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**Assessment of American plaice,
Hippoglossoides platessoides, in NAFO Division 4T**

by

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ABSTRACT

The provisional catch of American plaice in NAFO Division 4T in 1988 is 6,707 t. The proportion of the total catch taken by seines was 38%, representing no change from 1987. Bottom trawls took 35% of the total catch. Ageing discrepancies observed in the 1985 commercial data were corrected. Standardized catch rates from multiplicative analyses in the plaice directed, cod directed and combined fisheries showed stability in the plaice directed component and a decline in catch rates from the 1970s in the other two indices. None of the indices were considered to accurately reflect stock size because of violations in the assumptions of the multiplicative model. RV mean numbers per tow in 1988 were among the lowest in the series. The average age 8-18 total mortality estimates from the RV data were 0.56 for 1971-79 and for 1980-88. Fishing mortality during the 1980s was therefore above $F_{0.1}$. Status quo projections gave yields between 5,577 and 6,939 t. If M is raised to 0.25 the yield is 8,546. Fifteen per cent of the mature biomass gave a yield of 3,844 t. Therefore, a TAC of between 4,000 t and 9,000 t is considered to be closer to the $F_{0.1}$ level for this stock than the current TAC of 10,000 t.

RESUME

Les prises provisoires de plie canadienne dans la division 4T de l'OPANO se sont établies à 6 707 t en 1988, dont 38 % ont été capturées à la senne, ce qui ne représentait pas de changement par rapport à 1987, et 35 % chalut de fond. Les divergences sur la détermination de l'âge observées dans les données de la pêche commerciale de 1985 ont été corrigées. Les taux de prises normalisés provenant des analyses multiplicatives concernant la pêche dirigée de la plie ainsi que les pêches combinée et dirigée de la morue ont révélé une stabilité dans la première et une chute des taux de prises depuis 1970 dans les deux dernières. Aucun des indices, a-t-on estimé, ne reflétait avec précision la grosseur du stock, parce qu'on s'est écarté des hypothèses du modèle multiplicatif. Les chiffres moyens par trait obtenus par les navires de recherche (NR) en 1988 figuraient parmi les plus bas de la série. L'estimation de la mortalité totale à l'âge moyen 8-18, établie d'après les données des NR, était de 0,56 pour 1971-1979 et pour 1980-1988. Cela signifie que durant les années 1980, la mortalité a été supérieure à $F_{0.1}$. Des projections fondées sur le statu quo ont abouti à un rendement se situant entre 5 577 et 6 939 t. Si l'on fait passer M à 0,25, le rendement est de 8 546 t. Une proportion de 15 % de la biomasse de poissons parvenus à maturité donne un rendement de 3 844 t. On considère donc qu'un TPA qui se situerait entre 4 000 t et 9 000 t serait plus proche du niveau $F_{0.1}$ de ce stock que le TPA actuel de 10 000 t.

INTRODUCTION

Since 1965 nominal catches taken from the NAFO Division 4T American plaice stock have varied from a high of 11,780 t in 1966 to a low of 6,094 t in 1983 (Table 1). A TAC of 10000 t has been imposed on the landings of this fishery since 1977. Average annual landings have been over 1,000 t less than this. Landings for the last three years have been below 8,000 t.

Historically, the American plaice fishery was primarily a by-catch fishery of the southern Gulf of St. Lawrence cod fishery. Since 1986 a fishery directed for American plaice has taken roughly half the total catch. The stock is exploited both by mobile gears, such as otter trawler, Danish and Scottish seines, and fixed gears including gillnets, longlines and handlines. The composition of gears has changed from mainly longlines from 1937 to 1946 to a mixed fishery of longlines, otter trawl and Danish seine from 1947 to 1963 (Powles 1969). Since 1965 gillnets have been used also (Table 1). Danish seines have taken an increasing proportion of the total catch from 1965 to 1988 to become the dominant gear type.

A) Nominal Catches and Description of the Fishery in 1988

Nominal catch for 1988 was calculated using the provisional data supplied by the Statistics Branches of the Scotia-Fundy, Newfoundland, Quebec and Gulf regions of the Department of Fisheries and Oceans. The provisional estimate of catch for 1988 was 6,707 t, down over 1000 t's from 1987 and only 67.1% of the TAC. Nominal catches by gear and month are presented in Table 2. Nominal catches of flatfish in the entire Gulf of St. Lawrence are shown in Table 3. The total flatfish landings in the Gulf for 1988 are approximately 1,300 t higher than the 26 year average.

The proportion of the 4T plaice catch taken by Quebec decreased from 44% of the total catch in 1987 to 38% in 1988 (Table 4). The Maritimes took virtually all the remaining catch (62%). The proportion taken by Danish, Scottish and pair seines remained the same from 1987 to 1988 at about 38% of the catch (Table 1). Landings by fixed gear decreased slightly from 1,492

t in 1987 to 1,370 t in 1988.

During 1988, as in 1986 and 1987, there were no closures of the American plaice fishery in 4T (Table 5). The M.G. (65-100'), 45-65') and (<45') fishermen caught substantially less than their allocations. The F.G. fishermen also caught less than their allocation of 1500 t. Closures in the cod fishery to protect young cod (Chouinard and Sinclair 1989) may have impacted the fishing patterns of American plaice fishermen. The impact may have occurred in two ways: 1) when the cod fishery was closed more vessels would be directed towards American plaice; 2) fishermen complained that they were forced to stop fishing groundfish altogether during the cod fishery closures because they quickly exceeded their by-catch of cod when fishing for American plaice. This latter effect was most severe for the P.E.I. fishermen.

Re-ageing

The 1985 commercial fishery samples were re-aged to ensure consistency with the rest of the time series. This completes all re-ageing required to produce a consistent time series for American plaice in Div. 4T. Details of inconsistencies observed in the interpretation of ages were described by Tallman and Sinclair (1988). The new readings were used in the recalculation of catch and average weight at age in 1985. The procedures for calibration and age error checking used by the Gulf, MAFD cod program were applied throughout age reading (Tallman MS 1988 and Chouinard et al. 1988). The results of age reader agreement tests reading are shown in Table 6.

INPUT DATA

A) Commercial Fishery Data

i) Catch and Weight at Age

Sampling of the commercial fishery in 1988 was comparable to previous years. Samples were taken from May to November when 96% of the catch was taken. Over 17,000 fish were measured in 1988 (Table 7), and of these ages were determined for 959 fish.

Semi-annual age-length keys, were prepared for the periods before and after July 31. This split provided the best balance for the temporal aspects of the fishery which began in April and closed by the end of November (Table 2). As well, the partition provided the best balance of catch, ages and lengths sampled within the major gear types (Tables 2, 4, 5). We assumed that age at length was unaffected by gear sampled and combined otoliths within each half of the year to make the semi-annual keys.

The length frequencies by gear and semi-annual period weighted by the corresponding landings were used with the appropriate age-length key to obtain the catch at age by gear and half year period (Table 8). Sampled gears were grouped in the following categories: 1) otter trawls and PTB's; 2) seines, Danish and Scottish; 3) gillnets and longlines. Unsampled catch was incorporated by multiplying the catch at age for sampled gears by the ratio the total catch over sampled landings.

All calculations of age-length keys and catch by gear within semi-annual periods were done for each sex separately. The catch at age for males, females and juveniles were combined to give the overall catch at age for a gear type.

Catch at age and its variance by gear and semi-annual period is presented in Tables 9 and 10.

Weights at age from 1985 to 1988 were determined using a length-weight relationship calculated from RV survey data for each year. The parameter estimates for the power curve ($Y=aX^b$) for 1985 to 1988 are shown in Table 8. The correlation coefficients for the regression(s) were 0.97 (1985), 0.96 (1986), 0.93, 0.95 (1987) and 0.92, 0.96 (1988). The lengths and weights at age for 1988 by sex are shown in Tables 11 and 12.

A decline in the average length at age from the first half of 1988 to the second was observed in some age groups of the female plaice caught by otter trawl (Table 12). Tallman (1989) suggested that this effect was a result of the movement of the trawler fleet from the south-eastern part of the southern Gulf to the north-western part during the course of the fishing season. American plaice in the north-west grow more slowly than those of the south-east. Hence, the fleet may sample smaller fish at age during the latter half of the year. An alternative hypothesis (Tallman 1989) is that the larger females may migrate into a winter refugium in the Laurentian Channel somewhat sooner than the smaller males. Clay (1989) and Powles (1969) showed that the Channel is utilized by American plaice during the colder months.

The combined catch at age for 1985 to 1988 is shown in Table 13. In 1988 fewer fish over age 13 were caught relative to 1987.

ii) Commercial Catch Rates

Tallman and Sinclair (1988) used catch rates to judge relative changes in the American plaice stock. However, we deem the catch rate series to be unreliable as an indicator of stock

size because the fleets participating in both the plaice directed and cod directed fisheries are thought to change as a function of stock size. Catch rates are calculated here for illustrative purposes. Separate catch rates were calculated for the plaice directed (1977-1988) and cod directed (1966-1988) fisheries as well as the two groups combined (1966-1988). Gears used were restricted to otter trawls and Danish seiners. The two gears account for over 90% of the nominal catch in the fishery and well over 95% of the available catch rate data. The 1984-85 data were revised according to 1984 NAFO statistics and 1985 regional data respectively. Observations with less than 10 units of effort were removed. Months with less than 10 observations through the series were deleted in the combined run. A multiplicative model was used to calculate a standardized catch rate index for each gear (Gavaris 1980).

Observations were allocated to categories of gear/tonnage class/NAFO country code, month and year in the plaice directed and cod directed runs. Observations in the combined run were allocated to categories of gear/tonnage class/NAFO country code, plaice or cod directed fishery, month, and year. In all runs country codes 27 and 28 (Maritimes and Quebec, respectively) were combined into code 2 (the former Maritimes-Quebec code).

The analysis of variance tables from the three runs are shown in Tables 14, 16, and 18. For the plaice directed the model accounted for 40% of the variation and each category was significant. The model accounted for 62% and 70% of the variation in the cod directed and combined runs and in each case all categories were significant. The regression coefficients also are shown in Tables 14, 16, 18. Plots of the residuals of each run are shown in Figures 1, 2 and 3. In each case the residuals appear to be randomly distributed.

Catch rate in all models declined from 1987 to 1988 and are well below historical catch rates of the late 1970s and 1960s (Tables 15, 17, 19 and Figures 4 and 5).

The residual distribution did not indicate heteroscedasticity, consequently weighting was not used.

The cod by-catch and combined indices were rejected as useful indices of abundance on the grounds that sampling for plaice would not cover the same time periods or locations from year to year due to closures in the cod fishery in recent years. Also, these indices might involve different components of the fleet in different years. Similarly, the plaice directed index was not used in assessment because the vessels participating change depending on the cod fishery and the relative success rate in the plaice fishery.

B) Research Survey Data

In 1986, the research vessel E.E. Prince was replaced by the Lady Hammond to conduct the fall groundfish survey in the southern Gulf of St. Lawrence. A comparative fishing experiment between the two vessels had been conducted in the 1985 survey to determine conversion factors. CAFSAC recommended that the catch per tow of American plaice from the E.E. Prince be multiplied by a factor of 1.8 to be made comparable to the new survey estimates from the Lady Hammond. The numbers at age for 1971 through to 1985 were adjusted by the conversion factor.

In addition to the change of survey vessels, a change was made to the survey design. In 1984 the random Stratified Station design was replaced by a fixed survey with non-random initial allocation of stations. From this point onward the index was calculated from a consistent set of 61 fixed stations.

The Lady Hammond fished 24 hours a day but only the data from the day stations were used for the 1986 to 1988 population estimates. A constant trawlable unit size was used for both vessels.

From 1984 to 1986 length frequency sampling was conducted on sexes combined. Sexed length frequencies were resumed in 1987.

Sum of the mean numbers per tow at age from 1971-1988 are shown in Figure 7. Mean numbers per tow at age are presented in Table 20. The pattern of the mean numbers per tow reflects the high abundance at the end of the 1970s. The numbers per tow for 1986, 1987 and 1988 are the lowest in the series.

The mean numbers per tow by strata showed that American plaice occur in abundance in particular strata. The most notable are strata 19, 22, 23, 29, 33, 34. The pattern of distribution is relatively constant.

ESTIMATION OF PARAMETERS

A) Mortality from the Survey

Total mortality at age was calculated for the period as the \ln ratio of the population estimates for consecutive ages of a cohort (Table 21). While these were variable from year to year

there were generally higher total mortalities in the 1980s than in the 1970s as indicated by averages in Table 22. Also the total mortalities at age increased to about age 8 but were relatively constant to age 18. Estimates of older age abundance were not available at this time. The average age 8-18 values of F were 0.36 for 1971-79 and 0.56 for 1980-88. $F_{0.1}$ for this stock is estimated to be 0.2 with M assumed to be 0.2. Thus, fishing mortalities have been above the target in recent years.

RV mean number per tow for plus groups are shown in Table 25. Total mortalities using plus groups were calculated to smooth the total mortalities (Table 26).

B) Fishable Biomass

Total biomass was estimated from the RV survey from 1984 to 1988 by combining the biomass of the males, females, and juvenile plaice. This period was chosen because there was relative stability in the mean number per tow. Biomass for each sex was estimated by multiplying the weighted average weight at age times the weighted numbers at age.

The biomass of age 10 plus fish for the years 1984 to 1988 was estimated by combining the age 10+ biomass estimates of the males, females and juveniles (Table 27).

Estimation of Total Allowable Catch

The catch at age series has only been validated over the last four years and thus cannot be used for an analytical assessment. However, the RV survey has relatively low coefficients of variation (Table 23). Mortality estimates from the survey could be used to calculate biomass and thence a TAC.

The approach using age dis-aggregated total mortality estimates was as follows: The estimated average fishing mortality from age 8 to 18 is approximately 0.29. The abundance indices from both the RV survey and the commercial catch rates indicate relative stability in the population in the 1980s. The average catch over the same period has been 7,733 t. using the catch equations the biomass (B) may be estimated as:

$$B = \frac{C Z}{F (1 - e^{-Z})}$$

$$= 33,832 \text{ t}$$

where,

C = average catch (7,733 t)
 Z = current total mortality (0.49)
 F = current fishing mortality (0.29)

Therefore one could estimate the $F_{0.1}$ catch as

$$C = \frac{F_{0.1} B (1 - e^{-Z_{0.1}})}{Z_{0.1}}$$
$$= 5,577 \text{ t}$$

$$F_{0.1} = 0.2$$

$$Z_{0.1} = 0.4$$

This estimate is made with the assumption that biomass has been relatively stable in the recent past, the age structure is stable, recruitment has been stable and there is no changes in the partial recruitment.

Another estimate using the same method but with age aggregated plus groups gave a yield of 6,939 t (average total Z from ages 12 and 13 = 0.44, average total F = 0.24). Table 28 shows that the estimate is sensitive to changes in M (from a yield of 5,145 t at M = 0.1 to 8,546 t at M = 0.25).

An alternative method which approximates fishing at $F_{0.1}$ is to multiply the fishable biomass by 0.15 (D. Rivard, DFO, Ottawa, pers. comm.). Using this method with the age 10+ biomass from 1987 and 1988 the projected yield is 3,844 t.

PROGNOSIS

Catch rates are lower in recent years than during the late 1970s and the survey mean number per tow in 1988 is the lowest recorded. Estimates of F indicate levels in excess of $F_{0.1}$. The status quo projection suggests that fishing at $F_{0.1}$ would require a reduction in the TAC to between 5,000 and 8,500 t. Fifteen per cent of the fishable biomass suggests an even lower TAC of approximately 4,000 t. Given the concordance of all the indices a more appropriate TAC for this stock at this time is between 4,000 and 9,000 t. However, discarding continues to be a serious problem with this stock. A TAC that is restrictive to the fishery, such as 4,000 t, may result in more fish being discarded and no conservation gains from the reduction in landings.

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Table 1. Nominal catches (t) of 4T American plaice from 1965-1988 by major gear types.

YEAR	OTB	OTB-1	OTB-2	SNU	GN	LL	LHP	OTHERS	TOTAL
1965	7782	-	-	1854	388	212	-	149	10385
1966	-	8066	581	2322	375	2	-	434	11780
1967	-	7237	211	1151	326	117	50	259	9351
1968	-	7900	237	913	298	4	36	180	9568
1969	-	5609	425	1418	421	58	17	244	8192
1970	29	5793	477	2243	439	79	7	134	9201
1971	-	4996	409	2885	876	21	9	317	9513
1972	14	4275	860	2576	286	73	11	199	8294
1973	20	3087	471	2748	241	73	1	406	7047
1974	0	3556	585	3719	250	6	5	364	8485
1975	1	3207	795	3897	217	14	18	294	8443
1976	41	4097	2864	3395	225	2	6	562	11192
1977	35	4261	375	4015	242	16	17	359	9320
1978	58	3651	889	3495	379	42	38	479	9031
1979	83	3415	961	3719	721	9	17	1161	10086
1980	1485	1809	558	3500	717	55	5	163	8292
1981	1022	1311	290	3575	1084	98	2	452	7834
1982	742	580	137	4124	805	94	5	55	6542
1983	821	479	102	4095	494	76	10	17	6094
1984	235	601	2582	3702	1905	386	25	191	9627
1985	165	824	3027	3870	1007	404	29	164	9490
1986*	0	704	1925	3462	609	317	45	151	7213
1987*	0	986	2057	3078	800	619	73	181	7794
1988*	-	490	2017	2741	853	491	26	89	6707
AVERAGE	696	3345	951	3021	582	136	21	292	8728

* (PROVISIONAL DATA)

(Gear Types: OTB = Otter Trawl, OTB1 = Otter Trawl-Side, OTB2 = Otter Trawl-Stern, SNU = Seines, GN = Gillnet, LL = Longline, LHP = Hand Line)

Table 2. preliminary landings (t) for 1988 by gear and month.

GEAR	MONTH												TOTAL
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
OTB1	0.1	0	-	57.8	85.7	8.1	15.3	71.1	91	97.6	62.6	0.5	490.0
OTB2	0	0	0	48.3	189.5	171.9	229.1	536.7	339.6	364.4	128.4	8.3	2017.0
OTM2	0	0	0	-	2.7	-	-	-	-	-	-	-	2.7
PTB	-	-	-	1.1	15.7	11.7	9.7	11.2	5.7	2.1	0.6	-	57.9
TXS	-	-	0	11.1	1.1	1.5	0.5	0.9	0.5	0.1	0	-	15.7
SDN	0	-	-	153.8	296.8	261.8	311.7	228.5	164.3	299.9	133.7	1.7	1852.2
SSC	-	-	-	13.6	111.1	134.9	142.9	99.9	72.1	72	60.3	-	706.8
PS	-	-	-	-	-	0	0	0	-	0	0	-	0
SPR	-	-	-	1.2	14.5	33.6	83.5	36.7	5.9	4.3	2	-	181.7
GNS	-	-	0	15.5	192.3	230.7	154.1	119.7	76.9	60.9	2.8	-	852.9
GND	-	-	-	-	0	0	0	0	0	0	-	-	0
LLS	-	-	-	0.3	46.5	141.5	136.7	103.9	40.1	15.9	5.6	0.7	491.1
LHP	-	-	-	0.2	0.1	0.3	0.2	0.2	0.1	0	-	-	1.1
LH	-	-	-	-	0.7	4.6	6.8	7.1	3.2	1.5	1.4	-	25.3
FPN	-	0.5	0.5	-	0	0	0	1.8	3.5	6.4	0.4	0	13.0
FPO	-	-	-	-	0	0	0	0	-	-	-	-	0
FWR	-	-	-	-	0	0	-	-	0	-	-	-	0
RT	-	-	-	-	-	-	-	-	-	0	-	-	0
TOT	0.1	0.5	0.5	302.9	956.8	1000.6	1090.5	1217.5	803.0	926.1	397.8	11.2	6707.4

* Values of 0 indicate landings of less than 50 Kg.

- Indicate no landings

(Gear types: OTB1= otter trawl-side, OTB2= otter trawl-stern, OTM2= midwater trawl-stern, PTB= bottom pair trawl, TXS= shrimp trawl, SDN= danish seine, SSC= scottish seine, PS= pair seine, SPR= pair seine(2 boats), GNS= gillnet set, GND= drift gillnet, LLS= set lines, LHP= handlines, LH= handlines with bait, FPN= uncovered pound nets, FPO= covered pots, FWR= weirs, 66= , RT= rakes and tongs.)

Table 3. Commercial flatfish nominal catches (t) in NAFO Division 4RST from 1963 to 1988

YEAR	YELLOW TAIL	ATLANTIC HALIBUT	GREEN. HALIBUT	WITCH FLOUNDER	WINTER AMER. PLAICE	UNSPEC. FLOUNDER	TOTAL FLATFISH
1963	107	537	-	4250	3165	8470	16529
1964	65	615	-	3350	3014	8803	15856
1965	53	693	24	3608	4419	11098	19900
1966	157	612	365	3712	3136	12720	20702
1967	79	460	365	2714	2454	10497	16593
1968	12	444	689	3390	551	11932	17018
1969	268	510	802	4763	1710	10978	19031
1970	59	509	1112	4805	2694	13234	22413
1971	40	454	954	3821	2842	11770	19881
1972	3	310	683	2001	1911	9724	16005
1973	6	385	763	2224	2384	8149	16337
1974	27	418	1011	3247	1976	11261	18939
1975	3	272	1544	2722	2050	10177	20719
1976	37	196	2019	6875	2471	14265	27648
1977	30	150	3961	3036	1358	12755	23285
1978	13	135	6247	4510	1236	12375	25712
1979	69	132	8791	4561	1722	12933	29102
1980	46	202	7006	3527	2053	11115	25112
1981	14	95	3176	1912	2013	10210	17952
1982	6	91	2269	1282	2339	8092	14558
1983	50	174	1105	1177	1799	8382	13479
1984	82	176	2126	1107	178	11790	15524
1985	212	164	2364	1824	1883	11366	17815
1986*	409	437	6533	1139	3144	8897	20559
1987*	410	234	11047	2568	2263	9599	26121
1988*	222	255	7551	2657	1851	8706	21242
AVERAGE	95	333	2907	3107	2178	10742	19924

(* PROVISIONAL DATA)

Table 4. The 1988 provisional Gulf flatfish nominal catches (t) by NAFO division and provinces (see Figure 9).

	COUNTRY CODE	YELLOW TAIL	ATLANTIC HALIBUT	GREENLAND HALIBUT	WITCH	WINTER FLOUNDER	AMERICAN PLAICE
4R	CAN-M	0.1	0.7	56.1	35.5	1.4	40.5
	CAN-Q	0.0	15.7	8.3	0.0	1.1	2.9
	CAN-N	17.0	57.9	301.5	1035.3	391.2	966.2
TOTAL 4R		17.1	74.3	365.9	1078.8	393.7	1009.6
4S	CAN-M	0.1	4.5	120.5	32.9	0.0	66.3
	CAN-Q	1.0	91.8	2240.8	34.7	41.5	918.9
	CAN-N	0.0	0.0	4.0	2.0	0.0	3.5
TOTAL 4S		1.1	93.3	2365.3	69.6	41.5	988.7
4T	CAN-M	69.3	14.5	44.4	1195.9	1198.4	4137.6
	CAN-Q	134.7	69.4	4775.8	312.1	217.3	2550.9
	CAN-N	0.0	0.0	0.0	0.1	0.0	18.9
TOTAL 4T		204.0	83.9	4820.2	1508.1	1415.7	6707.4

(CAN-M = CANADA-MARITIMES, CAN-Q = CANADA-QUEBEC, CAN-N = CANADA-NEWFOUNDLAND)

Table 5. Resource allocation scheme for American plaice in Division 4T 1987-1989.

Year	Gear	Final Allocation (tonnes)	Catch (tonnes)	Closure
1987	M.G. (65-100')	500	602	none
	M.G. (less than 65')	8000	5908	none
	F.G. (less than 65')	1500	1498	none
1988	M.G. (65-100')	500	336	none
	M.G. (45-65')	3800	2305	none
	M.G. (less than 45')	4200	2636	none
	F.G. (less than 45')	1500	1234	none
1989	M.G. (65-100')	500		
	M.G. (45-65')	3800		
	M.G. (less than 45')	4200		
	F.G. (less than 45')	1500		

Table 6. Commercial otoliths. (+ or - indicates bias)

Date (1988)	Comparison (% agreement)	Comments
	Reader vs reference	
Nov 28	78	
Jan 20	89	
Jan 25*	80(-)	stopped ageing
Jan 25	88	resumed ageing
Feb 18	86	
Feb 24	74	
Mar 1	74	
Mar 8*	72	
Mar 8*	76(-)	
Mar 8	80	

* retest

Table 7. NUMBERS MEASURED AND AGED FOR 4T AMERICAN PLAICE IN 1988.

GEARS		MONTH							TOTAL	
		APR	MAY	JUN	JUL	AUG	SEP	OCT		NOV
GILLNETS	LENGTHS	-	-	867	308	-	-	-	-	1175
	AGED	-	-	52	0	-	-	-	-	52
LONGLINE	LENGTHS	-	-	-	425	290	-	12	-	727
	AGED	-	-	-	15	17	-	8	-	40
SEINE	LENGTHS	273	1476	2000	1157	2187	1704	2369	505	11671
	AGED	44	73	154	24	106	136	149	61	747
TRAWLS	LENGTHS	-	516	860	1144	468	538	249	263	4038
	AGED	-	0	54	20	46	0	0	0	120
SAMPLES		1	10	16	15	13	10	12	4	81

Table 8. Age-length tables used in the calculation for 1985 to 1988 catch at age.

YEAR	TABLE TYPE	GEARS	PERIOD	LENGTH AGED	SAMPLE SIZE	CATCH	COMBINED		SEPARATED			
							a	b	MALE	A	FEMALE	B
1985	TABLE	ALL GEARS	JAN-JUL	LENGTH AGED	4111 938	4423	.003017	3.3094	-	-	-	-
	TABLE	ALL GEARS	AUG-DEC	LENGTH AGED	3378 612	5067	.003017	3.3094	-	-	-	-
	LF	(10,11,12,16)	JAN-JUL	LENGTH	1306	1891	.003017	3.3094	-	-	-	-
	LF	(21,22,23)	JAN-JUL	LENGTH	2263	1784	.003017	3.3094	-	-	-	-
	LF	(41,42,51)	JAN-JUL	LENGTH	542	694	.003017	3.3094	-	-	-	-
	LF	(10,11,12,16)	AUG-DEC	LENGTH	549	2208	.003017	3.3094	-	-	-	-
	LF	(21,22,23)	AUG-DEC	LENGTH	2646	2086	.003017	3.3094	-	-	-	-
1986	TABLE	ALL GEARS	JAN-JUL	LENGTH AGED	11479 803	3961	.004863	3.1810	-	-	-	-
	TABLE	ALL GEARS	AUG-DEC	LENGTH AGED	8274 489	3252	.004863	3.1810	-	-	-	-
	LF	(11,12,16)	JAN-JUL	LENGTH	2429	1524	.004863	3.1810	-	-	-	-
	LF	(20)	JAN-JUL	LENGTH	7302	1921	.004863	3.1810	-	-	-	-
	LF	(50)	JAN-JUL	LENGTH	1195	513	.004863	3.1810	-	-	-	-
	LF	(11,12,16)	AUG-DEC	LENGTH	3784	1178	.004863	3.1810	-	-	-	-
	LF	(20)	AUG-DEC	LENGTH	3901	1542	.004863	3.1810	-	-	-	-
1987	TABLE	ALL GEARS	JAN-JUL	LENGTH AGED	8680 923	4119	-	-	.0006390	.0021	3.7540	3.4010
	TABLE	ALL GEARS	AUG-DEC	LENGTH AGED	10616 1445	3675	-	-	.0006390	.0021	3.7540	3.4010
	LF	(11,12,16)	JAN-JUL	LENGTH	1632	1706	-	-	.0006390	.0021	3.7540	3.4010
	LF	(20)	JAN-JUL	LENGTH	5628	1538	-	-	.0006390	.0021	3.7540	3.4010
	LF	(40&50)	JAN-JUL	LENGTH	1420	851	-	-	.0006390	.0021	3.7540	3.4010
	LF	(11,12,16)	AUG-DEC	LENGTH	2746	1473	-	-	.0006390	.0021	3.7540	3.4010
	LF	(20)	AUG-DEC	LENGTH	5692	1540	-	-	.0006390	.0021	3.7540	3.4010
1988	TABLE	ALL GEARS	JAN-JUL	LENGTH AGED	9026 436	3352	-	-	.0010	.0013	3.5270	3.628
	TABLE	ALL GEARS	AUG-SEP	LENGTH AGED	8585 523	3355	-	-	.0010	.0013	3.5270	3.628
	LF	(11,12,15,16)	JAN-JUL	LENGTH	2520	847	-	-	.0010	.0013	3.5270	3.628
	LF	(21,22,23,31,33)	JAN-JUL	LENGTH	4906	1559	-	-	.0010	.0013	3.5270	3.628
	LF	(41,42,51)	JAN-JUL	LENGTH	1600	918	-	-	.0010	.0013	3.5270	3.628
	LF	(11,12,15,16)	AUG-DEC	LENGTH	1518	1721	-	-	.0010	.0013	3.5270	3.628
	LF	(21,22,23,31,33)	AUG-SEP	LENGTH	6765	1181	-	-	.0010	.0013	3.5270	3.628
	LF	(41,42,51)	AUG-SEP	LENGTH	302	27	-	-	.0010	.0013	3.5270	3.628

* gear codes: 11 = OTB-1, 12 = OTB-2, 16 = PTB, 20 = SNU,
40 = GN, 50 = LL and HL.

** TABLE TYPE: TABLE = A FULL AGE-LENGTH KEY
LF = LENGTH FREQUENCY USED WITH ALL GEARS AGE-LENGTH KEY

TABLE 9. CATCH AT AGE BY GEAR AND SEASON FOR 1988.

AGE	JANUARY-JULY			AUGUST-DECEMBER			TOTAL	BUMP	CATCH
	OTB	SNU	GN,LL	OTB	SNU	GN,LL			
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
4	22.25	0.59	0.00	0.00	0.00	0.00	22.84	1.0176	23.241
5	49.49	8.03	1.10	0.00	0.00	0.00	58.62	1.0176	59.649
6	24.75	56.15	42.65	71.44	31.00	2.40	228.39	1.0176	232.399
7	58.55	97.37	84.45	32.89	14.64	0.90	288.80	1.0176	293.869
8	56.99	111.56	108.06	130.60	66.09	2.19	475.49	1.0176	483.836
9	56.09	160.57	195.61	227.41	109.48	5.70	754.86	1.0176	768.109
10	51.02	150.38	204.63	211.15	101.93	7.49	726.60	1.0176	739.353
11	50.44	138.52	188.73	275.14	125.37	30.06	808.26	1.0176	822.447
12	63.03	174.03	207.42	337.08	140.67	40.62	962.85	1.0176	979.750
13	43.48	116.04	160.05	292.36	122.25	52.18	786.36	1.0176	800.162
14	82.35	205.64	243.77	264.24	106.25	49.15	951.40	1.0176	968.099
15	41.19	98.00	88.86	323.85	164.34	97.63	813.87	1.0176	828.155
16	111.12	225.69	120.81	228.43	115.92	73.00	774.97	1.0176	788.572
17	60.20	97.10	56.57	97.82	74.04	39.62	425.35	1.0176	432.816
18	74.55	143.01	47.72	45.30	35.64	15.83	362.05	1.0176	368.405
19	19.84	41.40	19.95	62.32	62.22	23.23	228.96	1.0176	232.979
20	45.62	73.33	8.31	22.23	41.52	10.47	201.48	1.0176	205.016
21	20.99	28.12	1.11	11.05	13.37	5.08	79.72	1.0176	81.119
22	4.59	6.37	0.46	20.65	33.83	5.88	71.78	1.0176	73.040
23	14.28	21.62	5.94	1.16	3.19	0.22	46.41	1.0176	47.225
24	19.73	23.66	2.02	0.58	3.25	0.25	49.49	1.0176	50.359
25	7.14	6.22	0.32	2.76	5.88	0.92	23.24	1.0176	23.648
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0176	0.000
30	0.00	0.00	0.00	0.36	5.66	0.00	6.02	1.0176	6.126

TABLE 10. VARIANCE AT AGE BY GEAR AND SEASON FOR 1988.

AGE	JANUARY-JULY			AUGUST-DECEMBER			TOTAL
	OTB	SNU	GN,LL	OTB	SNU	GN,LL	
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	1	0	0	0	0	0	1
5	7	24	31	0	0	0	62
6	77	311	289	513	127	18	1335
7	161	657	569	233	59	8	1687
8	123	501	515	830	208	31	2208
9	244	986	843	1592	394	60	4119
10	223	901	740	1300	332	47	3543
11	223	899	730	1465	369	53	3739
12	247	1005	864	1861	468	63	4508
13	184	740	558	1806	445	61	3794
14	298	1200	941	1442	258	50	4289
15	131	527	385	1934	171	77	3525
16	292	1167	862	1309	316	49	3995
17	131	527	382	787	188	29	2044
18	195	777	894	102	97	14	2079
19	56	224	161	627	147	25	1240
20	95	378	278	409	96	16	1272
21	36	141	105	142	34	5	463
22	5	21	16	281	65	12	400
23	29	117	85	28	7	1	267
24	44	179	128	28	7	1	387
25	10	38	28	52	12	2	142
26	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0
30	0	0	0	15	11	2	28

TABLE 11. MEAN WEIGHT AT AGE BY GEAR AND SEASON FOR 1988.

SEX-MALE						
AGE	JANUARY-JULY			AUGUST-DECEMBER		
	OTB	SNU	GN,LL	OTB	SNU	GN,LL
1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.09	0.00	0.00	0.00	0.00	0.00
5	0.13	0.12	0.00	0.00	0.00	0.00
6	0.22	0.22	0.27	0.50	0.52	0.77
7	0.18	0.22	0.34	0.31	0.30	0.36
8	0.22	0.22	0.27	0.30	0.30	0.36
9	0.21	0.26	0.33	0.38	0.37	0.37
10	0.29	0.30	0.34	0.35	0.34	0.34
11	0.25	0.28	0.42	0.36	0.40	0.36
12	0.29	0.29	0.37	0.39	0.43	0.62
13	0.42	0.46	0.50	0.49	0.60	0.91
14	0.36	0.38	0.42	0.46	0.53	0.66
15	0.59	0.58	0.61	0.56	0.67	0.87
16	0.44	0.49	0.41	0.40	0.51	0.61
17	0.74	0.77	0.80	0.54	0.54	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	1.46	1.46	0.84	0.84	0.84
20	0.00	0.00	0.00	1.08	1.08	1.08
21	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00

SEX-FEMALE						
AGE	JANUARY-JULY			AUGUST-DECEMBER		
	OTB	SNU	GN,LL	OTB	SNU	GN,LL
1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.05	0.05	0.00	0.00	0.00	0.00
5	0.11	0.15	0.16	0.00	0.00	0.00
6	0.21	0.23	0.23	0.36	0.36	0.46
7	0.48	0.43	0.33	0.34	0.34	0.39
8	0.22	0.25	0.28	0.33	0.33	0.43
9	0.33	0.33	0.34	0.38	0.37	0.45
10	0.37	0.37	0.37	0.40	0.38	0.53
11	0.47	0.45	0.44	0.51	0.50	0.78
12	0.67	0.61	0.51	0.57	0.58	0.80
13	0.60	0.58	0.52	0.60	0.62	0.86
14	0.80	0.75	0.61	0.63	0.68	0.81
15	0.95	0.90	0.76	0.85	1.03	0.93
16	1.22	1.14	0.80	0.90	1.07	1.01
17	1.45	1.33	1.00	1.11	1.34	1.02
18	1.53	1.39	0.97	1.05	1.54	1.07
19	1.22	1.15	0.95	1.42	1.72	1.21
20	1.75	1.74	1.52	1.62	2.10	1.20
21	1.94	1.99	1.84	1.38	1.52	1.12
22	2.38	2.42	2.51	1.58	2.00	1.41
23	1.86	1.73	1.34	2.03	2.03	2.03
24	2.02	1.80	1.84	2.29	2.30	2.29
25	1.90	1.90	1.90	1.47	2.14	1.47
26	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	2.58	2.84	0.00

TABLE 12. AVERAGE LENGTH AT AGE BY GEAR AND SEASON FOR 1988.

SEX-MALE						
AGE	JANUARY-JULY			AUGUST-DECEMBER		
	OTB	SNU	GN,LL	OTB	SNU	GN,LL
1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
4	23.15	0.00	0.00	0.00	0.00	0.00
5	25.57	25.30	0.00	0.00	0.00	0.00
6	29.64	29.62	31.49	34.81	35.65	42.00
7	27.71	29.28	33.39	32.35	32.12	34.00
8	29.42	29.66	31.36	32.33	32.19	33.81
9	29.04	30.68	32.91	34.25	34.14	34.22
10	31.85	32.19	33.06	33.60	33.44	33.34
11	30.17	31.05	35.25	33.88	34.79	33.86
12	31.93	31.82	34.08	34.57	35.26	38.73
13	35.42	36.21	36.88	36.40	38.21	43.43
14	33.58	34.18	34.91	36.19	37.58	40.09
15	38.73	38.60	39.13	37.68	39.60	43.30
16	35.64	36.63	35.15	34.59	36.97	39.06
17	41.49	41.73	42.28	38.00	38.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	50.00	50.00	43.00	43.00	43.00
20	0.00	0.00	0.00	46.00	46.00	46.00
21	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00

SEX-FEMALE						
AGE	JANUARY-JULY			AUGUST-DECEMBER		
	OTB	SNU	GN,LL	OTB	SNU	GN,LL
1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
4	20.00	20.00	0.00	0.00	0.00	0.00
5	25.00	27.09	27.95	0.00	0.00	0.00
6	30.04	30.65	30.80	34.75	34.78	37.29
7	33.94	34.73	33.81	34.10	34.29	35.63
8	30.29	31.44	32.30	33.83	33.80	36.71
9	33.90	33.79	34.08	35.42	35.00	37.03
10	34.93	34.93	34.93	35.77	35.31	38.71
11	37.21	36.85	36.73	38.09	37.72	43.15
12	40.63	39.76	38.10	39.28	39.36	43.40
13	39.67	39.36	38.33	39.87	40.11	44.40
14	42.91	42.38	40.17	40.49	41.08	43.70
15	45.53	44.95	42.61	43.83	45.09	45.40
16	48.71	47.81	43.30	44.68	46.82	46.50
17	51.39	50.07	46.23	47.46	50.04	46.57
18	52.04	50.48	45.99	46.85	51.70	47.26
19	48.87	48.11	45.82	51.08	53.91	49.03
20	54.44	54.37	51.94	52.86	57.11	48.51
21	56.25	56.61	55.40	50.77	52.15	47.90
22	59.59	59.91	60.50	52.88	56.44	51.20
23	55.14	53.72	50.00	57.00	57.00	57.00
24	56.47	54.81	55.19	59.00	59.00	59.00
25	56.00	56.00	56.00	52.00	57.25	52.00
26	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	61.00	62.57	0.00

Table 13. Estimated catch at age (,000) and cv
for 4T plaice from 1985 to 1988.

AGE	1985		1986		1987		1988	
	CATCH	CV	CATCH	CV	CATCH	CV	CATCH	CV
4	99	0.198	-	-	1	0.000	23	0.043
5	85	0.193	21	0.273	48	0.188	60	0.132
6	99	0.198	417	0.172	139	0.116	232	0.157
7	475	0.106	757	0.122	483	0.062	294	0.140
8	677	0.088	1302	0.082	527	0.062	484	0.097
9	740	0.087	1221	0.087	574	0.059	768	0.084
10	1157	0.069	1149	0.078	794	0.050	739	0.081
11	1634	0.054	1397	0.073	784	0.050	822	0.074
12	2032	0.047	1653	0.063	868	0.049	980	0.069
13	1687	0.048	1497	0.059	1094	0.041	800	0.077
14	1431	0.052	1081	0.071	984	0.043	968	0.068
15	1051	0.056	863	0.067	958	0.044	828	0.072
16	761	0.066	607	0.069	699	0.049	890	0.071
17	505	0.078	377	0.084	664	0.049	433	0.104
18	248	0.109	185	0.112	337	0.066	368	0.123
19	286	0.111	173	0.101	315	0.068	233	0.151
20	135	0.174	145	0.127	295	0.07	205	0.174
21	72	0.237	127	0.122	164	0.093	81	0.265
22	58	0.252	33	0.166	118	0.103	73	0.274
23	26	0.486	33	0.215	87	0.122	47	0.346
24	12	0.522	16	0.202	45	0.176	50	0.390
25	21	0.615	6	0.271	24	0.211	24	0.504
26	0	0	5	0.370	26	0.245	0	0
27	0	0	1	0.000	6	0.253	0	0
28	0	0	2	0.822	13	0.284	0	0
29	1	2.995	10	0.385	5	0.220	0	0
30	0	0	12	0.305	2	0.000	6	1.243

Table 14. ANOVA and coefficient estimates from the plaice directed catch rate standardization.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R.....0.630
 MULTIPLE R SQUARE...0.397

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	6.196E0002	6.196E0002	
REGRESSION	32	4.868E0001	1.521E0000	5.794
TYPE 1	13	1.768E0001	1.360E0000	5.180
TYPE 2	8	1.307E0001	1.635E0000	6.227
TYPE 3	11	7.233E0000	6.575E-001	2.505
RESIDUALS	282	7.403E0001	2.625E-001	
TOTAL	314	7.423E0002		

TYPE 1 - COUNTRY, GEAR, TONNAGE CLASS
 TYPE 2 - MONTH
 TYPE 3 - YEAR

CATEGORY	CODE	REGRESSION COEFFICIENTS	STD. ERROR	NO. OBS
INTERCEPT	2114	-1.95049898	0.32578420	315
CGT	5			
MONTH	77			
YEAR				
CGT	2111	0.62151547	0.43987001	3
	2112	-0.25072300	0.34016110	14
	2113	0.57420183	0.31648317	34
	2121	0.39895724	0.36524961	9
	2122	1.05199615	0.34513556	12
	2123	0.66227314	0.31922045	37
	2211	0.27336977	0.36907507	8
	2212	0.44123806	0.31585361	92
	2213	0.61589259	0.31573294	67
	2221	0.12932708	0.38655305	7
	2222	0.22595716	0.36809706	9
	2223	0.52245297	0.33464893	16
	3113	1.42261077	0.48567594	1
MONTH	4	0.31175334	0.14297198	21
	6	-0.11205384	0.11583878	42
	7	-0.35228141	0.11704608	44
	8	-0.23620952	0.11609557	43
	9	-0.31605132	0.11441110	46
	10	-0.14765109	0.11530731	42
	11	0.16390430	0.12473101	33
	12	0.72097045	0.27776432	4
YEAR	78	0.14505786	0.12810596	29
	79	0.25523040	0.11918576	37
	80	0.19959804	0.12901133	29
	81	0.30502404	0.13321583	25
	82	0.09549708	0.16603651	14
	83	0.07730812	0.15851886	16
	84	-0.21314452	0.13665961	25
	85	-0.06803016	0.27789659	4
	86	-0.15789423	0.14299022	24
	87	0.00241108	0.12746765	40
	88	-0.16331512	0.15068460	30

CODE CGT : LAST DIGIT EQUALS TONNAGE CLASS NEXT TWO DIGITS FROM THE LEFT EQUALS GEAR (10 - 19 ARE TRAWLERS, 20 - 29 ARE SEINERS) THE FOURTH AND FIFTH DIGITS FROM THE LEFT ARE COUNTRY CODES.

Table 15. Standardized catch rate for plaice directed fishery

 PREDICTED CATCH RATE

standards used variable numbers: 2114 5

YEARS	TOTAL CATCH	PROP.	CATCH RATE		EFFORT
			MEAN	S.E.	
77	9320	0.446	0.166	0.05	55977
78	9031	0.361	0.189	0.059	47805
79	10086	0.279	0.218	0.064	46336
80	8292	0.206	0.198	0.061	41887
81	7834	0.19	0.218	0.068	35911
82	6542	0.264	0.177	0.057	36860
83	6094	0.291	0.175	0.056	34743
84	9627	0.146	0.129	0.04	74483
85	9490	0.008	0.161	0.061	58904
86	7213	0.112	0.142	0.045	50799
87	7794	0.166	0.175	0.054	44450
88	6707	0.170	0.159	0.061	40044

AVERAGE C.V. FOR THE MEAN: 0.322

Table 16. ANOVA and coefficient estimates from the cod directed catch rate standardization.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R.....0.793
 MULTIPLE R SQUARE...0.629

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	8.133E0003	8.133E0003	
REGRESSION	44	5.474E0002	1.244E0001	31.160
TYPE 1	13	3.328E0002	2.560E0001	64.127
TYPE 2	9	4.215E0001	4.683E0000	11.732
TYPE 3	22	1.063E0002	4.831E0000	12.105
RESIDUALS	808	3.226E0002	3.990E-001	
TOTAL	852	9.003E0003		

TYPE 1 - GEAR, TONNAGE CLASS, COUNTRY
 TYPE 2 - MONTH
 TYPE 3 - YEAR

CATEGORY	CODE	REGRESSION COEFFICIENTS	STD. ERROR	NO. OBS
INTERCEPT	2112	-3.75497364	0.18512263	853
CGT	5			
MONTH	66			
YEAR	2113	0.73968339	0.06951380	123
CTG	2114	1.43231164	0.10964552	56
	2121	0.95643374	0.24937208	8
	2122	1.26472947	0.37310263	3
	2123	1.11100863	0.09224746	71
	2124	1.61004284	0.14109715	28
	2212	1.62773154	0.08173034	114
	2213	1.75765449	0.08316357	100
	2221	1.89336692	0.38821831	3
	2222	1.86289427	0.25167860	6
	2223	2.00849133	0.09715699	63
	3113	1.89029576	0.28252526	6
	3114	1.49458839	0.15581973	233
MONTH	1	-0.69652708	0.19149970	144
	4	0.49485831	0.09541134	77
	6	-0.12172343	0.08465597	77
	7	-0.21814407	0.09014116	22
	8	-0.00941857	0.08740043	50
	9	0.16115750	0.08843153	50
	10	0.20749784	0.08434577	100
	11	0.28837656	0.08561958	47
	12	0.36287796	0.10204846	50
YEAR	67	-0.26987092	0.20350551	100
	68	-0.03885779	0.20533906	100
	69	-0.15426311	0.19554110	100
	70	-0.21921180	0.19399779	100
	71	-0.29272940	0.19101229	100
	72	-0.43768407	0.19512931	100
	73	-0.51353516	0.19454835	100
	74	-0.44550503	0.20767238	100
	75	-0.75154410	0.21503253	100
	76	-0.36005280	0.21089049	100
	77	-0.01984189	0.20030265	100
	78	-0.09430420	0.19801684	100
	79	-0.30321951	0.18724594	100
	80	-0.23680165	0.18953850	100
	81	-0.51189625	0.18997317	100
	82	-0.93616844	0.19094918	100
	83	-0.74195584	0.19517701	100
	84	-1.38748089	0.19281144	100
	85	-0.81414720	0.19678171	100
	86	-1.05159280	0.20628522	100
	87	-0.64154737	0.22389755	100
	88	-0.99071022	0.20805719	100

CODE CGT: LAST DIGIT EQUALS TONNAGE CLASS, NEXT FROM THE LEFT TWO DIGITS EQUALS GEAR TYPE (10 - 19 ARE TRAWLERS, 20 - 29 ARE SEINERS), THE FOURTH AND FIFTH DIGITS FROM THE LEFT ARE COUNTRY CODES.

Table 17. Standardized catch rate for cod directed fishery

PREDICTED CATCH RATE

Standard used variable numbers: 2112 5

YEAR	TOTAL CATCH	PROP.	CATCH RATE		EFFORT
			MEAN	S.E.	
66	11780	0.233	0.029	0.005	407437
67	9351	0.297	0.022	0.003	419259
68	9568	0.339	0.028	0.004	340557
69	8192	0.3	0.025	0.003	326559
70	9201	0.284	0.023	0.003	392347
71	9513	0.311	0.022	0.003	438213
72	8294	0.333	0.019	0.002	439736
73	7047	0.252	0.018	0.002	401845
74	8485	0.169	0.019	0.003	452463
75	8443	0.133	0.014	0.002	613577
76	11192	0.094	0.021	0.003	545716
77	9320	0.291	0.029	0.004	325991
78	9031	0.33	0.026	0.003	352011
79	10086	0.333	0.022	0.002	468765
80	8292	0.368	0.024	0.003	352684
81	7834	0.299	0.017	0.002	457772
82	6542	0.292	0.011	0.001	571783
83	6094	0.283	0.014	0.002	437501
84	9627	0.186	0.007	0.001	1310321
85	9490	0.288	0.012	0.001	819689
86	7213	0.1	0.01	0.001	712424
87	7794	0.079	0.015	0.002	512782
88	6707	0.080	0.01	0.001	500388

AVERAGE C.V. FOR THE MEAN: 0.129

Table 18. ANOVA and coefficient estimates from the plaice directed and cod directed combined catch rate standardization.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R.....0.838
 MULTIPLE R SQUARE...0.702

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	8.086E0003	8.086E0003	
REGRESSION	43	1.086E0003	2.525E0001	61.698
TYPE 1	11	3.162E0002	2.875E0001	70.225
TYPE 2	1	3.255E0002	3.255E0002	795.239
TYPE 3	9	5.433E0001	6.037E0000	14.756
TYPE 4	22	1.110E0002	5.045E0000	12.321
RESIDUALS	1113	4.556E0002	4.094E-001	
TOTAL	1156	9.627E0003		

TYPE 1 - GEAR, TONNAGE CLASS, COUNTRY
 TYPE 2 - MONTH
 TYPE 3 - YEAR

REGRESSION COEFFICIENTS

CATEGORY	CODE	COEFFICIENT	STD.ERROR	NO.OBS
INTERCEPT	2122	-1.94464013	0.24650983	1157
CGT	6			
MONTH	10			
YEAR	11			
DIRECTED	12			
CGT	21	-1.63581081	0.17964816	155
	11	-0.85147421	0.17636913	23
	11	-0.233553048	0.19756252	99
	11	-0.52103042	0.23195913	17
	12	-0.44845189	0.1800793	108
	12	-0.16100882	0.21802658	8
	12	-0.054560162	0.17512274	11
	12	-0.33433633	0.17512274	6
	12	-0.13470086	0.27697709	6
	12	-0.26017976	0.1793392	2
	12	-0.43320294	0.2209332	3
	12	-0.49280851	0.0850448	3
	12	-0.3514700	0.0950210	3
	12	-0.7255245	0.0762210	1
	12	-0.09114611	0.0748189	5
	12	-0.0862514	0.0749909	4
	12	-0.09068951	0.0734672	3
	12	-0.32145723	0.0748016	6
	12	-0.43197906	0.0968519	1
	12	-0.33781887	0.2069400	3
	12	-0.08309100	0.2089572	2
	12	-0.21323812	0.1969875	2
	12	-0.26162898	0.1937244	9
	12	-0.35402620	0.1931275	2
	12	-0.48275596	0.1968299	0
	12	-0.52206091	0.1961674	9
	12	-0.55155962	0.2089189	5
	12	-0.66392070	0.2162827	2
	12	-0.42373443	0.2118039	4
	12	-0.40097466	0.1873092	3
	12	-0.28903988	0.1866875	1
	12	-0.42047455	0.1824401	7
	12	-0.4079293	0.1820045	7
	12	-0.35890611	0.1837443	9
	12	-0.00620805	0.1896332	9
	12	-0.7244000	0.1879998	4
	12	-0.45118953	0.1863360	4
	12	-0.05632600	0.1813787	2
	12	-0.68814755	0.1826655	6
	12	-1.03511724	0.1807518	9
DIRECTED	40	1.42027508	0.05036473	66

CODE CGT : LAST DIGIT EQUALS TONNAGE CLASS, NEXT FROM THE LEFT TWO DIGITS EQUAL GEAR TYPE (10 - 19 ARE TRAWLERS, 20 - 29 ARE SEINERS) THE FOURTH AND FIFTH DIGITS FROM THE LEFT ARE COUNTRY CODES.

Table 19. Standardized catch rate for combined plaice
and cod directed fishery

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PREDICTED CATCH RATE

Standard used variable numbers: 2122 2 5

YEAR	TOTAL	PROP.	CATCH RATE		EFFORT
	CATCH		MEAN	S.E.	
66	11780	0.233	0.520	0.130	22650
67	9351	0.292	0.378	0.084	24770
68	9580	0.298	0.489	0.110	19575
69	8192	0.296	0.430	0.093	19047
70	9201	0.282	0.400	0.086	23021
71	9513	0.309	0.372	0.079	25578
72	8294	0.333	0.327	0.071	25371
73	6905	0.257	0.307	0.066	22506
74	8485	0.169	0.306	0.069	27720
75	8443	0.133	0.224	0.052	37759
76	11193	0.094	0.348	0.079	32180
77	9230	0.736	0.365	0.071	25304
78	9031	0.673	0.402	0.081	22471
79	9996	0.618	0.356	0.069	28090
80	8292	0.567	0.359	0.070	23081
81	7834	0.487	0.313	0.062	25062
82	6542	0.555	0.206	0.041	31819
83	6094	0.574	0.239	0.049	25489
84	9599	0.322	0.139	0.028	69116
85	9490	0.296	0.202	0.040	46948
86	7213	0.196	0.185	0.038	38886
87	7794	0.202	0.277	0.053	28099
88	6707	0.197	0.245	0.050	26012

AVERAGE C.V. FOR THE MEAN: 0.210

Table 20. 4T plaice R.V. mean catch per tow adjusted (Prince*1.8)

AGE	1971	1972	1973	1974	1975	1976	1977	1978
1	1.24	1.04	0.88	0.82	0.48	0.00	0.71	0.00
2	8.41	8.16	7.14	16.56	4.58	5.23	5.63	1.30
3	26.07	14.66	23.35	57.59	22.79	52.49	80.11	10.26
4	43.52	33.63	32.56	116.32	85.16	175.19	228.75	83.33
5	41.88	32.68	37.79	97.87	159.00	257.07	312.34	110.19
6	43.55	36.62	29.36	80.00	81.14	202.69	183.02	122.79
7	45.03	42.02	24.69	52.60	62.77	96.91	121.98	113.10
8	27.44	28.91	27.33	40.63	39.77	42.43	53.74	74.98
9	9.50	13.15	21.39	45.37	28.44	38.05	21.81	24.63
10	6.65	7.74	9.52	27.72	19.16	26.51	14.65	15.92
11	5.89	3.67	5.05	12.39	14.70	17.88	8.67	8.39
12	3.79	3.53	3.87	4.04	4.31	11.82	5.93	4.27
13	2.78	1.83	3.16	3.37	2.40	7.03	3.68	4.67
14	2.36	1.17	3.58	3.42	1.85	3.65	2.13	1.53
15	1.45	0.51	1.94	2.44	1.11	1.58	1.19	1.41
16	1.22	0.64	1.48	1.24	1.07	1.37	0.32	0.55
17	1.07	0.16	1.34	0.60	0.15	1.44	0.44	0.32
18	0.47	0.16	0.59	0.54	1.09	0.55	0.13	0.14
19	0.12	0.06	1.65	0.17	0.58	0.04	0.60	0.14
20+	0.36	0.06	1.68	0.35	0.92	0.66	0.12	0.28
1+	272.80	230.40	238.35	564.04	531.47	942.59	1045.95	578.20

AGE	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0.08	2.64	2.76	1.69	2.94	0.22	1.36	3.76	0.49	0.79
2	1.37	7.13	14.65	13.81	11.96	2.78	6.66	3.72	5.54	4.16
3	6.81	35.17	29.90	14.49	29.46	5.13	17.39	13.24	12.88	16.39
4	66.07	80.13	72.80	18.18	35.37	23.95	22.11	32.01	24.31	28.29
5	181.36	90.62	97.81	34.73	43.37	32.29	41.75	28.52	36.39	34.54
6	163.86	113.05	115.73	30.03	42.15	30.48	37.40	43.28	31.70	53.86
7	184.15	79.65	125.42	44.95	31.36	27.54	27.01	26.82	32.47	34.18
8	138.53	64.02	72.78	61.72	50.35	25.84	20.37	15.55	19.41	32.50
9	63.76	33.11	49.09	32.29	47.79	23.77	17.54	10.52	16.63	19.72
10	32.86	17.42	25.68	21.50	27.65	28.18	13.12	6.66	10.35	9.65
11	18.31	10.55	11.67	9.06	27.48	10.46	17.89	8.90	7.82	6.99
12	9.89	5.84	5.65	3.98	14.04	8.97	18.47	13.98	7.30	5.81
13	6.05	4.10	3.25	2.05	5.85	4.23	15.31	9.54	2.52	5.39
14	5.57	2.15	2.04	2.21	2.86	1.60	7.78	11.04	2.97	4.51
15	2.94	0.90	1.47	1.24	2.28	1.61	3.19	3.82	1.22	2.39
16	2.14	0.46	1.29	1.25	1.23	0.65	2.99	2.34	0.68	1.02
17	0.53	0.36	0.42	0.96	1.22	0.55	2.08	2.45	0.60	1.25
18	0.69	0.11	0.17	0.39	0.90	0.53	1.60	2.61	0.43	0.36
19	0.38	0.14	0.36	0.51	0.33	0.41	0.73	0.60	0.41	0.34
20+	1.01	0.18	0.38	0.44	0.58	0.61	2.42	2.34	0.55	0.68
1+	886.36	547.73	633.32	295.48	379.17	229.80	277.17	241.70	214.64	262.81

Table 21. Z at age for 4T plaice from rv results. Age and year are for first age and year.

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	-1.880	-1.928	-2.932	-1.721	-2.379	.000	-.604	.000	-4.479	-1.712	-1.611	-1.960	.056	-3.427	-1.005	-.438	-2.139
2	-.556	-1.052	-2.088	-.319	-2.438	-2.729	-.601	-1.658	-3.246	-1.434	.011	-.757	.846	-1.833	-.687	-1.148	-1.085
3	-.255	-.798	-1.606	-.391	-2.040	-1.472	-.039	-1.862	-2.465	-.727	.497	-.893	.207	-1.460	-.610	-.566	-.787
4	.286	-.116	-1.100	-.313	-1.105	-.578	.730	-.778	-.316	-.199	.740	-.869	.091	-.556	-.253	.057	-.351
5	.134	.107	-.750	.187	-.243	.340	.934	-.397	.473	-.245	1.181	-.193	.353	-.147	-.036	-.098	-.392
6	.036	.394	.583	.243	-.178	.508	.481	-.405	.721	-.104	.946	-.043	.425	.121	.332	.270	-.025
7	.443	.430	.498	.280	.391	.589	.487	-.203	1.057	.090	.709	-.113	.194	.302	.552	.543	-.001
8	.736	.302	-.507	.357	.044	.665	.780	.162	1.431	.266	.813	.256	.751	.388	.661	.253	-.015
9	.205	.323	-.259	.862	.070	.954	.315	-.288	1.298	.254	.826	.155	.528	.594	.969	.098	.544
10	.595	.427	-.264	.634	.069	1.118	.557	-.140	1.136	.401	1.042	-.245	.972	.454	.388	-.019	.393
11	.513	-.054	.223	1.057	.218	1.104	.708	-.165	1.143	.624	1.077	-.438	1.120	-.568	.246	.410	.297
12	.725	.108	.139	.520	-.491	1.167	.239	-.347	.881	.585	1.012	-.386	1.200	-.535	.661	1.760	.303
13	.864	-.670	-.076	.597	-.421	1.194	.879	-.177	1.036	.697	.389	-.332	1.295	-.610	.327	1.212	-.582
14	1.525	-.503	.385	1.127	.157	1.123	.411	-.657	1.821	.377	.502	-.035	.576	-.691	.712	2.312	.217
15	.812	-1.057	.445	.821	-.217	1.588	.778	-.416	1.867	-.362	.167	.003	1.263	-.620	.310	1.590	.179
16	2.037	-.736	.896	2.132	-.292	1.129	.002	.038	1.781	.090	.298	.018	.816	-1.170	.198	1.495	-.609
17	1.871	-1.309	.921	-.588	-1.311	2.404	1.188	-.752	1.547	.754	.069	.064	.845	-1.078	-.226	2.190	.511
18	2.142	-2.305	1.229	-.072	3.217	4.086	-.084	-1.026	1.573	-1.160	-1.104	.164	.797	-.327	.983	2.583	.235
19	.761	-3.420	1.539	-1.672	-.136	-.999	.758	-1.971	.769	-.970	-.200	-.126	-.615	-1.783	-1.165	.366	-.506

TABLE 22. Average Z from RV for 4T American plaice.

AGE	Mortality		
	1971-88	1971-79	1980-88
1	-1.656	-1.431	-1.857
2	-1.222	-1.430	-1.037
3	-0.898	-1.058	-0.756
4	-0.272	-0.372	-0.184
5	0.071	0.039	0.100
6	0.253	0.208	0.294
7	0.368	0.364	0.370
8	0.432	0.317	0.534
9	0.438	0.273	0.585
10	0.442	0.375	0.502
11	0.442	0.451	0.435
12	0.444	0.258	0.609
13	0.331	0.274	0.381
14	0.551	0.446	0.643
15	0.421	0.344	0.489
16	0.478	0.651	0.324
17	0.418	0.303	0.520
18	0.398	0.377	0.416
19	-0.551	-0.642	-0.470

Table 23. STANDARD ERROR (tot/var) FROM RV.

AGE	1984	1985	1986	1987	1988
0	0.1622	0.02	0.6929		
1	0.0922	0.2289	0.8665	0.2421	0.2909
2	0.3509	0.7423	3.7628	1.322	1.0081
3	0.4155	1.6141	9.1701	4.6774	3.5181
4	1.9228	2.2969	9.108	5.1128	4.9227
5	3.6375	5.6925	12.4277	6.5785	5.3983
6	3.1656	3.9945	8.5417	6.2132	8.44
7	2.2392	3.1843	3.7935	6.3231	5.4875
8	2.0152	2.6729	3.5426	3.7264	5.4358
9	1.7263	1.8841	1.6523	3.1242	2.932
10	2.5632	1.6823	2.8548	2.0347	1.3304
11	0.8	2.064	3.5805	1.562	0.8832
12	0.9055	1.9365	2.5652	1.634	0.6708
13	0.5099	1.4213	2.924	0.5657	0.7416
14	0.1732	0.7746	1.0909	0.7483	0.6481
15	0.1732	0.2646	0.9644	0.2449	0.4359
16	0.1414	0.2	1.1136	0.1732	0.2236
17	0.1414	0.1414	0.9539	0.1732	0.2828
18	0.1414	0.1	0.2236	0.2236	0
19	0.1	0	0.4899		
20	0.1	0.1	0		
21	0	0.2	0	0	
22	0	0	0.4123		
23	0	0	0		
24	0	0	0		
25	0	0	0		
26	0	0			

Table 24. COEFFICIENTS OF VARIATION FROM RV SURVEY.

AGE	1984	1985	1986	1987	1988
0	0.2123	0.1927			
1	0.6407	0.3715	0.331	0.4905	0.3691
2	0.2439	0.2175	0.2151	0.2385	0.2424
3	0.1705	0.1704	0.2954	0.3631	0.2147
4	0.2108	0.1892	0.301	0.2103	0.174
5	0.2184	0.2439	0.3057	0.1808	0.1563
6	0.1962	0.2288	0.3024	0.196	0.1567
7	0.1672	0.229	0.2816	0.1947	0.1605
8	0.1611	0.2032	0.2644	0.192	0.1672
9	0.1381	0.1982	0.2485	0.1879	0.1486
10	0.1494	0.1933	0.2306	0.1967	0.1379
11	0.1622	0.193	0.2796	0.1997	0.1263
12	4.1989	0.1832	0.2407	0.224	0.1155
13	0.1751	0.1899	0.2864	0.2246	0.1374
14	0.1714	0.1477	0.27	0.2522	0.1436
15	0.241	0.1502	0.2223	0.2007	0.1825
16	0.3183	0.1265	0.399	0.2552	0.2184
17	0.2773	0.1295	0.5469	0.288	0.3123
18	0.3433	0.1211	0.4625	1.9338	0
19	0.3934	0	0.3709		
20	0.6031	0.2018	0.5327		
21	0	0.6011	0	0	
22	0	0	0		
23	0	0	0.6812		
24	0	0	0		
25			0		
26		0	0		

Table 25. RV mean numbers per tow for ages 1+ to 20+ from 1971 to 1988 .

A G E	YEAR																	
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1+	272.80	230.40	238.35	564.04	531.47	942.59	1045.95	578.20	886.36	547.73	633.32	295.48	379.17	229.80	277.17	241.70	214.67	262.82
2+	271.56	229.36	237.47	563.22	530.99	942.59	1045.24	578.20	886.28	545.09	630.56	293.79	376.23	229.58	275.81	237.94	214.18	262.03
3+	263.15	221.20	230.33	546.66	526.41	937.36	1039.61	576.90	884.91	537.96	615.91	279.98	364.27	226.80	269.15	234.22	208.64	257.87
4+	237.08	206.54	206.98	489.07	503.62	884.87	959.50	566.64	878.10	502.79	586.01	265.49	334.81	221.67	251.76	220.98	195.76	241.48
5+	193.56	172.91	174.42	372.75	418.46	709.68	730.75	483.31	812.03	422.66	513.21	247.31	299.44	197.72	229.65	188.97	171.45	213.19
6+	151.68	140.23	136.63	274.88	259.46	452.61	418.41	373.12	630.67	332.04	415.40	212.58	256.07	165.43	187.90	160.45	135.06	178.65
7+	108.13	103.61	107.27	194.88	178.32	249.92	235.39	250.33	466.81	218.99	299.67	182.55	213.92	134.95	150.50	117.17	103.36	124.79
8+	63.10	61.59	82.58	142.28	115.55	153.01	113.41	137.23	282.66	139.34	174.25	137.60	182.56	107.41	123.49	90.35	70.89	90.61
9+	35.66	32.68	55.25	101.65	75.78	110.58	59.67	62.25	144.13	75.32	101.47	75.88	132.21	81.57	103.12	74.80	51.48	58.11
10+	26.16	19.53	33.86	56.28	47.34	72.53	37.86	37.62	80.37	42.21	52.38	43.59	84.42	57.80	85.58	64.28	34.85	38.39
11+	19.51	11.79	24.34	28.56	28.18	46.02	23.21	21.70	47.51	24.79	26.70	22.09	56.77	29.62	72.46	57.62	24.50	28.74
12+	13.62	8.12	19.29	16.17	13.48	28.14	14.54	13.31	29.20	14.24	15.03	13.03	29.29	19.16	54.57	48.72	16.68	21.75
13+	9.83	4.59	15.42	12.13	9.17	16.32	8.61	9.04	19.31	8.40	9.38	9.05	15.25	10.19	36.10	34.74	9.38	15.94
14+	7.05	2.76	12.26	8.76	6.77	9.29	4.93	4.37	13.26	4.30	6.13	7.00	9.40	5.96	20.79	25.20	6.86	10.55
15+	4.69	1.59	8.68	5.34	4.92	5.64	2.80	2.84	7.69	2.15	4.09	4.79	6.54	4.36	13.01	14.16	3.89	6.04
16+	3.24	1.08	6.74	2.90	3.81	4.06	1.61	1.43	4.75	1.25	2.62	3.55	4.26	2.75	9.82	10.34	2.67	3.65
17+	2.02	0.44	5.26	1.66	2.74	2.69	1.29	0.88	2.61	0.79	1.33	2.30	4.26	2.10	6.83	8.00	1.99	2.63
18+	0.95	0.28	3.92	1.06	2.59	1.25	0.85	0.56	2.08	0.43	0.91	1.34	1.81	1.55	4.75	5.55	1.39	1.38
19+	0.48	0.12	3.33	0.52	1.50	0.70	0.72	0.42	1.39	0.32	0.74	0.95	1.81	1.55	4.75	5.55	1.39	1.38
20+	0.36	0.06	1.68	0.35	0.92	0.66	0.12	0.28	1.01	0.18	0.38	0.44	0.58	0.61	3.15	2.94	0.96	1.02
															2.42	2.34	0.55	0.68

Table 26. TOTAL Z AMER PLAICE (4T) FROM RV

GROUP	YEAR							
	1971	1972	1973	1974	1975	1976	1977	1978
1+	0.17345	-0.0302	-0.85993	0.06038	-0.57298	-0.10337	0.592761	-0.42711
2+	0.20512	-0.0042	-0.83379	0.06759	-0.56832	-0.09797	0.594333	-0.42557
3+	0.24223	0.0664	-0.75299	0.08201	-0.51936	-0.02334	0.606877	-0.42009
4+	0.31563	0.1690	-0.58829	0.15592	-0.34299	0.19137	0.685754	-0.35981
5+	0.32230	0.2355	-0.45487	0.36231	-0.07845	0.52835	0.672171	-0.26612
6+	0.38114	0.2679	-0.35511	0.43275	0.03746	0.65379	0.513682	-0.22402
7+	0.56283	0.2269	-0.28245	0.52268	0.15308	0.79013	0.539585	-0.12146
8+	0.65796	0.1086	-0.20777	0.62996	0.04396	0.94167	0.599851	-0.04906
9+	0.60208	-0.0355	-0.01847	0.76418	0.04383	1.07184	0.461294	-0.25548
10+	0.79698	-0.2202	0.17023	0.69173	0.02828	1.13942	0.556583	-0.23340
11+	0.87660	-0.4923	0.40896	0.75080	0.00142	1.15217	0.556068	-0.29686
12+	1.08766	-0.6413	0.46391	0.56722	-0.19118	1.18427	0.475244	-0.37211
13+	1.27021	-0.9825	0.56547	0.58318	-0.01300	1.19705	0.678161	-0.38309
14+	1.48929	-1.1458	0.83112	0.57689	0.18262	1.19932	0.551535	-0.56516
15+	1.46847	-1.4443	1.09631	0.33760	0.19213	1.25365	0.671945	-0.51434
16+	1.99655	-1.5832	1.40124	0.05675	0.34809	1.14654	0.604068	-0.60168
17+	1.97606	-2.1871	1.60186	-0.44484	0.78481	1.15206	0.834461	-0.86020
18+	2.06897	-2.4759	2.02002	-0.34720	1.30833	0.55165	0.704982	-0.90912
19+	2.07944	-2.6391	2.25279	-0.57054	0.82098	1.76359	0.944462	-0.87745

GROUP	Year								
	1979	1980	1981	1982	1983	1984	1985	1986	1987
1+	0.48617	-0.14083	0.768111	-0.24160	0.50173	-0.18250	0.152612	0.12088	-0.19936
2+	0.49925	-0.12215	0.811890	-0.21503	0.50613	-0.15902	0.163451	0.13141	-0.18564
3+	0.56531	-0.08555	0.841524	-0.17885	0.49671	-0.10441	0.197197	0.17937	-0.14618
4+	0.73119	-0.02051	0.862694	-0.12034	0.52671	-0.03537	0.286888	0.25378	-0.08529
5+	0.89428	0.01733	0.881367	-0.03481	0.59337	0.05094	0.358574	0.33587	-0.04114
6+	1.05776	0.10257	0.822218	-0.00628	0.64055	0.09459	0.472284	0.43976	0.07909
7+	1.20901	0.22854	0.778331	-0.00005	0.68895	0.08874	0.510272	0.50250	0.13165
8+	1.32250	0.31715	0.831338	0.03996	0.80562	0.04076	0.501342	0.56250	0.19879
9+	1.22806	0.36322	0.844935	-0.10665	0.82740	-0.04799	0.472645	0.76376	0.29340
10+	1.17620	0.45799	0.863400	-0.26418	1.04735	-0.22605	0.395582	0.96458	0.19276
11+	1.20489	0.50039	0.717409	-0.28212	1.08618	-0.61103	0.396945	1.23966	0.11906
12+	1.24594	0.41748	0.507283	-0.15733	1.05584	-0.63347	0.451593	1.64751	0.04538
13+	1.50201	0.31504	0.292670	-0.03794	0.93951	-0.71307	0.359449	1.62218	-0.11755
14+	1.81928	0.05007	0.246664	0.06797	0.76824	-0.78065	0.384051	1.86843	0.12730
15+	1.81678	-0.19771	0.141597	0.11726	0.86634	-0.81195	0.229698	1.66834	0.06368
16+	1.79387	-0.06204	0.130265	0.15838	0.70733	-0.90972	0.204980	1.64789	0.01509
17+	1.80332	-0.14141	-0.007491	0.23958	0.67031	-0.81621	0.207527	1.75014	0.36605
18+	1.87180	-0.54286	-0.043017	0.38698	0.57352	-0.70915	0.479735	1.75462	0.30950
19+	2.04410	-0.17185	0.519875	0.49343	0.39999	-0.86396	0.297252	1.67625	0.34484

Table 27. Biomass (t): age 1 to 9 and fishable biomass (age 10+) for 1987 and 1988.

YEAR	Age 1 to 9			Age 10+		
	MALES	FEMALES	TOTAL	MALES	FEMALES	TOTAL
1987	26,893.6	24,089.0	50,982.6	6,197.6	18,884.5	25,082.1
1988	30,994.9	29,347.9	60,342.8	7,548.3	18,619.7	26,168.0

Table 28. The effect of changing natural mortality on estimates of yield calculations with the catch equation. (F assumed to be 0.2).
0.1

M	F	Yield
0.10	0.20	5,145
0.15	0.20	5,867
0.20	0.20	6,939
0.25	0.20	8,546

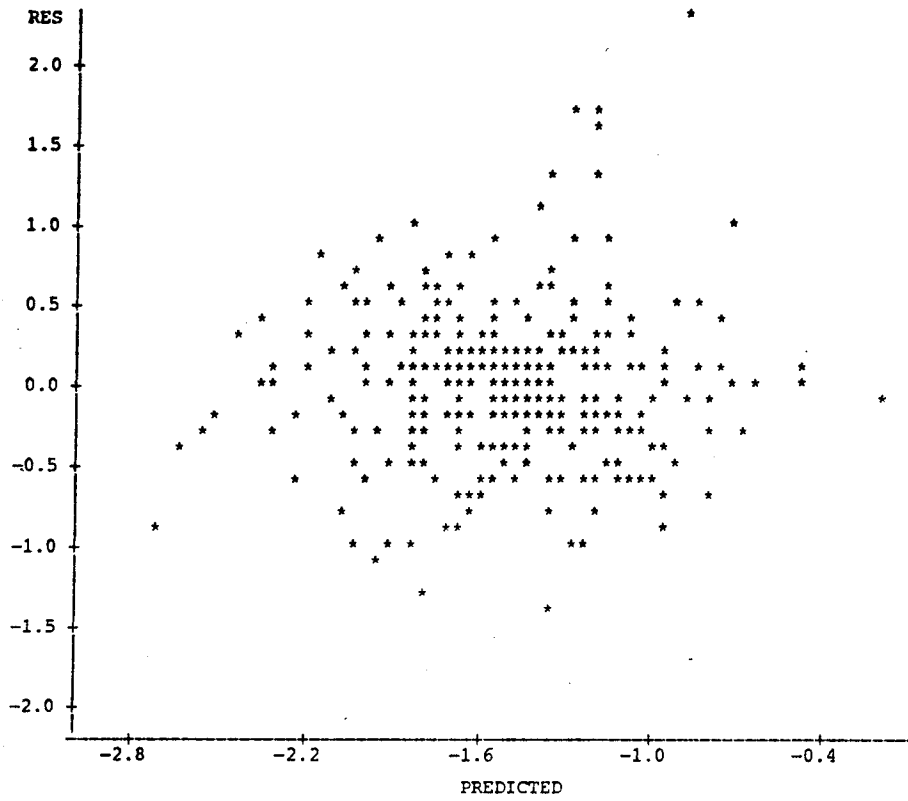


Figure 1. Residuals versus predicted ln catch rate for plaice directed run of the multiplicative model.

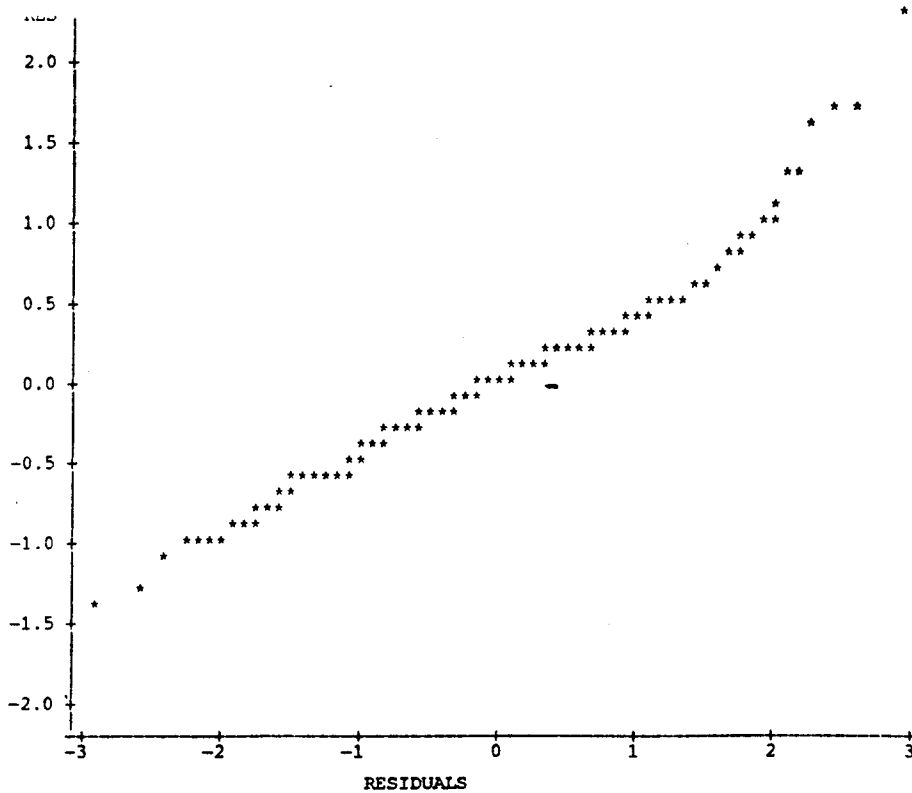


Figure 1b. Plot of normalized residuals of the plaice directed run of the multiplicative model.

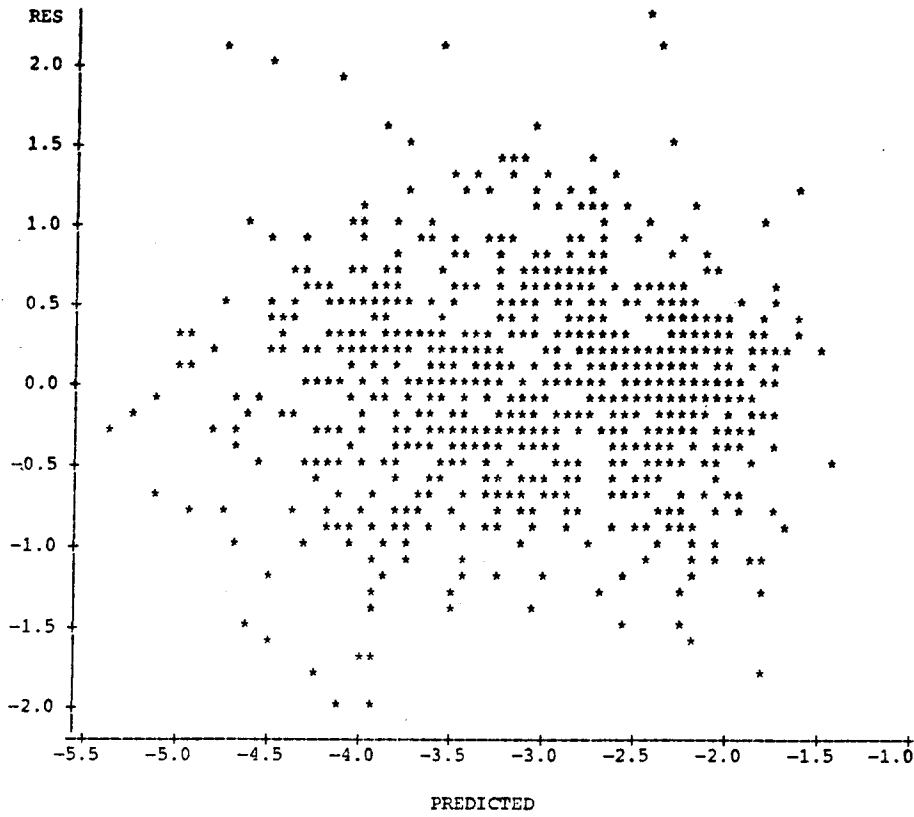


Figure 2a. Residuals versus predicted ln catch rates for plaice directed run of the multiplicative model.

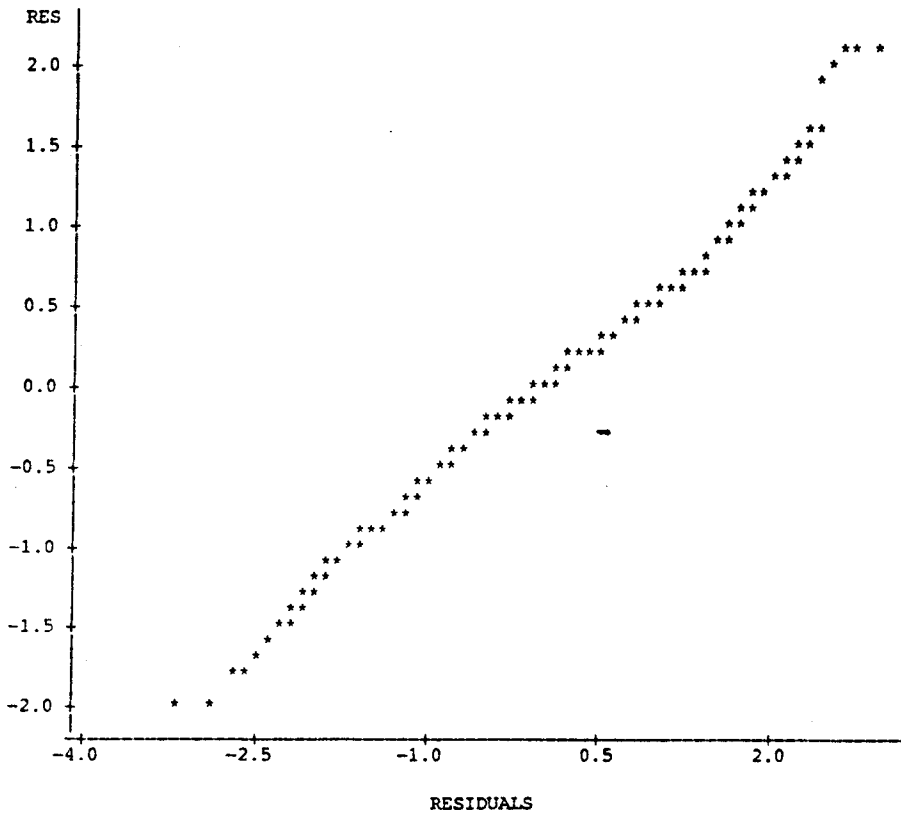


Figure 2b. Plot of normalized residuals of the cod directed run of the multiplicative model.

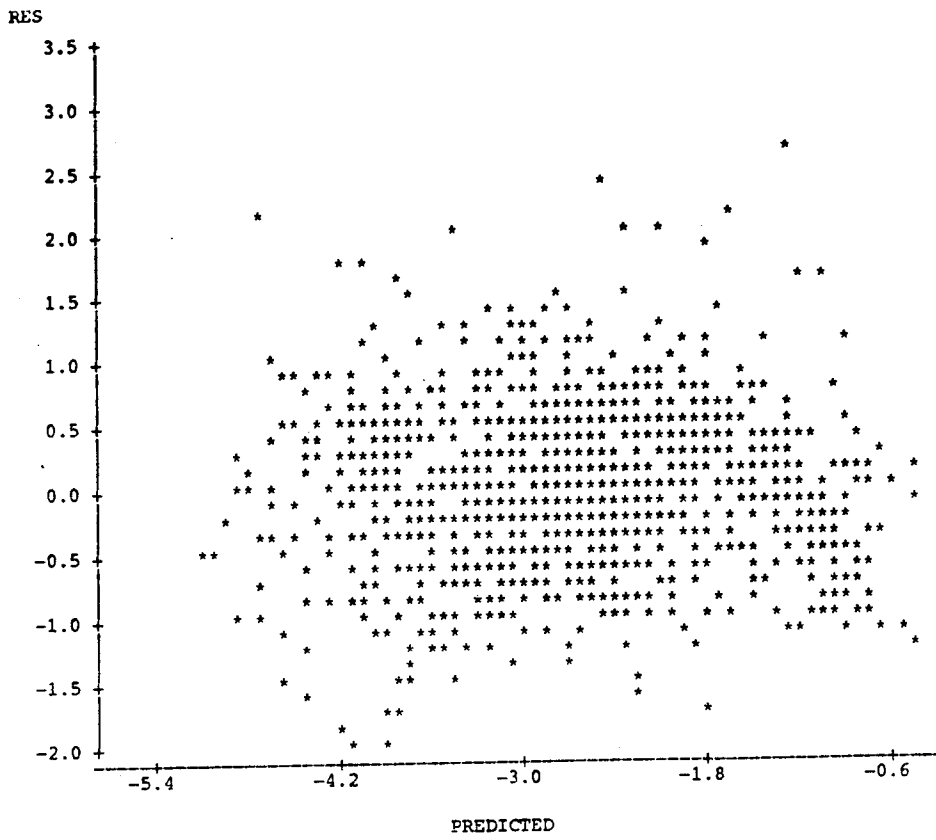


Figure 3a. Residuals versus predicted ln catch rate for plaice directed run of the multiplicative model.

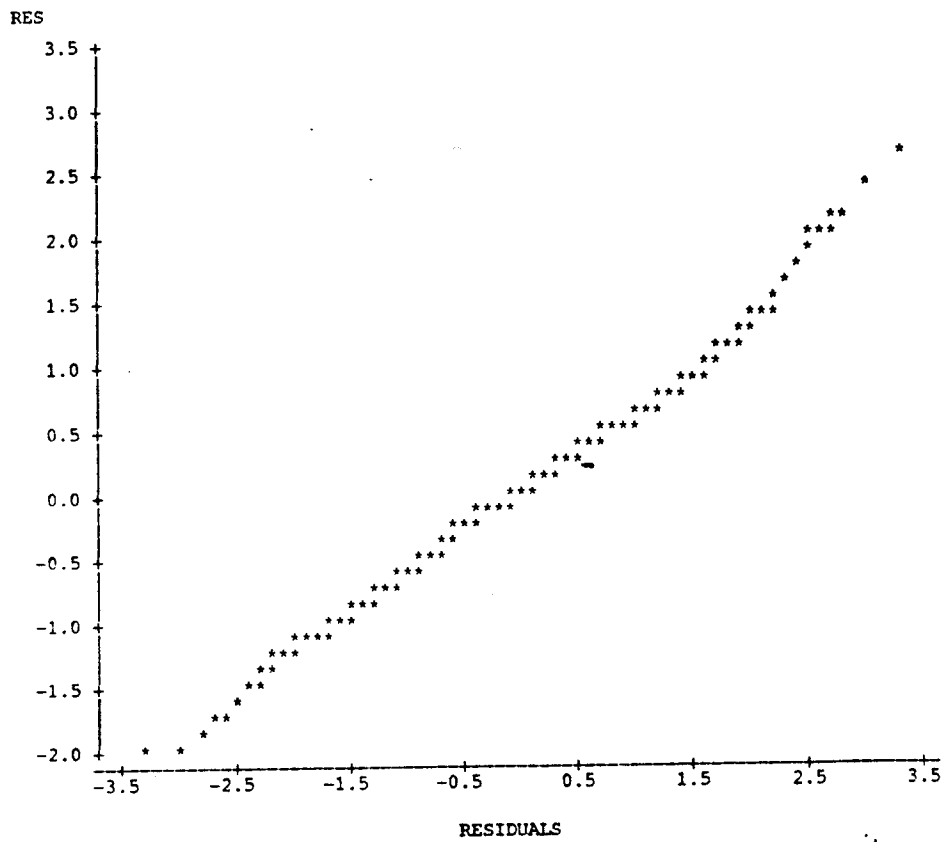


Figure 3b. Plot of normalized residuals of the combined run of the multiplicative model.

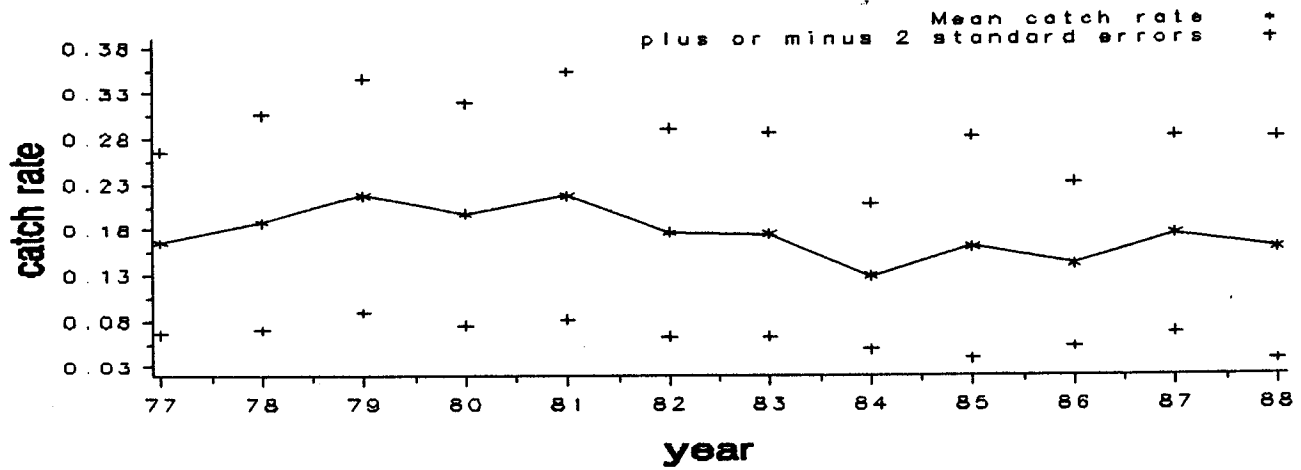


Figure 4. Catch rate from plaice directed plaice fishery in NAFO Div. 4T

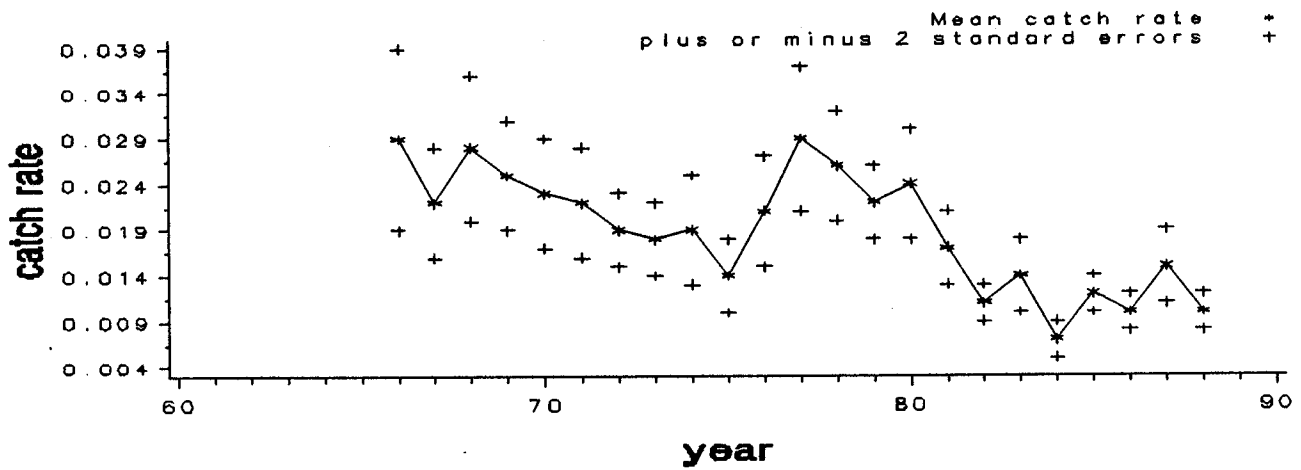


Figure 5. Catch rate from cod directed plaice fishery in NAFO Div. 4T

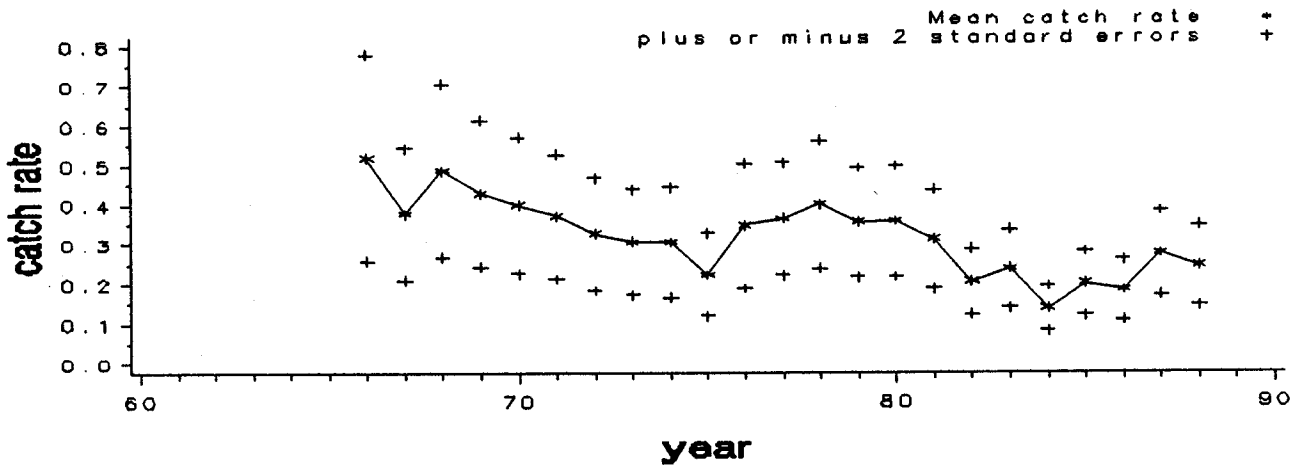


Figure 6. Catch rate from combined fishery in NAFO Div. 4T

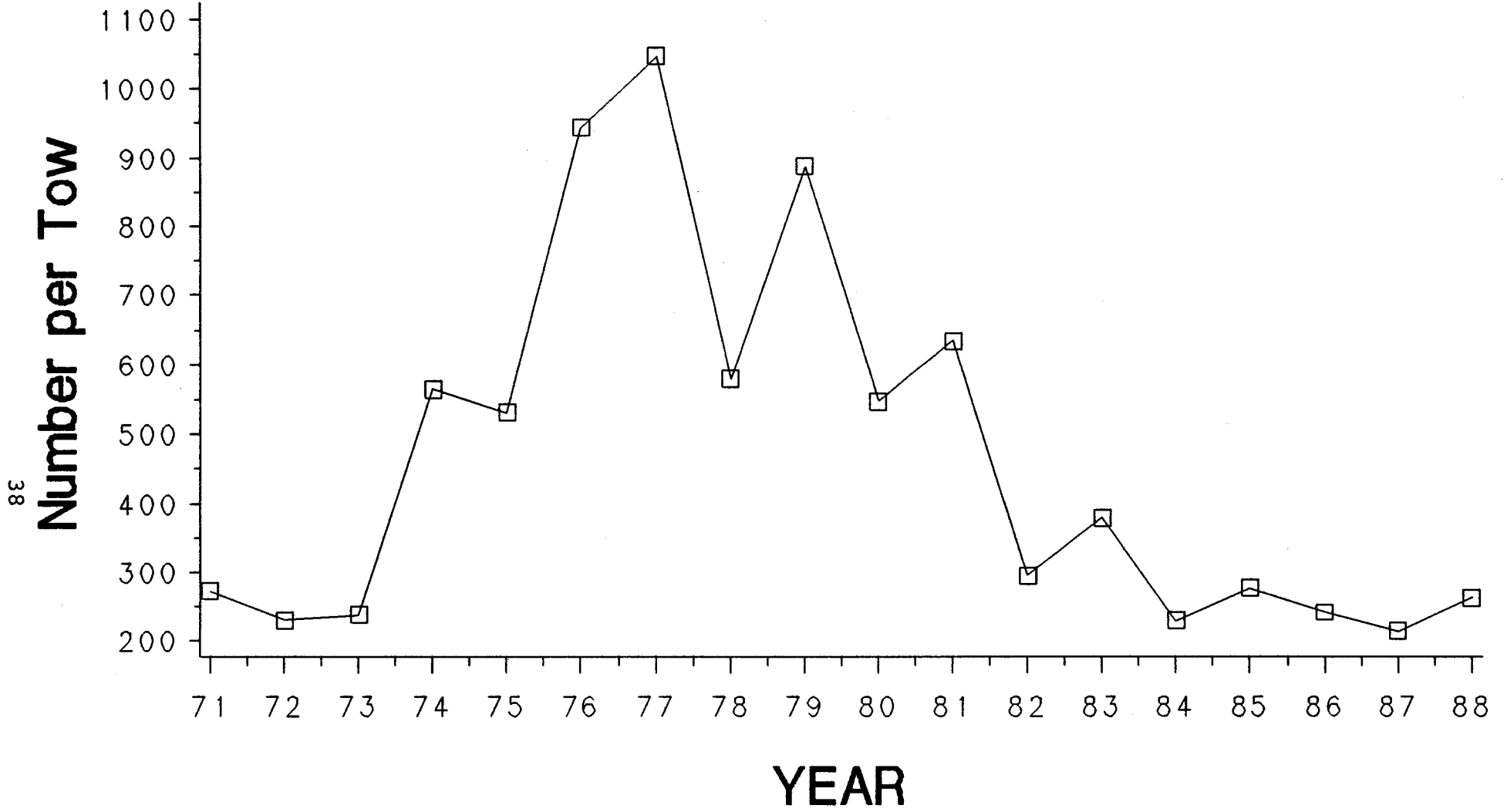


Figure 7. Mean number per tow from research vessel survey.

LANDINGS
(in 1000 metric tonnes)

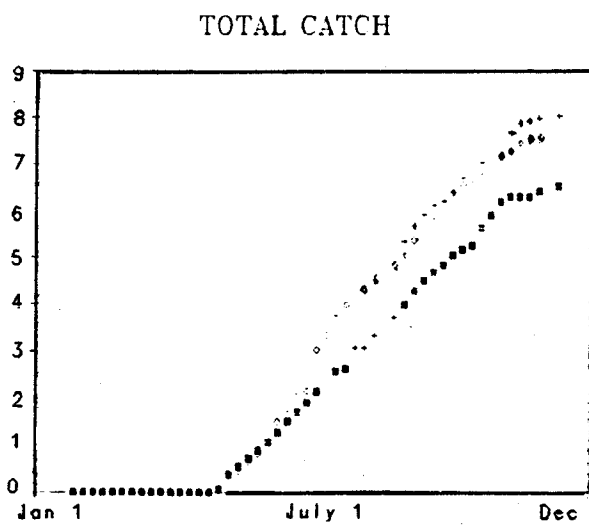
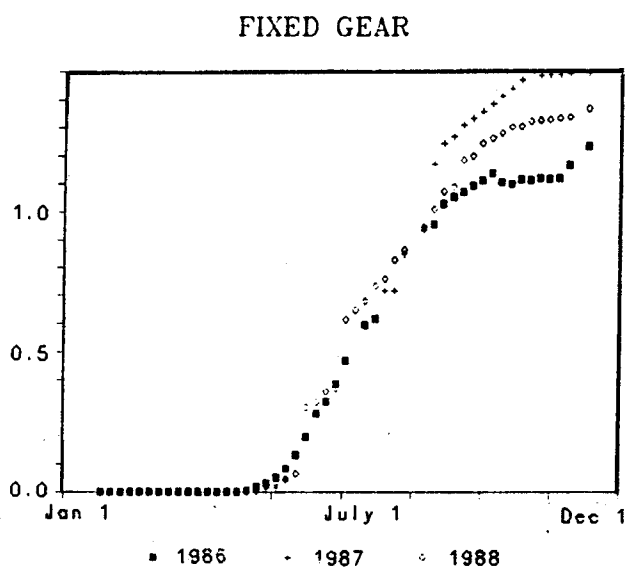
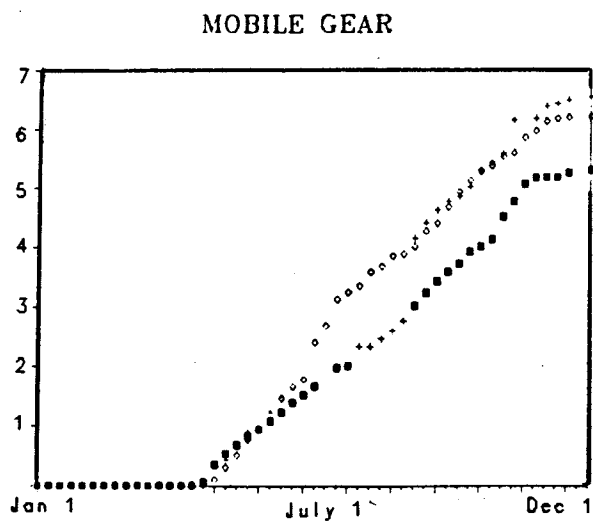


Figure 8. Weekly catches of American plaice

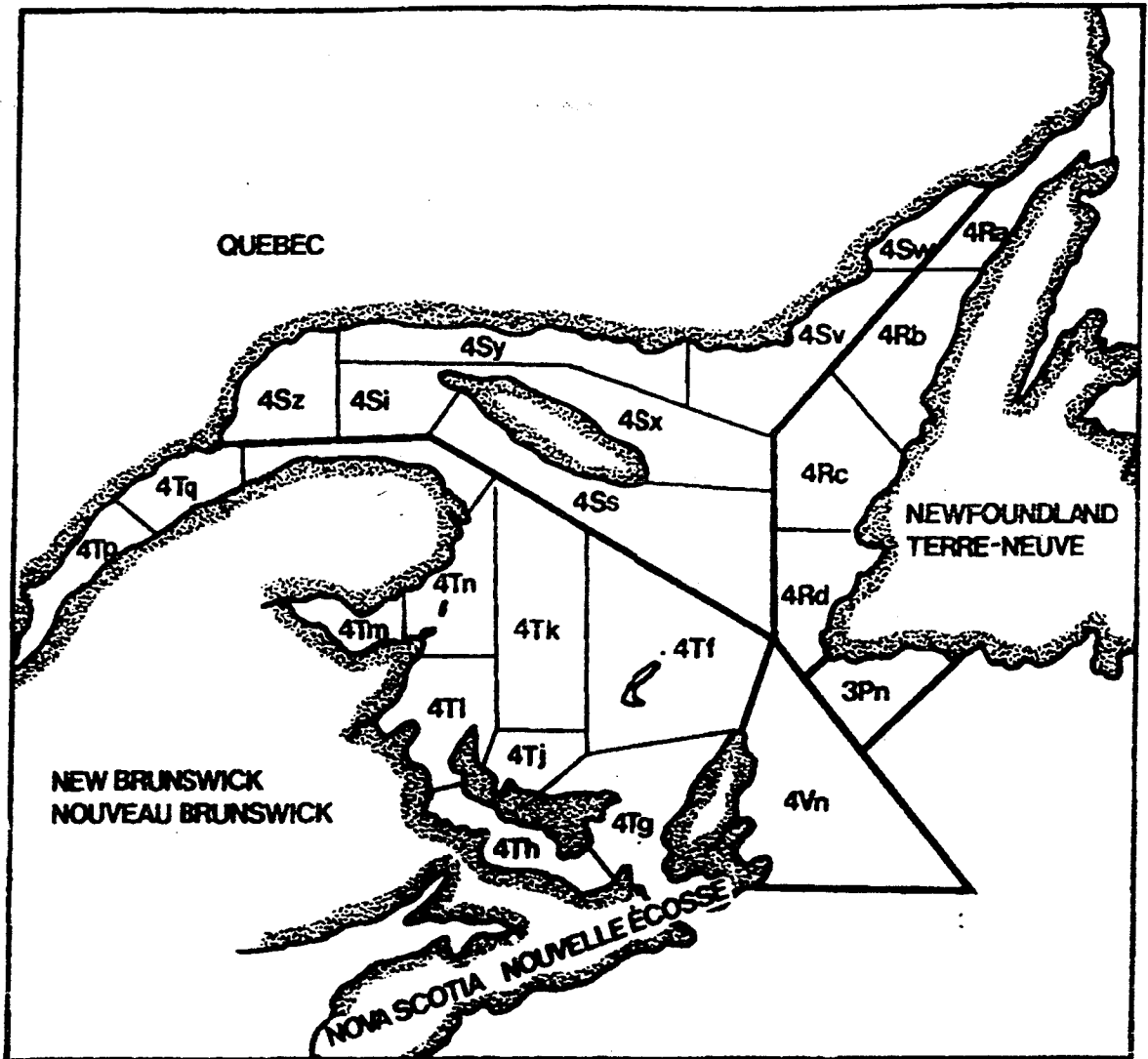


Figure 9. Gulf of St. Lawrence.