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Assessment of Pollock (*Pollachius virens*) in Division 4VWX and Subdivision 5Zc for 1993

by

E.A. Trippel and L.L. Brown

Biological Sciences Branch
Scotia-Fundy Region
Gulf of Maine Section
St. Andrews Biological Station
St. Andrews, New Brunswick
E0G 2X0

Abstract

The 1993 fishery for 4VWX5Zc pollock landed 21,105t, about equal to the 1993 TAC of 21,000t and ~13,000t less than in 1992. Nearly 85% of landings were made in 4X with landings in this area only slightly down from previous years. 1993 landings in 4VW of ~3,000t, however, are lower than 1992 landings (9,000t) and indicate a marked decrease compared to the 1985-1990 4VW landings which were in the 15,000-20,000t range. The foreign bycatch of pollock, managed under the silver hake allocations, decreased to 860t. Research surveys conducted from 1970-1993 indicate an increase in the age 4-9 abundance during the early 1980's with subsequent estimates being highly variable.

Output from ADAPT formulations that utilized the survey data produced optimistic assessments that were inconsistent with information about fishing effort, commercial catch rates, and other views of the resource. For these reasons, the survey was not used to estimate population numbers. Observer mobile gear TC 5 catch rates for ages 4-10 were used as an index of abundance in the final ADAPT formulation. The fully recruited F for 1993 was 0.51; nearly twice the $F_{0.1}$ of 0.30. The 1988 year class is estimated to be above average in size and the 1989 year class is average. There are no signs of any strong year classes since 1989. Stock size (age 2+) was low in the early 1970's, peaked during the mid-1980's and has declined since. Spawning stock biomass (age 4+) has declined since the mid-1980's and so has the abundance of age 7+ fish.

Commercial TC 5 catch rates have been declining steadily from 1984 to 1991 with catch rates in 1992 and 1993 slightly higher than in 1991. If the TAC of 24,000t is caught in 1994, the resulting fishing mortality would be 0.56. With this level of fishing in 1994, the $F_{0.1}$ catch for 1995 is estimated at 13,000t. Reduced exploitation would prolong the contribution of existing year classes and maintain higher spawning biomass.

Résumé

En 1993, les débarquements de goberge provenant de 4VWX5Zc se sont chiffrés à 21 105 t; ils correspondaient pratiquement au TAC de l'année et étaient inférieurs de ~ 13 000 t à ceux de 1992. Près de 85 % d'entre eux provenaient de 4X, division où ils sont légèrement en recul par rapport à l'année précédente. Les débarquements en provenance de 4VW, soit ~ 3 000 t, sont inférieurs à ceux de 1992 (9 000 t) et marquent un net recul par rapport à ceux de la période 1985-1990, alors qu'ils étaient de l'ordre de 15 000 à 20 000 t. Les prises accidentelles étrangères de goberge, gérées avec les allocations de merlu argenté, sont tombées à 860 t. Les relevés de recherche réalisés de 1970 à 1993 révèlent une augmentation de l'abondance des poissons de 4 à 9 ans au début des années 1980, les estimations des années subséquentes étant très variables.

L'utilisation du modèle ADAPT sur les données des relevés de recherche a produit des évaluations optimistes ne concordant pas avec les renseignements sur l'effort de pêche, sur les taux de prises commerciales et sur d'autres appréciations de la ressource. On s'est servi des taux de prises fournis par les observateurs à bord de bateaux de pêche aux engins mobiles de CT 5 pour ce qui est des âges 4 à 10 afin d'estimer l'abondance selon la formule ADAPT acceptée. La valeur F de plein recrutement en 1993 était de 0,51, soit près de deux fois $F_{0.1}$ à 0,30. On estime que la classe d'âge de 1988 est supérieure à la moyenne pour ce qui est de l'effectif, tandis que celle de 1989 est moyenne. Il n'y a pas eu d'indice de forte classe d'âge depuis 1989. L'effectif du stock (âge 2+) était faible au début des années 1970, a atteint un sommet vers le milieu des années 1980 et a diminué depuis. La biomasse du stock reproducteur (âge 4+) a régressé depuis le milieu des années 1980, comme d'ailleurs l'abondance des poissons d'âge 7 +.

Les taux de prises commerciales des bateaux de CT 5 n'ont cessé de diminuer de 1984 à 1991, puis ont connu une légère reprise en 1992 et 1993. Si le TAC de 24 000 t est capturé en 1994, la mortalité par pêche correspondante serait de 0,56. À ce niveau d'exploitation en 1994, on estime que les prises $F_{0.1}$ seraient de 13 000 t en 1995. Une réduction de l'exploitation prolongerait l'apport des classes d'âge existantes et permettrait de maintenir à un niveau plus élevé la biomasse de reproducteurs.

Introduction

Description of the Fishery

The 1993 pollock TAC was set at 35,000 t based on industry's request to have the multi-year 43,000 TAC lowered and was subsequently reduced in September to 21,000 t after further advise by the Fisheries Resource Conservation Council (FRCC) (Anon. 1993a). The combined 1993 Canadian and foreign landings were 21,105t. As in previous years the Canadian pollock landings (20,285t in 1993) account for the majority of the catch (Table 1; Figs. 1 and 2). Catches by foreign fleets have been primarily incidental with the major share taken by Cuban and Russian trawlers fishing for silver hake (Table 1). Since the extension of jurisdiction in 1977, catches by foreign vessels other than the USA have generally averaged less than 2,000 t with 1993 foreign landings below this value. With the definition of the international boundary, the ICJ line in 1984, no USA catches have been reported. The pollock management unit 4VWX5Zc is shown in Fig. 3.

The pollock fishery is prosecuted mainly in 4X and 5Zc with a smaller portion taken in 4VW (Fig. 2). For example, in 1993, 86% of pollock were taken in 4X and 5Zc. 1993 landings of 2,918 t in 4VW are lower than 1992 landings (9,173 t) and indicate a marked decrease compared to the 1985-1990 annual landings which were in the 15,000-20,000 t range (Table 2). The fishery in 4VW is dominated by large offshore vessels greater than 100 ft. using mobile gear, whereas in 4X and 5Zc the fishery is dominated by inshore vessels less than 65 ft. using both mobile and fixed gear. A number of factors may account for the decrease in 4VW pollock landings. Of these, the decline in 1993 was partly due to restrictive measures put on the 4VW cod fishery (i.e. after August it was a bycatch fishery only). As well, a year round restriction on small fish was enforced (no greater than 15% of catch <43 cm).

Seasonal breakdowns (Table 3) indicate a year round fishery, although with a greater proportion of landings occurring during May-August. 1993 small mesh landings by the USSR (176 t) declined from 1989-1992 levels of ~1,000 t. The overall small mesh landings have declined from 2,102 t in 1992 to 860 t in 1993 (Table 1). The usage of separator grates in this fishery became mandatory in August 1993. The effect of these grates on the 1993 fishery was likely minimal as the silver hake fishery is primarily prosecuted between April-June. Grates will have implications in upcoming years as presumably catches of small pollock (<40 cm) will be reduced (Anon. 1993b).

The Canadian catch is broken down by gear, area and season in Table 4. The large trawler tonnage class (TC) 4+ landings in 1993 were low compared to the 1985-1989 period with an especially sharp drop in 4VW since 1989. TC 1-3 landings by otter trawlers in 4X and 5Zc have decreased from 1991-1992 values of ~10,000 t to 6,640 t in 1993. Pollock landed under the Vessel Replacement Program have decreased from 4,160 t to 1,204 t from 1992 to 1993. This program has inshore boats (TC 1-3) fishing offshore allocations (TC 4+), with an especially high incidence of this occurring possibly in the latter part of the year when operators of large otter trawlers (e.g., Sea Freeze) realize they may not catch their enterprise allocation by year end.

Since 1982, the pollock fishery has been regulated by quotas on four gear sectors: 1) fixed gear; (2) mobile gear greater than 100 ft; (3) mobile gear less than 65 ft; and, (4) mobile gear 65-100 ft. In 1988 mobile gear and fixed gear less than 65 ft were further divided: a) mobile gear and fixed gear less than 45 ft; and, b) mobile gear and fixed gear 45-65 ft. In 1991, management initiatives included the introduction of Individual Transfer Quotas (ITQ) (cod haddock pollock 4VWX). Mobile gear <65 ft is now divided into two categories or fleets; (1) mobile gear <65 ft ITQ fishery and (2) mobile gear <45 ft generalists. The non ITQ fleet sector continues to be managed using licence conditions and trip limits. For further details on the history of management measures affecting the 4VWX5Zc pollock fishery refer to Annand and Beanlands (1992).

Quota allocations and associated catch for 1993 are presented in Table 5. The shortfall in 1993 Canadian allocations (from quota reports) amounted to 1,252 t (8% of TAC). The mobile gear sector >100 ft and 65-100 ft had a combined shortfall of 3,053 t. The over-run by the fixed gear < 45 ft and the mobile gear < 65 ft ITQ fishery may be related to the reduction in TAC from 35,000 to 21,000 t in September. The Vessel Replacement Program has confounded reporting of landings such that it is no longer possible to record an exact correspondence between quota allocations and landings data.

Reports from industry indicate pollock abundance has been declining since 1987, but 1994 seems to be better than 1993. Also, in the 1993 fishery, otter trawlers TC 1-3 reported good catches of 38-46 cm pollock in the Fundian channel and on the edges of Browns and Georges Bank. 4VW inshore fishermen reported a lack of pollock in recent years. A lack of large pollock in the fishery was a widespread concern.

Catch at Age

The catch at age prior to 1993 was taken from Trippel and Brown (1992). Catch and mean weight at age were estimated by making adjustments for the duplicate reporting of foreign fleet domestic allocations. Catch and mean weight at age for 1993 landings were estimated using samples from the commercial fisheries. Within-age reader agreement was high among all ages assessed (ages 3-12 y) (Appendix 1). Sampling for 1993 is shown in Table 6. Seasonal age length keys were generated separately for the otter trawlers TC4+ in 4VW and 4X+5. Annual keys were generated for small trawlers TC1-3 (4VWX+5) and fixed gears (4VWX+5). Length-weight parameters were obtained from analysis of the 1993 summer groundfish survey collections. Input data for generating the six keys used for the Canadian catch at age are given in Table 7. These keys accounted for 20,285 t or 96% of the entire catch, the difference consisting of the foreign by-catch. The age composition of the small mesh catch was based on pollock length frequencies from IOP data for the Cuban and Russian fisheries and the 4VW age-length key of the July RV survey. Weights at age were from the July RV survey. The total combined catch at age reflects the total landings (21,105 t of pollock in 4VWX and 5Zc). The total catch at age is given in Table 8 along with the Canadian catch at age and the small mesh and foreign catch-at-age matrices. As in most years, five or fewer year-classes contributed significantly to the annual landings.

Catch at age for 1993 was dominated by the 1986-1989 year-classes (ages 4-7) accounting for 91% of the catch in number (Table 8). The 1989 year-class at age 4 comprised 31% of the catch. The 1988 year-class at age 5 was 37% of the catch; the greatest proportion by numbers of any year-class in 1993. The small mesh catch at age was comprised predominatly of age 4 and 5 fish, with very few age 2 pollock captured. Since the mid-1980's weight at age has declined (Table 9).

Abundance Indices

Research Surveys

Three vessels have been involved in the summer stratified random surveys of the Scotian Shelf since 1970 (Fig. 4). After analysis of comparative fishing experiments, pollock catches were found to be the same between the different research vessels and hence no conversion factors were applied. The mean number per tow and estimated total numbers at age from these surveys for strata 40-95 are in Tables 10, 11, and 12 and abundance are plotted in Figures 5 and 6. In 1993, large catches of pollock occurred in warm water along the edges of the shelf in 4VW .

The research surveys from 1970-1993 indicate an increase in the age 4-9 abundance during the early 1980's with subsequent estimates being highly variable. The 1993 age 4-9 estimate was the second highest in the 24 year time series. The 1987, 1990 and 1993 survey numbers were all years in which high numbers of pollock were captured, especially for ages 4-5 (Table 12). In general, the survey exhibits pronounced year effects making it difficult to estimate year class strengths, incoming recruitment and short-term changes in abundance (Table 12). For example, in recent years the abundance of age 4+ pollock has fluctuated by 3-fold from one year to the next. Pollock, especially at smaller sizes, is considered a schooling fish and occasionally has the tendency of occurring off the bottom where survey trawls may not capture them in large numbers. It is these habits that make pollock particularly difficult to survey in a reliable fashion compared to the more bottom dwelling cod and haddock.

Commercial Catch Rates

Because of the difficulties experienced in generating a reliable measure of pollock abundance from research vessel survey data (see previous section) we used commercial catch rates as an alternative measure of abundance. Commercial catch rates were estimated using Observer data for domestic otter trawlers, TC 5. TC 5 vessels comprise a large part of the large otter trawler fleet (TC 4-6) and have been consistent over time in their use of diamond mesh. Smaller draggers TC 1-3 have switched from diamond to square mesh. Note, however, a switch in mesh size from 145 to 155 mm occurred for the TC 5 vessels in 1990. The analysis spanned the time period 1982-1993 as only a limited amount of Observer data existed for earlier years. The Observer TC 5 catch rate estimates were made by calculating the ratio of total catch and total effort (tonnes/hour) for sets made by these vessels from April-November for which >50% of the catch was pollock.

Data on otter trawl TC 4-6 catch at age in the time series were readily available (C. Annand, Marine Fish Division, Bedford Institute of Oceanography) and were used as a representation of the TC 5 catch at age (TC 5 vessels comprise a large majority of the TC 4-6 fleet). Age disaggregated catch rates were estimated by dividing catch at age for the TC 4-6 fleet by the standardized effort of a specific year. Standardized effort was estimated by dividing the TC 4-6 landings by the TC 5 catch rate. Results indicate TC 5 catch rates (age aggregated) have declined from the high values in the 1982-1986 period (Fig. 7). Values in 1992-1993 are slightly higher than in 1991 but remain lower than pre-1986 levels. The age disaggregated catch rates (Table 13) indicate a similar pattern with catch rates for ages 5 and 6 slightly higher in 1993 than in recent years, though catch rates for ages 9-10 were very low in 1993.

Sequential Population Analysis

Estimation of Stock Parameters

Results from ADAPT formulations that utilized the survey data (which included the strong 1993 survey results) produced optimistic assessments that were inconsistent with information about continued high fishing effort, low commercial catch rates, a paucity of large pollock, and other views of the resource which indicated on the contrary that stock conditions have not improved. For these reasons the survey was not used to estimate abundance trends.

ADAPT (Gavaris 1988) was used to calibrate the sequential population analysis with the age disaggregated Observer TC 5 catch rates (Table 14). Population abundance at the beginning of 1994 for ages 5-11 were estimated by ADAPT using otter trawl catch rate data for ages 4-10. Natural mortality was assumed constant and equal to 0.2 and the F for age 11 was calculated as the average for ages 7-10. The abundance of ages 3 and 4 were initially calculated based on the average partial recruitment (PR) to the fishery. The partial recruitment vector was derived from the F matrix from 1990-1992. The average PR of 1990-1992 is assumed to reflect the exploitation pattern in 1993. The estimate of number at age 3 (the 1991 year class) was lower than any previously observed. Given the uncertainty surrounding the partial recruitment at this age the strength of this year class was set to be roughly equivalent to the lowest previously observed.

The relative error and bias derived from the ADAPT formulation (Gavaris 1993) indicate there is substantial uncertainty in the estimates (Table 15). However, the residual plots for the model do not display any serious problematic trends or patterns (Fig. 8).

The change from using survey data to using commercial catch data to estimate population numbers marks a significant change in the formulation of the sequential population analysis over that used previously. Further exploration and discussion with industry in the use of catch rates to estimate population size is recommended for this resource.

Assessment Results

The 1979 (76 million) year-class at age 2 is the largest observed in the 1974-1993 period (Fig. 9). In the last assessment of this resource, the 1988 and 1989 year-classes were estimated to be well above average in size. In the present assessment, the 1989 year class is estimated to be closer to the long-term average and the 1988 year class is above average in size. These two year classes in 1994 will be nearly fully recruited to the fishery. The 1990 year class is estimated to be amongst the weakest and the 1991 year class was weaker than any previously observed.

Stock numbers and biomass (age 2+ and 4+, the latter representing spawning stock) has declined steadily since the mid-1980's with the movement of the strong 1989 year class out of the fishery (Fig. 10). The exploitable biomass of the current stock is comprised primarily of the 1988 and 1989 year classes (ages 5 and 6 in 1994). Stock size is lower than predicted from the previous assessment of this stock primarily because of the smaller estimates of the 1988 and 1989 year classes and the below average recruitment since 1989.

Fishing mortality at fully recruited ages (7+) since 1985 has ranged from 0.51-0.95 since 1985 (Fig. 11). Fishing mortality in 1991 was 0.95 and has declined to 0.51 in 1993 remaining above the $F_{0.1}$ of 0.30. The beginning of year numbers, biomass, and fishing mortality matrix are presented in Tables 16-18. Decline in F may be due to restrictive measures put on the 4VW cod fishery and reduced quota.

Prognosis:

Catch projections were made for 1995 using the following data:

Age	1994 beginning population numbers ('000)	Beginning of Year Weight (kg)[a]	Mean of Year Weight[a] (kg)	PR[b]
2	28,000[c]	0.33	0.47	0.01
3	4,000[d]	0.69	0.98	0.10
4	7,434	1.25	1.57	0.30
5	11,072	1.96	2.25	0.50
6	9,992	2.66	2.91	0.80
7	2,888	3.24	3.43	1.00
8	1,208	3.83	4.05	1.00
9	513	4.46	4.84	1.00
10	179	5.18	5.36	1.00
11	85	5.64	5.87	1.00
12	31	5.91		1.00

a= 1991-1993 average
b= 1990-1992 average
c= Geometric Mean (GM) recruitment (74-92) is 28 million
d= 1991 year class was set to the lowest previously observed

Assuming the 24,000t TAC for 1994 is caught, this would result in $F_{0.1}$ catches in 1995 of 13,000t. Catching 24,000t in 1994 would result in a F=0.56 which is about twice the $F_{0.1}$. A summary of projected 1995 catches and the resulting adult biomasses at various levels of fishing mortality in 1995 are shown (Table 19; Fig. 12).

Pollock abundance is very low with poor recruitment prospects for the near future. Reduced exploitation would prolong the contribution of existing year classes to the fishery and maintain a higher spawning stock biomass.

Uncertainties exist in the estimation of pollock abundance whether using survey data or commercial catch rate data in sequential population analysis. Difficulties in the survey data are

inherent in the nature of the pronounced year effects in abundance trends in the time series and the limitations of the survey design for a "schooling" species like pollock. Factors that would influence the TC 5 catch rates include annual differences in concentration of effort between 4VW and 4X, the validity of the premise that when >50% of a set was comprised of pollock it represented a set directed for pollock, and possible changes in the way industry managers may direct the operation of the TC 5 fleet. In light of these items, commercial catch rate data and research vessel data should be further scrutinized in future assessments of the estimation of stock size.

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Table 1a. Pollock landings (t round fresh) by country for divs. 4VWX and Subdiv. 5Zc, 1974-1977.

Year	Canada	Fed. Rep. Germany	German Dem. Rep.	Japan	Spain	USSR	United Kingdom	U.S.A.	Other	Total
1974	24975	149	-	40	1500	2301	47	435	14	29461
1975	26548	236	95	-	708	2004	-	403	124	30118
1976	23565	994	24	-	303	1466	-	443	385	27180
1977	24653	368	-	1	-	182	-	325	53	25582

Table 1b. Pollock landings (t round fresh) by country for divs. 4VWX and Subdiv. 5Zc.

Year	Canada	Japan	France		Cuba	USSR	U.S.A.	Other	Total
			St. Pierre & Mainland						
1978	26801	110	15	18	141	502	451	-	28038
1979	29967	19	8	15	50	1025	391	7	31482
1980	35986	81	19	80	32	950	443	-	37591
1981	40270	15	17	73	-	358	918	-	41651
1982	38029	3	30	14	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	37798	38	-		459	1177	-	-	39472
*1992	32191	72	9		1015	1006	-	-	34293
*1993	20285	-	-		644	176	-	-	21105

* - Provisional catch statistics
** - From 1983 on, French catches are combined

Table 2. Pollock landings (t, round fresh) for divisions 4VWX and Subdivision 5Zc.

Year	4V	4W	4X	5Y	5Zc	Total 4VW	Total 4X, 5Y +5Zc	Total
1974	307	4740	19731	680	4003	5047	24414	29461
1975	799	5697	17977	420	5225	6496	23622	30118
1976	1102	3424	19164	57	3433	4526	22654	27180
1977	1347	6082	14381	237	3535	7429	18153	25582
1978	2931	4910	14997	341	4859	7841	20197	28038
1979	4877	4963	18219	573	2850	9840	21642	31482
1980	3893	7511	20110	530	5547	11404	26187	37591
1981	2316	15678	18689	713	4255	17994	23657	41651
1982	2939	9373	20771	926	5288	12312	26985	39297
1983	5491	5787	17603	1079	4628	11278	23310	34588
1984	5474	6043	18926	2091	2890	11517	23907	35424
1985	12085	3262	26685	853	911	15347	28449	43796
1986	15250	4046	22845	654	1537	19296	25036	44332
1987	12820	4425	26756	-	2096	17245	28852	46097
1988	11871	4240	24596	-	2404	16111	27000	43111
**1989	12027	3863	23283	530	1409	*17772	25222	*42994
**1990	8150	4044	21903	346	1735	*13495	23984	*37479
**1991	4131	7448	25533	465	1718	*11756	27716	*39472
**1992	2203	6970	20737	443	3036	*9173	24216	*34293
**1993	835	2083	13611	371	4205	*2918	18187	*21105

* - Includes catch where division is unknown.
** - Data from DFO Statistics Branch, provisional data for countries other than Canada.

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

Canada (Maritimes & Newfoundland)

Year	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	4391	2282	3994	10667	6668	13719	6744	27131
*1992	2500	2658	2528	7685	4588	13625	5420	23633
*1993	590	1394	450	2434	4231	9118	4070	17419

* - Data from DFO Statistics Branch

USSR

Year	4VW					4X + 5Zc				
	Jan-Apr	May-Aug	Sept-Oct	UK Mon.	Total	Jan-Apr	May-Aug	Sept-Dec	UK Mon.	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	-	-	-	-	-
1983	16	204	-	-	220	-	6	-	-	6
1984	-	97	-	-	97	-	-	-	-	-
1985	-	336	-	-	336	-	-	-	-	-
1986	-	564	-	-	564	-	-	-	-	-
1987	-	314	-	-	314	-	-	-	-	-
1988	96	958	-	-	1054	-	-	-	-	-
**1989	605	1177	-	-	1782	-	-	-	-	-
**1990	342	698	-	-	1040	-	-	-	-	-
**1991	151	640	2	-	793	-	384	-	-	384
**1992	519	350	-	-	868	2	135	-	-	136

** - Provisional data

Table 3. (Continued)

Other Foreign Countries

Year	4VW					4X + 5Zc				
	Jan-Apr	May-Aug	Sept-Oct	UK Mon.	Total	Jan-Apr	May-Aug	Sept-Dec	UK Mon.	Total
1974	176	196	173	-	545	746	605	289	-	1640
1975	421	57	263	-	741	145	253	427	-	825
1976	254	318	162	2	736	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	-	-	-	-	-
1986	204	291	24	-	519	-	-	-	-	-
1987	110	311	32	-	453	-	-	-	-	-
1988	4	222	-	-	226	-	-	-	-	-
**1989	99	1	-	-	100	-	-	-	-	-
**1990	153	108	-	-	261	-	-	-	-	-
**1991	209	169	-	1	379	-	118	-	-	118
**1992	259	361	-	1	620	12	464	-	-	476
**1993	33	213	-	-	246	4	343	-	-	347

** - Provisional data

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

OTTER TRAWLERS -- Tonnage Classes 4+

Year	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	3851	1533	2487	7871	1513	2607	1496	5616
*1992	2157	1794	999	4950	1330	2163	1280	4773
*1993	500	519	265	1284	2582	685	1460	4727

* - Provisional

Table 4. (Continued)

OTTER TRAWLERS -- Tonnage Classes 1-3

Year	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970	8	0	0	8	336	2042	483	2861
1971	4	0	0	4	245	1708	717	2670
1972	0	9	1	10	537	2035	902	3474
1973	0	0	2	2	1922	6762	618	9302
1974	0	39	40	79	562	3398	591	4551
1975	0	0	0	0	745	2610	836	4191
1976	0	0	0	0	1039	2844	715	4598
1977	0	2	0	2	896	2224	808	3928
1978	9	23	2	34	955	2187	961	4103
1979	0	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	317	72	641	1030	4334	5164	2086	11584
*1992	220	149	968	1337	2645	6406	1377	10428
*1993	29	89	8	125	1360	4166	1114	6640

* - Provisional

Table 4. (Continued)

GILLNET, LONGLINE and MISCELLANEOUS Gears -- all tonnage classes

Year	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970	0	46	224	270	53	893	663	1609
1971	0	118	72	190	5	979	544	1528
1972	0	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	223	677	865	1765	822	5948	3162	9932
*1992	123	715	561	1399	613	5056	2763	8432
*1993	61	786	177	1025	289	4267	1496	6053

* - Provisional

Table 5. Allocations and percent taken for pollock in 1993.

Year	Fleet	Alloc. (t) (Quota rpts.)	Reported catch (t) (Quota rpts.)	Percent taken (%)
1993	All vessels	20840	19588	94
	Fixed gear <45′	5894	6951	118
	Fixed gear 45-65′	154	84	55
	Mobile gear >100′	9185	6225	68
	Mobile gear 65-100′	961	868	90
	Mobile gear <65′	4599	5436	118
	ITQ fishery			
	Mobile gear <45′	47	24	51
	Generalists			

Table 6. Canadian commercial samples available for pollock in divs. 4VW and in Div. 4X and Subdiv. 5Zc by gear and season for 1993.

	OTB 4+				OTB TC, 1-3				GN				LL & Others			
Area	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
4VW	2	4	1	7	1	2	1	4	0	0	4	4	0	0	1	1
4X+5Zc	11	4	6	21	9	18	16	43	0	10	10	20	2	3	2	7

Table 7. Grouping of catch by gears and time period for estimation of removals-at-age for 1993. OTB trawls are primarily stern bottom trawls, but there are some side trawls; GN are gillnets, LL are longlines, and Others are primarily inshore fisheries.

Period	Tonnage Class	Gear	No. of Samples	Area	Number Aged	Number Measured	Catch (t)	Weight-Length Relationship		Cruise	Date
								a	b		
Jan-Dec	TC 1-6	GN, LL, Other	32	4VWX+5	647	5212	7300	0.0117	2.96844	Needler 189/190	July 1993
Jan-Dec	TC 1-3	OTB	48	4VWX+5	1271	10314	6915	0.0117	2.96844	Needler 189/190	July 1993
Jan-Apr	TC 4+	OTB	2	4VW	79	515	501	0.0096	3.08294	Needler 189/190	July 1993
May-Aug	TC 4+	OTB	4	4VW	73	884	519	0.0096	3.08294	Needler 189/190	July 1993
Sept-Dec	TC 4+	OTB	1	4VW	26	206	265	0.0096	3.08294	Needler 189/190	July 1993
Jan-Apr	TC 4+	OTB	11	4X+5	294	2359	2583	0.0117	2.96844	Needler 189/190	July 1993
May-Aug	TC 4+	OTB	4	4X+5	75	813	786	0.0117	2.96844	Needler 189/190	July 1993
Sep-Dec	TC 4+	OTB	6	4X+5	120	1098	1461	0.0117	2.96844	Needler 189/190	July 1993

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

Total Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	0	0	0	0	0	8	0	10	0	1
2	197	175	178	36	23	98	171	871	134	56
3	5603	1058	1361	1476	835	2763	291	1334	4018	1999
4	2662	4023	1974	2873	3119	5786	1864	673	1589	9514
5	2356	2090	3649	1785	3084	3482	5306	2044	563	1256
6	1088	1904	1089	2181	1276	1705	3169	4019	1873	238
7	317	835	1089	732	1167	528	1075	2432	2295	524
8	164	196	207	417	257	249	277	713	1069	835
9	80	55	36	108	143	47	168	208	389	428
10	83	57	14	19	17	15	32	148	172	163
11	74	35	18	25	19	14	9	31	87	50
12	40	31	49	80	18	0	2	24	22	58

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	1	1	1	0	1	0	8	0	0	0
2	87	37	60	10	27	71	51	300	30	4
3	803	493	635	467	683	585	1226	1427	2066	367
4	3493	2190	3062	2259	2669	4371	2139	3696	5070	2770
5	7155	4160	3562	4908	3290	3952	3996	3159	3380	3318
6	639	6183	3595	3538	3390	2378	2549	3944	1763	2105
7	92	1105	3306	2404	1860	1977	1551	1681	1106	879
8	217	131	299	1736	1181	886	851	782	433	314
9	210	139	82	177	1005	675	545	349	239	113
10	92	230	117	39	43	402	243	288	182	42
11	18	85	171	48	19	15	88	192	84	17
12	23	59	116	98	97	14	34	203	52	10

Table 8 (Cont'd) Canadian Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	0	0	0	0	0	8	0	0	0	0
2	185	167	126	36	23	98	128	42	132	54
3	4784	986	1207	1433	786	2752	244	1333	3516	1857
4	2364	3567	1738	2855	3070	5582	1733	672	1584	9309
5	2125	1852	3170	1760	3022	3341	5035	2043	563	1248
6	954	1660	939	2128	1222	1645	3113	4019	1872	237
7	273	795	1001	710	1142	495	1047	2432	2294	523
8	144	132	194	395	246	248	269	712	1067	833
9	64	45	35	90	134	47	165	207	389	428
10	51	56	12	19	17	15	32	148	172	163
11	33	34	16	25	19	14	9	31	87	50
12	10	30	42	80	18	0	2	24	22	58

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	0	0	0	0	0	0	0	0	0
2	22	24	4	8	27	44	6	16	1	2
3	720	477	317	428	618	495	1018	688	1136	345
4	3491	2179	2868	2231	2493	3691	1940	3213	4208	2507
5	7152	4126	3519	4859	3235	3772	3674	3043	3183	3188
6	639	6178	3575	3489	3345	2335	2484	3885	1646	2050
7	91	1102	3291	2372	1784	1911	1531	1666	1061	871
8	215	126	298	1672	1146	847	835	772	416	310
9	207	134	82	175	991	650	535	337	232	112
10	148	221	113	35	43	382	243	285	176	42
11	31	78	165	44	17	12	86	188	81	17
12	24	57	113	95	93	10	28	202	50	10

Table 8 (Cont'd)

Foreign Catch at Age

	1974	1975	1976	1977-1993
1	0	0	0	0
2	12	8	17	0
3	291	67	121	0
4	162	228	160	0
5	152	87	237	0
6	77	78	64	0
7	20	23	42	0
8	9	4	14	0
9	6	2	2	0
10	3	1	2	0
11	3	1	2	0
12	1	1	8	0

Small Mesh Gear Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	0	0	0	0	0	0	0	10	0	0	1	1
2	0	0	35	0	0	0	43	829	2	2	65	13
3	528	6	33	43	49	11	47	1	502	142	83	16
4	136	229	77	18	49	104	131	1	5	205	2	11
5	79	151	242	25	62	141	271	1	0	8	3	34
6	57	166	86	53	54	60	56	0	1	1	0	5
7	24	17	46	22	25	33	28	0	1	1	1	3
8	10	60	0	22	11	1	8	1	2	2	2	5
9	10	9	0	18	9	0	3	1	0	0	3	5
10	29	0	0	0	0	0	0	0	0	0	0	9
11	38	0	0	0	0	0	0	0	0	0	0	7
12	29	0	0	0	0	0	0	0	0	0	2	2

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

Table 9. Mean Weights at Age (kg)

Total Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	.00	.00	.00	.00	.00	.19	.00	.00	.00	.63
2	.82	.86	.59	.79	1.14	.77	1.03	.68	.76	.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	.00	11.65	9.22	8.65	8.72

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	.36	.00	.10	.00	.00	.00	.25	.14	.00	.00
2	.73	.74	.35	.64	1.17	.67	.49	.47	.47	.46
3	1.64	1.49	1.13	1.32	1.37	1.23	1.35	.95	1.04	.96
4	2.36	1.96	2.00	1.96	1.88	1.77	2.03	1.69	1.69	1.33
5	2.67	2.73	2.52	2.50	2.64	2.48	2.55	2.29	2.52	1.95
6	3.84	3.12	3.29	2.94	3.21	3.25	2.95	2.79	3.33	2.62
7	5.41	3.42	3.61	3.71	3.51	3.80	3.83	3.34	3.72	3.22
8	5.97	4.39	4.20	4.03	4.23	4.10	4.11	3.84	4.25	4.05
9	5.90	6.10	5.66	4.55	4.41	4.81	4.92	4.65	5.00	4.88
10	6.32	5.86	6.09	6.26	5.26	5.16	5.10	4.77	5.63	5.69
11	7.69	6.17	6.11	6.15	7.18	7.77	5.94	5.08	5.95	6.59
12	8.53	7.52	6.68	7.57	8.46	7.39	7.22	5.62	6.35	7.03

Table 9 (Cont'd) Canadian Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	.00	.00	.00	.00	.00	.19	.00	.00	.00	.00
2	.83	.86	.63	.79	1.14	.77	1.12	1.01	.76	.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	.00	11.65	9.22	8.65	8.72

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	1.46	.94	.83	.72	1.17	.83	.76	.48	.84	.41
3	1.68	1.52	1.39	1.37	1.46	1.26	1.45	1.12	1.30	.96
4	2.36	1.96	2.02	1.97	1.92	1.88	2.05	1.75	1.77	1.33
5	2.67	2.74	2.52	2.51	2.64	2.51	2.55	2.31	2.55	1.95
6	3.84	3.12	3.29	2.95	3.22	3.26	2.96	2.80	3.39	2.62
7	5.41	3.43	3.61	3.72	3.51	3.83	3.84	3.34	3.75	3.22
8	5.97	4.39	4.20	4.04	4.23	4.12	4.12	3.83	4.27	4.05
9	5.90	6.13	5.66	4.55	4.41	4.84	4.94	4.65	5.00	4.87
10	6.34	5.89	6.09	6.32	5.26	5.19	5.10	4.75	5.64	5.68
11	7.69	6.19	6.11	6.27	8.03	8.66	5.94	5.07	5.96	6.59
12	8.76	7.56	6.86	7.62	8.52	7.44	7.39	5.61	6.34	7.04

Table 9 (Cont'd)

Foreign Weight at Age

	1974	1975	1976	1977-93
1	.00	.00	.00	.00
2	.59	.84	.63	.00
3	1.24	1.13	1.04	.00
4	1.81	1.68	1.88	.00
5	2.89	2.32	2.83	.00
6	3.97	3.25	3.52	.00
7	5.23	4.33	4.83	.00
8	6.70	5.13	5.90	.00
9	6.72	5.13	6.70	.00
10	7.00	.00	8.26	.00
11	8.43	.00	9.46	.00
12	13.00	.00	8.68	.00

Small Mesh Gear Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.77	.66	.62	.43
3	1.02	1.11	.92	.74	.83	1.23	1.25	1.52	.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	.00	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	.00	5.90	6.45	5.98	6.32	5.41	6.30	4.35
9	7.01	8.00	.00	6.92	8.01	.00	6.37	7.36	8.82	5.03
10	7.73	.00	.00	.00	.00	.00	.00	8.87	7.43	7.08
11	8.99	.00	.00	.00	.00	.00	.00	.00	.00	7.61
12	10.20	.00	.00	.00	.00	.00	.00	.00	8.50	8.39

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	.36	.00	.00	.00	.00	.00	.25	.14	.00	.00
2	.48	.37	.32	.32	.26	.42	.45	.47	.46	.50
3	1.29	.62	.87	.79	.50	1.08	.86	.79	.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	.00	4.78	4.30	3.99	4.32	4.54	4.31	5.10
10	5.96	5.35	6.14	5.74	.00	4.45	5.74	6.02	4.60	6.10
11	7.25	5.94	6.04	4.84	.00	4.19	6.12	5.86	5.85	6.80
12	6.19	6.46	.00	5.96	7.04	7.24	6.45	8.25	6.80	7.80

Table 10. Mean number/tow of Pollock in Canadian summer bottom trawl surveys (strata 40-95)[1].

Stratum	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
40	0	0	0	0	0	0	0	0	0	0	0	0	.26	.41	45.11	.34	.51	3.09	2.83	0	0
41	0	0	0	0	0	.31	0	0	1.46	.65	1.30	.29	1.03	.21	37.43	9.14	14.10	3.89	4.32	.78	11.54
42	0	0	0	0	0	0	0	0	0	0	0	0	.34	0	.16	.33	0	.39	.22	.83	0
43	0	0	0	0	0	0	0	0	0	.21	.23	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	.17	0	0	0	0	0	0	0	.26	.83	.34	0	0	0	.26	.12	3.06
45	0	0	0	0	0	0	0	0	0	0	0	0	21.63	.17	5.85	0	0	0	0	0	0
46	0	0	0	0	.34	0	0	0	0	.97	16.47	0	3.09	.69	0	.97	13.35	2.07	.34	2.31	0
47	.37	0	.44	0	0	0	.61	0	0	.51	.26	0	0	0	0	0	.66	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0		4.08	0	0	0	0	5.35	0	.52	0	0	0	0	0	0	112.86
50	0	0	.36	0	0	0	1.56	0	15.10	1.09	0	0	0	.34	.34	0	0	32.73	0	.65	0
51	0	0	0	.55	.49	3.13	25.93	0	2.92	571.50	0	0	96.76	1.09	133.02	22.13	6.09	21.23	0	9.26	378.45
52	0	0	0	0	.55	.49	3.60	0	0	5.05	3.60	113.75	6.69	60.03	.34	.55	.52	.65	7.29	1.49	.51
53	0	0	0	0	.34	0	0	0	0	0	0	0	0	.34	0	.58	0	0	3.83	20.42	225.02
54	0	0	0	0	0	.39	0	0	0	0	0	0	1.05	0	0	0	0	0	0	1.46	.48
55	0	0	0	0	0	0	0	0	.29	1.42	.26	0	0	.13	.12	0	.15	.68	8.36	1.12	2.32
56	.18	0	0	0	.34	0	0	0	0	0	.16	2.97	1.94	.17	.70	4.73	.35	1.40	19.19	.28	.36
57	0	0	0	0	0		0	0	0	.49	0	0	0	0	0	0	0	0	0	0	.49
58	0	0	0	0	0	0	0	0	0	0	2.27	0	0	.21	0	1.03	0	.20	0	0	0
59	.58	0	0	.20	.63	.24	0	0	0	0	.58	17.06	2.34	10.47	3.94	9.43	.78	0	0	4.86	.25
60	4.12	0	5.07	0	.97	14.72	2.89	353.50	.97	6.55	29.17	36.66	12.40	8.92	337.21	10.49	40.88	111.02	35.08	4.37	34.71
61	.51	0	20.26	0	2.78	0	0	0	0	2.76	1.46	1.61	5.06	3.78	11.67	3.28	3.28	3.09	4.52	.97	3.09
62	0	5.10	2.73	.51	0	3.82	1.22	55.19	6.87	.78	0	1.29	60.12	14.78	3.98	6.85	2.80	13.68	1.51	6.08	19.58
63	0	0	3.31	6.13	1.17	0	5.83	.51	5.41	.31	4.86	0	1.46	2.57	6.69	.55	8.23	5.14	4.09	5.58	6.93
64	0	0	0	.32	1.79	3.52	.97	0	0	0	41.22	.62	2.96	.28	4.57	1.58	23.77	1.37	6.00	17.78	2.65
65	0	25.03	1.17	2.33	1.95	.41	.21	0	.85	.15	.51	1.29	2.72	.19	5.65	1.88	3.31	.82	13.27	7.11	2.00
66	0	0	0	0	0	0	0	0	0	0	0	0	3.24	.39	.55	0	2.19	0	0	0	178.54
70	27.47	2.40	.49	96.62	18.47	74.79	9.30	1.09	16.40	0	42.41	6.56	60.82	19.56	72.06	74.27	9.07	364.41	41.63	75.35	5.35
71	.55	0	0	0	6.35	3.04	0	4.86	1.37	0	.97	1.63	27.79	4.63	108.57	6.85	1.03	4.03	6.02	6.81	157.46
72	1.09	2.57	0	2.13	1.74	.46	.34	16.42	5.83	.49	5.47	1.75	377.22	6.18	3.60	8.51	14.41	.98	2.07	19.93	8.25
73	0	0	0	0	.55	0	0	.38	0	0	0	0	.49	2.13	.51	0	0	0	0	.49	.49
74	0	0	0	0	0	0	0	.52	0	0	0		0	1.88	.55	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	.51	0	1.03	0	0	1.03	0	0	.49	.49
76	9.24	8.07	7.70	2.19	20.79	1.75	0	1.17	0	0	6.03	50.95	0	26.74	1.68	35.97	4.31	439.15	2.44	4.13	9.52
77	1.84	0	0	0	0	0	.58	0	0	0	1.03	0	0	0	23.50	0	0	.22	.56	2.29	25.42
78	.97	0	1.09	0	0	1.75	1.72	0	0	0	0	0	3.89	.36	0	4.12	0	20.78	0	22.21	63.68
80	.46	0	0	.23	34.81	.55	0	.97	0	.51	1.46	0	1.84	3.25	14.67	.22	1.42	1.35	2.99	3.11	.94
81	6.00	1.30	0	.29	0	2.11	0	2.42	1.46	1.80	2.73	.26	.46	8.14	.68	2.36	.73	104.49	18.36	2.17	76.00
82	0	0	0	.32	.73	1.02	13.64	1.35	4.04	1.41	1.00	.88	.49	1.03	4.25	3.62	38.11	2.98	34.58	14.25	6.46
83	0	0	0	1.95	.49	0	.58	.78	0	.52	.51	1.54	.49	0	1.64	1.03	0	12.43	49.97	1.85	3.60
84	1.78	1.34	1.58	21.52	2.38	.49	9.82	.25	16.54	.26	0	3.43	3.56	2.40	4.72	14.68	.74	5.60	9.39	10.21	2.28
85	83.38	2.17	0	1.99	127.10	1.59	19.79	32.42	3.57	58.78	1.70	23.70	13.35	46.03	14.24	127.16	23.64	6.56	9.28	2.04	200.51
90	0	3.98	1.19	8.17	.78	8.61	3.28	1.35	15.75	2.60	8.20	0	90.55	2.94	.23	1.98	1.56	17.39	43.42	1.29	2.43
91	5.64	1.13	.65	2.52	1.53	0	46.01	1.92	.53	.60	1.88	3.09	6.06	26.08	64.80	3.65	6.57	3.70	4.23	3.89	9.46
92	1.63	3.19	2.02	2.10	3.68	2.27	0	0	.29	11.08	1.03	.36	.65	8.43	3.47	5.93	.51	2.06	1.23	6.54	.65
93	1.54	0	.46	.58	1.16	0	.69	1.32	0	4.25	1.94	0	46.94	.65	4.12	0	.34	.92	.92	.65	0
94	0	.42	.46	2.17	0	0	1.03	.51	0	0	0	.55	.49	0	0	0	0	0	.94	0	0
95	0	1.54	.70	0	0	0	1.06	1.21	2.92	0	.67	0	.92	0	0	0	1.64	0	0	0	0

1. Survey vessels: 1970 - 1981 A.T. Cameron
1982 Lady Hammond
1983 Alfred Needler

Table 11. Stratified average numbers per tow in Canadian summer bottom trawl surveys (strata 40-95).

Age	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	.000	.000	.000	.007	.000	.000	.000	.000	.000	.012	.007	.000	.100	.035	.007	.051	.000	.020	.013	.152	.020	0	.010
2	.733	.019	.389	.042	.009	.029	.261	.007	.000	1.142	.159	.196	.119	.471	1.579	.606	.591	.029	.055	9.763	1.077	.247	1.840
3	.607	.013	.477	.941	.018	.219	.770	.147	.109	1.257	.175	2.787	.916	.229	4.819	.653	2.447	.599	.139	7.494	1.138	1.426	4.820
4	.168	.146	2.150	.230	.324	.667	.985	.607	.631	3.327	.051	.266	1.702	.702	3.565	.965	3.683	1.155	.848	3.161	1.020	1.582	8.040
5	.039	.321	.818	.279	.279	1.242	2.029	.941	.799	5.282	.505	.118	.196	2.013	3.479	1.008	5.840	2.196	.965	5.230	1.333	1.040	3.340
6	.018	.140	.082	.130	.374	.313	1.415	.351	.581	1.403	.505	.368	.048	.307	2.910	1.383	2.300	1.954	.893	1.963	1.475	.717	1.370
7	.032	.037	.050	.152	.059	.540	.184	.330	.238	.797	.352	.252	.090	.211	.440	1.015	1.674	1.825	1.125	.524	.437	.244	.450
8	.011	.068	.047	.086	.092	.197	.308	.102	.169	.248	.242	.148	.262	.458	.124	.073	1.369	1.010	.540	.344	.462	.097	.340
9	.007	.049	.059	.066	.036	.043	.108	.048	.010	.097	.109	.130	.166	.691	.224	.011	.052	.584	.311	.215	.202	.044	.120
10	.022	.024	.002	.037	.008	.044	.052	.022	.036	.058	.076	.072	.056	.428	.348	.103	.118	.040	.114	.066	.064	.035	.030
11	.000	.012	.020	.087	.009	.015	.030	.000	.000	.000	.028	.012	.059	.071	.117	.136	.089	.043	.028	.031	.035	.012	.010
12+	.000	.026	.011	.031	.000	.048	.012	.023	.000	.000	.013	.049	.020	.157	.112	.089	.352	.164	.051	.122	.010	.029	.010
UK	.000	.004	.014	.000	.000	.011	.004	.017	.023	.029	.046	.034	.027	.044	.003	.007	.030	.000	.013	.000	.000	.000	0
TOTAL	1.638	.860	4.118	2.087	1.209	3.367	6.158	2.595	2.596	13.650	2.267	4.433	3.763	5.816	17.729	6.101	18.546	9.621	5.094	29.065	7.273	5.473	20.380
4+	.297	.823	3.238	1.097	1.182	3.108	5.123	2.424	2.465	11.211	1.880	1.417	2.600	5.038	11.320	4.783	15.478	8.972	4.875	11.656	5.038	3.800	13.710
5+	.129	.678	1.088	.867	.858	2.442	4.138	1.817	1.833	7.884	1.829	1.150	.898	4.336	7.755	3.818	11.795	7.817	4.027	8.495	4.018	2.218	5.670
6+	.090	.357	.270	.588	.579	1.200	2.109	.876	1.034	2.603	1.324	1.032	.702	2.323	4.276	2.810	5.955	5.621	3.062	3.265	2.685	1.178	2.330

Table 12. Stratified total numbers at age (x 10^3) in Canadian summer bottom trawl surveys (strata 40-95).

Year

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	0	30	0	0	0	0	0	49	29	0	426	148	30	216	0	86	55	645	83	0	54
2	82	1649	179	37	122	1108	29	0	4842	673	832	504	1989	6694	2570	2504	122	231	41392	4568	1047	7786
3	55	2021	3989	77	928	3266	610	462	5328	744	11816	3884	966	20433	2770	10375	2541	588	31771	4824	6046	20415
4	618	9117	975	1375	2826	4177	2525	2676	14106	215	1129	7218	2965	15116	4090	15614	4896	3597	13403	4324	6707	34098
5	1361	3467	1183	1182	5264	8604	3915	3389	22393	2142	502	830	8509	14751	4273	24762	9311	4090	22173	5653	4411	14164
6	595	347	549	1587	1328	5999	1459	2462	5947	2140	1558	203	1297	12336	5865	9752	8285	3784	8323	6253	3038	5806
7	157	213	643	252	2289	779	1372	1007	3378	1491	1070	383	892	1865	4304	7099	7738	4768	2221	1850	1036	1907
8	288	197	365	389	836	1308	424	715	1052	1028	628	1113	1934	527	309	5802	4284	2290	1457	1959	411	1434
9	209	248	278	151	183	458	198	44	412	461	553	703	2920	951	47	221	2477	1319	911	858	188	499
10	100	10	158	35	188	219	91	155	245	321	306	239	1811	1475	438	502	169	484	280	269	147	138
11	52	83	368	40	62	129	0	0	0	121	50	250	301	497	575	379	184	119	130	147	51	54
12+	111	48	131	0	203	49	98	0	0	54	208	86	662	477	377	1490	696	218	516	42	122	32
UK	17	59	0	0	45	15	71	99	122	195	143	116	186	15	31	129	0	55	0	0	0	0
TOTAL	3646	17459	8848	5125	14275	26110	10793	11009	57875	9612	18796	15954	24578	75167	25866	78630	40789	21597	123222	30830	23204	86386
4+	3491	13730	4651	5010	13179	21721	10083	10450	47534	7972	6006	11024	21290	47996	20279	65622	38039	20668	49414	21355	16111	72500
5+	2873	4613	3676	3636	10353	17544	7558	7773	33428	7756	4877	3806	18324	32879	16189	50008	33143	17072	36011	17031	9404	24003
6+	1512	1147	2493	2454	5089	8940	3642	4384	11035	5615	4375	2976	9815	18129	11915	25246	23832	12982	13838	11378	4993	9869

Table 13. Otter trawl (TC 5) catch rates (tonnes/hr) based on IOP data for sets in which >50% of landings were pollock. Refer to page 6 for methods used to estimate age disaggregated catch rates.

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
4	.0787	.4919	.2059	.1779	.1170	.0732	.0901	.0984	.0646	.0367	.1423	.1053
5	.0212	.0311	.5722	.2031	.1739	.1274	.0887	.1046	.1169	.0506	.0918	.1610
6	.0789	.0052	.0247	.4034	.1641	.0951	.0973	.0659	.0897	.0642	.0473	.1190
7	.1105	.0185	.0026	.0755	.1754	.0490	.0539	.0548	.0556	.0424	.0340	.0431
8	.0509	.0415	.0099	.0066	.0184	.0438	.0342	.0306	.0420	.0246	.0154	.0182
9	.0191	.0211	.0109	.0080	.0024	.0036	.0321	.0213	.0231	.0085	.0104	.0056
10	.0125	.0084	.0051	.0153	.0056	.0005	.0010	.0125	.0112	.0089	.0051	.0024

Table 14.

Parameters for the ADAPT formulation

- Year class estimates
  N_i, 1994 i=8

- Calibration constants for Otter Trawl Catch Rate (TC 5)

  K_i i=4-10

Framework: assumptions and structure imposed

- Natural mortality = 0.20
- Error in catch at age assumed negligible
- No intercepts
- Partial recruitment for ages 2-6 in 1993 was the average from 1990-1992, age 7 and older assumed to be fully recruited.

Age	2	3	4	5	6	7	8	9	10	11	12
PR	.01	.10	.30	.50	.80	1	1	1	1	1	1

Input

- Number at age 2= 28 million (1974-93 geometric mean)
- $C_{i,t}$ i=2 to 11 t=1974-1993 commercial catch
- $I_{i,t}$ i=4 to 10 t=1982-1993 otter trawl (TC 5) catch rate

Objective Function

Minimize $\Sigma_{i,t} (\ln I_{i,t} - \ln K_i N_{i,t})^2$

Table 15. Final parameter estimates and significant statistics for age 4-11 numbers and 4-10 slopes from ADAPT.

Estimated parameters and standard errors
Approximate statistics assuming linearity near solution

Orthogonality offset.....0.001307
Mean square residuals.....0.222910

	Par. Est.	Std. err	Rel. Err	Bias %
		Population Numbers		
Age				
4	7107	1563	0.22	-0.05
5	12879	6972	0.54	0.14
6	10917	4808	0.44	0.08
7	3167	1552	0.49	0.09
8	1136	585	0.51	0.10
9	568	286	0.50	0.10
10	198	102	0.52	0.10
11	94	48	0.51	0.10
		Otter Trawl Catch Rate K's		
Age				
4	0.67×10^{-5}	0.99×10^{-6}	0.15	0.583×10^{-2}
5	1.16×10^{-5}	1.66×10^{-6}	0.14	0.653×10^{-2}
6	1.60×10^{-5}	2.29×10^{-6}	0.14	0.741×10^{-2}
7	1.98×10^{-5}	2.83×10^{-6}	0.14	0.796×10^{-2}
8	2.33×10^{-5}	3.35×10^{-6}	0.14	0.875×10^{-2}
9	2.32×10^{-5}	3.35×10^{-6}	0.14	1.053×10^{-2}
10	2.63×10^{-5}	3.35×10^{-6}	0.14	1.353×10^{-2}

Table 16. Estimated beginning of year population numbers (000s), bias adjusted, for pollock.

	1974	1975	1976	1977	1978	1979	1980	1981	1982
2	16785	26156	37150	45924	19829	4929	14351	75920	43851
3	27820	13564	21257	30255	37567	16213	3947	11595	61370
4	10237	17707	10148	16172	23435	30001	10774	2968	8286
5	8317	5973	10857	6522	10641	16364	19328	7135	1821
6	3085	4677	2999	5587	3725	5922	10247	11024	3992
7	806	1542	2107	1470	2601	1895	3306	5522	5388
8	378	373	506	740	541	1073	1073	1734	2321
9	240	161	128	227	228	211	653	628	774
10	183	124	82	72	88	57	130	383	326
11	180	74	50	54	42	56	33	77	179
12	0	81	29	24	21	17	33	19	36
2+	68030	70433	85313	107048	98718	76739	63876	117004	128345
3+	51246	44277	48163	61124	78889	71810	49525	41085	84494
4+	23426	30713	26906	30869	41322	55597	45578	29490	23124
5+	13189	13006	16758	14697	17888	25595	34804	26521	14838

	1983	1984	1985	1986	1987	1988	1989	1990
2	34424	35994	26439	27355	32444	21096	27662	39261
3	35781	28134	29390	21613	22342	26554	17248	22584
4	46610	27486	22307	23617	17121	17870	21122	13592
5	5346	29552	19343	16282	16565	11973	12215	13338
6	981	3241	17721	12072	10108	9121	6826	6425
7	1573	588	2075	8914	6631	5074	4401	3437
8	2335	814	398	699	4307	3254	2471	1814
9	933	1156	470	207	302	1955	1595	1222
10	282	376	756	259	95	87	692	695
11	112	83	225	411	106	43	32	203
12	68	46	52	107	182	43	18	13
2+	128446	127469	119176	111537	110203	97071	94282	102583
3+	94022	91476	92736	84182	77759	75975	66620	63322
4+	58240	63342	63346	62568	55417	49421	49373	40739
5+	11630	35856	41039	38952	38296	31551	28251	27147

	1991	1992	1993	1994
2	27872	11619	4890	28000
3	32098	22548	9486	4000
4	17380	24988	16591	7434
5	9193	10886	15871	11077
6	7305	4668	5854	9992
7	2954	2412	2227	2888
8	1411	898	974	1028
9	715	447	343	513
10	507	270	150	179
11	350	155	56	85
12	86	112	51	31
2+	99870	79002	56492	65226
3+	71998	67383	51602	37226
4+	39901	44835	42117	33226
5+	22520	19847	25525	25792

Table 17. Estimated beginning of year population biomass (000 t), bias adjusted, for pollock.

	1974	1975	1976	1977	1978	1979	1980	1981
2	11103	18964	16053	29076	22218	2570	11372	39025
3	29594	13787	21684	24373	37031	18804	4489	15523
4	16750	29047	15784	21932	32975	41424	16879	6131
5	20065	14553	25414	14232	21155	35537	40049	17553
6	10806	15814	10106	17523	11585	17609	30853	33530
7	3672	7014	8887	6021	10425	7795	12374	21351
8	2114	2145	2706	3738	2824	5418	5282	8569
9	1540	1095	867	1387	1403	1328	3924	3896
10	1284	879	627	514	614	402	1008	2721
11	1432	579	405	479	324	454	256	639
12	0	746	249	232	244	149	320	172
2+	98361	104624	102781	119507	140798	131490	126806	149111
3+	87258	85660	86729	90431	118579	128920	115434	110086
4+	57664	71873	65045	66057	81548	110116	110945	94563
5+	40914	42825	49261	44125	48573	68691	94066	88432

	1982	1983	1984	1985	1986	1987	1988	1989
2	25987	20326	18391	15833	4930	14192	24073	13057
3	55205	34875	32824	30652	19764	15186	24864	20691
4	17927	65510	47209	39994	40769	25480	28150	32892
5	5438	15488	62216	49097	36186	37041	27236	26376
6	13923	3732	11217	51148	36180	27512	25839	19995
7	20774	7069	2776	7520	29917	23167	16300	15369
8	10991	11101	4370	1939	2649	16428	12890	9375
9	4664	5137	6328	2834	1033	1319	8244	7197
10	2368	1773	2286	4447	1577	568	425	3299
11	1414	873	584	1402	2460	648	287	206
12	244	554	379	432	652	1135	268	138
2+	158934	166439	188581	205298	176116	162676	168577	148594
3+	132947	146113	170190	189465	171186	148484	144504	135537
4+	77742	111238	137366	158813	151422	133298	119640	114847
5+	59815	45728	90157	118819	110654	107818	91490	81955

	1990	1991	1992	1993	1994
2	13816	8806	3813	1605	9075
3	21478	21899	15764	6385	2739
4	21477	26253	31662	19520	9798
5	28337	19820	22465	28782	22278
6	17379	19484	12890	15028	26631
7	12126	9273	7771	7291	9276
8	7169	5410	3382	3780	3933
9	5487	3127	1960	1562	2277
10	3445	2456	1380	799	911
11	1121	1779.	823	342	466
12	121	549	570	336	185
2+	131957	118856	102480	85430	87569
3+	118141	110050	98667	83825	78494
4+	96663	88150	82903	77440	75755
5+	75185	61898	51241	57920	65957

Table 18. estimated fishing mortality, bias adjusted, for pollock.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	0.01	0.01	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.00
3	0.25	0.09	0.07	0.06	0.02	0.21	0.08	0.14	0.08	0.06	0.03	0.02
4	0.34	0.29	0.24	0.22	0.16	0.24	0.21	0.29	0.24	0.26	0.15	0.11
5	0.38	0.49	0.46	0.36	0.39	0.27	0.36	0.38	0.42	0.30	0.31	0.27
6	0.49	0.60	0.51	0.56	0.48	0.38	0.42	0.52	0.73	0.31	0.25	0.49
7	0.57	0.91	0.85	0.80	0.69	0.37	0.45	0.67	0.64	0.46	0.19	0.89
8	0.65	0.87	0.60	0.98	0.74	0.30	0.34	0.61	0.71	0.50	0.35	0.45
9	0.46	0.48	0.38	0.75	1.18	0.28	0.33	0.45	0.81	0.71	0.22	0.40
10	0.70	0.71	0.21	0.35	0.24	0.35	0.32	0.56	0.87	1.02	0.32	0.41
11	0.60	0.75	0.52	0.73	0.72	0.33	0.36	0.58	0.77	0.68	0.27	0.54

	1986	1987	1988	1989	1990	1991	1992	1993
2	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
3	0.03	0.02	0.03	0.04	0.06	0.05	0.11	0.04
4	0.15	0.16	0.18	0.26	0.19	0.27	0.25	0.20
5	0.28	0.40	0.36	0.44	0.40	0.48	0.42	0.26
6	0.40	0.49	0.53	0.49	0.58	0.91	0.54	0.51
7	0.53	0.51	0.52	0.69	0.69	0.99	0.71	0.57
8	0.64	0.59	0.51	0.50	0.73	0.95	0.76	0.44
9	0.58	1.04	0.84	0.63	0.68	0.78	0.89	0.45
10	0.69	0.60	0.79	1.03	0.49	0.99	1.37	0.37
11	0.62	0.69	0.67	0.72	0.65	0.93	0.92	0.41

Table 19. Projections for pollock.

Beginning of Year

Population Numbers				Population Biomass			
	1994	1995	1996		1994	1995	1996
2	28000	28000	28000	2	9151	9151	9151
3	4000	22797	22856	3	2743	15632	15672
4	7434	3097	18113	4	9321	3884	22712
5	11077	5150	2318	5	21742	10107	4549
6	9992	6864	3629	6	26624	18291	9669
7	2888	5239	4421	7	9346	16952	14306
8	1028	1355	3177	8	3931	5182	12155
9	513	482	822	9	2288	2148	3661
10	179	241	292	10	926	1248	1515
11	85	84	146	11	478	473	824
12	31	40	51	12	181	235	301
2+	65226	73348	83824	2+	86731	83302	94514
3+	37226	45348	55824	3+	77580	74151	85363
4+	33226	22551	32969	4+	74837	58519	69691
5+	25792	19453	14856	5+	65516	54635	46979

Mid-Year

Population Numbers			Population Biomas		
	1994	1995		1994	1995
2	25309	25341	2	11786	11800
3	3530	20365	3	3475	20053
4	6222	2689	4	9771	4222
5	8803	4345	5	19825	9785
6	7361	5553	6	21433	16169
7	2026	4122	7	6941	14126
8	721	1066	8	2916	4313
9	360	379	9	1743	1836
10	125	189	10	672	1016
11	59	66	11	349	387
2+	54517	64116	2+	78912	83709
3+	29207	38775	3+	67126	71908
4+	25678	18410	4+	63650	51855
5+	19456	15721	5+	53880	47633

Fishing Mortality			Catch Numbers			Catch Biomass		
	1994	1995		1994	1995		1994	1995
2	0.01	0.00	2	141	76	2	66	35
3	0.06	0.03	3	197	611	3	194	602
4	0.17	0.09	4	1040	242	4	1633	380
5	0.28	0.15	5	2452	652	5	5523	1468
6	0.45	0.24	6	3281	1333	6	9553	3881
7	0.56	0.30	7	1129	1237	7	3867	4238
8	0.56	0.30	8	401	320	8	1625	1294
9	0.56	0.30	9	201	114	9	971	551
10	0.56	0.30	10	70	57	10	374	305
11	0.56	0.30	11	33	20	11	195	116
			2+	8945	4660	2+	24000	12869
			3+	8804	4584	3+	23934	12834
			4+	8607	3973	4+	23741	12232
			5+	7567	3731	5+	22108	11852

Fig. 1. **Nominal Landings for all Countries of Divs. 4VWX and Subdiv. 5Zc Pollock**

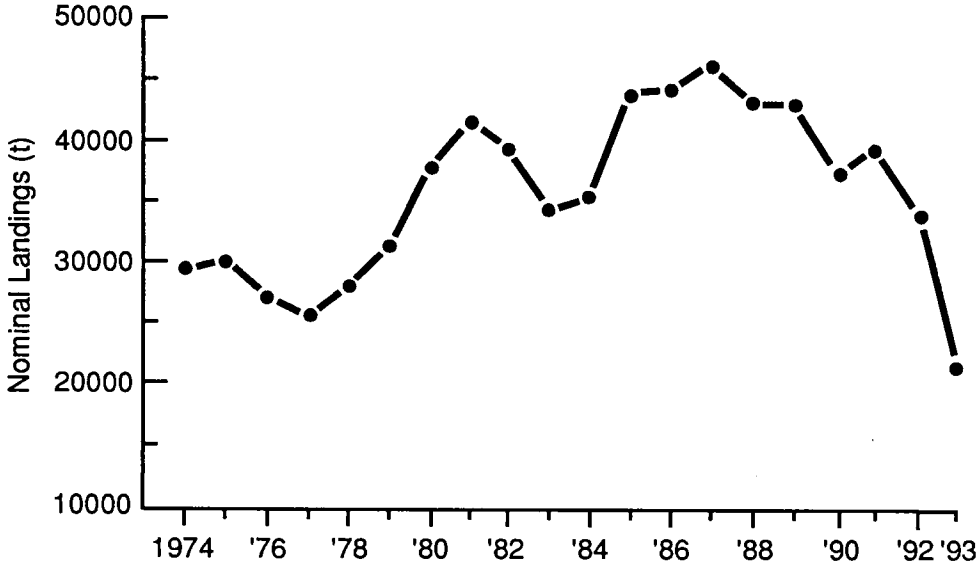
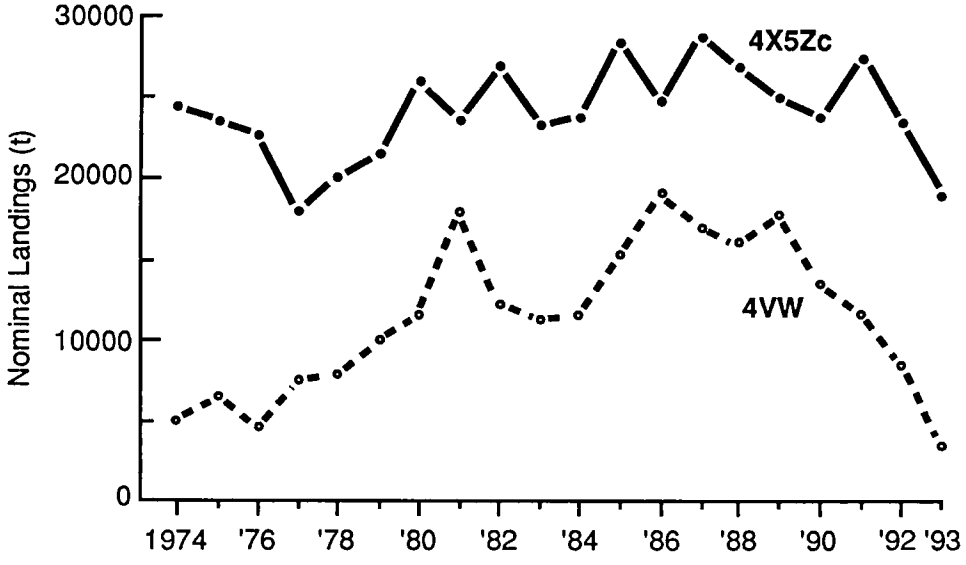


Fig. 2 **Nominal Landings, by Area, for all Countries of Divs. 4VWX and Subdiv. 5Zc Pollock**



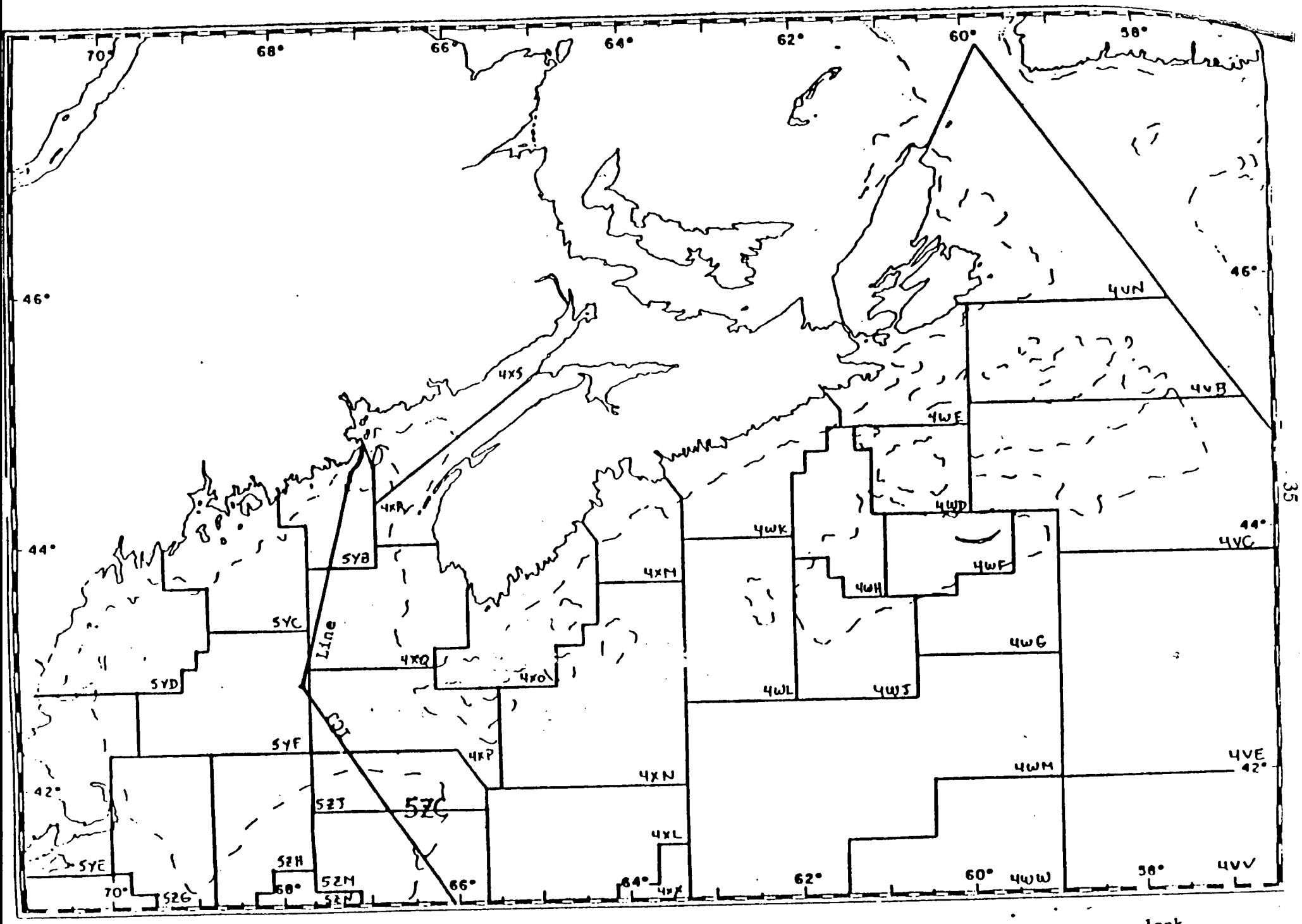


Fig 3. Pollock management unit Division 4VWX and Subdivision 5Zc.

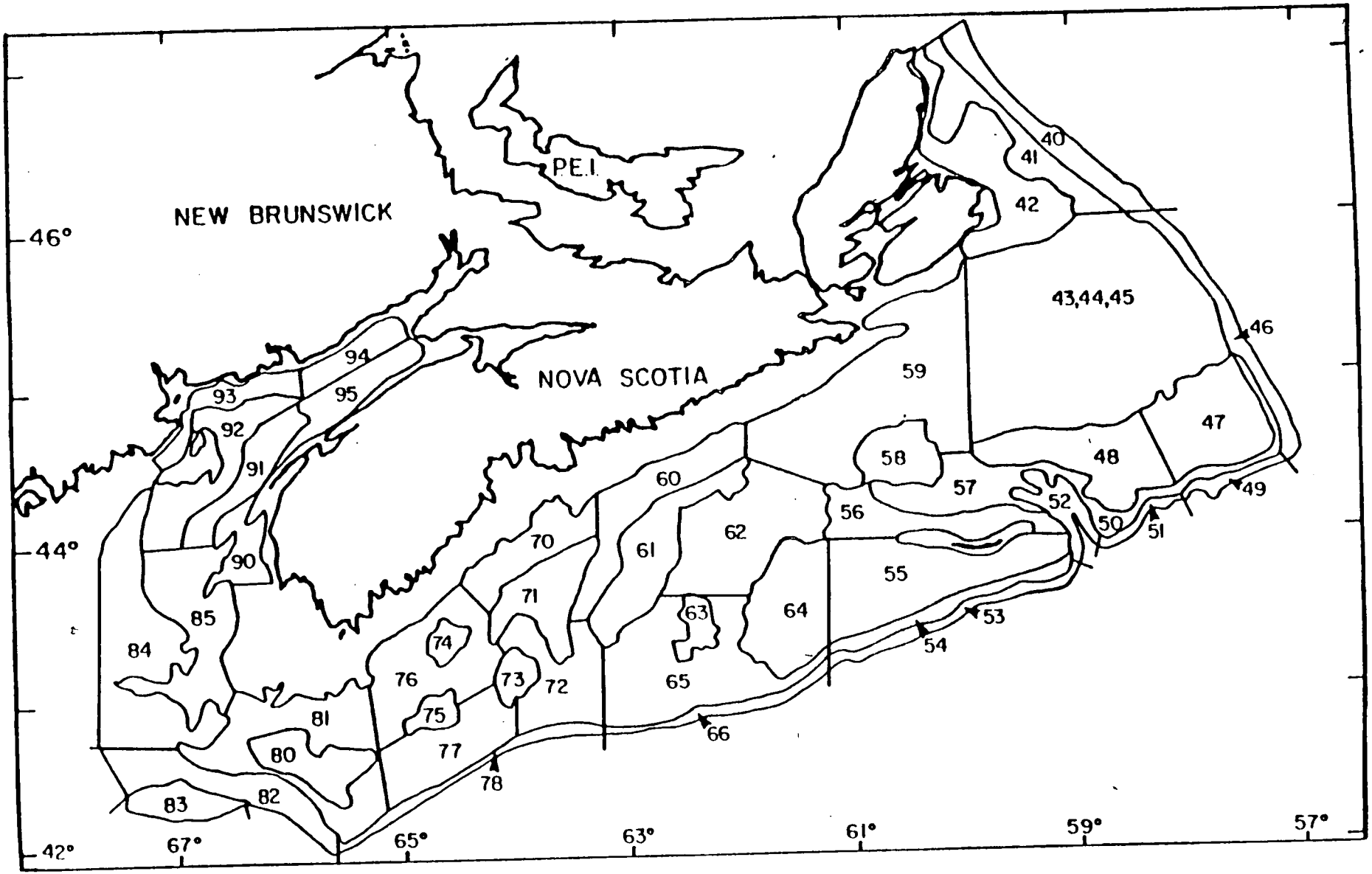


Figure 4 . Stratification used for Canadian RV bottom trawl surveys (divs. 4VWX and Sudiv. 5Zc).

Fig. 5 **July RV Stratified Numbers (age 4-9 and 1-3) for Divs. 4VWX5 Pollock**

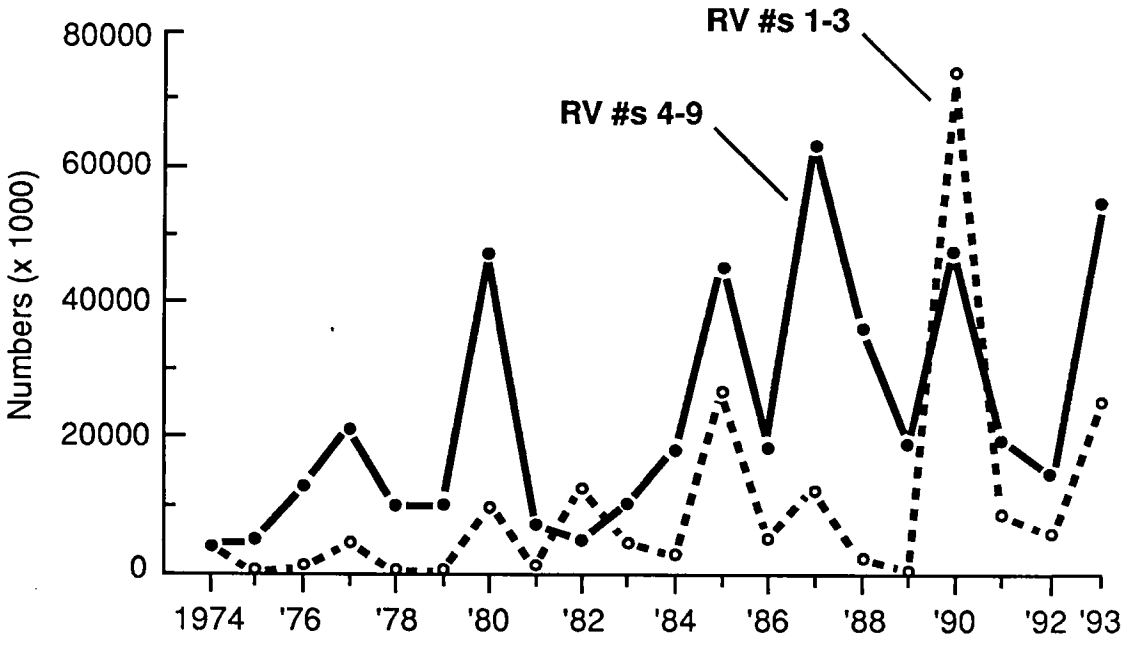
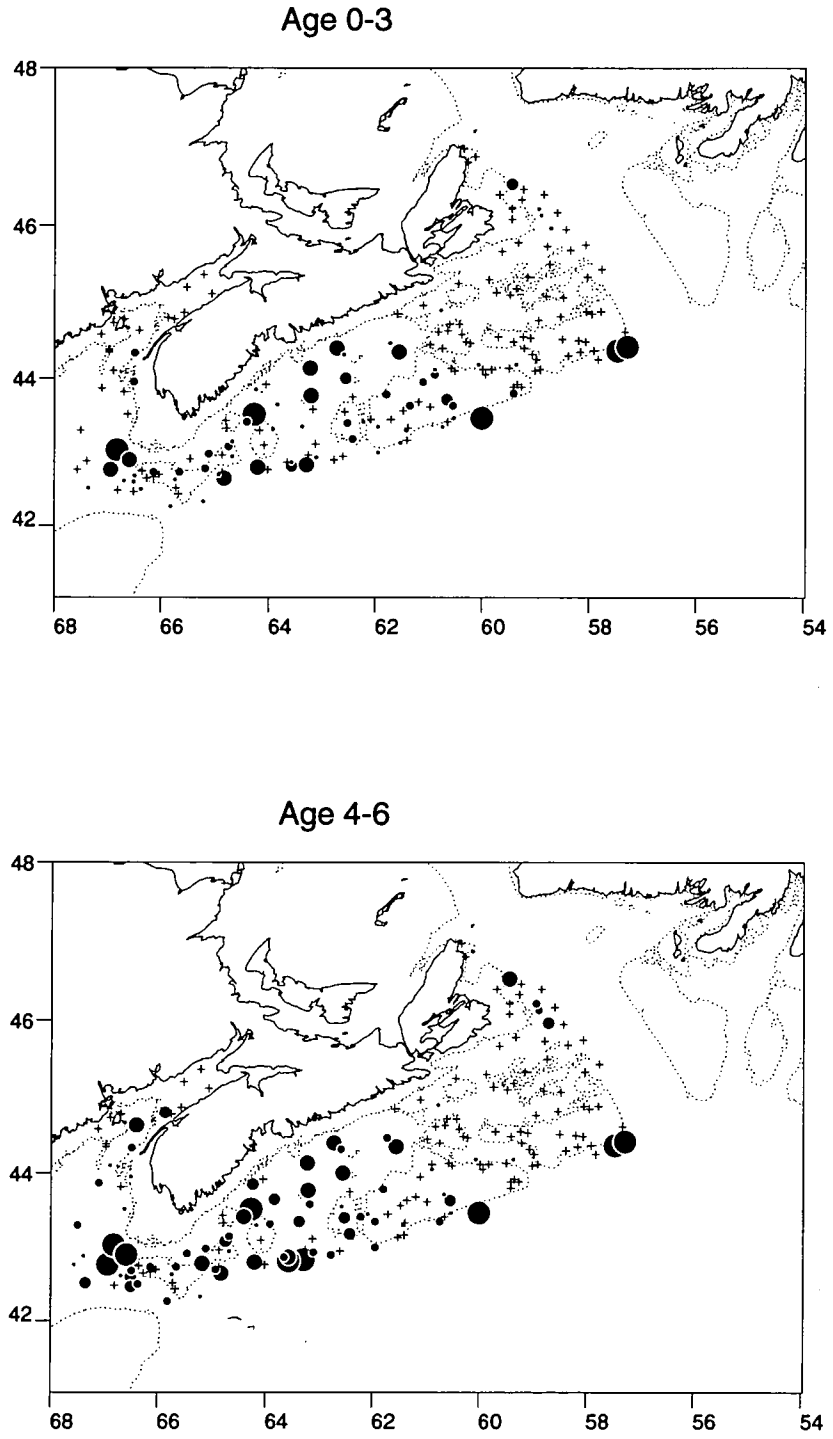


Fig. 6. N189/190 Summer 1993 Pollock Distribution



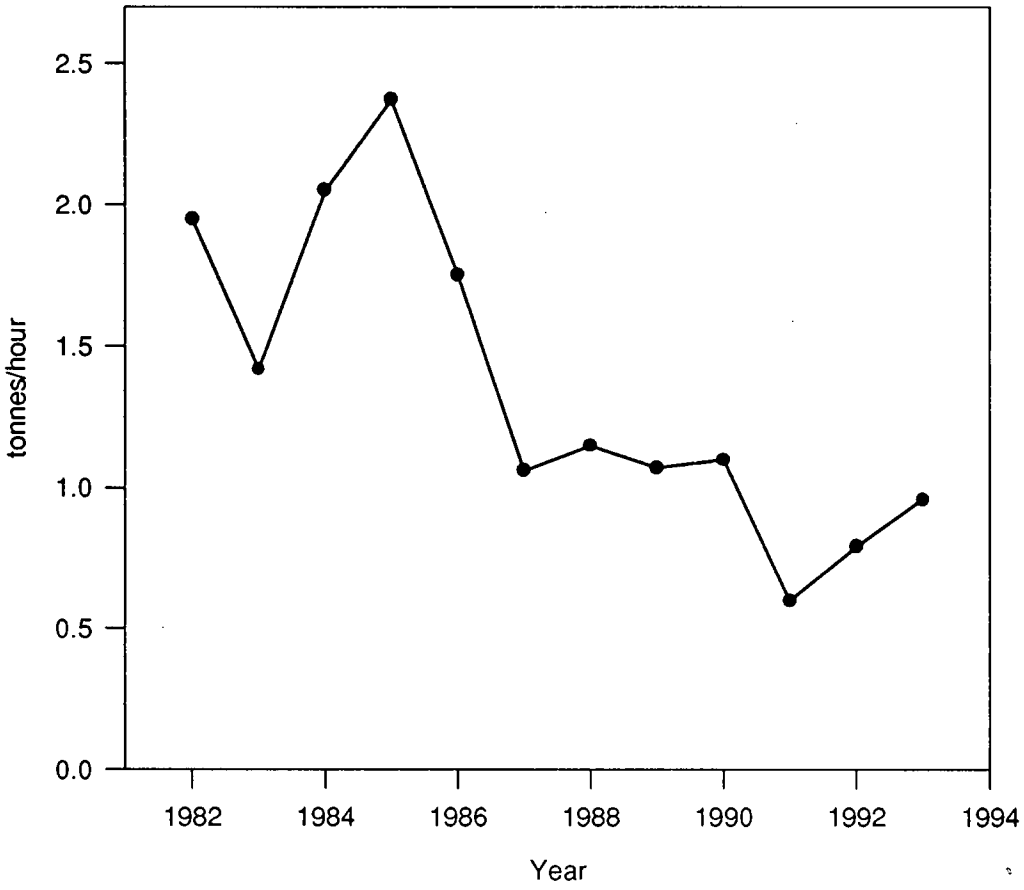


Fig. 7. Pollock T.C. 5 Otter Trawl Catch Rate.

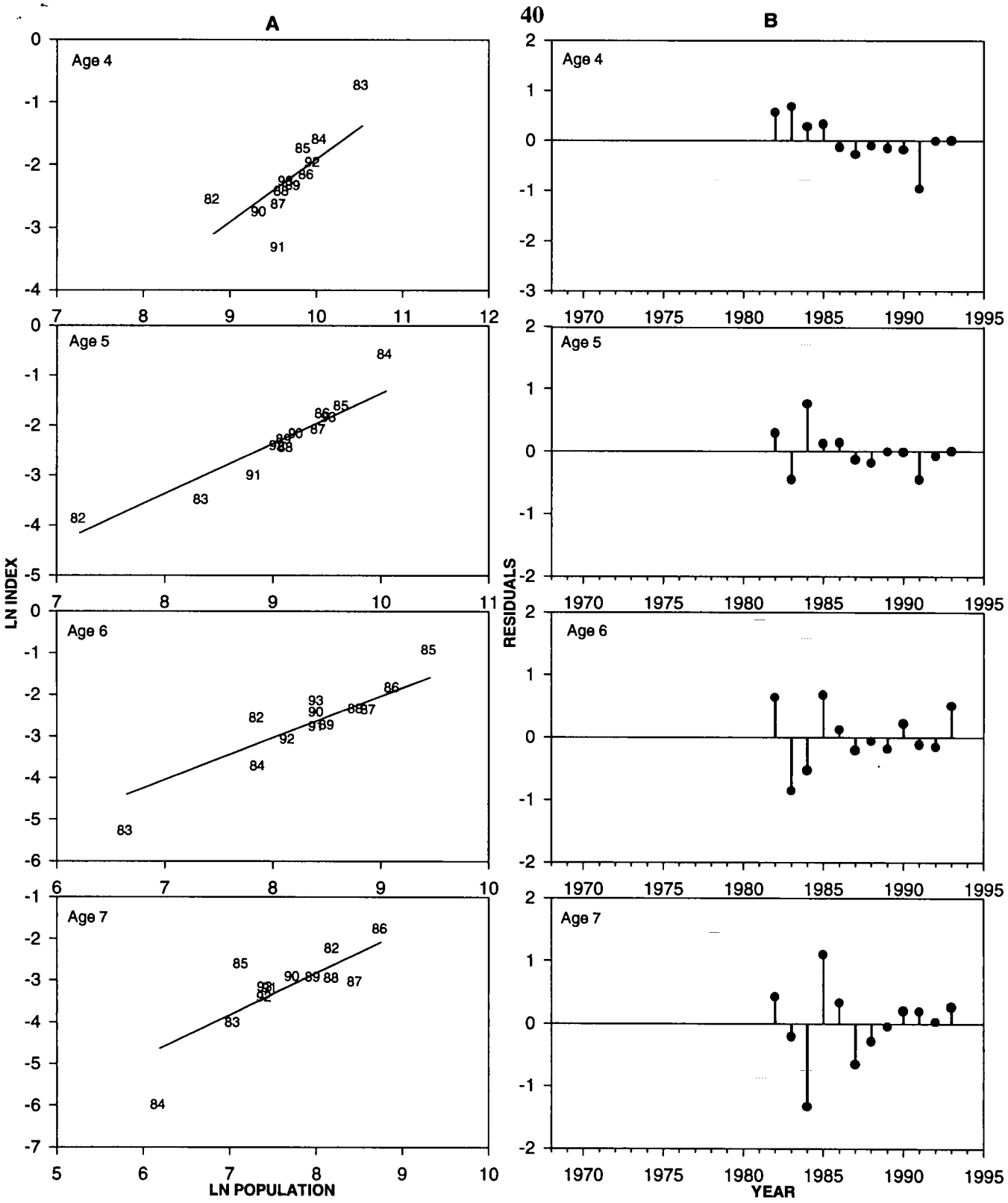


Fig. 8a. Age by age plots of A) the observed and predicted ln abundance index versus ln population numbers and B) residuals plotted against year of the otter trawl (TC 4-6) catch rate for pollock.

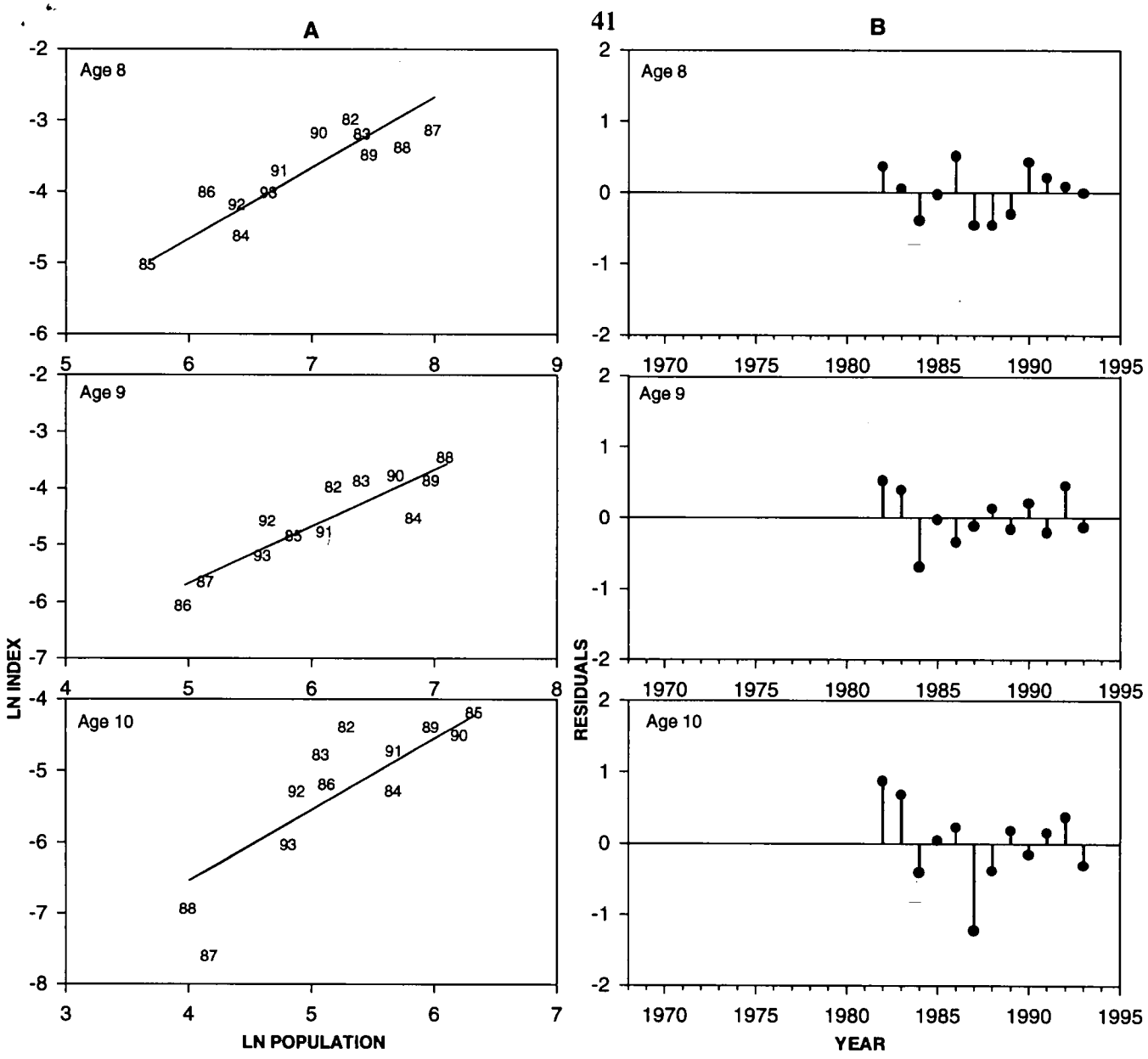


Fig. 8b. Age by age plots of A) the observed and predicted ln abundance index versus ln population numbers and B) residuals plotted against year of the otter trawl (TC 4-6) catch rate for pollock.

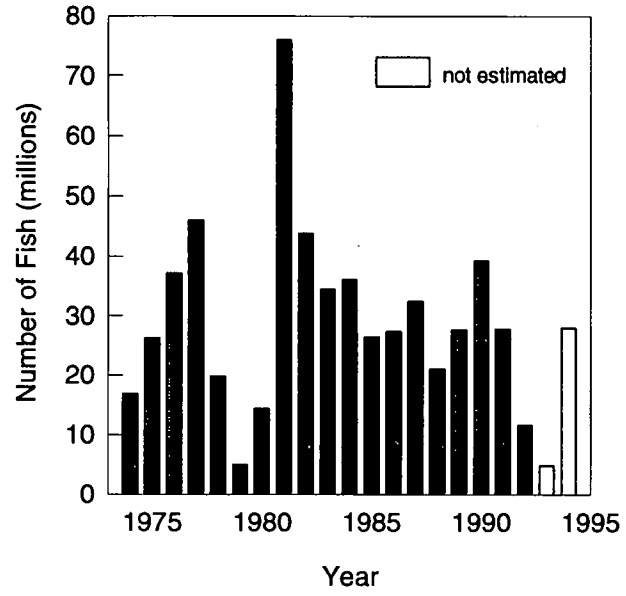


Fig 9. Recruitment (age 2) for pollock.

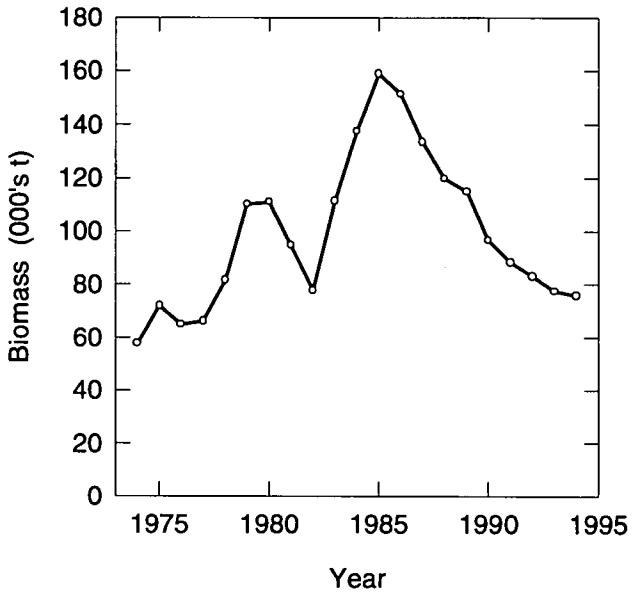


Fig. 10. Beginning of year biomass (4+) for pollock.

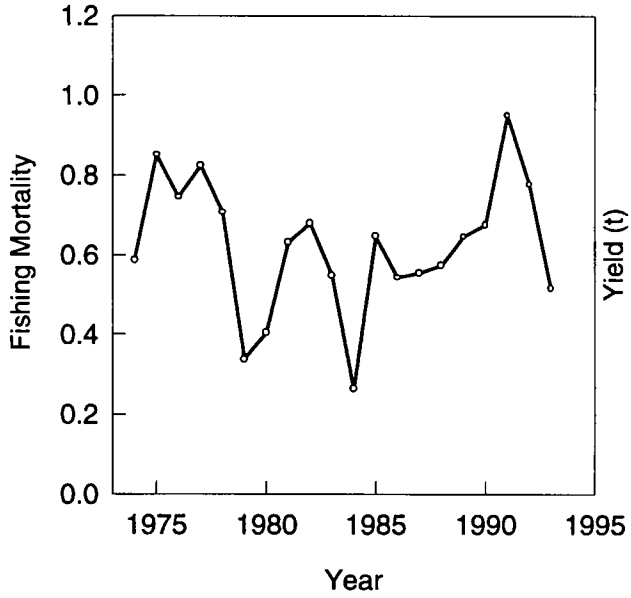


Fig. 11. Fishing mortality (7+) for pollock.

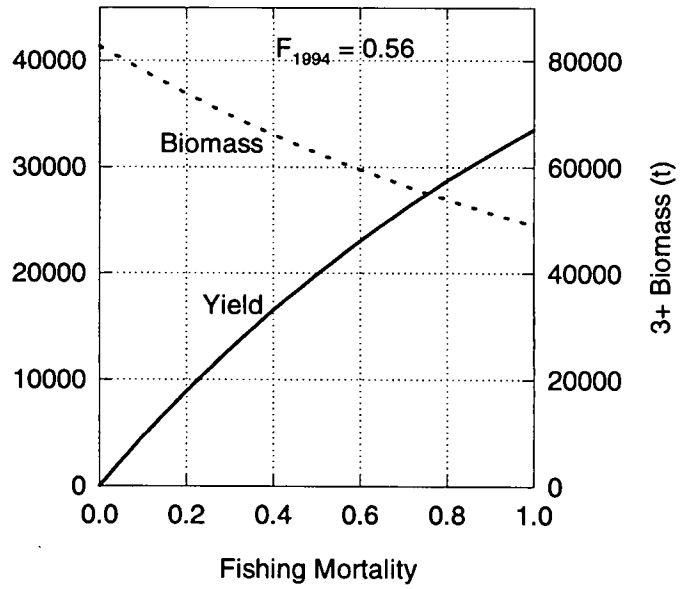


Fig. 12. Projected pollock yield for 1995 and beginning of year biomass in 1996.

Appendix 1

TEST 2nd QUARTER

Stock: Pollock

Initial

Second \ Age	1	2	3	4	5	6	7	8	9	10	11	12	Tot
1													
2													
3			8										8
4				23									23
5				2	28	1							31
6						24							24
7							12	1					13
8								6					6
9									2				2
10										1	1		2
11													
12												5	5
Tot			8	25	28	25	12	7	2	1	1	5	114

First reading relative to second (1st-2nd)

+2*	+1	0	-1	-2*	
	2	109	3		Number
	1.75	95.61	2.63		Percent