	0.271	0.365	0.533	0.611	0.547	0.354	0.385	0.430	0.474
1982	0.003	0.079	0.212	0.382	0.676	0.672	0.601	0.663	0.557	0.411	0.623
1983	0.002	0.065	0.272	0.258	0.275	0.403	0.557	0.517	0.656	0.309	0.533
1984	0.003	0.032	0.155	0.338	0.202	0.162	0.289	0.261	0.197	0.135	0.227
1985	0.001	0.018	0.105	0.254	0.423	0.680	0.430	0.411	0.516	0.450	0.509
1986	0.002	0.038	0.150	0.271	0.380	0.441	0.433	0.528	0.475	0.753	0.469
1987	0.001	0.021	0.142	0.351	0.480	0.550	0.549	0.648	0.507	0.397	0.564
1988	0.001	0.031	0.180	0.350	0.468	0.505	0.512	0.722	0.275	0.457	0.503
1989	0.004	0.053	0.283	0.445	0.496	0.693	0.532	0.682	0.815	0.256	0.680
1990	0.002	0.061	0.192	0.430	0.664	0.701	0.806	0.831	0.742	0.556	0.770
1991	0.019	0.115	0.341	0.540	0.992	1.120	1.005	0.955	1.249	0.960	1.083
1992	0.007	0.228	0.584	0.715	0.871	0.992	1.148	1.631	1.673	1.205	1.361
1993	0.006	0.160	0.523	0.780	0.772	0.591	0.777	0.948	0.939	1.087	0.814
1994	0.002	0.036	0.173	0.659	1.132	1.376	1.058	2.116	1.777	2.370	1.582
1995	0.002	0.026	0.139	0.537	1.026	1.329	0.682	0.294	2.127	1.165	1.108
1996	0.008	0.029	0.098	0.294	0.789	1.527	1.244	0.305	0.046	0.781	0.781
1997	0.000	0.022	0.099	0.198	0.479	0.770	0.887	0.158	0.000	0.015	0.000
1998	0.000	0.018	0.190	0.266	0.260	0.338	0.465	0.450	0.246	0.000	0.000

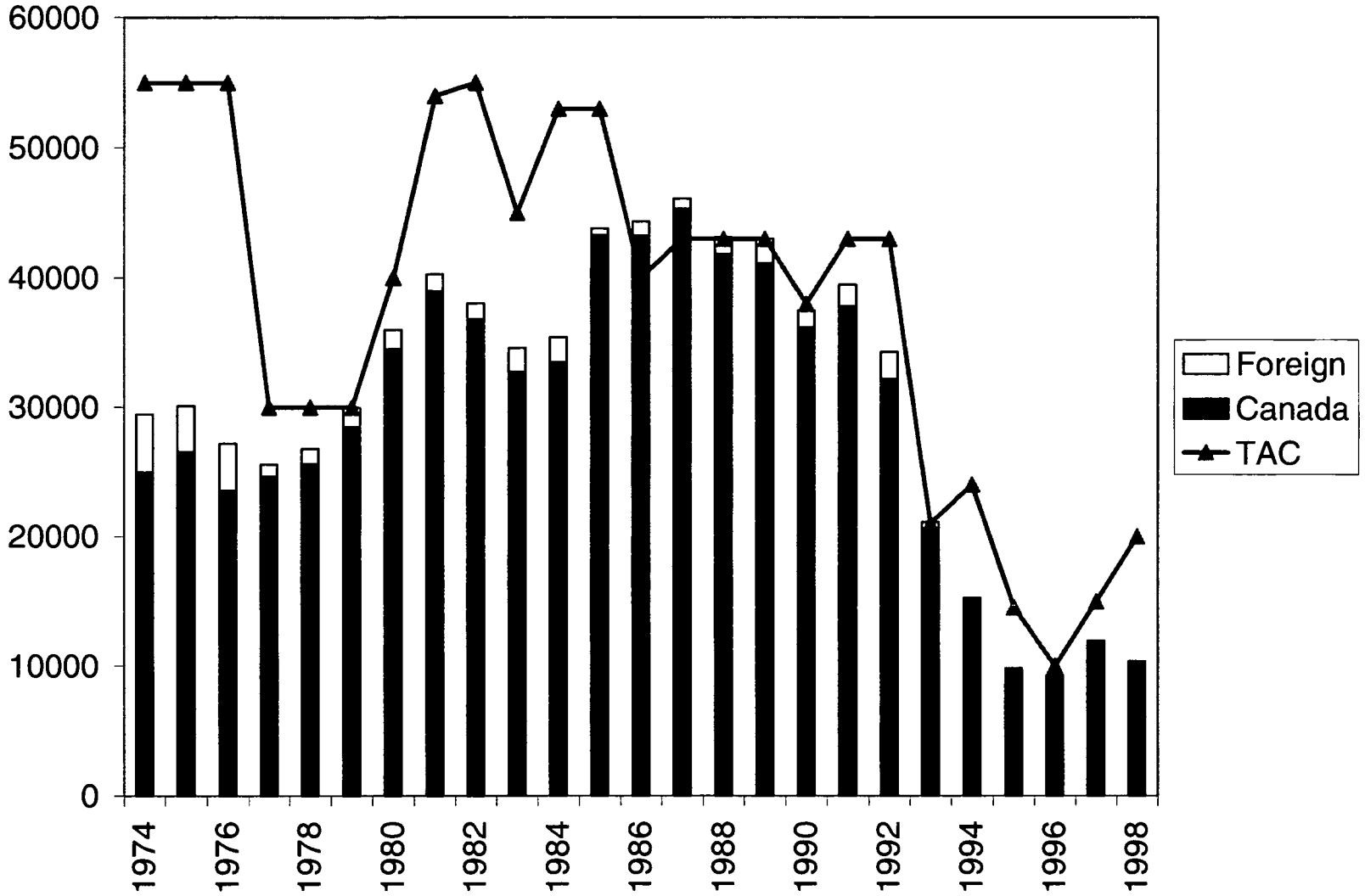


Fig. 1. Landings of 4VWX5Zc pollock by Canada and Foreign countries, shown with respect to the TAC.

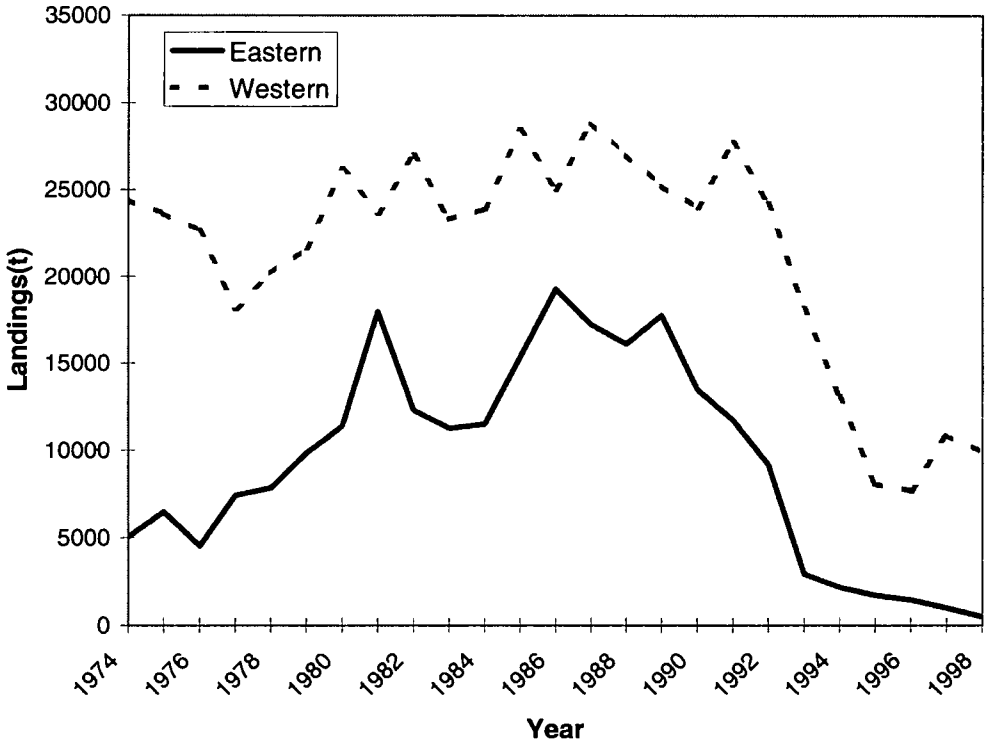


Fig. 2. Landings of 4VWX5Zc pollock, split into eastern and western halves of the management unit.

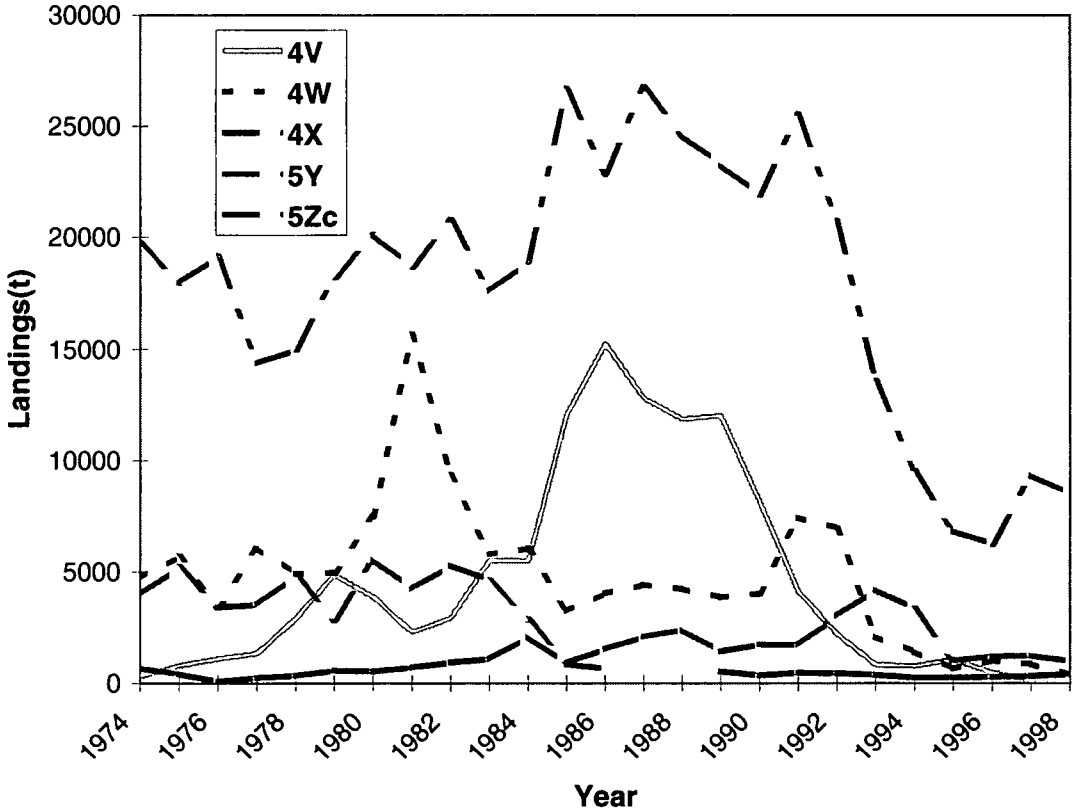


Fig. 3. Landings of 4VWX5Zc pollock by NAFO subdivision.

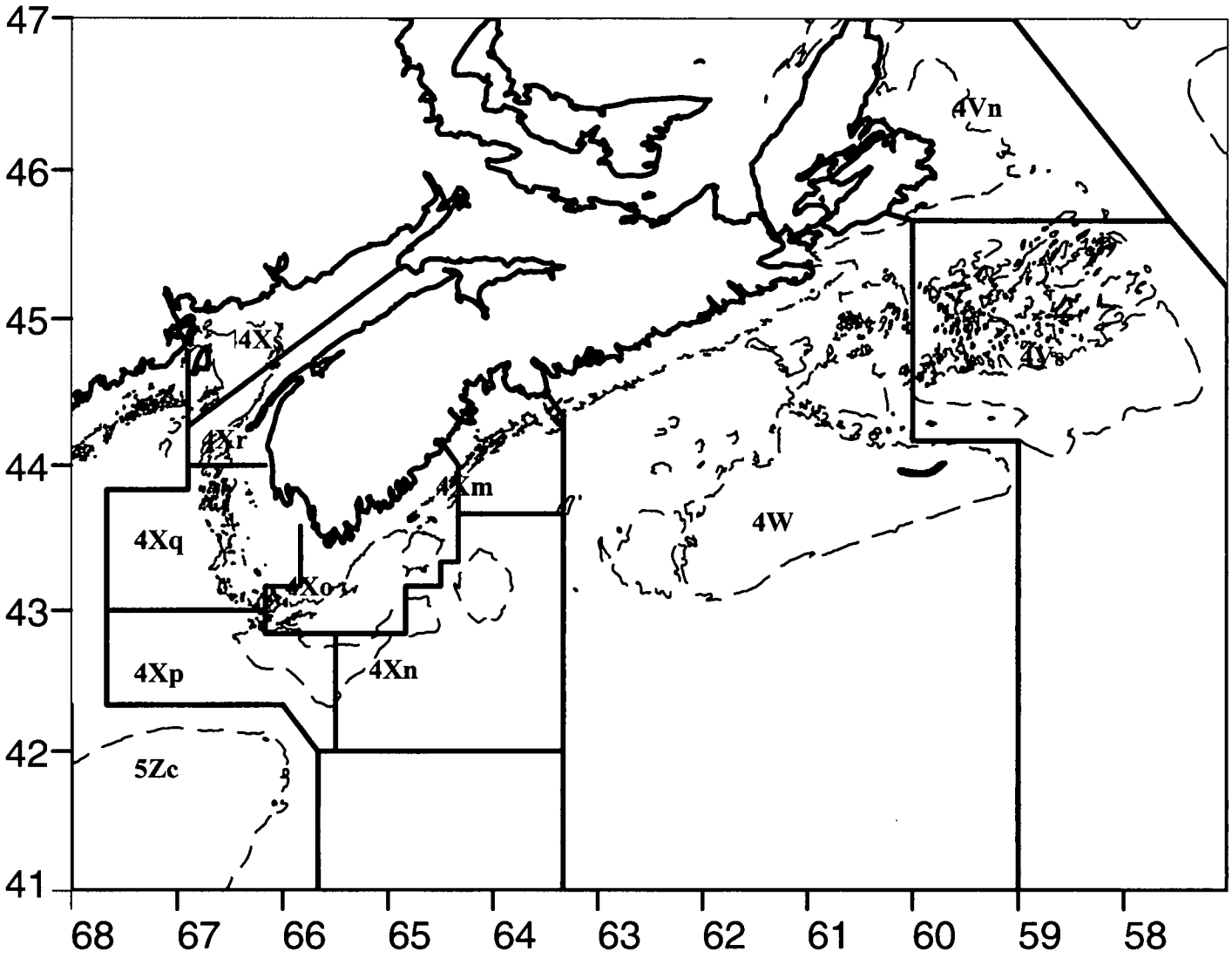


Fig. 4. Map of pollock management unit with additional detail of NAFO Unit Areas in Div. 4X

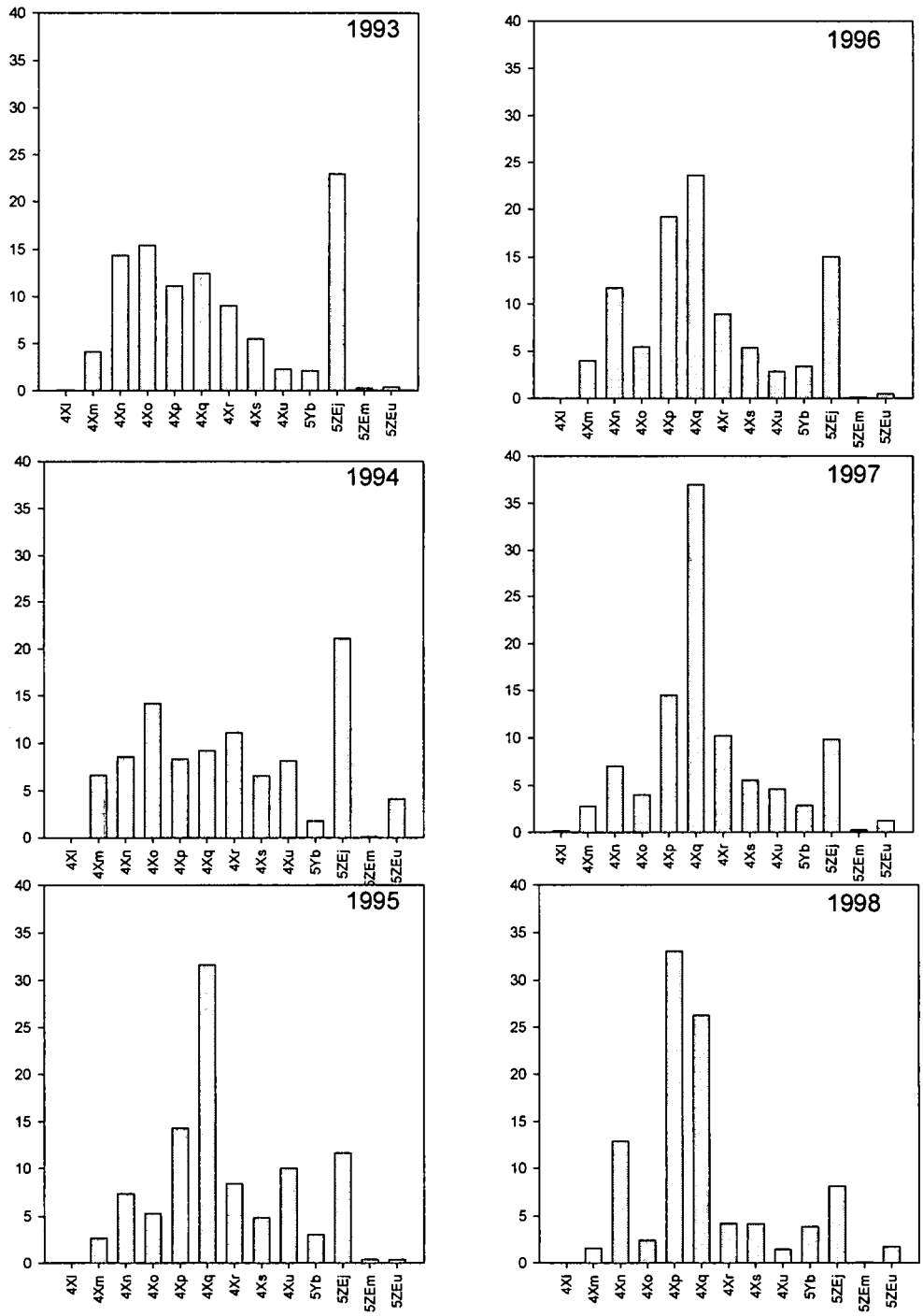


Fig.5. Proportion of pollock landings by unit area from 1993 to 1998.

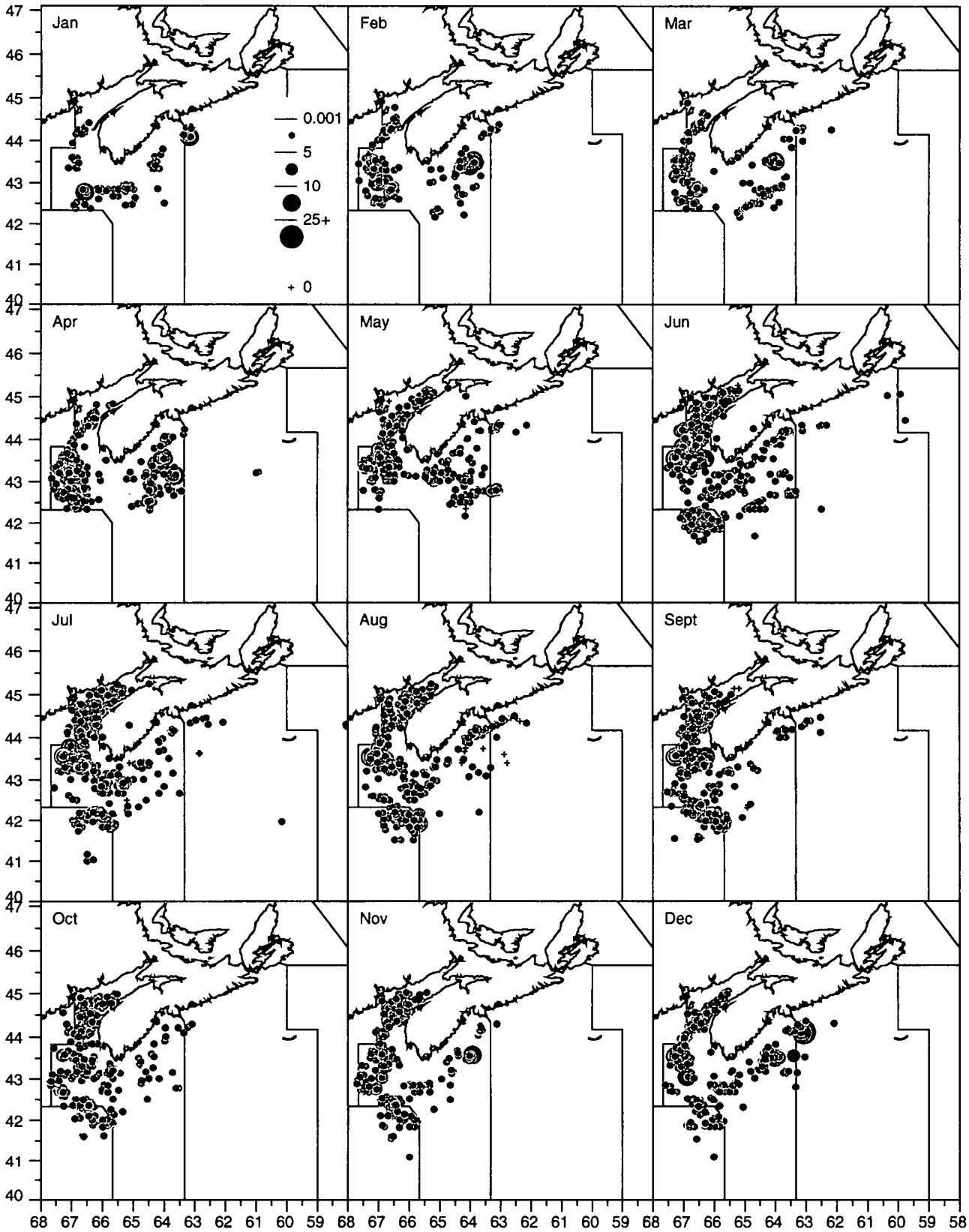


Fig. 6. Distribution of commercial pollock landings by month in 4VWX & 5Zc in 1997, TC 1-3 mobile gear.

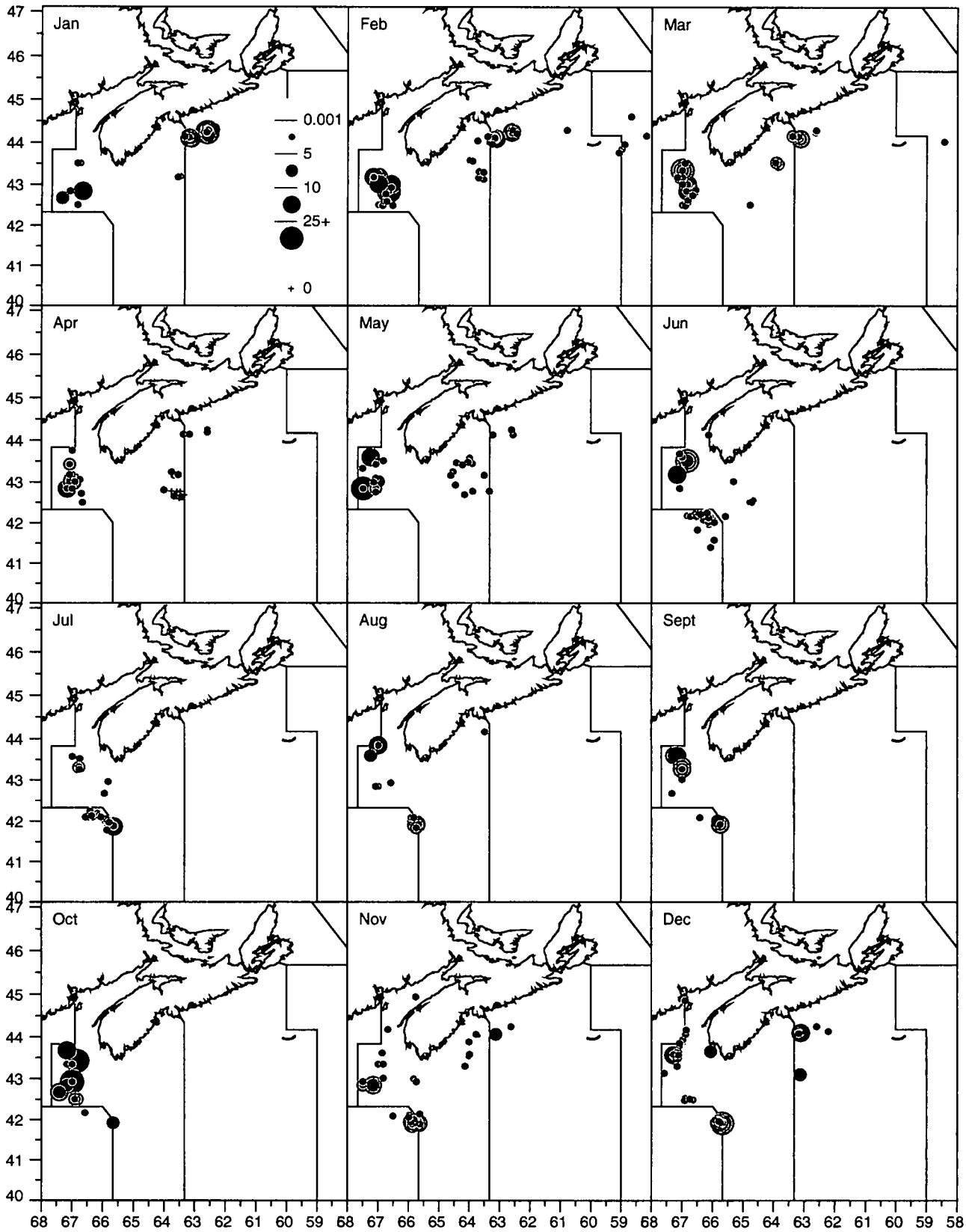


Fig. 7. Distribution of commercial pollock landings by month in 4VWX & 5Zc in 1997, TC 4+ mobile gear.

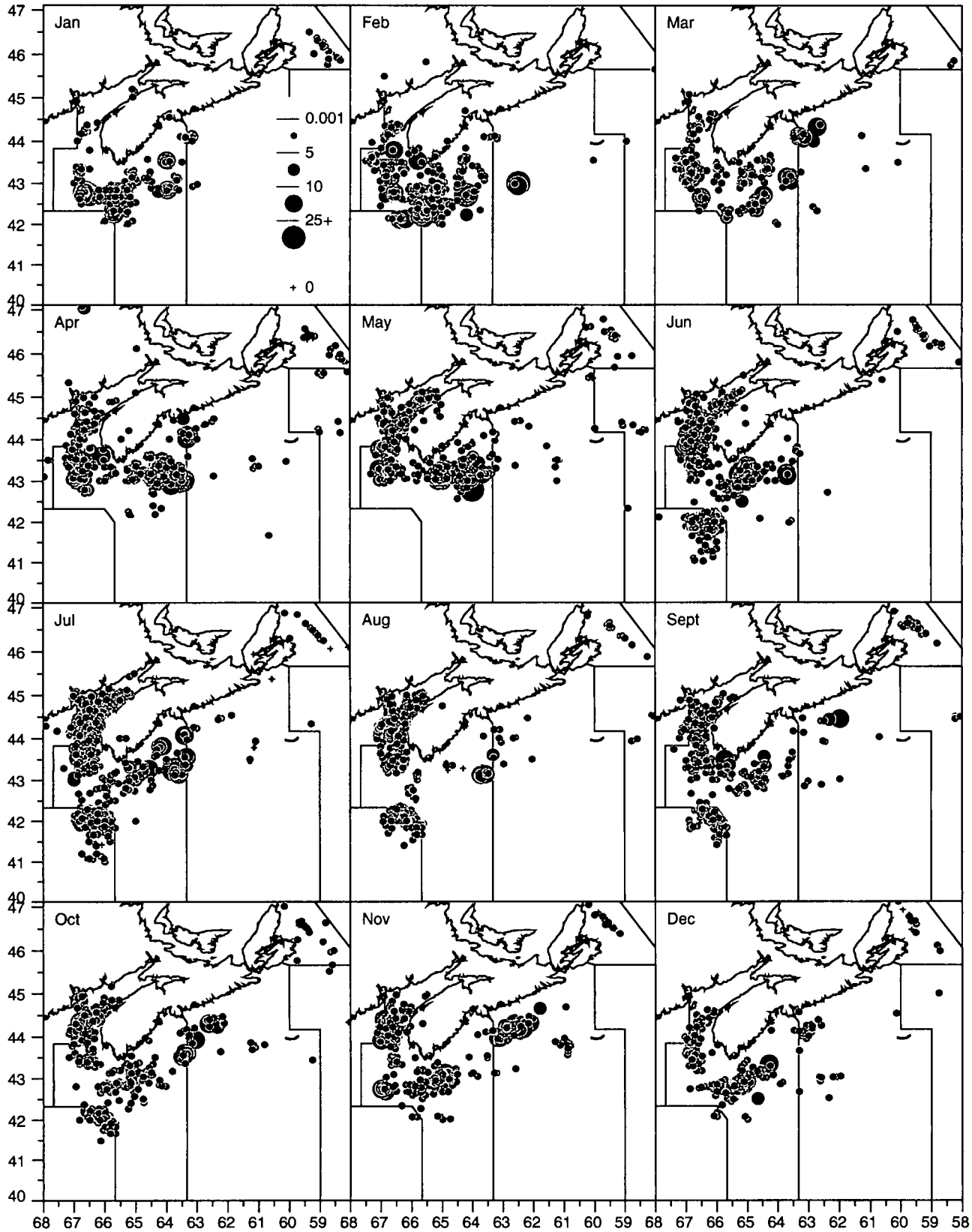


Fig. 8. Distribution of commercial pollock landings by month in 4VWX & 5Zc in 1991, TC 1-3 mobile gear.

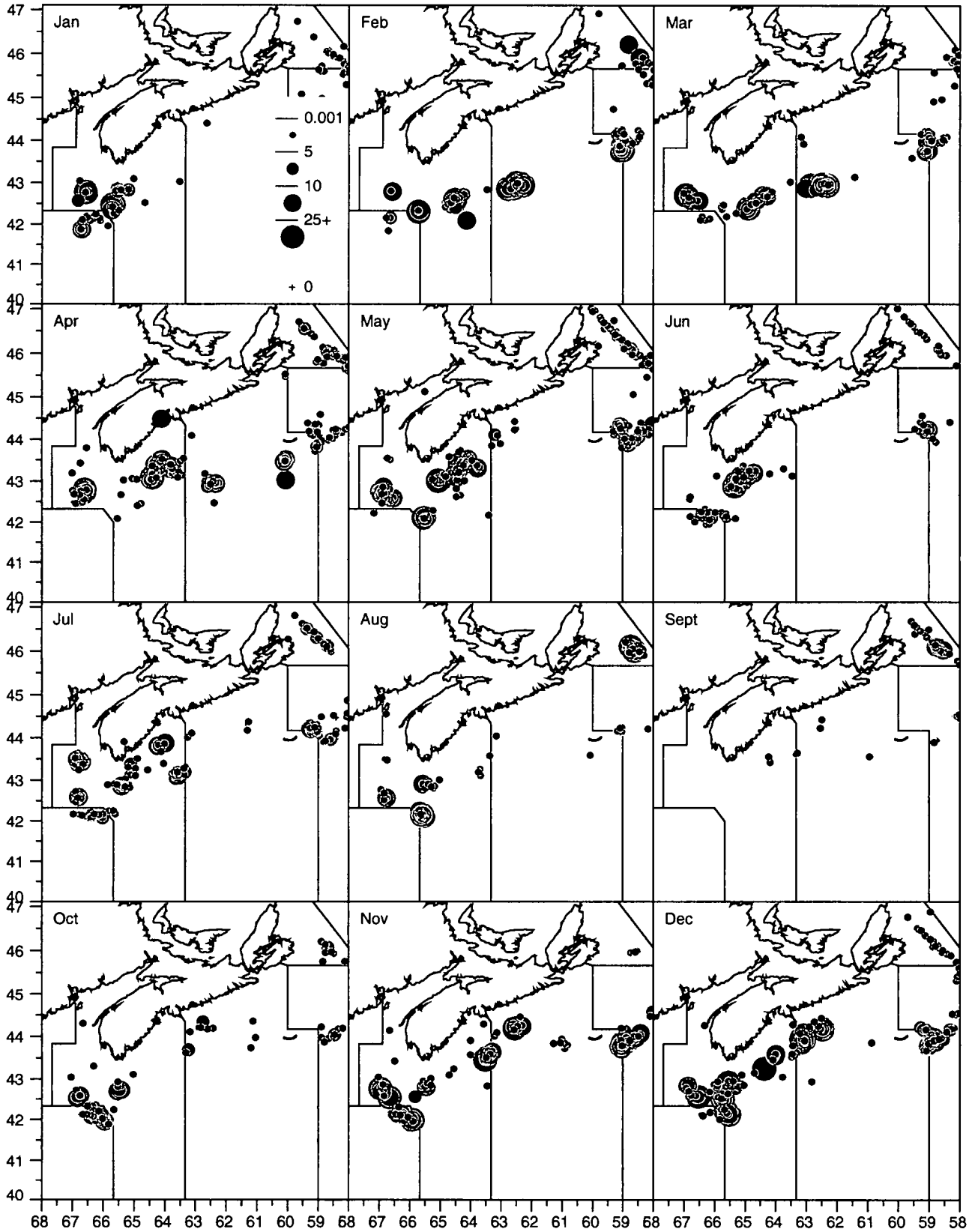


Fig. 9. Distribution of commercial pollock landings by month in 4VWX & 5Zc in 1991, TC 4+ mobile gear.

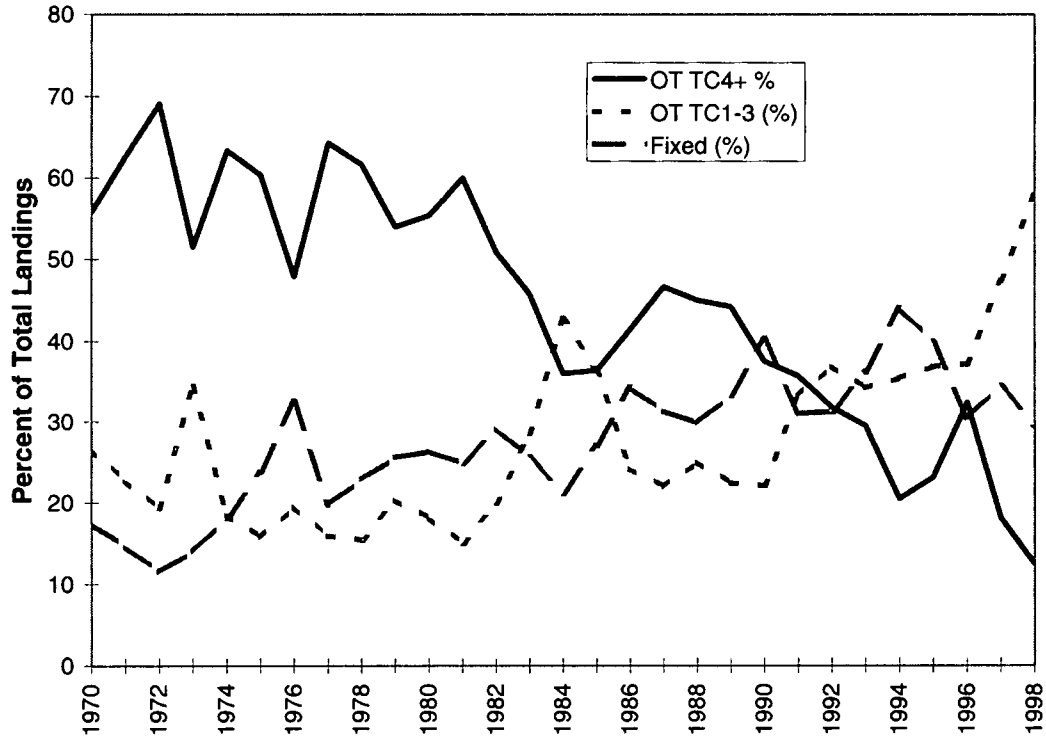


Fig. 10. Landings of 4VWX5Zc pollock by major gear type.

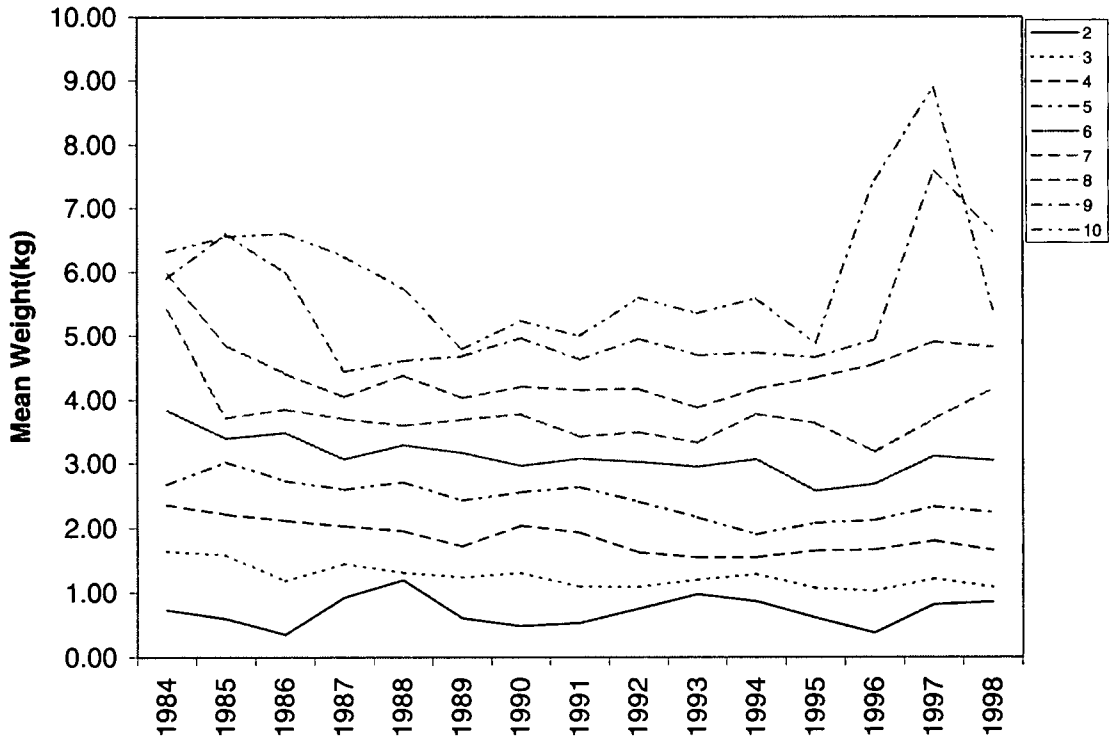


Fig. 11. Trend in mean weight at age from the 4VWX5Zc pollock fishery, 1984 to 1998.

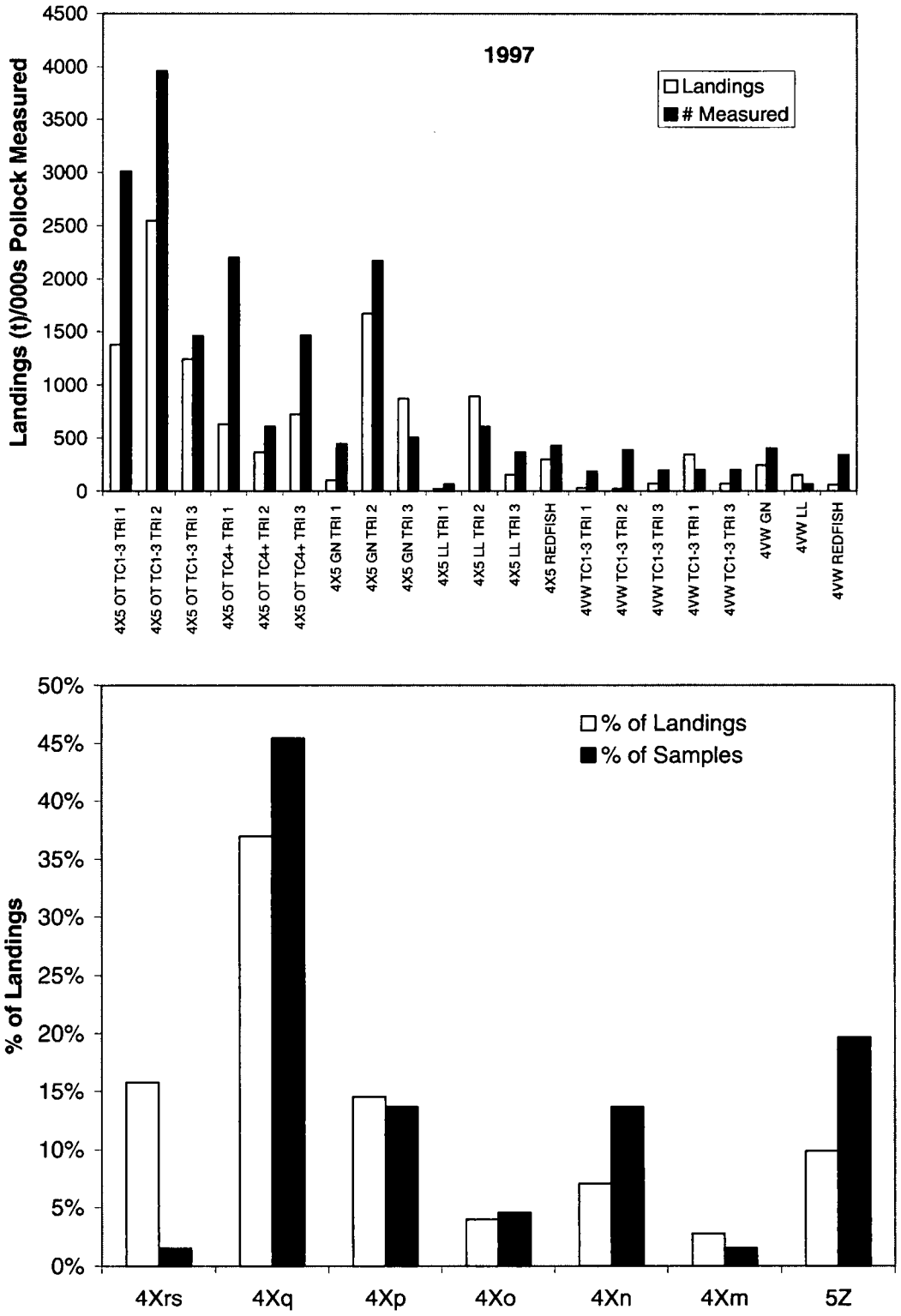


Fig. 12. Landings and number of pollock measured by gear type,area and trimester for 1997(upper panel). Bottom panel illustrates the percent of samples vs percent of landings for 4X5 for 1997.

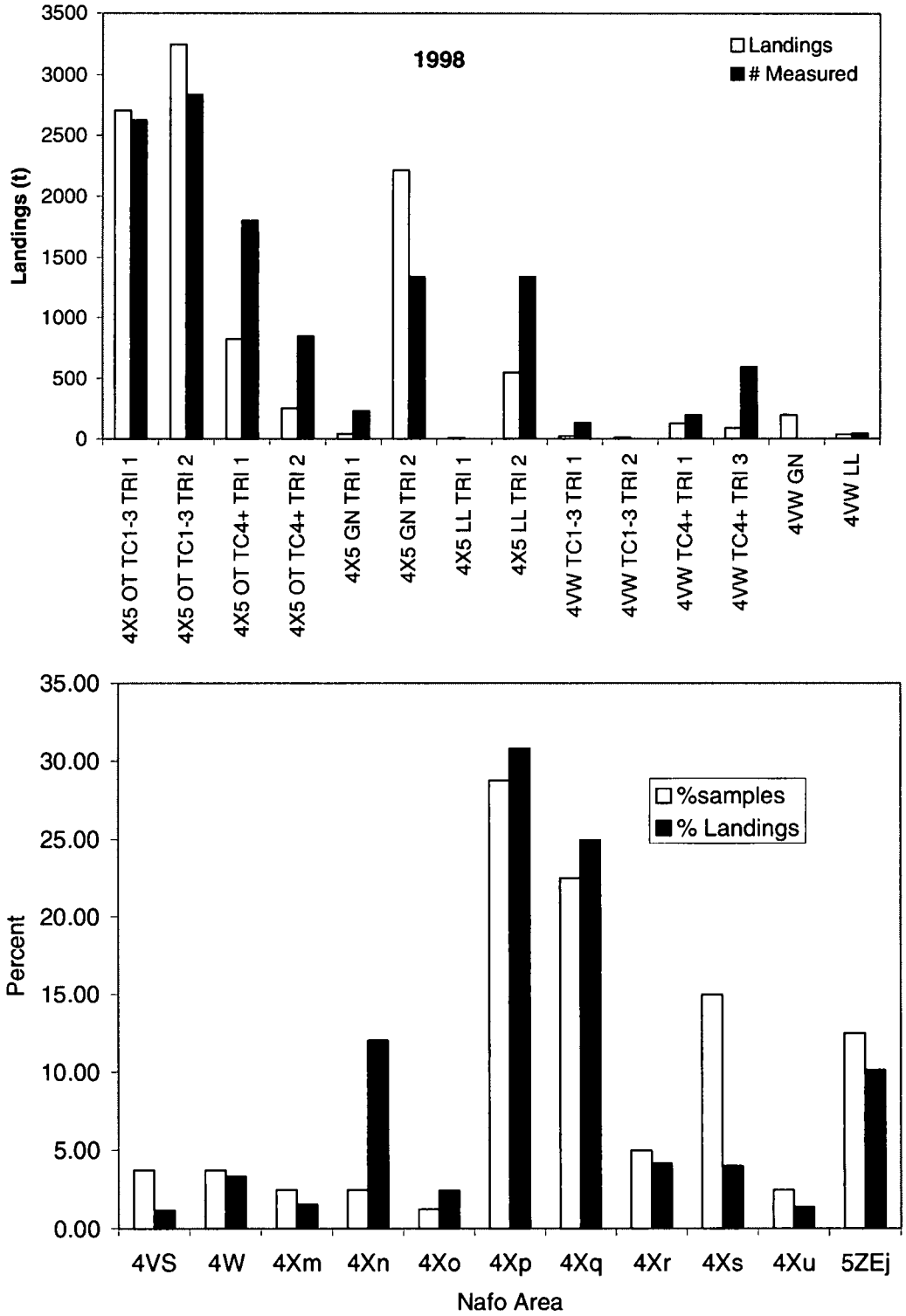


Fig. 13. Landings and number of pollock measured by gear type,area and trimester for 1998(upper panel). Bottom panel illustrates the percent of samples vs percent of landings for 4X5 for 1998.

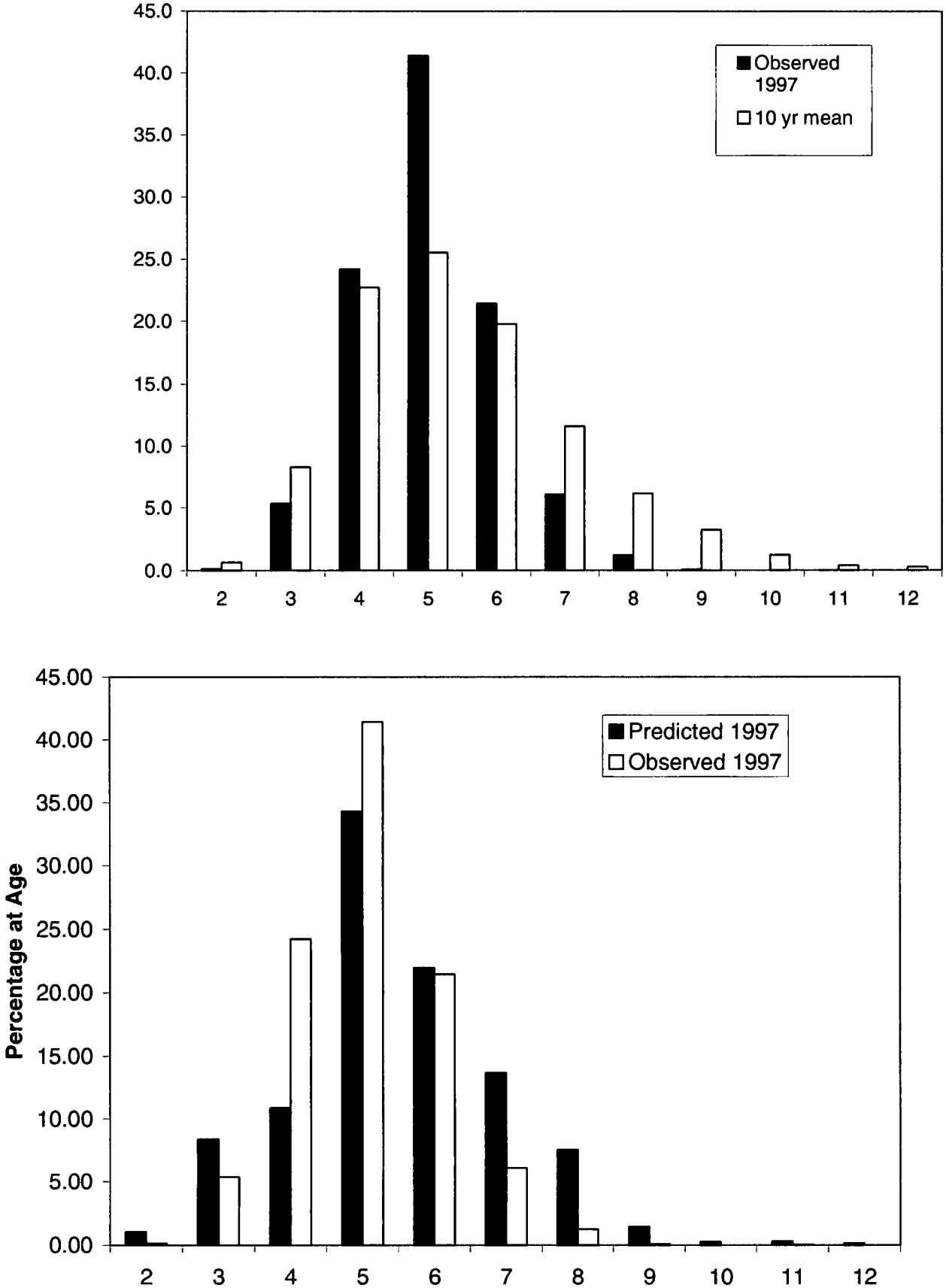


Fig. 14. (Upper panel) Comparison of observed and expected catch composition by age, pollock in 4VWX5Zc, 1997, (Bottom panel) Observed age composition in 1997(percent) compared with the ten year mean. Pollock in 4VWX5Zc.

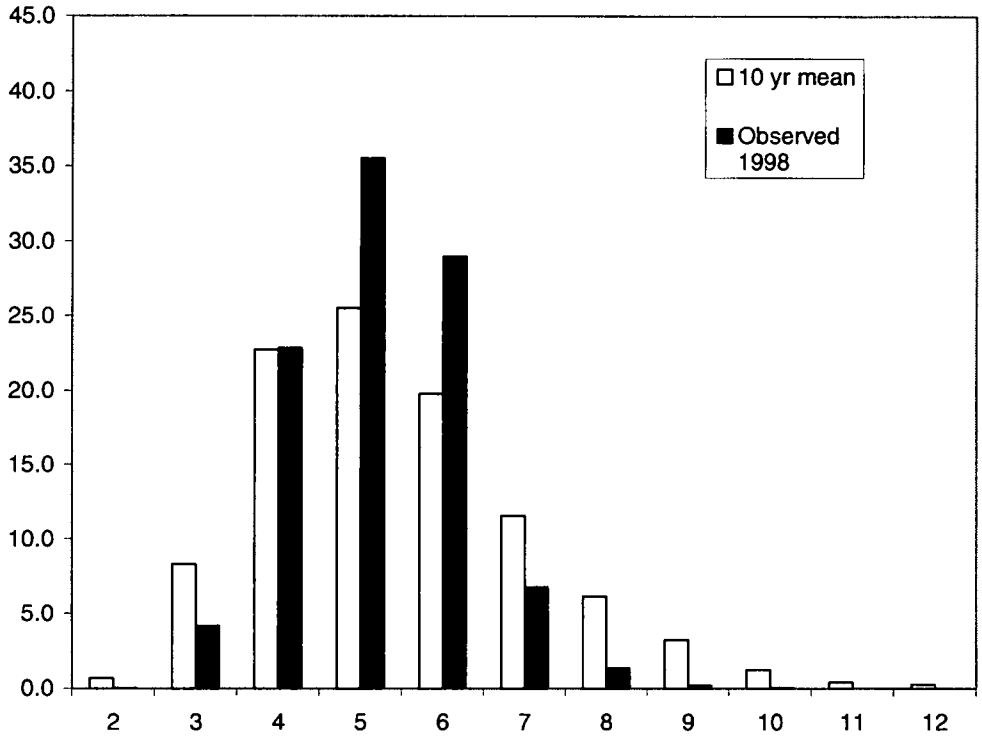


Fig. 15. Observed age composition in 1998 (percent) compared with the ten year mean. Pollock in 4VWX5Zc.

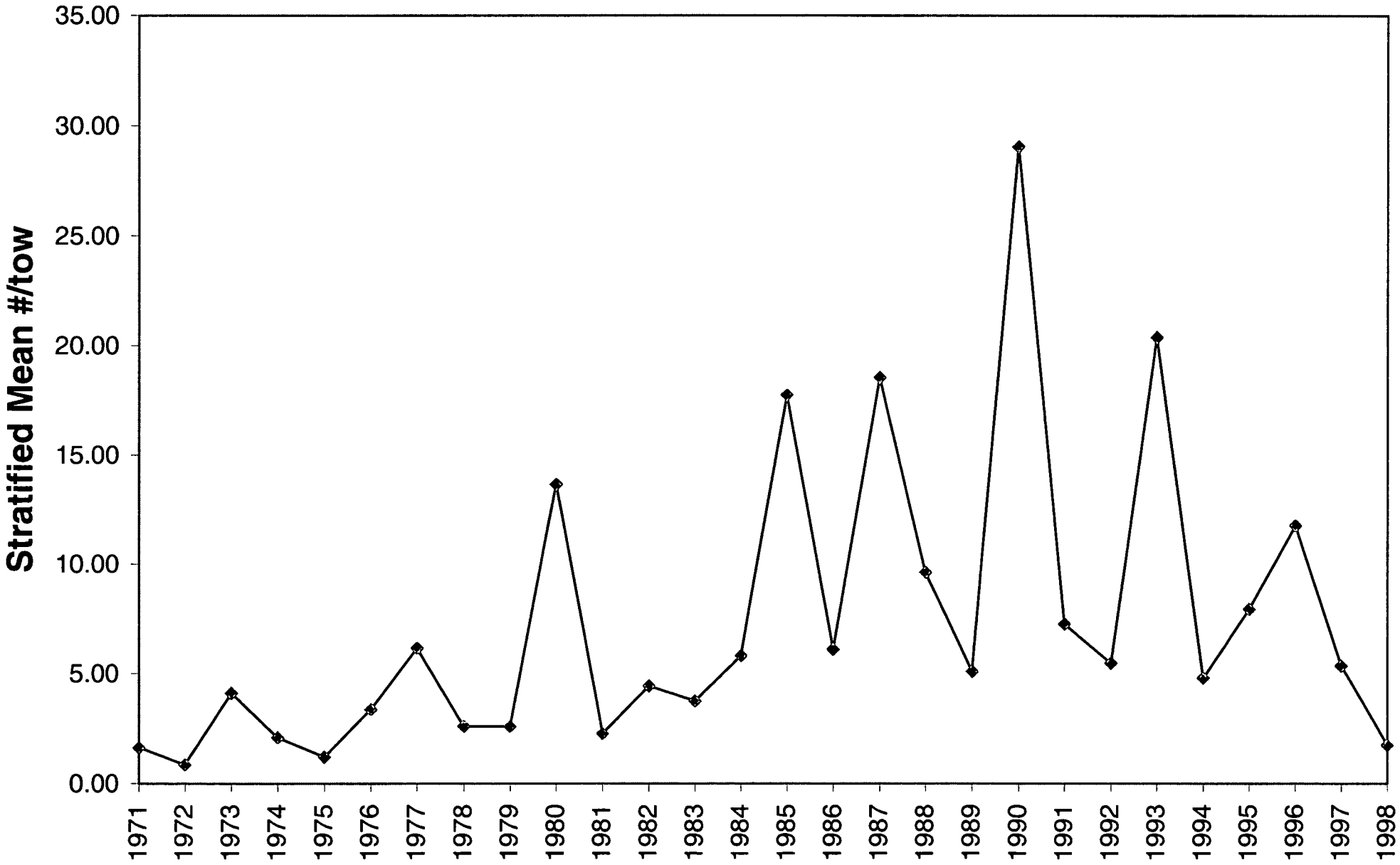


Fig 16. Pollock catch per tow from summer RV surveys. Strata included were 440 – 495.

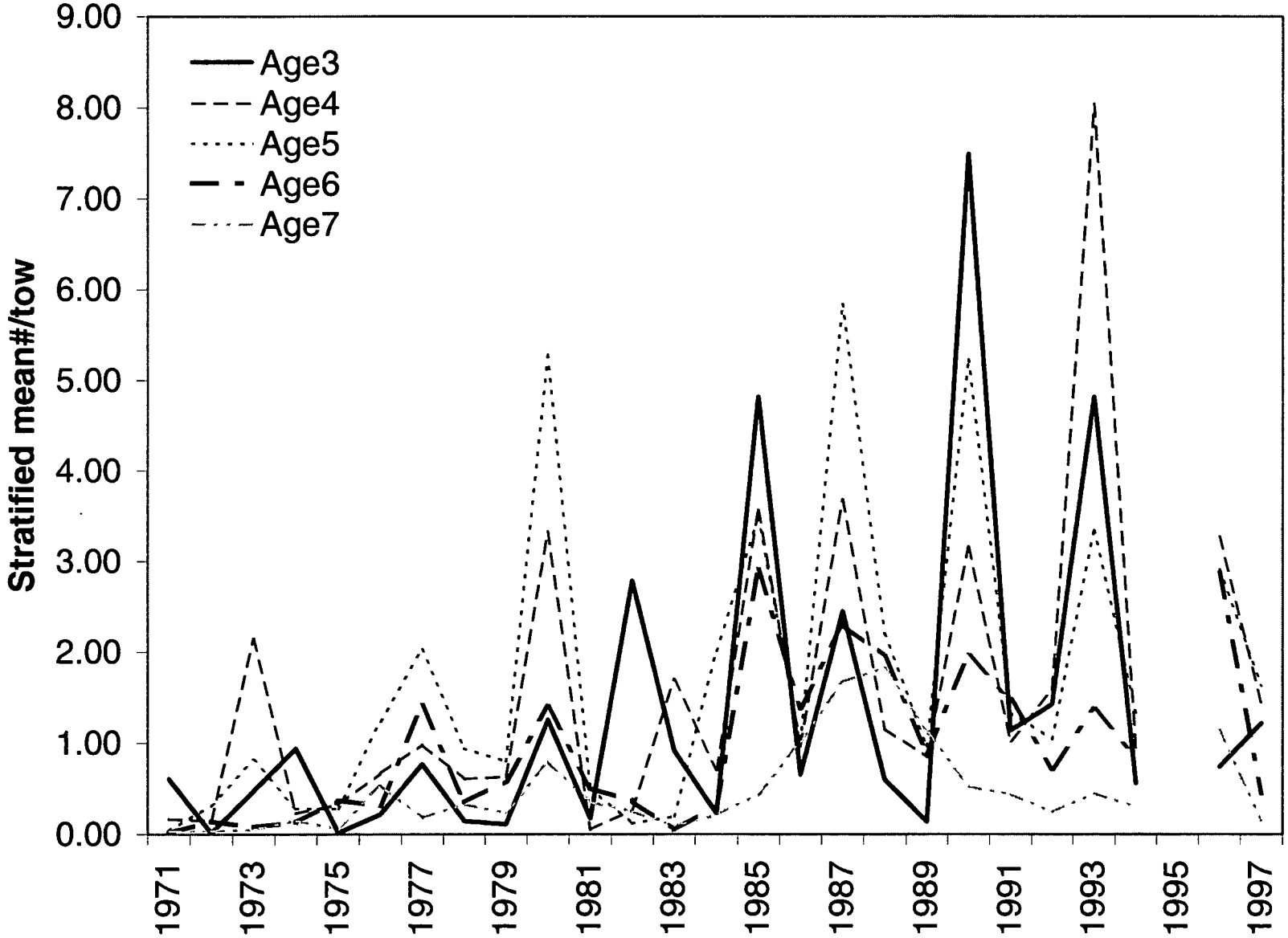


Fig. 17. Pollock catch per tow from summer surveys, disaggregated by age.

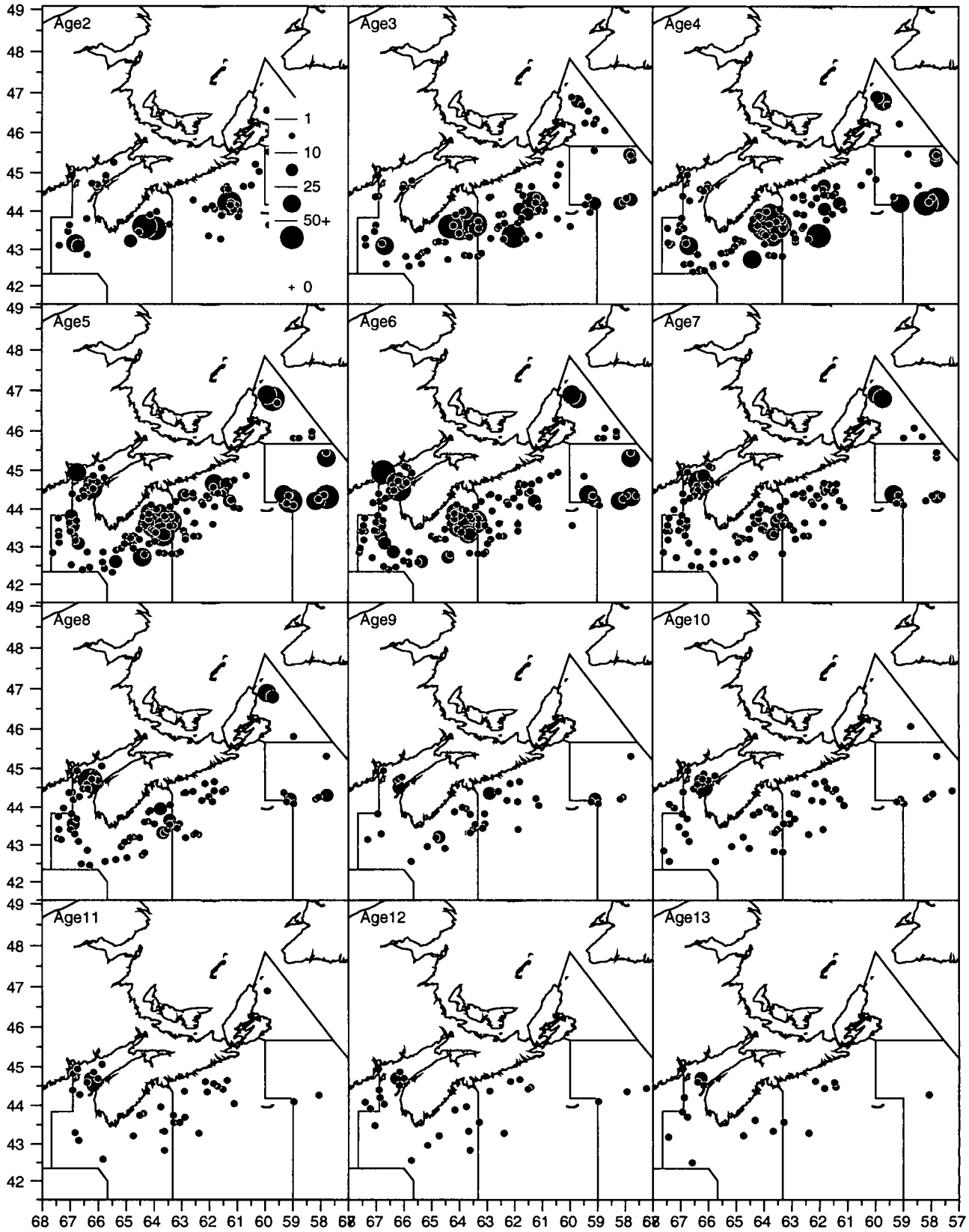


Fig.18a. Distribution of pollock by age in 4VWX & 5Zc from the summer RV surveys,1983-1987.

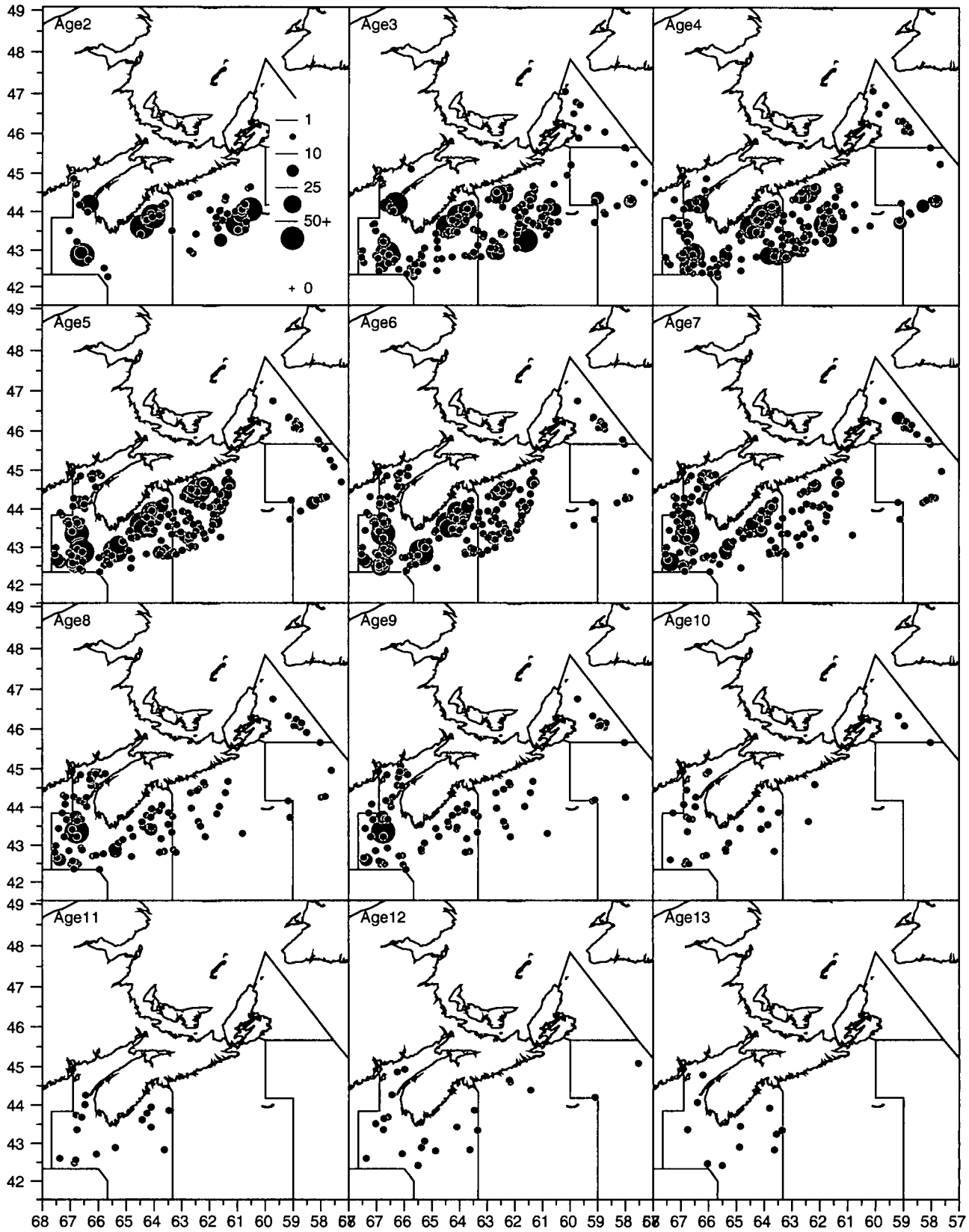


Fig.18b. Distribution of pollock by age in 4VWX & 5Zc from the summer RV surveys,1988-1992.

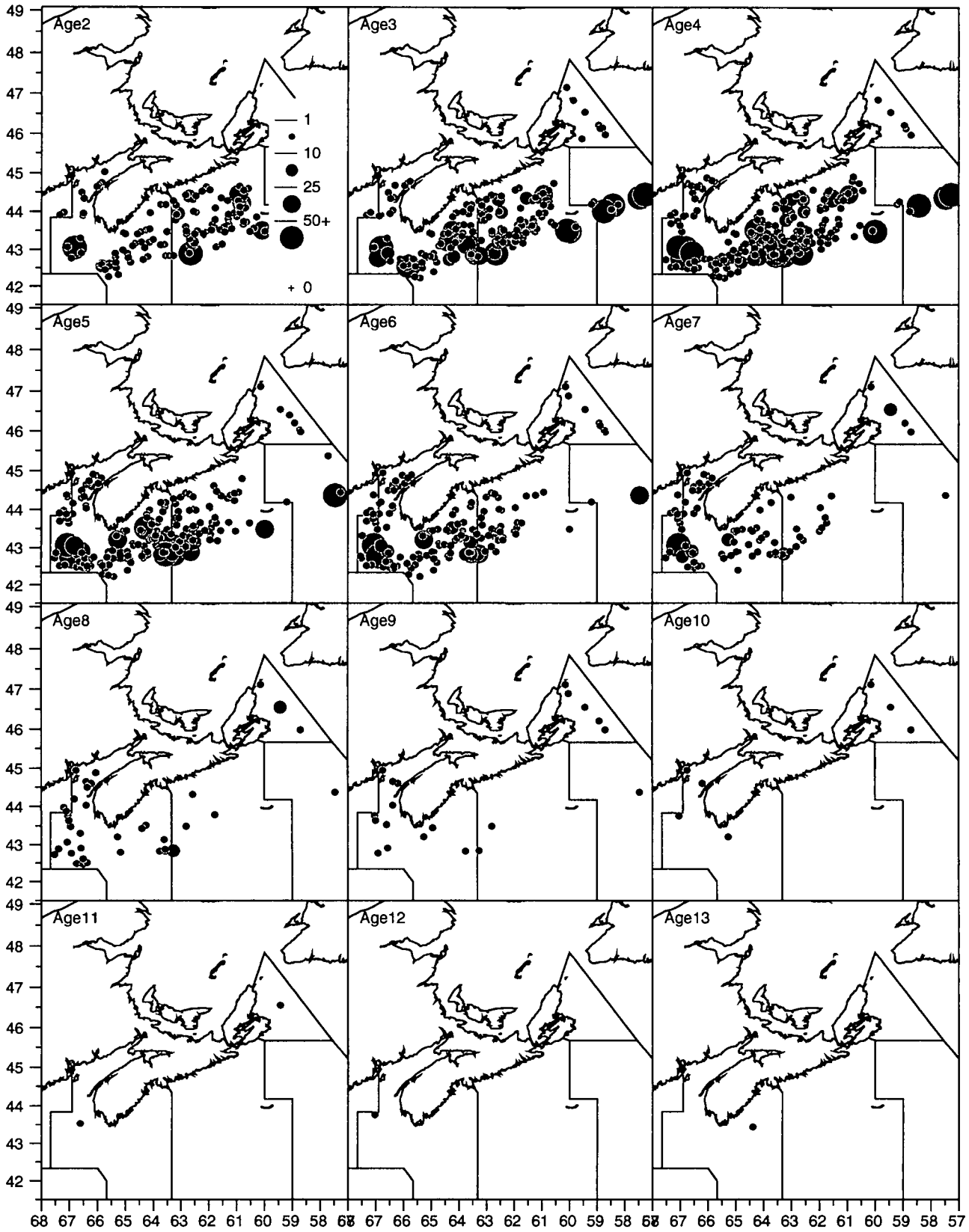


Fig.18c. Distribution of pollock by age in 4VWX & 5Zc from the summer RV surveys,1993-1997.

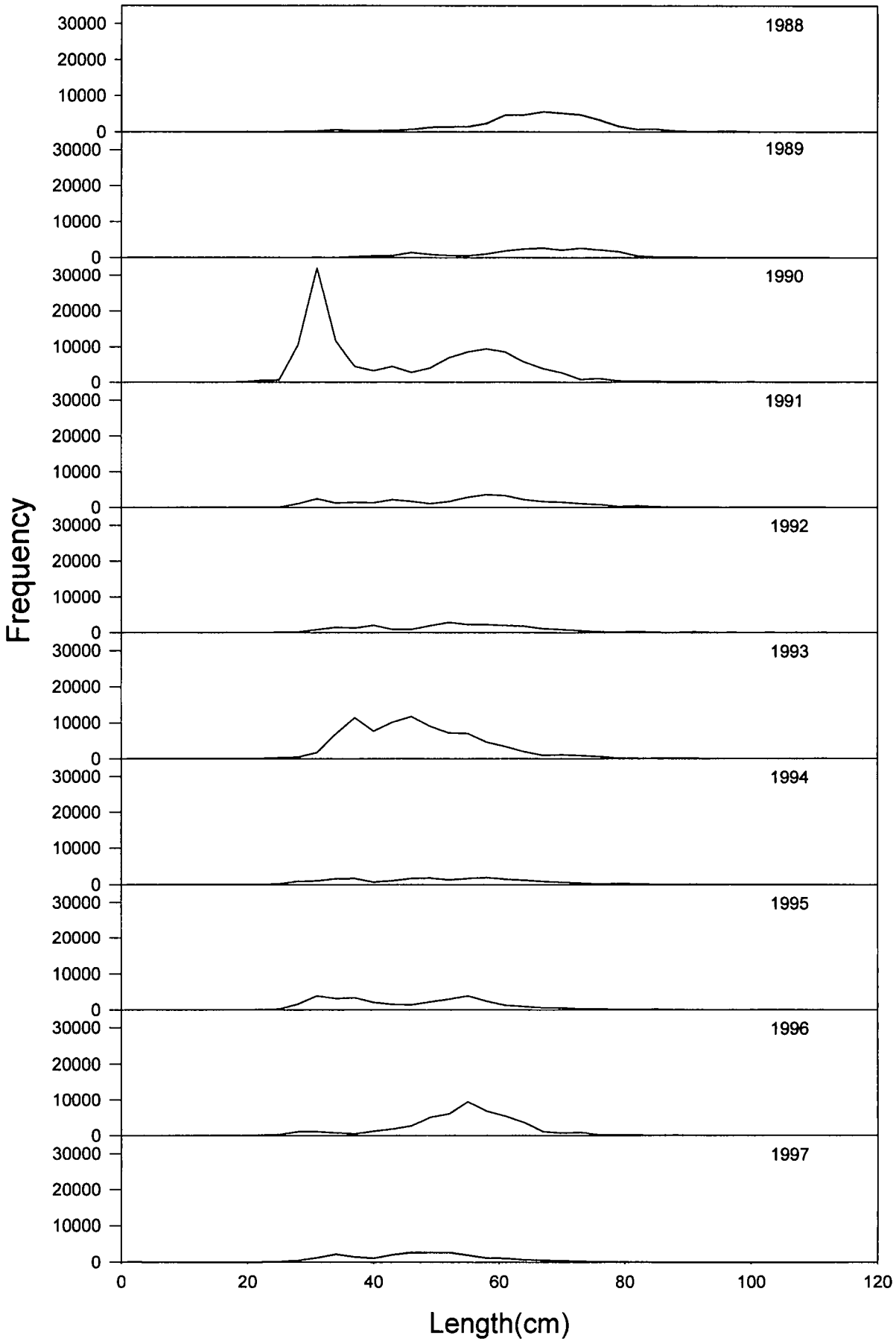


Fig. 19. Length frequency distribution from the summer RV surveys, 1988 to 1998.

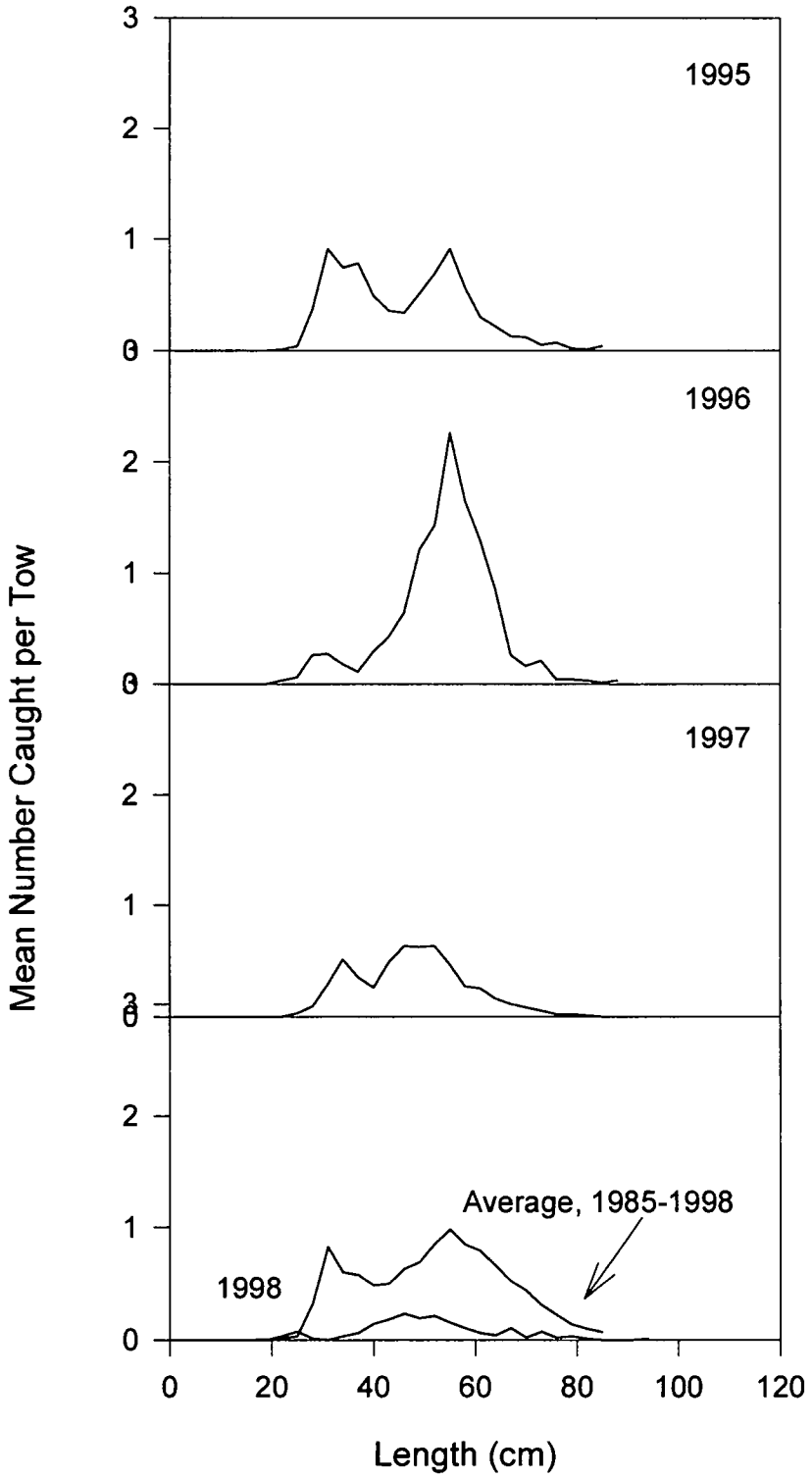


Fig.20. Pollock length frequency distributions from summer groundfish surveys, 1995-1998.

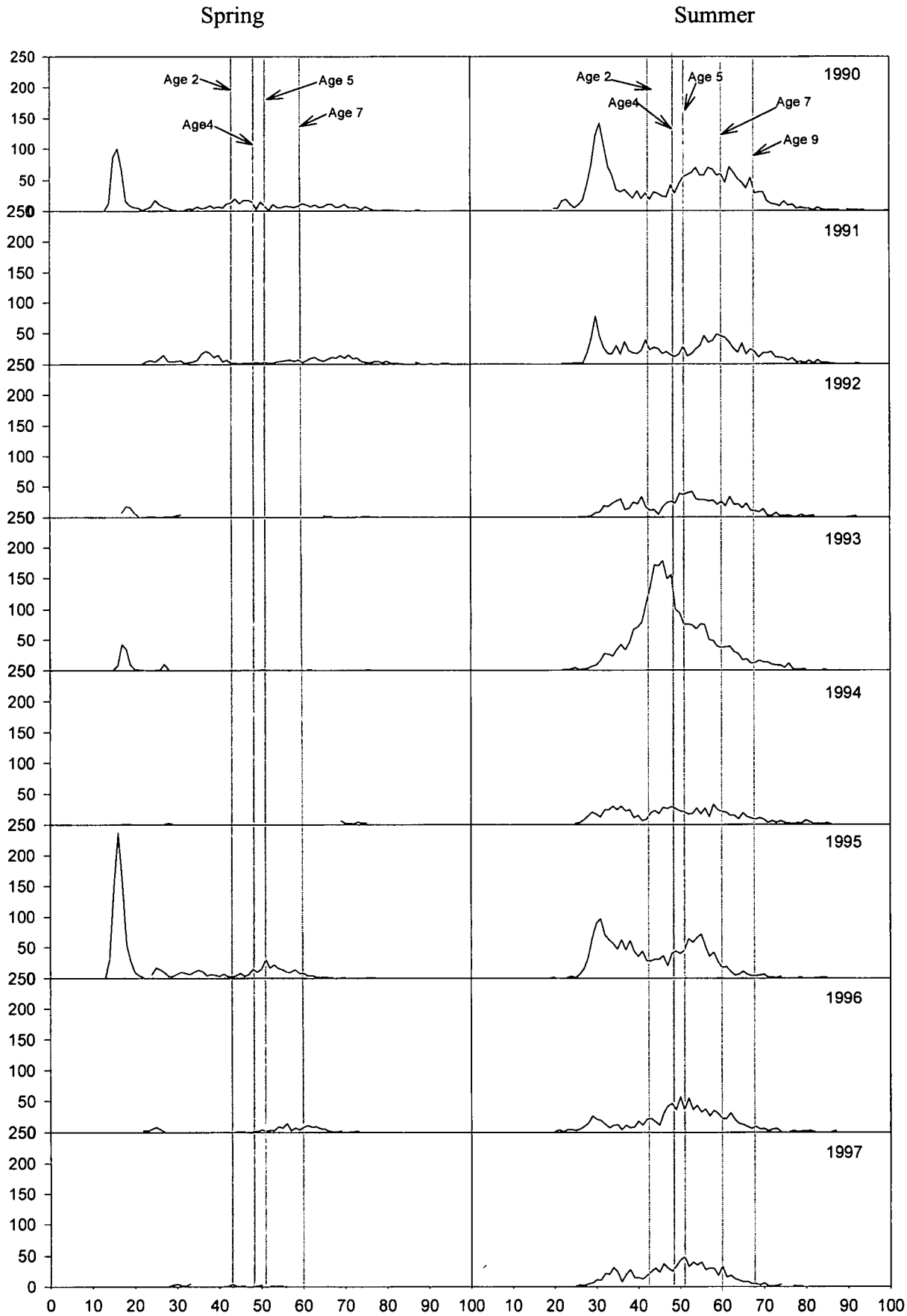


Fig. 21. Size composition for 4VW from the 4VW spring groundfish surveys and the 4VW portion of the summer groundfish surveys, 1990 to 1997

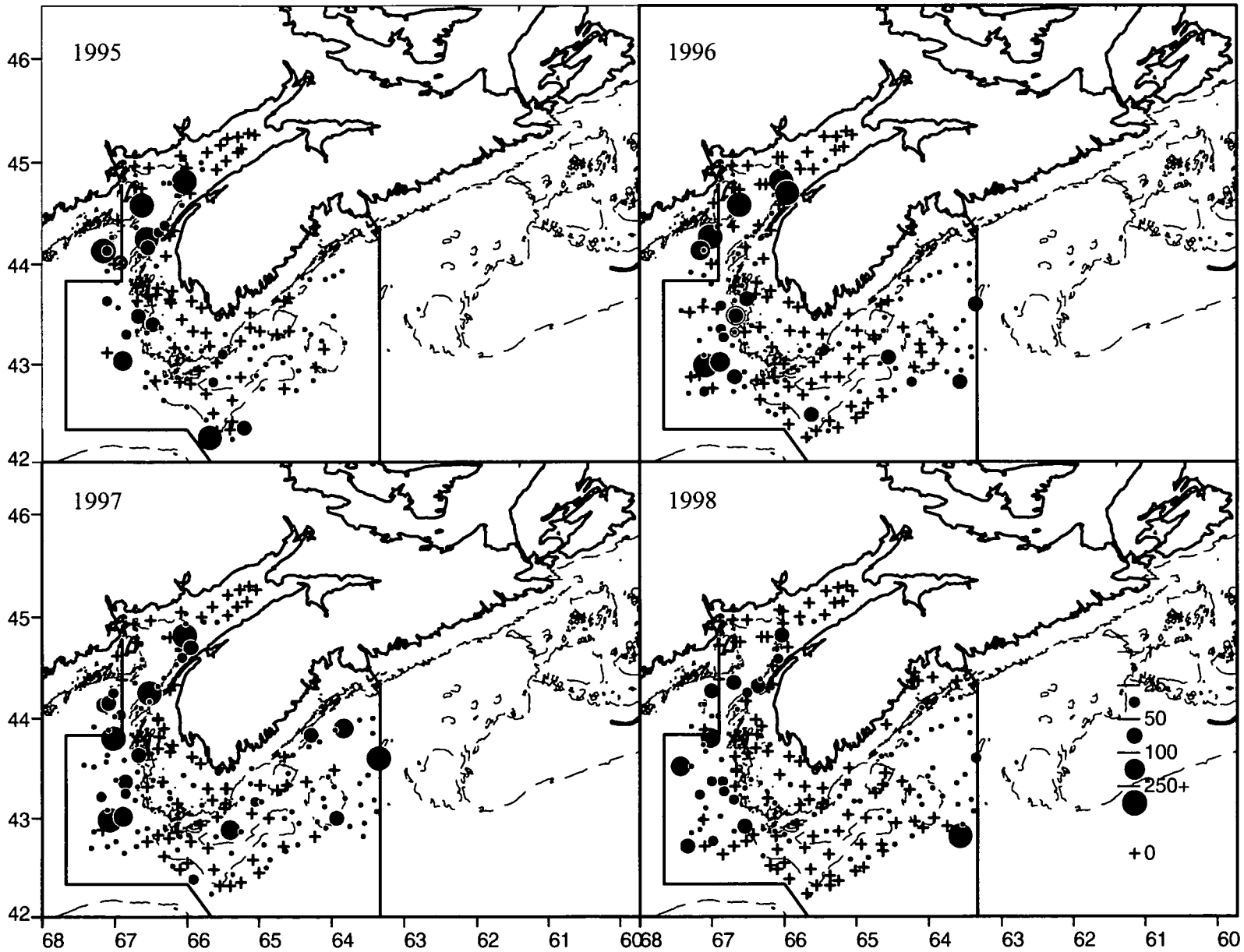


Fig. 22. ITQ survey distribution of pollock(kg), 1995 to 1998.

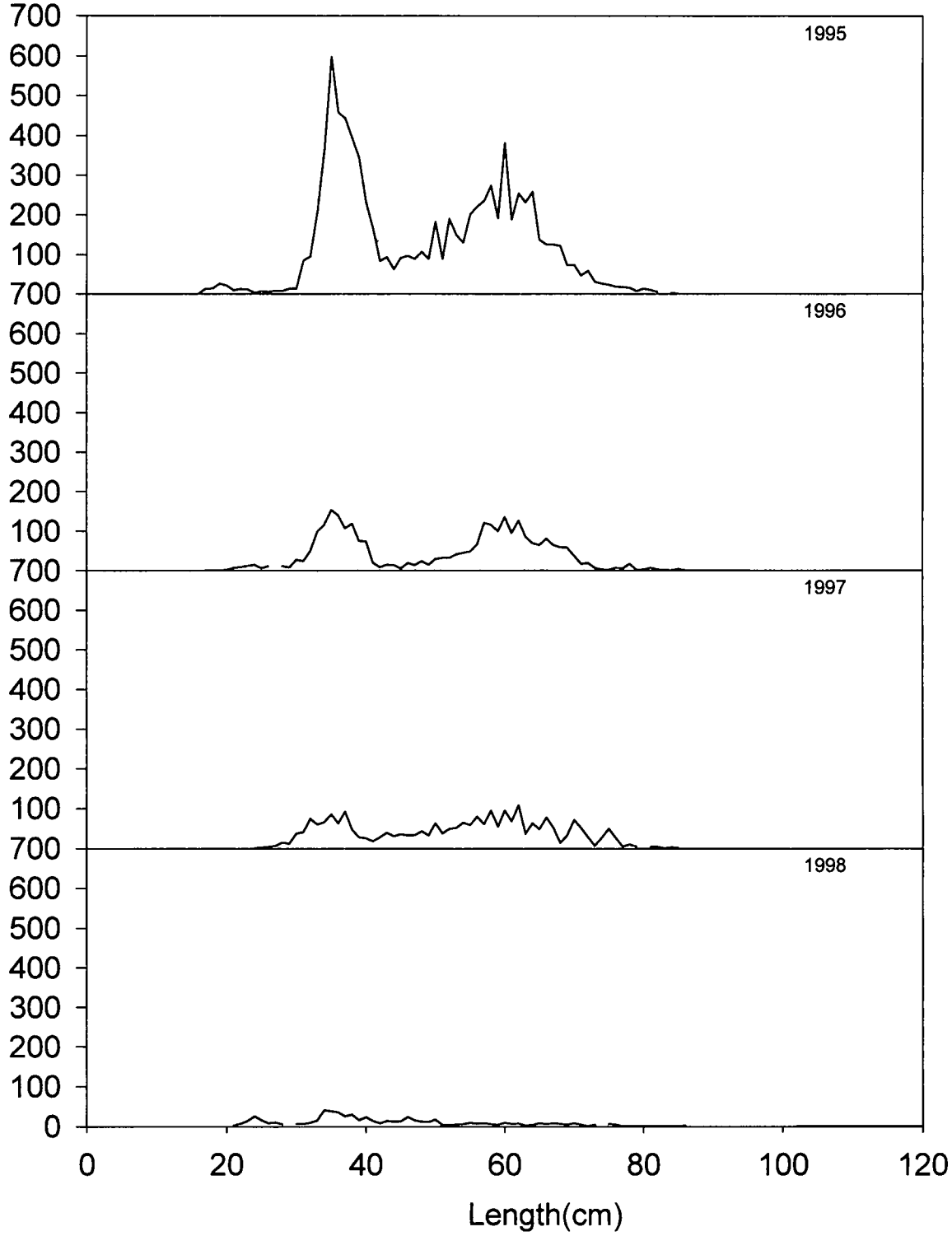


Fig.23. ITQ survey length frequencies; 1995 to 1998.

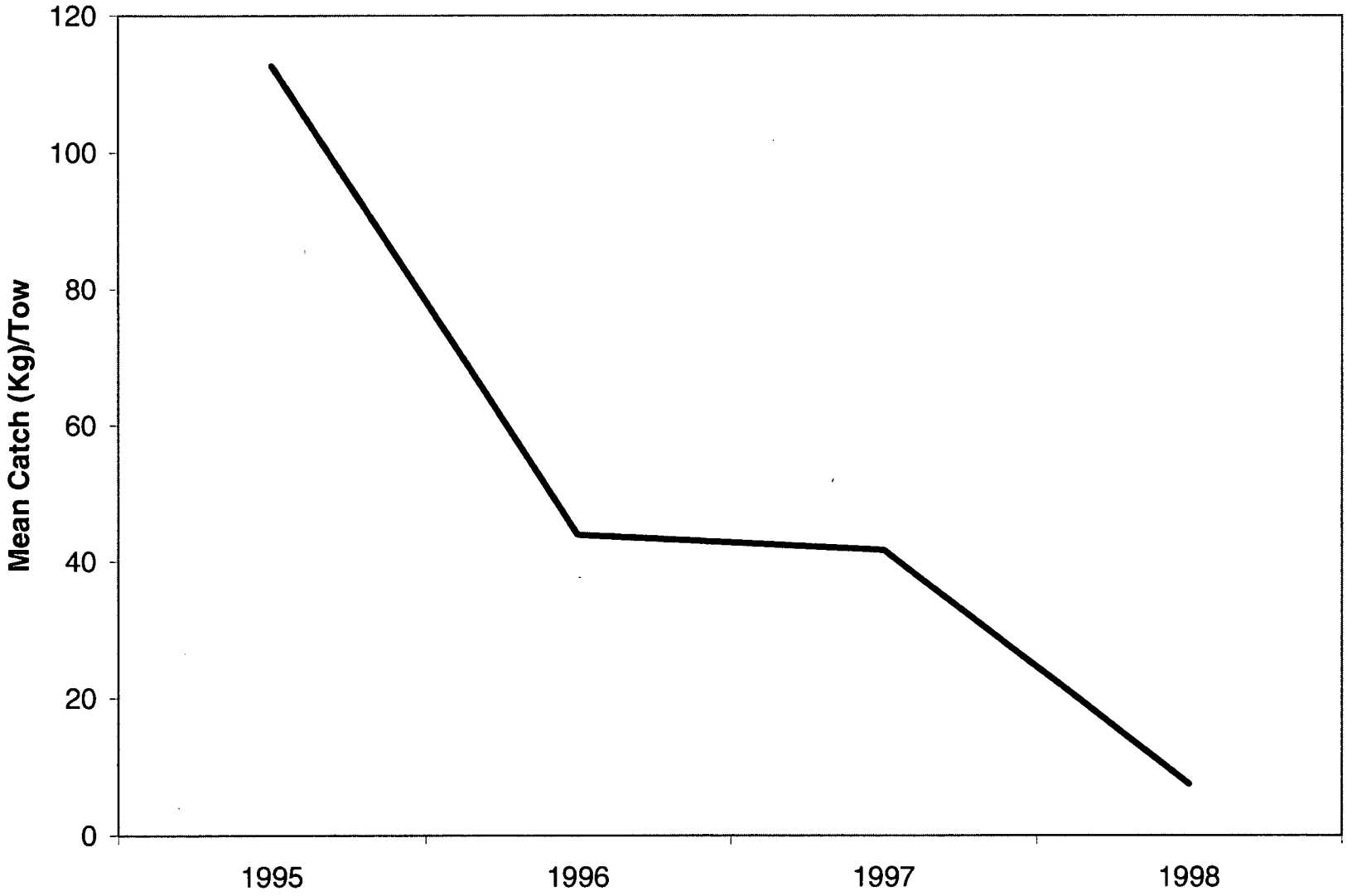


Fig. 24. ITQ index of abundance, 1995 to 1998.

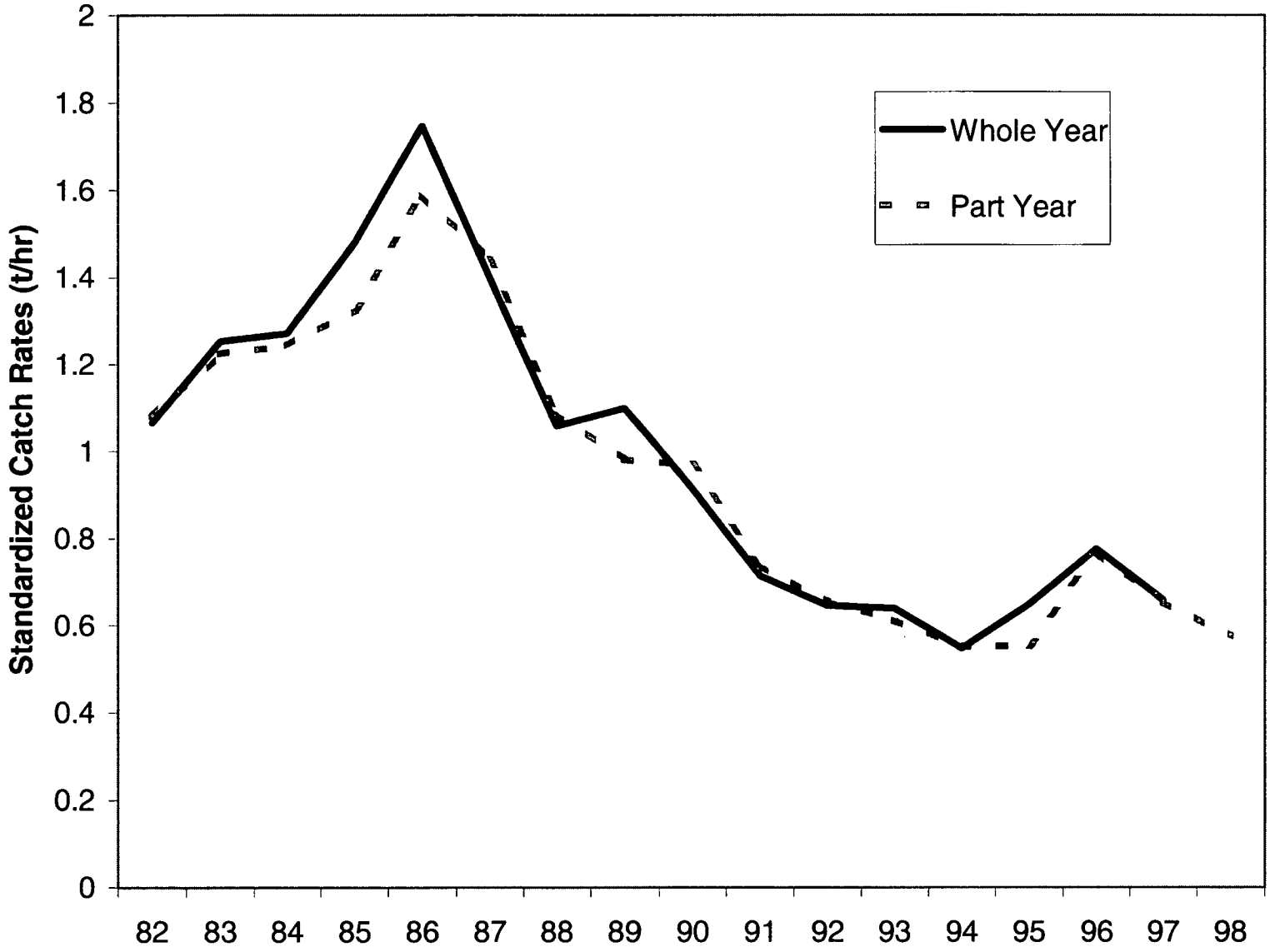


Fig.25. Standardized catch rate series (partial vs whole year) for otter trawlers fishing pollock in 4VWX5Zc, 1982 to 1998.

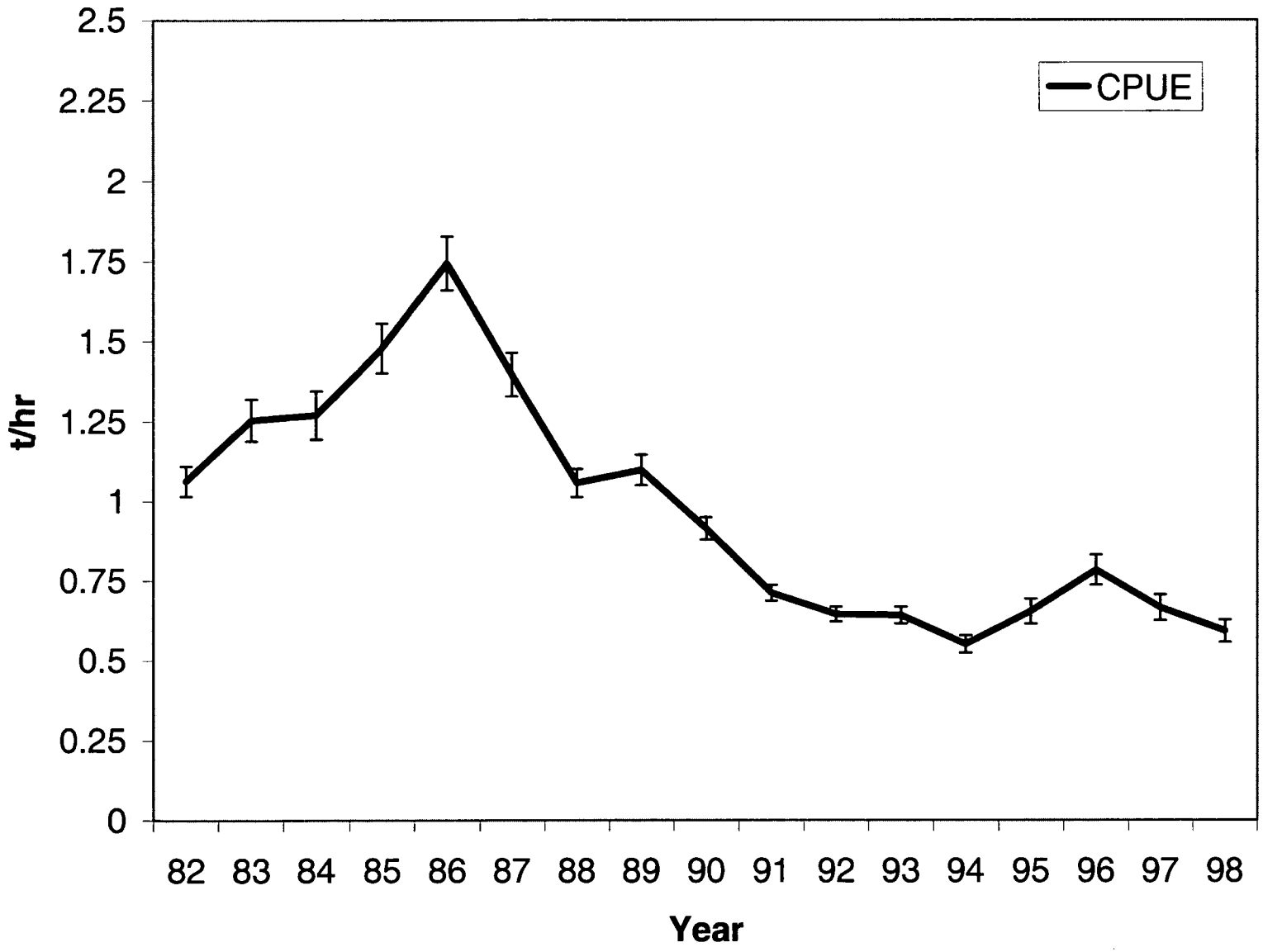


Fig.26. Standardized catch rate series for otter trawlers fishing pollock in 4VWX5Zc, 1992 to 1998. The error bars represent +/- one stadard error.

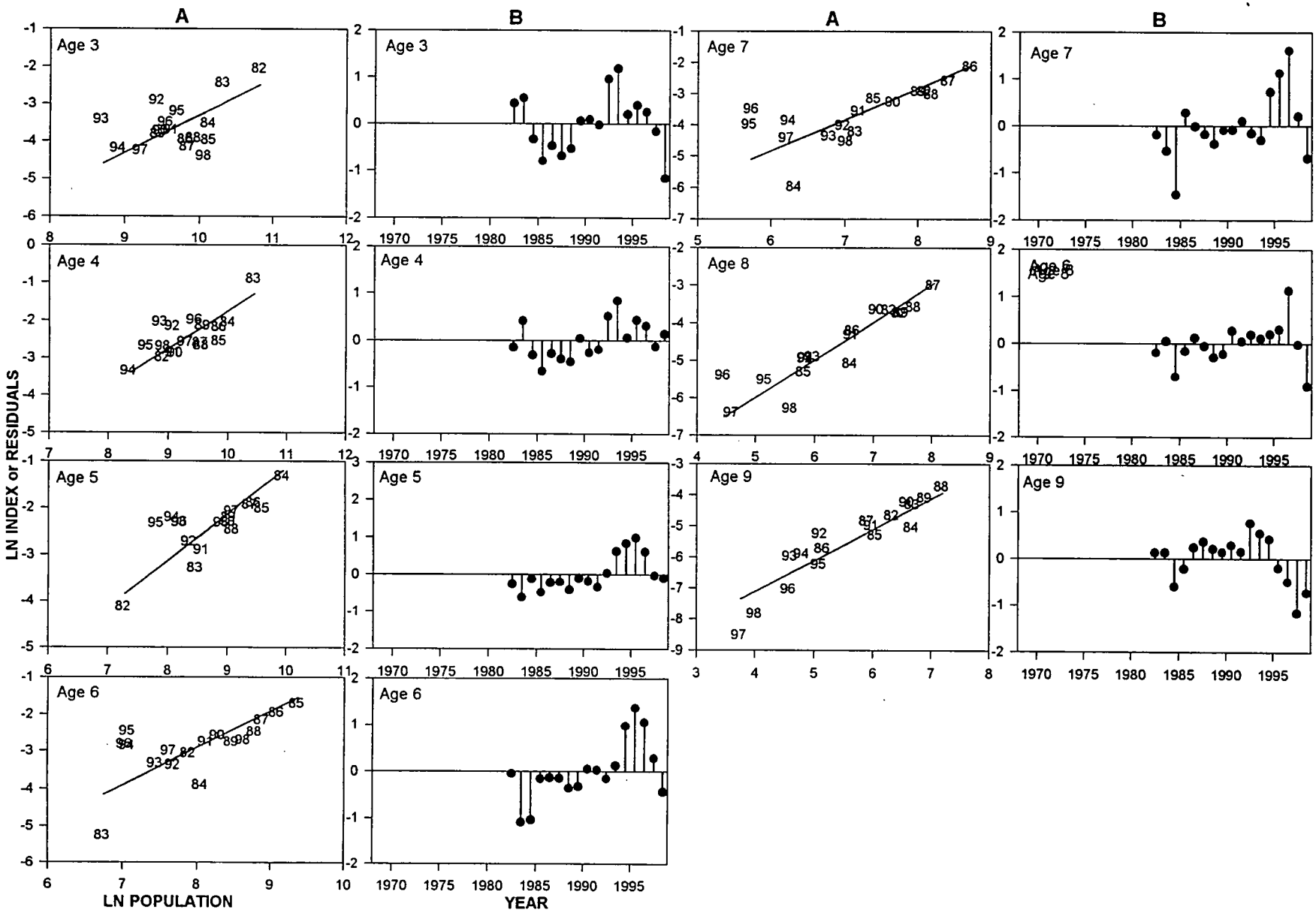
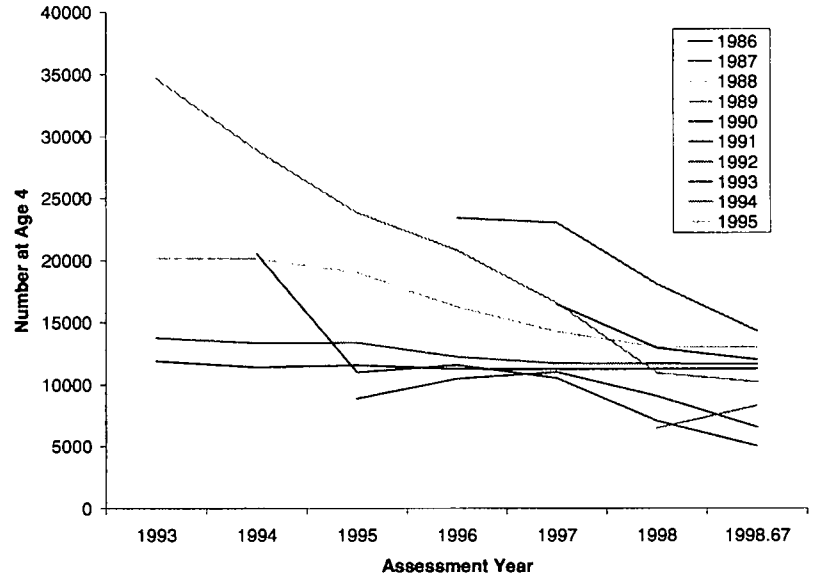
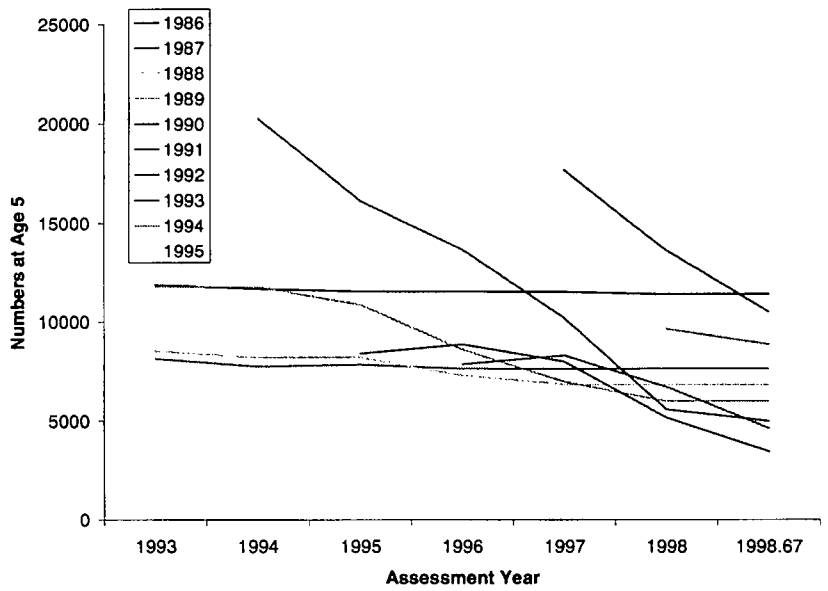


Fig.27. Age by age plots of A) the observed and predicted ln abundance index versus ln population numbers, and B) residuals, 4VWX5Zc pollock 1998.





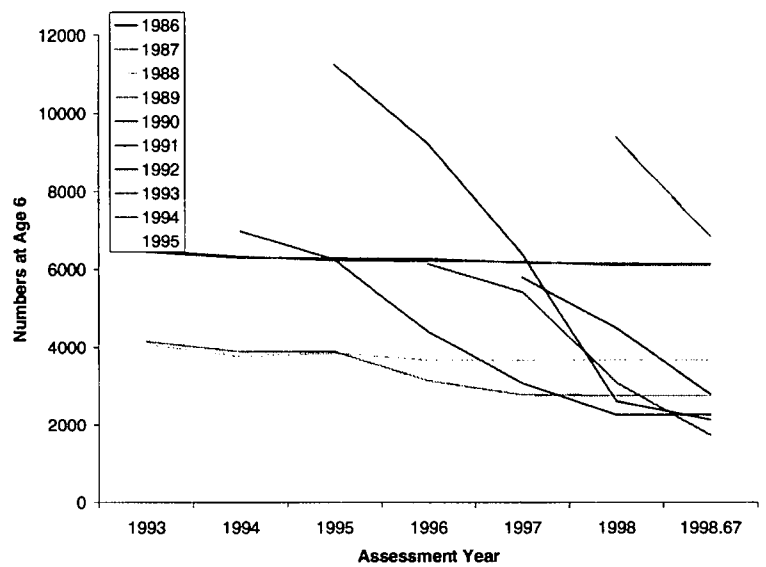


Fig.28. Retrospective analyses of pollock in 4VWX5Zc, ages 4 to 6, 1993 to 1998.67

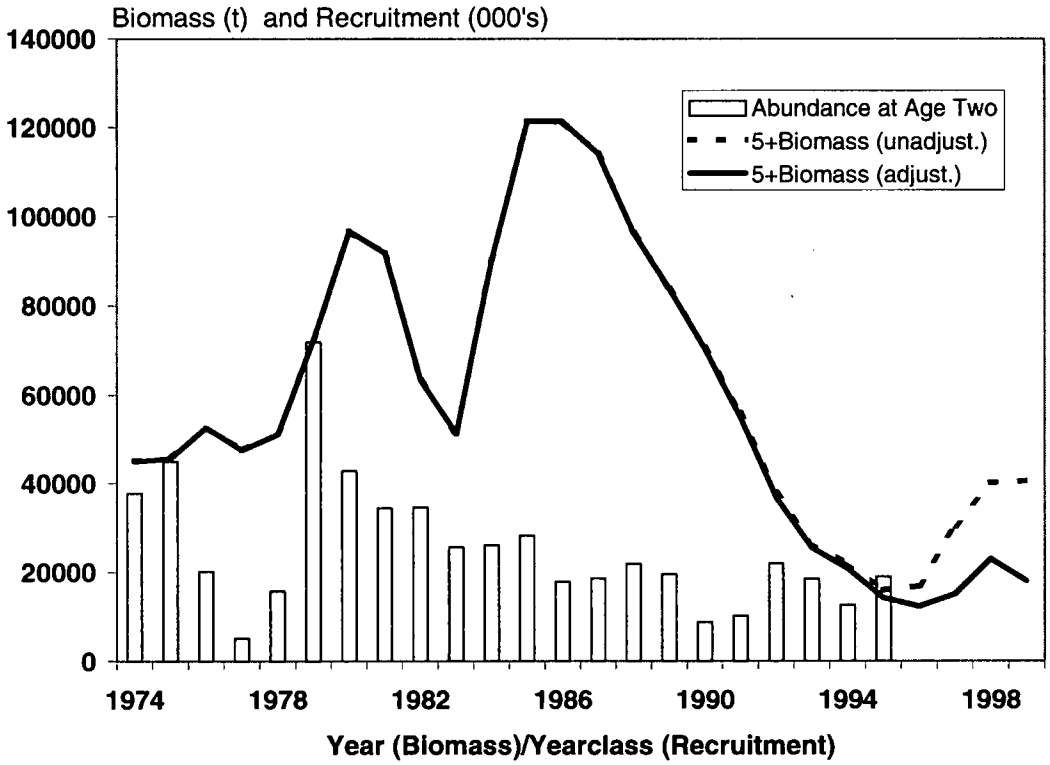


Fig. 29. Trends in age 5+ biomass and age 2 recruitment, 4VW5Zc pollock. The solid line shows the impact of adjusting the last year to reflect observed retrospective differences from 1994 to 1996.

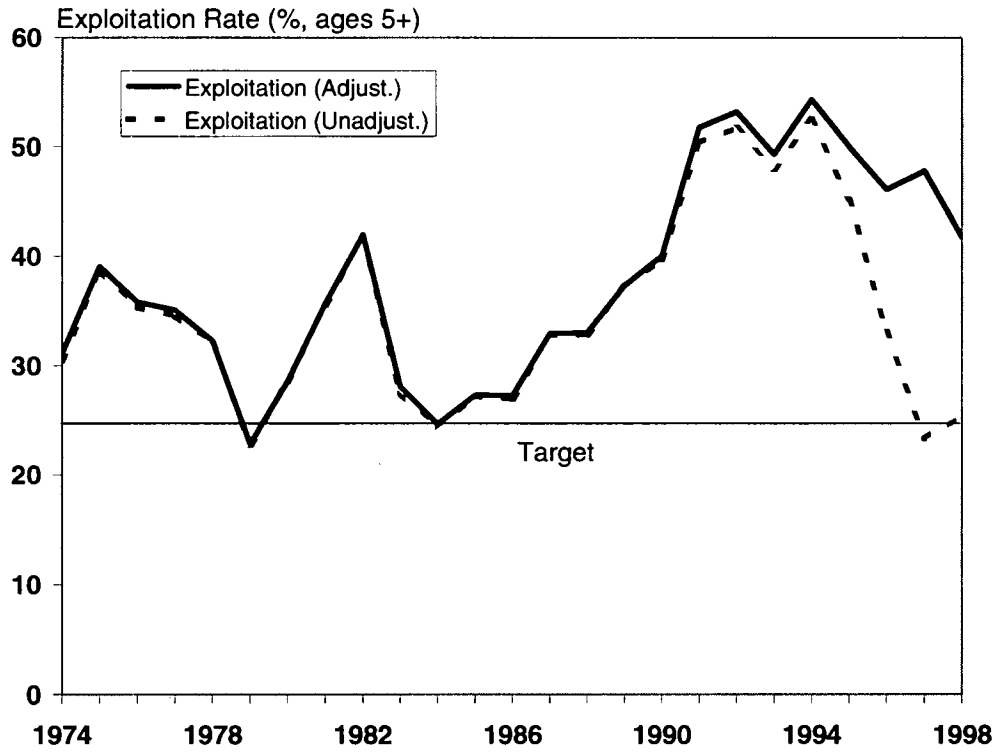


Fig. 30. Trends in age 5+ exploitation rate, 4VWX5Zc pollock. The solid line shows the impact of adjusting the last year to reflect observed retrospective differences from 1994 to 1996.

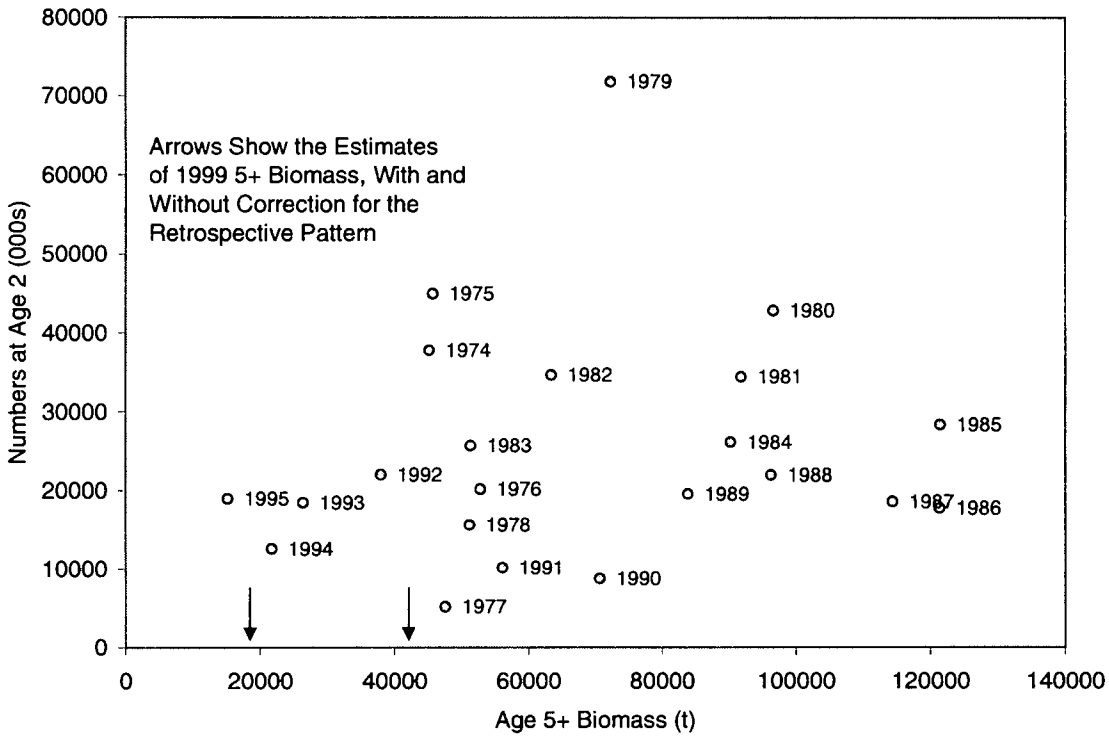


Fig. 31. The relationship between age 5+ biomass and recruitment at age 2, 4VWX5Zc pollock.

Appendix I

Precision Of Aging For 4VWX5Zc Pollock

Strict testing was done following established protocol to ensure the precision of ages to be used for this assessment. The protocol established ensures there is no shift or bias from the interpretation of the previous ager and also that the current ager can duplicate his own results with an acceptable level of precision. This testing is done prior to the start of production aging and also periodically throughout the aging process. If at any time during this process problems appear, production aging is immediately stopped until the problems are corrected and the affected production ages are redone. Production aging is then resumed.

Three time periods were chosen to test for precision and bias trends. Examples of each type of test done for this year are shown below along with their results.

Test 1. Shows current ager against previous ager.

	SAMPLES FROM 1992											
Count of	Harry											
Cecil	2	3	4	5	6	7	8	9	10	11	12	Total
2												
3		13										13
4			20									20
5				22								22
6				1	13	1						15
7					4	10	1					15
8						1	7	2				10
9							1	5	4			10
10									6			6
11										4	1	5
12										1	2	3
Total		13	20	23	17	12	9	7	10	5	3	119
	% agree	0.857										
	sum of dif	1										
	>0	9										
	<0	8										

A random selection was made of samples aged by the previous reader and reread by the current reader. This test was for agreement and any bias in interpretation between the two readers to maintain consistency in the data throughout the time series being used for assessment. The results of this test were considered acceptable. Although the percent agreement is down slightly, it is considered acceptable since most disagreement occurred in the older, more difficult ages. Also since the reference samples are now 6 years old there has been some loss in clarity of the samples examined. There was no apparent bias indicated.

Test 2. Current reader against self using 1996 samples.

	SAMPLES FROM 1996											
Count of	Cecil 1											
Cecil 2	2	3	4	5	6	7	8	9	10	11	12	Total
2	1											1
3		4	2									6
4			21	2								23
5				26								26
6					16							16
7						14						14
8						1	6					7
9							1	1				2
10									1	1		2
11									1			1
12												
Total	1	4	23	28	16	15	7	1	2	1		98
	% agree	0.918										
	sum diff	2										
	>0	5										
	<0	3										

A random selection of samples previously aged by the current ager were chosen and re-examined. The agreement was high and no apparent bias was detected. This is an example of what was done periodically during production aging to monitor precision and reduce the possibility of any bias.

Test 3. Current ager against this years samples .

	SAMPLES FROM 1997											
Count of	Cecil 1											
Cecil 2	2	3	4	5	6	7	8	9	10	11	12	Total
2												
3		6										6
4			28									28
5				21	2							23
6				3	7	1						11
7						6						6
8						1	1					2
9												
10												
11												
12												
Total		6	28	24	9	8	1					76
	% agree	0.908										
	sum diff	1										
	>0	3										
	<0	4										

Appendix II

Catch Rate Standardization

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.414
MULTIPLE R SQUARED..... 0.171

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.483E4	1.483E4	
REGRESSION	40	9.771E3	2.443E2	139.970
Year	16	2.079E3	1.300E2	74.463
Tonnage Class	4	2.419E3	6.047E2	346.480
Month (Group)	6	6.437E2	1.073E2	61.470
Unit Area	13	5.817E2	4.474E1	25.637
Mesh Type	1	2.378E1	2.378E1	13.629
RESIDUALS	27119	4.733E4	1.745E0	
TOTAL	27160	7.193E4		

REGRESSION COEFFICIENTS

CATEGORY	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
88	INTERCEPT	¯0.811	0.044	27160
3				
13				
4Xn				
D				
82	1	0.166	0.056	921
83	2	0.180	0.063	629
84	3	0.331	0.057	862
85	4	0.496	0.050	1216
86	5	0.274	0.051	1145
87	6	¯0.005	0.045	1841
89	7	0.033	0.045	1903
90	8	¯0.151	0.041	2923
91	9	¯0.401	0.040	3562
92	10	¯0.499	0.043	2694
93	11	¯0.504	0.045	2308
94	12	¯0.656	0.051	1685
95	13	¯0.484	0.061	945
96	14	¯0.303	0.061	1033
97	15	¯0.467	0.061	1042

98	16	¯0.584	0.063	720
5	17	0.104	0.027	13118
4	18	¯0.124	0.051	920
7	19	0.951	0.039	2407
2	20	¯0.554	0.027	3596
1	21	0.516	0.037	1652
2	22	0.403	0.034	1889
3	23	0.282	0.032	2142
4	24	0.068	0.032	2194
11	25	0.169	0.035	1846
12	26	0.434	0.041	1261
4Wh	27	¯0.443	0.085	268
4Wl	28	0.352	0.047	1061
4Xp	29	0.217	0.033	3145
5Zj	30	0.344	0.038	2170
4Vs	31	0.169	0.032	4672
4Xm	32	¯0.183	0.075	337
4Wg	33	0.452	0.052	838
4Wk	34	0.191	0.043	1412
4Xq	35	0.136	0.034	3141
4Xo	36	¯0.155	0.038	1909
4Vn	37	0.092	0.043	1556
4Xr	38	¯0.066	0.042	1756
4Xs	39	0.206	0.051	964
S	40	¯0.133	0.036	4445

CPUETAb

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
82	¯0.8110	0.0019	1.063	0.047	6309	5938
83	¯0.6448	0.0027	1.254	0.066	5459	4353
84	¯0.6315	0.0035	1.270	0.075	8723	6866
85	¯0.4800	0.0028	1.479	0.078	10891	7364
86	¯0.3151	0.0023	1.744	0.084	8918	5112
87	¯0.5374	0.0024	1.397	0.068	8457	6055
88	¯0.8162	0.0017	1.057	0.044	6656	6296
89	¯0.7785	0.0019	1.098	0.048	5949	5420
90	¯0.9621	0.0015	0.914	0.035	8898	9738
91	¯1.2119	0.0013	0.712	0.025	13747	19311
92	¯1.3098	0.0013	0.645	0.023	11143	17263
93	¯1.3147	0.0017	0.642	0.026	7985	12434
94	¯1.4673	0.0024	0.551	0.027	4553	8262
95	¯1.2954	0.0036	0.654	0.039	3244	4960
96	¯1.1141	0.0037	0.784	0.047	3187	4065
97	¯1.2775	0.0036	0.666	0.040	4224	6344
98	¯1.3947	0.0035	0.592	0.035	4474	7554

APPENDIX THREE

ADAPT RUNS

SATURDAY, OCTOBER 24, 1998 10:34:54.560 AM

APL Ver. 2.0.00

ADAPT_W Ver. 1.3

Workspace size = 6000000

Catch

	2	3	4	5	6	7	8	9	10	11	12
1974.00	197	5603	2662	2356	1088	317	164	80	83	74	40
1975.00	175	1058	4023	2090	1904	835	196	55	57	35	31
1976.00	178	1361	1974	3649	1089	1089	207	36	14	18	49
1977.00	36	1476	2873	1785	2181	732	417	108	19	25	80
1978.00	23	835	3119	3084	1276	1167	257	143	17	19	18
1979.00	98	2763	5786	3482	1705	528	249	47	15	14	0
1980.00	171	291	1864	5306	3169	1075	277	168	32	9	2
1981.00	871	1334	673	2044	4019	2432	713	208	148	31	24
1982.00	134	4018	1589	563	1873	2295	1069	389	172	87	22
1983.00	56	1999	9514	1256	238	524	835	428	163	50	58
1984.00	87	803	3493	7155	639	92	217	210	92	18	23
1985.00	19	459	2028	3830	5022	1162	150	179	233	126	41
1986.00	59	705	2889	3550	3440	2790	342	94	109	150	68
1987.00	15	411	1986	4326	3577	2587	1744	247	44	48	47
1988.00	11	648	2563	3170	3158	1884	1156	1006	53	20	32
1989.00	61	670	4104	3832	2424	2170	970	702	434	31	14
1990.00	49	803	1777	3598	2727	1563	986	641	308	120	47
1991.00	329	1763	3054	2890	3486	1607	803	402	291	142	88
1992.00	53	2895	5265	3168	1933	1058	435	308	169	67	54
1993.00	58	923	3784	2954	1337	506	275	101	37	21	13
1994.00	50	273	693	2184	1396	709	338	172	44	18	7
1995.00	32	467	795	1256	1236	401	96	37	17	5	1
1996.00	95	430	1366	1117	793	446	84	21	4	1	1
1997.00	5	205	1112	1963	1021	290	59	4	0	1	0
1998.00	2	175	951	1477	1206	283	56	9	3	0	0
1998.67											

OTB CPUE

	3	4	5	6	7	8	9
1982.50	0.13	0.05	0.02	0.05	0.05	0.02	0.01
1983.50	0.09	0.41	0.04	0.01	0.01	0.03	0.01
1984.50	0.03	0.13	0.27	0.02	0.00	0.01	0.01
1985.50	0.02	0.08	0.13	0.18	0.04	0.01	0.01

1986.50	0.02	0.11	0.15	0.14	0.12	0.02	0.00
1987.50	0.02	0.07	0.15	0.12	0.08	0.05	0.01
1988.50	0.02	0.07	0.09	0.09	0.05	0.03	0.02
1989.50	0.02	0.12	0.11	0.06	0.05	0.02	0.02
1990.50	0.02	0.06	0.10	0.08	0.04	0.03	0.01
1991.50	0.02	0.06	0.06	0.06	0.03	0.01	0.01
1992.50	0.06	0.12	0.07	0.03	0.02	0.01	0.01
1993.50	0.03	0.13	0.10	0.04	0.01	0.01	0.00
1994.50	0.02	0.04	0.11	0.06	0.02	0.01	0.00
1995.50	0.04	0.07	0.10	0.09	0.02	0.00	0.00
1996.50	0.03	0.14	0.10	0.06	0.03	0.00	0.00
1997.50	0.01	0.08	0.13	0.05	0.01	0.00	0.00
1998.50	0.01	0.07	0.10	0.07	0.01	0.00	0.00

Ages for which abundance will be estimated
4 5 6 7 8 9 10 11 12
Initial values
11000 10000 5000 3000 1000 500 300 100 20
Ages for which abundance will be calculated using PR

PR for these yearclasses in the previous time period

Estimated ages used in the PR calculations
4 5 6 7 8 9 10 11 12
PR for these estimated yearclasses in the previous time period
0.1 0.4 0.8 0.9 1 1 1 1 1
Ages assigned a fixed value
2 3
Assigned abundance for these ages
16700 13400
Ages being averaged for oldest age F
7 8 9 10
PR multiplier for oldest age F
1
Unweighted oldest age F

M

	2	3	4	5	6	7	8	9	10	11	12
1974.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1975.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1976.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1977.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1978.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1979.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1980.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1981.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1982.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1983.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1984.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1985.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1986.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1987.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

1988.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1989.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1990.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1991.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1992.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1993.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1994.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1995.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1996.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1997.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1998.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

LAMBDA 1.00000Eý2
RSS 5.04337E1
NPHI 5.04337E1

Parameters
9.30565E0 9.21034E0 8.51719E0 8.00637E0 6.90776E0 6.21461E0 5.70378E0 4.60517E0 2.99573E0

LAMBDA 1.00000Eý3
RSS 3.53623E1
NPHI 3.53623E1

Parameters
8.84701E0 8.83813E0 8.55222E0 7.20111E0 6.12841E0 5.00752E0 4.42494E0 4.30598E0 4.91946E0

LAMBDA 1.00000Eý4
RSS 3.33356E1
NPHI 3.33356E1

Parameters
8.84880E0 8.82992E0 8.55517E0 6.99638E0 5.78440E0 4.38801E0 3.82181E0 4.16475E0 4.43733E0

LAMBDA 1.00000Eý5
RSS 3.30391E1
NPHI 3.30391E1

Parameters
8.84665E0 8.82705E0 8.55075E0 6.94451E0 5.63477E0 4.11556E0 3.55617E0 4.09952E0 4.35025E0

LAMBDA 1.00000Eý5
RSS 3.29952E1

```
NPHI          3.29952E1

Parameters
   8.84534E0      8.82530E0      8.54779E0      6.92893E0      5.57122E0      4.00813E0      3.44973E0      4.07235E0      4.32561E0


LAMBDA        1.00000Eý5
RSS           3.29890E1
NPHI          3.29890E1

Parameters
   8.84480E0      8.82457E0      8.54648E0      6.92363E0      5.54495E0      3.96804E0      3.40959E0      4.06167E0      4.31636E0


LAMBDA        1.00000Eý5
RSS           3.29881E1
NPHI          3.29881E1

Parameters
   8.84459E0      8.82428E0      8.54596E0      6.92170E0      5.53430E0      3.95338E0      3.39484E0      4.05761E0      4.31290E0


LAMBDA        1.00000Eý5
RSS           3.29880E1
NPHI          3.29880E1

Parameters
   8.84450E0      8.82417E0      8.54576E0      6.92099E0      5.53005E0      3.94805E0      3.38946E0      4.05609E0      4.31162E0

RELATIVE CHANGE IN RESIDUAL SUM OF SQUARES LESS THAN 0.00001


LAMBDA        1.00000Eý2
RSS           3.29880E1
NPHI          3.29880E1

Parameters
   8.84450E0      8.82417E0      8.54576E0      6.92099E0      5.53005E0      3.94805E0      3.38946E0      4.05609E0      4.31162E0
ý1.32776E1     ý1.17470E1     ý1.11344E1     ý1.09026E1     ý1.08324E1     ý1.09818E1     ý1.11189E1


LAMBDA        1.00000Eý3
RSS           3.29880E1
NPHI          3.29880E1

Parameters
```

```
   8.84447E0      8.82412E0      8.54568E0      6.92072E0      5.52837E0      3.94612E0      3.38750E0      4.05553E0      4.31114E0
ý1.32775E1     ý1.17470E1     ý1.11344E1     ý1.09025E1     ý1.08322E1     ý1.09815E1     ý1.11186E1


RELATIVE CHANGE IN RESIDUAL SUM OF SQUARES LESS THAN 0.00001

...done...

...working...

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET.........        0.002166
MEAN SQUARE RESIDUALS .......        0.320272

Estimates for index catchability parameters
   PAR. EST.   STD. ERR.   REL. ERR.     BIAS      REL. BIAS
   ---------   ---------   ---------   ---------   ---------
 ý1.328E1     1.417Eý1   ý1.067Eý2   ý3.721Eý3    2.802Eý4
 ý1.175E1     1.425Eý1   ý1.213Eý2   ý3.216Eý3    2.737Eý4
 ý1.113E1     1.412Eý1   ý1.268Eý2   ý2.846Eý3    2.556Eý4
 ý1.090E1     1.410Eý1   ý1.293Eý2   ý3.189Eý3    2.925Eý4
 ý1.083E1     1.426Eý1   ý1.316Eý2   ý3.882Eý3    3.584Eý4
 ý1.098E1     1.474Eý1   ý1.342Eý2   ý1.997Eý3    1.819Eý4
 ý1.112E1     1.543Eý1   ý1.388Eý2    2.533Eý3   ý2.278Eý4

...still working...

Terminal year-class abundance
   PAR. EST.   STD. ERR.   REL. ERR.     BIAS      REL. BIAS
   ---------   ---------   ---------   ---------   ---------
       16700           0        0.00           0        0.00
       13400           0        0.00           0        0.00
        6936        3098        0.45         670        0.10
        6796        2751        0.40         502        0.07
        5144        2034        0.40         340        0.07
        1013         454        0.45          83        0.08
         252         119        0.47          24        0.09
          52          25        0.48           5        0.10
          30          16        0.55           4        0.12
          58          29        0.51           6        0.10
          75          39        0.53           8        0.10
           0           0        1.00           0        1.00
          22          11        0.52           2        0.10
           1           0        0.20           0        0.00
           1           0        0.21           0       -0.01
           2           0        0.19           0        0.02
          10           1        0.06           0        0.01
          17           0        0.02           0        0.00
          40           0        0.00           0        0.00
          36           0        0.00           0        0.00
          13           0        0.00           0        0.00
          44           0        0.00           0        0.00
```

56	0	0.00	0	0.00
102	0	0.00	0	0.00
55	0	0.00	0	0.00
81	0	0.00	0	0.00
74	0	0.00	0	0.00
23	0	0.00	0	0.00
35	0	0.00	0	0.00
5	0	0.00	0	0.00
23	0	0.00	0	0.00
19	0	0.00	0	0.00
68	0	0.00	0	0.00
70	0	0.00	0	0.00
35	0	0.00	0	0.00
73	0	0.00	0	0.00
0	0	1.00	0	1.00

Population Numbers

	2	3	4	5	6	7	8	9	10	11	12	13
1974.00	17249	28114	10221	8430	2958	828	422	504	347	175	134	0
1975.00	26403	13944	17977	5977	4787	1447	394	199	340	209	77	73
1976.00	37806	21459	10462	11101	3021	2215	443	148	113	227	140	35
1977.00	44940	30792	16341	6789	5817	1498	842	178	89	80	170	70
1978.00	20138	36761	23878	10793	3955	2809	573	318	50	55	43	68
1979.00	5146	16467	29344	16740	6068	2094	1256	240	132	25	28	19
1980.00	15650	4125	10994	18819	10573	3437	1240	805	154	95	8	23
1981.00	71795	12659	3115	7323	10644	5813	1850	766	508	97	70	5
1982.00	42809	57994	9162	1945	4161	5116	2584	876	440	283	52	35
1983.00	34441	34928	43856	6071	1087	1733	2138	1160	370	207	154	23
1984.00	34683	28148	26793	27351	3841	676	949	1003	566	157	124	74
1985.00	25676	28318	22320	18789	15966	2569	471	582	632	381	112	81
1986.00	26122	21005	22770	16446	11938	8567	1065	251	316	309	199	55
1987.00	28370	21333	16561	16039	10272	6686	4512	566	121	161	119	102
1988.00	17752	23214	17095	11769	9247	5204	3158	2133	242	60	89	56
1989.00	18567	14524	18421	11688	6789	4740	2573	1550	848	151	31	44
1990.00	21902	15147	11286	11391	6133	3386	1943	1238	642	308	96	13
1991.00	19534	17888	11676	7640	6099	2585	1377	712	443	251	145	36
1992.00	8791	15696	13056	6816	3668	1894	691	414	225	105	79	40
1993.00	10170	7150	10245	5979	2752	1281	609	180	67	35	26	17
1994.00	21950	8274	5022	4999	2260	1060	596	253	57	22	10	10
1995.00	18428	17926	6528	3487	2141	612	241	187	55	8	2	2
1996.00	12584	15059	14255	4628	1730	654	146	111	120	30	2	1
1997.00	18948	10217	11941	10439	2785	708	141	45	72	95	24	1
1998.00	19097	15508	8180	8774	6780	1366	320	63	33	59	77	19
1998.67	16700	13400	6266	6295	4805	931	228	47	26	52	67	0

Fishing Mortality

	2	3	4	5	6	7	8	9	10	11	12
1974.00	0.013	0.247	0.337	0.366	0.515	0.542	0.553	0.192	0.305	0.622	0.398
1975.00	0.007	0.087	0.282	0.482	0.570	0.984	0.781	0.361	0.203	0.203	0.582
1976.00	0.005	0.072	0.232	0.446	0.502	0.767	0.713	0.311	0.146	0.091	0.484
1977.00	0.001	0.054	0.215	0.340	0.528	0.761	0.775	1.075	0.268	0.417	0.720
1978.00	0.001	0.025	0.155	0.376	0.436	0.605	0.672	0.675	0.470	0.470	0.605
1979.00	0.021	0.204	0.244	0.259	0.368	0.324	0.246	0.243	0.133	0.913	0.000
1980.00	0.012	0.081	0.206	0.370	0.398	0.420	0.281	0.261	0.259	0.110	0.305
1981.00	0.013	0.123	0.271	0.365	0.533	0.611	0.547	0.354	0.385	0.430	0.474

1982.00	0.003	0.079	0.212	0.382	0.676	0.672	0.601	0.663	0.557	0.411	0.623
1983.00	0.002	0.065	0.272	0.258	0.275	0.403	0.557	0.517	0.656	0.309	0.533
1984.00	0.003	0.032	0.155	0.338	0.202	0.162	0.289	0.261	0.197	0.135	0.227
1985.00	0.001	0.018	0.105	0.254	0.423	0.680	0.430	0.411	0.516	0.450	0.509
1986.00	0.002	0.038	0.150	0.271	0.380	0.441	0.433	0.528	0.475	0.752	0.469
1987.00	0.001	0.021	0.142	0.351	0.480	0.550	0.549	0.648	0.507	0.396	0.563
1988.00	0.001	0.031	0.180	0.350	0.468	0.504	0.512	0.722	0.275	0.457	0.503
1989.00	0.004	0.052	0.281	0.445	0.496	0.692	0.531	0.681	0.814	0.256	0.680
1990.00	0.002	0.060	0.190	0.425	0.664	0.700	0.804	0.829	0.740	0.556	0.768
1991.00	0.019	0.115	0.338	0.534	0.969	1.120	1.003	0.951	1.241	0.954	1.079
1992.00	0.007	0.227	0.581	0.707	0.852	0.934	1.146	1.614	1.647	1.180	1.335
1993.00	0.006	0.153	0.518	0.773	0.754	0.565	0.678	0.942	0.907	1.028	0.771
1994.00	0.003	0.037	0.165	0.648	1.107	1.282	0.957	1.322	1.731	1.997	1.301
1995.00	0.002	0.029	0.144	0.501	0.986	1.234	0.572	0.245	0.411	1.054	0.582
1996.00	0.008	0.032	0.112	0.308	0.693	1.333	0.982	0.233	0.037	0.037	0.616
1997.00	0.000	0.022	0.108	0.232	0.513	0.593	0.609	0.104	0.000	0.012	0.000
1998.00	0.000	0.018	0.198	0.296	0.314	0.373	0.308	0.248	0.152	0.000	0.000

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THIS PROJECTION ASSUMED 1998 CATCH BIOMASS WAS 15,000 T.

Projection results using bootstrap bias adjusted point estimates
Projected Population Numbers

	2	3	4	5	6	7	8	9	10	11	12
1998.67	16700	13400	6388	6406	4810	934	222	44	25	47	56
1999.00	19000	15610	12357	5632	5319	3934	753	179	35	20	38
2000.00	19000	15509	12403	8973	3627	3324	2386	457	109	21	12

Fishing Mortality

	2	3	4	5	6	7	8	9	10	11	12
1998.67	0.005	0.045	0.182	0.364	0.409	0.454	0.454	0.454	0.454	0.454	0.454
1999.00	0.003	0.030	0.120	0.240	0.270	0.300	0.300	0.300	0.300	0.300	0.300

M

	2	3	4	5	6	7	8	9	10	11	12
1998.67	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1999.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

PR

	2	3	4	5	6	7	8	9	10	11	12
1998.67	0.01	0.10	0.40	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00
1999.00	0.01	0.10	0.40	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00

Beg Wt

	2	3	4	5	6	7	8	9	10	11	12
1998.67	0.63	0.94	1.35	1.84	2.50	3.19	3.87	4.46	5.25	5.92	6.28
1990.00	0.63	0.94	1.35	1.84	2.50	3.19	3.87	4.46	5.25	5.92	6.28

2000.00	0.63	0.94	1.35	1.84	2.50	3.19	3.87	4.46	5.25	5.92	6.28

Projected Population Biomass

	2	3	4	5	6	7	8	9	10	11	12	2+	3+	4+	5+
1998.67	10521	12596	8624	11787	12024	2981	860	195	130	276	352	60347	49826	37230	28606
1999.00	11970	14673	16683	10363	13297	12550	2914	799	185	118	236	83787	71817	57144	40462
2000.00	11970	14579	16744	16511	9068	10604	9234	2037	570	127	76	91520	79550	64971	48227

Projected Catch Numbers

	2	3	4	5	6	7	8	9	10	11	12
1998.67	24	193	360	701	588	126	30	6	3	6	8
1999.00	52	418	1269	1093	1146	929	178	42	8	5	9
2000.00											

Avg Wt

	2	3	4	5	6	7	8	9	10	11	12
1998.67	0.72	1.13	1.60	2.14	2.86	3.48	4.23	4.80	5.77	6.60	6.76
1999.00	0.72	1.13	1.60	2.14	2.86	3.48	4.23	4.80	5.77	6.60	6.76

Projected Catch Biomass

	2	3	4	5	6	7	8	9	10	11	12	2+	3+	4+	5+
1998.67	17	218	576	1501	1682	439	127	28	19	42	51	4700	4683	4464	3888
1999.00	37	473	2030	2340	3277	3232	752	203	48	31	60	12484	12446	11974	9943
2000.00															

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