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An Assessment of the Yellowtail Flounder Stock in Divisions 3LNO

by

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TAC regulation

TACs have been in place since 1973, when a precautionary level of 50,000 t was established. In 1976, the TAC was set at 9000 t, following a series of high catches (Fig. 1, Table 1) and a reduction in stock size. From 1977-88, the TAC varied between 12,000 t and 23,000 t and was unchanged at 15,000 t for the last 4 years of that period. The TAC was set at 5000 t in 1989 and maintained at that level for 1990, following sharp declines in stock size after the large catches in 1985 and 1986. For 1991, the TAC was raised to 7000 t as there was some improved recruitment to the fishable stock.

Catch trends

The nominal catch increased from negligible levels in the early 1960s to a peak of over 39,000 t in 1972 (Fig. 1). Canada and the USSR were the major participants in the fishery up to 1975, with Canada taking virtually all the catch from 1976-81 (Table 1). Catches by other nations began to increase in 1982 as freezer trawlers started to fish in the NAFO Regulatory Area on the Tail of the Bank (Fig. 6). In 1985 and 1986, catches for all other nations exceeded those of Canada and total removals from the stock were about 30,000 t in each year. Catches by most fleets declined in subsequent years as some of the fishing effort was diverted to redfish in the deeper waters of the Regulatory Area.

The following text table shows the catches for 1989 and 1990:

	1989	1990
Canada	5,009	4,969
EEC/Spain	1,139	119
EEC/Portugal	5	11
Fra/SP	139	
USA	319	6
S. Korea	3,515	5,903
Others	100[a]	2,981[a,b]
Total	10,226	13,989

[a]Estimated, not report to NAFO.
[b]Includes 2881 tons estimated for NAFO member countries.

The 1990 value for S. Korea includes 2256 t determined from a breakdown of 2743 t of unspecified flounder. The Korean catch in 1990 is the highest value for this country (Table 1). The 1989 Korean catch includes 948 t determined from the unspecified flounder catch. The total Korean catch for 1989 of 3515 t is 2515 t higher than the estimate used for this country in the 1990 assessment. USA catches have declined steadily (Table 2), with the small catch in 1990 likely to be the result of improved yellowtail flounder catches off New England (NAFO SCS Doc. 91/8).

As in most years, catches of yellowtail flounder in 1989 and 1990 were mainly from Div. 3N. Table 3 shows the trends by division from 1965 to 1988.

Overall, the catches in 1989 and 1990 were lower than the preceding few years. However, there is still some doubt about the precise catch levels from this stock in recent years. About 25% of the estimated catch from this stock in 1984-86 came from Canadian surveillance and estimates of the proportion of yellowtail flounder in catches of unspecified flounder by S. Korea. Based on the above text table, the estimated portion of the catch in 1990 is between 35% and 40%. Given that Panama and Cayman islands continue to fish in the Regulatory Area along with vessels from several other nations who are not Contracting Parties of NAFO, it is possible that some yellowtail flounder has been taken in recent years, probably as a by-catch, which is not included in the catch estimates. Data from surveillance for these nations is not always adequate to allow a breakdown of flounder catches by species.

Determination of catch-at-age and mean weights-at-age from the commercial fishery

Length frequency samples are available from the Portuguese catch (11 t), the Spanish catch (119 t), and the Canadian catch (4969 t) in 1990. About 70% of the Portuguese catch was between 30 cm and 35 cm, meaning most of the yellowtail flounder were 5 and 6 years old. The Spanish length frequency data were summed over all months and adjusted to represent a catch of 3000 t. An age-length key from the Canadian fall survey in Div. 3N was used to determine numbers-at-age. Table 5 shows that ages 4 and 5 made up over 72% of the catch numbers, with the dominant year-class being that of 1985. This was also the dominant year-class in the 1989 Spanish catch, when it accounted for 53% of the catch numbers (Fig. 2).

Data from the Canadian fishery is shown in Table 6 and the resulting age composition is given in Table 7. Ages 6-8 dominated the Canadian catch in 1990, which is consistent with other years (Table 8). The mean weights-at-age from the Canadian catch in 1990 are virtually identical to recent values (Table 9).

In the last assessment of this stock, it was demonstrated that large changes in the age composition of the catch could be generated by slight changes in how samples were applied to catches, given the large differences in the age composition of catches by different fleets. It was also stated that large portions of catch in some years (e.g., 40%-45% in 1986) had no sampling whatsoever. These same caveats apply to the 1990 data, where the S. Korean catch is estimated to be about 42% of the total catch, and for which no sampling data are available. Thus, there can be no reliable catch-at-age calculated for the total removals from this stock for many of the years since 1984.

Commercial C/E data

A multiplicative analysis was carried out on the catch and effort data for this stock, using the same model as in the recent assessments. Canada took almost all the catch from this stock from 1976 to 1983, so only data from this fishery is available as a C/E index. Table 10 shows a summary of the Canadian data from 1965 to 1990 which were input to the model. Table 11 gives the results of the analysis, including the C/E index, which is also shown in Figure 3. Catch per effort declined fairly steadily from 1965 to 1976, then rose gradually to a relatively stable level in 1983-85. The index declined sharply in 1986 and has remained at a relatively low level, although there was an increase from 1989-90 of about 15%. Recent C/E values are close to previously observed lows in the mid-1970s.

Table 12 shows the catch rate at age in number of fish per hour from the Canadian fishery from 1986-1990. The effort values used were those derived from the multiplicative analysis described above and shown in Table 11. These data show the C/E at ages 6 and 7 in 1990 to be the highest at these ages in the 5-year series, while the value at age 8 is close to the mean at this age. There is generally very little catch at ages other than 6-8 from this fishery.

Research vessel surveys

A) Spring groundfish surveys

Stratified-random trawl surveys have been conducted by Canada in Div. 3LNO since 1971 with the exception of 1983. Stratification is based on depth and the survey strata are presented in Figure 6. Tables 13 to 15 give the mean weight per tow by stratum as well as the total biomass for Div. 3L, 3N, and 3Ø respectively. Most of the biomass for this stock occurs in Div. 3N (about 60%-70% in recent years) and has declined from 65,000 t in 1986 to about 33,000 t in 1989. The Div. 3N biomass in 1990 and 1991 was approximately 40,000 t. The total stock biomass has been variable and in the range of 80,000-140,000 t during the early 1980s; however, during the 1988-91 period the biomass has been fairly stable but lower, averaging about 55,000 t. Trends in biomass for strata 360 and 376, which are located mainly outside the 200-mile limit, are shown in Table 16 for the 1984-91 period. Biomass estimated from these two strata declined steadily from just over 30,000 t in 1984 to almost nil in 1988; however, during 1989 and 1991, about 40% of the total 3N biomass occurred in these strata.

Survey abundance at age for all three divisions combined is presented in Table 17. To account for incomplete survey coverage, during some years, estimates for non-sampled strata, derived using a multiplicative model, were included in the calculation of total abundance. It was assumed that the age composition in these non-sampled strata was the same as those strata where sampling occurred. The estimates for 1971-82 were also increased by a factor of 1.4 to account for a different vessel-gear combination used during this period. Total survey abundance for the 1973-84 period was fairly stable, averaging just under 300 million fish;

however, during 1985-88, a steady decline occurred and the 1988 abundance was estimated to be only about 100 million fish (Fig. 4). The 1989-91 values are about 30%-50% higher than the 1988 estimate but are still among the lowest in the 19-year research vessel time series for this stock. The trends in abundance for this stock observed from the Canadian research vessel results during the 1980s are similar to those observed from surveys conducted by the USSR.

The Canadian surveys are usually dominated by yellowtail of ages 5-8 years (Table 17). The 1985 and 1986 year-classes, age 6 and 5 years respectively in 1991, appear to be larger than any year-classes at these ages in the most recent 5 or 6 years. The 1985 year-class also appeared to be quite large as age 4 yellowtail in the 1989 survey. 1984 year-class (age 7 in 1991) appears to be on a par with recent year-classes at that same age. The 1983 year-class, which appeared relatively strong at ages 6 and 7 in 1989 and 1990 respectively is now estimated to be one of the lowest in the time series at age 8. It should be noted that all year-class strengths observed from surveys in the most recent period are considerably lower than those observed during the 1970s and early 1980s.

During the autumn of 1990, an additional survey was conducted by Canada in Div. 3NØ. Autumn surveys have been conducted in Div. 3L since 1981. Results of the 1990 autumn survey for yellowtail indicate that, although the total abundance during autumn is lower than that estimated during spring, the age composition estimated from the spring and autumn surveys are virtually identical (Fig. 5).

B) Juvenile yellowtail surveys

During August-September of 1990, a stratified-random survey of the Grand Bank (Fig. 6) was conducted by the research vessel WILFRED TEMPLEMAN, consisting of 195 successful 30-minute fishing hauls. This survey constituted year 6 in a time series for juvenile flatfish. The majority of fishing hauls were made inside the 91-m depth zone and out to the 183-m zone.

The standard juvenile flatfish trawl, a Yankee 41 shrimp trawl, was used in the survey. This trawl has a mesh size of 38 mm throughout, uses a 12-mm stretched mesh codend liner, and is rigged with 30-cm rubber bobbin footgear. The standard towing speed used was 2.5 knots and each haul was 30 minutes duration, covering a distance of 1.25 miles.

The WEBBER[1] sampling design, formulated in 1985 to give independent day and night biomass estimates of yellowtail flounder using randomly assigned day and night hauls within strata to track diel variability in trawl catches, was modified in 1988 (see Walsh, 1986, for a detailed description of this method). In 1985-87, an attempt was made to sample all strata inside the 91-m contour using this day/night split survey; but in 1988, it was decided to only use this design in the selected strata 352, 360, 361, 375, and 376, which are used to monitor juvenile yellowtail abundance. All of the other strata were surveyed in the regular way. This scheme was again followed for the 1989 and 1990 surveys and the areal coverage extended into the slope waters to a depth of 183 m, beginning in 1989.

Table 18 shows the average numbers and weights, along with biomass and abandunce estimates from the juvenile surveys in 1985-90. In 1990, largest catches (in numbers) of yellowtail were made in stratum 376 (dominated by the 1985 and 1986 year-classes); strata 360, 361, 362, and 375 in Div. 3N; and stratum 352 in Div. 3Ø. Catches in Div. 3L were smaller in comparison as is the case for all other years. Biomass estimates for Div. 3L and 3N increased from 1989, but Div. 3Ø was down slightly.

Table 19 shows a comparison of average numbers and weights of yellowtail flounder derived from independent day and night estimates, and the sum of the two, for juvenile yellowtail, from the selected strata in 1985-90 surveys. Again in 1990, as in other years, the abundance estimates of yellowtail derived from night catches were larger than those derived from day catches; however, the biomass estimates were almost the same. Biomass estimates showed an increase from 1989 due to large numbers of 4 and 5-year old fish (1985 and 1986 year-classes) occurring in the catches in strata 360 and 376 of Div. 3N. Biomass trends in the selected strata showed an increase in 1989 and 1990 with the 1990 biomass estimate being twice the size of the low 1988 value, when the stock was declining (Fig. 7).

Tables 20 and 21 contain information on the age compositions of the 1985-90 juvenile surveys from selected strata. In 1990, the overall average numbers per tow increased by 20% over the 1989 estimate from selected strata, being greatly inflated by the 1985 and 1986 year-classes showing up strongly at ages 5 and 4 in the catches (Table 20). Estimates of ages 1 to 4 contributed 45% of the total abundance. The 1985 and 1986 year-classes constituted 49% of the total abundance. In the 1989 survey, the abundance estimates of age 7+ showed an increase from 1988, dominated by the 1982 year-class; however, in the 1989 survey, the age 7+

1. An acronym based on the names of researchers at DFO's Newfoundland Region who designed a double (day and night) biomass stratified-random survey.

abundance decreased by 25%. Again, in 1990, as was the case in the 1989 survey, the 1984 (age 6) and the 1985 (age 5) year-class estimates are the largest in the time series. As well, in the 1990 survey, the 1986 year-class, which showed up as moderate in the 1989 survey, is the second largest in the survey and second to the 1985 year-class, at age 4, in the time series. The estimate of the 1987 year-class at age 3 is the largest in the 6-year time series at this age (Table 21; Fig. 8).

Tables 22 and 23 show the distribution of the 1985 and 1986 year-classes, at ages 5 and 4 years, in the selected strata during the surveys since 1986. In comparison to the total abundance estimates in all of Divisions 3LNO, it is evident that 97 to 100% of the estimates are from the selected strata, which are on or immediately adjacent to the Southeast Shoal. From 1986 to 1990, the majority of the 1985 year-class was found in strata 360 and 376. Similarly, for the 1986 year-class, the majority was found in the same two strata over the time period 1987 to 1990. Generally, it is stratum 376 on the southern region of the Southeast Shoal that contains most of the concentrations. These comparisons show that the juveniles are sedentary in their distribution and that the area of the southern Southeast Shoal and the area southwest of the shoals, which are mainly outside of the 200-mile boundary, act as the nursery site for juveniles. Table 24 clearly outlines the consistency of distribution of the age groups in NAFO Div. 3N in the 1989-91 juveniles and regular spring surveys. Juveniles aged 1 to 6 years are consistently found in larger amounts outside the 200-mile limit in strata 360 and 376, while age 7+ are concentrated more inside the 200-mile limit, mainly in the area of strata 361 and 375 of Div. 3N and stratum 352 in Div. 3Ø.

Standard number-per-tow of different age groups of yellowtail were contoured to represent spatial distribution. These data points describe a three-dimensional surface with latitude, longitude, and density; and the surface formed is defined by Delaunay triangles. The algorithm used to define these triangles is taken from Watson (1982). This shading contour program can be used to plot irregular spaced data (G. A. P. Black, 1988, Department of Fisheries and Oceans, Halifax, Nova Scotia; pers. comm.). Density plots of age-1 juveniles in the 1989 and 1990 surveys showed concentrations were found in the Southeast Shoal area: strata 375, 376, and 360 in Div. 3N (Fig. 9 and 10) agreeing with the 1985-88 surveys (Walsh 1990). As in the case of the 1989 survey, the age-4 juveniles were also concentrated in the same general area as the age-1 juveniles (Fig. 11 and 12). Yellowtail aged 1-4 years are absent from surveys in Div. 3L. The density plots of yellowtail age 5+ show that the distribution overlaps the age-1 and age-4 year olds and radiates in a northerly direction being found in large numbers in strata 360, 361, 375, and 376 in Div. 3N and stratum 352 in Div. 3Ø (Fig. 13 and 14). The Southeast Shoal and surrounding area to the west and southwest is proposed to be an oceanic nursery area for Grand Bank yellowtail flounder.

Assessment

Sequential population analysis (SPA) has been used in the past to assess this stock but has not been used since 1984 as the basis of advice. Since then, it was concluded that the very high value of fishing mortality at the older ages could not be fully explained and that the SPA models attempted were not appropriate. In 1990, the previously noted difficulties with the catch at age were raised, with the conclusion being that catch at age based models, such as SPA, were not suitable for this stock. Thus, evaluation of stock status relies heavily on the interpretation of the independent indices of abundance.

All 4 indices used to evaluate this stock (Canadian spring groundfish surveys, Canadian juvenile flatfish surveys, USSR groundfish surveys, and C/E from the Canadian commercial fleet) indicate an increase in abundance from 1988 to 1990 or 1991. However, the stock is still at a low level compared to historic values. The decline in stock size in the mid- to late-1980s was caused by poor recruitment from the year-classes of the early 1980s and a rapid increase in catches to about 30,000 t in 1985-86 from 10,000-15,000 t in 1980-83. The year-classes of 1984-86, and possibly 1987, are stronger than their immediate predecessors. Although they do not appear to be as strong as most of the 1970's year-classes at ages 4 and 5, comparisons are somewhat difficult, given that large numbers of the recent year-classes were caught at younger ages relative to the earlier cohorts; i.e., there is likely to be more of an influence from fishing mortality on the recent estimates of year-classes at ages 4 and 5 compared to the years prior to the mid-1980s. This would be caused by the exploitation of younger fish in the Regulatory Area; e.g., the Spanish catches in 1989 and 1990 were dominated by the 1985 year-class.

Prognoses

In the 1990 assessment of this stock, the recent C/E and Canadian r.v. survey abundance at ages 5-7 were compared to historically stable levels to determine stock status. Both these indices increased slightly in the most recent year (1991 for r.v., 1990 for C/E; Fig. 15 and 3) but are still at relatively low levels. The increase in catch from 1989 to 1990 is likely a measure of strong recruitment, particularly the 1985 and 1986 year-classes, although the age composition of about half the catch in 1990 is unknown. Thus, the prognosis is that the stock is showing a slight increase, due to improved recruitment, and that a catch of 7000 t in 1992 will not be harmful to the stock. In the short term, the strength of the 1985-87 year-classes will determine the success of most fisheries. However, the increase in catch in the Regulatory Area in 1990 to around 9000 t is cause for concern. If the Canadian allocation for 1992 is close to the TAC, as has been in recent history, increasing catches in the Regulatory Area will mean total catches from the stock could be 2-3 times higher than the TAC. Given the relatively low level of abundance at present, it is unlikely the stock will rebuild to former levels - when catches averaged 14,000 t and the stock was relatively stable - if catches continue to escalate well beyond the TAC.

References

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Table 1. Nominal catches by country and TACs (tons) of yellowtail in NAFO Divisions 3LNO.

Year	Canada	France	USSR	South Korea[a]	Other	Total	TAC
1963	138	–	380	–	–	518	
1964	126	–	21	–	–	147	
1965	3,075	–	55	–	–	3,130	
1966	4,185	–	2,834	–	7	7,026	
1967	2,122	–	6,736	–	20	8,878	
1968	4,180	14	9,146	–	–	13,340	
1969	10,494	1	5,207	–	6	15,708	
1970	22,814	17	3,426	–	169	26,426	
1971	24,206	49	13,087	–	–	37,342	
1972	26,939	358	11,929	–	33	39,259	
1973	28,492	368	3,545	–	410	32,815	50,000
1974	17,053	60	6,952	–	248	24,313	40,000
1975	18,458	15	4,076	–	345	22,894	35,000
1976	7,910	31	57	–	59	8,057	9,000
1977	11,295	245	97	–	1	11,638	12,000
1978	15,091	375	–	–	–	15,466	15,000
1979	18,116	202	–	–	33	18,351	18,000
1980	12,011	366	–	–	–	12,377	18,000
1981	14,122	558	–	–	–	14,680	21,000
1982	11,479	110	–	1,073	657	13,319	23,000
1983	9,085	165	–	1,223	–	10,473	19,000
1984	12,437	89	–	2,373	1,836[b]	16,735	17,000
1985	13,440	–	–	4,278	11,245[b]	28,963	15,000
1986	14,168	77	–	2,049	13,882[b]	30,176	15,000
1987	13,420	51	–	125	2,718	16,314	15,000
1988	10,607	–	–	1,383	4,166[b]	16,158	15,000
1989[c]	–	–	–	–	–	–	5,000
1990	–	–	–	–	–	–	5,000
1991							7,000

[a]See text for explanation of South Korean catches.
[b]Includes some catches estimated from surveillance reports. See Table 2.
[c]See text for details of 1989 and 1990 catches.

Table 2. Breakdown of 1984-88 catches from Table 1 listed as "other."

Year	Spain	Portugal	Panama[a]	USA	Cayman Islands[a]	Other	Total
1984	25	–	1,800	–	–	11	1,836
1985	2,425	–	4,208	3,797	803	12	11,245
1986	366	5,521	4,044	2,221	1,728	2	13,882
1987	1,183	–	–	1,535	–	–	2,718
1988	3,205	–	–	863	–	100[b]	4,163

[a]Not reported to NAFO. Catches estimated from surveillance reports.
[b]Includes some estimated catches.

Table 3. Breakdown of nominal catches (tons) of yellowtail by NAFO Div. 3L, 3N, and 3Ø for 1965-88.

Year	3L	3N	30	UNK	Total
1965	117	2,958	55	-	3,130
1966	62	6,442	522	-	7,026
1967	453	6,117	2,308	-	8,878
1968	2,815	8,459	2,066	-	13,340
1969	5,287	7,215	3,206	-	15,708
1970	7,419	18,668	339	-	26,426
1971	6,632	25,174	5,536	-	37,342
1972	9,292	25,788	4,179	-	39,259
1973	4,856	23,693	4,266	-	32,815
1974	1,544	19,329	3,440	-	24,313
1975	2,638	16,156	4,100	-	22,894
1976	516	5,023	2,518	-	8,057
1977	2,651	7,381	1,606	-	11,638
1978	2,547	11,079	1,840	-	15,466
1979	2,595	14,556	1,200	-	18,351
1980	1,898	9,805	674	-	12,377
1981	2,345	11,733	602	-	14,680
1982[a]	2,305	9,327	1,687	-	13,319
1983[a]	2,552	6,966	925	-	10,473
1984[a,b]	5,264	10,799	672	-	16,735
1985[a,b]	3,478	23,912	1,573	-	28,963
1986[a,b]	3,053	25,475	1,648	-	30,176
1987[a]	1,600	12,791	1,923	-	16,314
1988[a,b]	2,127	12,331	1,700	-	16,158

[a]Includes estimated breakdown of unspecified flounder catches by S. Korea.
[b]Includes estimates of non-reported catch outside Canadian 200-mile limit. These catches are attributed 90%: 10% to Div. 3N:3Ø.

Table 4. Breakdown of Canadian (N+SF) catches by division, month, and gear for yellowtail in Divisions 3LNO in 1990.

	3L				3N				3Ø				
	OT		SS		OT		SS		OT		SS		
	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	Total
Jan													
Feb													
Mar													
Apr	2										14		16
May	185				308		6		154	2	41		696
Jun	264	26			472	3			271	15	14		1065
Jul	386		2		589		7		72		10		1066
Aug	276				805	31	63	34	53		2	19	1283
Sep	65		1		376	3	37	25	68		2		577
Oct	31	2			92	25	1	9	8		4		172
Nov	23				13		1	4	5	3	9		58
Dec	2				15		1		6	8		4	36
Total	1234	28	3		2670	62	116	72	637	28	96	23	4969

Div. Totals	3L	3N	3Ø
	1265	2920	784

(N) = Canada (Newfoundland)
(SF) = Canada (Scotia-Fundy)
OT = Otter trawl
SS = Scottish seine

Table 5. Percent age composition of yellowtial in the Spanish fishery in 1988-1990.

Age	Year 1988	1989	1990
2	0.01	1.6	1.7
3	11.1	11.7	11.9
4	45.0	53.4	32.8
5	27.7	25.5	39.6
6	8.9	6.8	10.0
7	5.0	0.8	3.5
8	2.0	0.2	0.5
9	0.2	0.1	0.0

Table 6. Samples used to calculate catch at age and mean weights at age for yellowtail in the Canadian fishery in Divisions 3LNO in 1990. Numbers in parentheses are the number of observations, and n is the number of samples.

Age-length key	Length frequency	n	Catch (t)	Description
Offshore, Q2, 3L (26) 3N (101) 3Ø (218)	OT, May, 3L (312)	1	477	3L, Jan-Jun
Offshore, Q3, 3L (126)	OT, Jul, 3L (1473) Aug (325)	4 1	388 342	3L, Jul Aug-Sep
Offshore, Q3, 3L (126) Q4, (63)	OT, Nov, 3L (344)	1	139	3LO, Oct-Dec, 3N, Nov-Dec
Offshore, Q2, 3L (26) 3N (101) 3Ø (218)	OT, May, 3N (635) Jun, 3N (288)	2 1	314 475	3N, Jan-May Jun
Offshore, Q3, 3N (397)	OT, Jul, 3N (1348) Aug (1333) Sep (717)	4 4 2	596 933 568	3N, Jul Aug Sep-Oct
Offshore, Q2, 3Ø (218)	Sc.S., Apr, 3Ø (320) Jun (333) OT, May (961) Jun (326)	1 1 3 1	14 55 156 286	3Ø, Sc.S., Jan-Apr May-Jun OT, Jan-May Jun
Offshore, Q3, 3Ø (105)	OT, Aug, 3Ø (325) Sep (323)	1 1	156 70	3Ø, Jul-Aug Sep
	Total Canadian catch = 4969 t			

Table 7. Catch at age and mean weights at age of yellowtail in the Canadian fishery in Div. 3LNO in 1990.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
4	0.139	26.500	4	3.75	1.06
* 5	0.211	29.816	259	34.95	0.13
* 6	0.315	33.493	1762	101.83	0.06
7	0.447	37.110	4912	137.28	0.03
8	0.626	40.888	2968	107.53	0.04
* 9	0.894	45.374	330	29.35	0.09
*10	1.369	51.442	2	1.49	0.61

Table 8. Catch at age of yellowtail in the Canadian fishery in Div. 3LNO from 1986-1990.

AGE	1986	1987	1988	1989	1990
4	4	3	85	0	4
5	813	471	546	131	259
6	4210	5055	2877	986	1762
7	13007	10935	7365	3978	4912
8	8088	8437	7322	4150	2968
9	1650	1609	1226	541	330
10	186	107	66	16	2
4+	27958	26617	19487	9802	10237

Table 9. Mean weights at age of yellowtail in the Canadian fishery in Div. 3LNO from 1986-1990.

AGE	1986	1987	1988	1989	1990
4	0.090	0.150	0.180	0.000	0.140
5	0.260	0.220	0.250	0.220	0.210
6	0.360	0.330	0.330	0.320	0.320
7	0.470	0.450	0.450	0.440	0.450
8	0.620	0.610	0.620	0.590	0.630
9	0.840	0.840	0.920	0.870	0.890
10	1.030	1.210	1.280	1.370	1.370

Table 10. Summary of actual Canadian catch (t) and effort (hrs) data used in the multiplicative analysis of CPUE.

Year	Div. 3L Catch	Div. 3L Effort	Div. 3N Catch	Div. 3N Effort	Div. 3Ø Catch	Div. 3Ø Effort
1965	–	–	1374	1732	–	–
1966	–	–	1282	1699	104	160
1967	190	351	705	998	52	132
1968	1585	2428	524	648	104	183
1969	1103	1863	2110	3393	19	40
1970	4138	8295	8208	12875	72	166
1971	3030	6291	11066	17885	60	154
1972	3031	7040	11218	17063	297	652
1973	1617	3206	18338	28083	1272	2226
1974	399	1329	13002	30222	624	2224
1975	1312	4385	10303	23882	1730	5274
1976	107	491	3673	10749	1106	3589
1977	847	2420	3563	7696	646	2324
1978	599	1917	7830	14769	865	2719
1979	873	2606	11872	22214	526	1567
1980	568	1579	6878	10150	414	1020
1981	682	1725	9566	15120	174	345
1982	699	1802	4794	9013	92	321
1983	477	1247	4071	6925	54	88
1984	1890	4247	4861	10064	107	217
1985	830	1928	5804	9771	235	727
1986	624	1976	7819	16472	450	1567
1987	198	690	8144	17857	607	1933
1988	243	856	5254	11831	598	2148
1989	64	260	1386	3797	594	2057
1990	195	659	1860	4119	245	793

Table 11. Analysis of catch and effort data, using a multiplicative model, from the Canadian directed yellowtail fishery in 1965-1990.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R............. 0.762
MULTIPLE R SQUARED..... 0.581

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.254E1	2.254E1	
REGRESSION	40	2.943E0	7.357E¯2	24.561
TYPE 1	2	4.107E¯1	2.054E¯1	68.552
TYPE 2	2	2.602E¯1	1.301E¯1	43.435
TYPE 3	11	4.485E¯1	4.077E¯2	13.611
TYPE 4	25	1.119E0	4.475E¯2	14.939
RESIDUALS	709	2.124E0	2.996E¯3	
TOTAL	750	2.760E1		

Type 1: Country-Gear-TC
3114=Can(N),OTB1,TC4
3124=Can(N),OTB2,TC4
3125=Can(N),OTB2,TC5

Type 2: Division
32=3L,34=3N,35=3O

Type 3: Month

Type 4: Year

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.147	0.105	750
2	34				
3	10				
4	65				
1	3114	1	¯0.291	0.028	156
	3124	2	¯0.222	0.031	130
2	32	3	¯0.189	0.025	180
	35	4	¯0.200	0.029	143
3	1	5	¯0.235	0.074	19
	2	6	¯0.304	0.073	20
	3	7	¯0.230	0.057	33
	4	8	¯0.262	0.047	54
	5	9	¯0.299	0.040	107
	6	10	¯0.374	0.042	97
	7	11	¯0.328	0.042	97
	8	12	¯0.227	0.042	91
	9	13	¯0.045	0.043	79
	11	14	¯0.097	0.048	50
	12	15	¯0.191	0.057	36
4	66	16	¯0.016	0.132	11
	67	17	¯0.057	0.132	12
	68	18	¯0.260	0.128	14
	69	19	¯0.371	0.119	20
	70	20	¯0.369	0.109	41
	71	21	¯0.401	0.108	41
	72	22	¯0.524	0.108	44
	73	23	¯0.385	0.107	50
	74	24	¯0.785	0.110	36
	75	25	¯0.827	0.110	35
	76	26	¯0.898	0.116	26
	77	27	¯0.700	0.111	36
	78	28	¯0.697	0.108	51
	79	29	¯0.648	0.108	46
	80	30	¯0.542	0.112	30
	81	31	¯0.547	0.112	30
	82	32	¯0.629	0.115	23
	83	33	¯0.473	0.114	23
	84	34	¯0.536	0.115	27
	85	35	¯0.507	0.113	29
	86	36	¯0.805	0.113	30
	87	37	¯0.777	0.113	29
	88	38	¯0.857	0.115	26
	89	39	¯0.842	0.123	16
	90	40	¯0.707	0.121	16

Table 11. Continued.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1965	0.1469	0.0111	1.154	0.121	3075	2666
1966	0.1313	0.0088	1.137	0.106	4185	3681
1967	0.0900	0.0095	1.091	0.106	2122	1946
1968	-0.1130	0.0072	0.891	0.075	4180	4690
1969	-0.2245	0.0052	0.798	0.058	10494	13150
1970	-0.2219	0.0026	0.801	0.041	22814	28478
1971	-0.2544	0.0024	0.776	0.038	24206	31209
1972	-0.3772	0.0023	0.686	0.033	26939	39269
1973	-0.2380	0.0022	0.789	0.037	28492	36134
1974	-0.6377	0.0028	0.529	0.028	17053	32264
1975	-0.6797	0.0025	0.507	0.025	18458	36413
1976	-0.7508	0.0039	0.472	0.030	7910	16767
1977	-0.5529	0.0031	0.575	0.032	11295	19636
1978	-0.5499	0.0024	0.577	0.028	15091	26146
1979	-0.5015	0.0024	0.606	0.030	18116	29904
1980	-0.3954	0.0035	0.673	0.040	12011	17840
1981	-0.4002	0.0033	0.670	0.038	14122	21074
1982	-0.4821	0.0038	0.617	0.038	11479	18598
1983	-0.3259	0.0035	0.722	0.043	9085	12589
1984	-0.3893	0.0038	0.677	0.042	12437	18364
1985	-0.3598	0.0031	0.698	0.039	13440	19261
1986	-0.6583	0.0032	0.518	0.029	14168	27368
1987	-0.6304	0.0032	0.532	0.030	13420	25211
1988	-0.7101	0.0037	0.491	0.030	10614	21597
1989	-0.6953	0.0056	0.498	0.037	5009	10053
1990	-0.5600	0.0050	0.571	0.040	4969	8708

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.063

Table 12. C/E at age from the Canadian fishery for yellowtail in NAFO Div. 3LNO from 1986-1990.

AGE	1986	1987	1988	1989	1990
4	0.1	0.1	3.9	0.0	0.5
5	29.7	18.7	25.3	13.0	29.7
6	153.8	200.5	133.2	98.1	202.3
7	475.3	433.7	341.0	395.7	564.1
8	295.5	334.7	339.0	412.8	340.8
9	60.3	63.8	56.8	53.8	37.9
10	6.8	4.2	3.1	1.6	0.2

Table 13. Mean weight of yellowtail per 30 minute tow, by stratum, from research vessel surveys in Division 3L. Numbers in parentheses are the number of successful tows in each stratum.

			Year-Trip												
Depth (fm)	Stratum	No. of trawlable units	1971 ATC 187	1972 ATC 199	1973 ATC 207-9	1974 ATC 222	1975 ATC 233	1976 ATC 245-6	1977 ATC 262-3	1978 ATC 276-7	1979 ATC 289-91	1980 ATC 303-5	1981 ATC 317-9	1982 ATC 327-9	1984 AN 27-28
51-100	328	114,023	-	-	-	-	-	-	0.0(3)	-	0.0(5)	-	0.0(2)	0.0(3)	0.0(2)
51-100	341	118,151	-	-	0.0(3)	-	-	-	0.1(4)	0.1(4)	0.0(6)	0.0(6)	0.0(2)	0.0(5)	0.0(4)
51-100	342	43,913	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(4)	0.0(4)	-	0.0(3)	0.0(4)
51-100	343	39,409	-	-	-	-	-	-	0.0(2)	0.0(3)	0.0(4)	0.0(4)	0.0(2)	0.0(4)	-
101-150	344	112,146	-	-	-	-	-	0.0(4)	0.0(4)	0.0(4)	0.0(2)	0.0(3)	0.0(5)	0.0(4)	-
151-200	345	107,492	-	-	-	-	-	0.0(4)	0.0(4)	0.0(2)	0.0(4)	0.0(5)	0.0(4)	0.0(4)	-
151-200	346	64,931	-	-	-	-	0.0(2)	0.0(2)	0.0(3)	-	0.0(4)	0.0(3)	0.0(3)	0.0(3)	-
101-150	347	73,788	0.0(2)	-	-	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(4)	0.0(4)	0.0(5)	0.0(4)	0.0(2)	-
51-100	348	159,136	0.0(3)	0.0(3)	-	0.0(6)	0.0(4)	0.0(6)	0.0(6)	0.0(6)	0.0(6)	0.0(7)	0.0(7)	0.0(4)	-
51-100	349	158,686	4.8(3)	0.0(4)	-	0.0(4)	0.0(2)	0.2(3)	0.0(6)	0.0(6)	0.0(7)	0.0(9)	0.0(4)	0.0(6)	0.1(6)
31-50	350	155,458	32.2(3)	2.3(2)	0.0(4)	0.2(3)	0.0(3)	0.2(4)	3.8(4)	1.5(6)	1.1(9)	1.1(10)	0.3(3)	0.6(7)	1.5(6)
31-50	363	133,614	119.8(3)	21.3(3)	12.5(4)	0.5(4)	1.0(3)	2.5(4)	27.4(5)	6.3(5)	22.3(8)	39.3(5)	3.0(3)	30.4(5)	28.2(5)
51-100	364	211,456	13.7(4)	0.0(3)	-	0.0(4)	0.0(2)	0.0(3)	0.2(7)	0.1(6)	0.1(8)	0.4(6)	0.0(3)	0.0(6)	0.6(5)
51-100	365	78,142	0.0(3)	0.0(2)	-	0.0(3)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	0.0(4)	0.0(4)	0.0(2)	0.0(3)	-
101-150	366	104,639	0.0(3)	-	-	0.0(3)	0.0(4)	0.0(4)	0.0(4)	-	0.0(4)	0.0(4)	0.0(3)	0.0(5)	-
151-200	368	25,071	0.0(2)	-	-	0.0(2)	0.0(2)	0.0(3)	0.0(3)	-	0.0(4)	0.0(2)	0.0(2)	0.0(2)	-
101-150	369	72,137	0.0(3)	-	-	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(2)	0.0(4)	0.0(3)	0.0(2)	0.0(2)	-
51-100	370	99,085	1.4(2)	0.3(3)	-	0.0(3)	0.0(3)	0.0(3)	0.5(3)	0.2(3)	0.0(4)	0.0(3)	0.0(2)	0.0(2)	-
31-50	371	84,147	88.5(3)	6.4(2)	-	0.0(3)	-	-	1.4(3)	0.3(3)	0.5(3)	80.5(3)	0.0(2)	1.1(4)	-
31-50	372	184,658	135.3(4)	28.1(3)	39.6(3)	7.1(3)	7.6(3)	44.2(3)	32.1(6)	20.5(7)	24.3(9)	25.0(6)	13.3(4)	19.8(6)	59.4(5)
31-50	384	84,072	86.0(3)	3.0(2)	2.3(3)	0.6(3)	-	-	7.0(2)	0.0(3)	1.5(4)	0.0(2)	0.4(2)	10.3(2)	-
51-100	385	176,851	0.0(4)	0.0(4)	0.2(3)	0.0(2)	0.0(4)	0.0(2)	0.0(6)	0.0(6)	0.0(7)	0.0(4)	0.0(3)	0.0(3)	-
101-150	386	73,788	0.0(2)	-	-	0.0(3)	0.0(3)	0.0(2)	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(2)	0.0(3)	-
151-200	387	53,896	0.0(3)	-	-	0.0(3)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(4)	0.0(2)	0.0(2)	0.0(3)	-
151-200	388	27,098	0.0(2)	-	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	-
101-150	389	61,628	0.0(3)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(2)	0.0(2)	-
51-100	390	111,170	0.3(3)	0.0(3)	0.0(3)	0.0(3)	0.0(3)	-	0.0(2)	0.0(4)	0.0(5)	0.3(3)	0.0(2)	0.8(4)	-
101-150	391	21,168	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	-	0.0(2)	0.0(2)	0.0(4)	0.0(2)	0.0(2)	0.0(2)	-
151-200	392	10,884	-	-	0.0(3)	0.0(4)	0.0(2)	-	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	-
201-300	729	13,962	-	-	-	-	-	-	-	-	-	-	-	-	-
301-400	730	12,761	-	-	-	-	-	-	-	-	-	-	-	-	-
201-300	731	16,214	-	-	-	-	-	-	-	-	-	-	-	-	-
301-400	732	17,340	-	-	-	-	-	-	-	-	-	-	-	-	-
201-300	733	35,130	-	-	-	-	-	-	-	-	-	-	-	-	-
301-400	734	17,115	-	-	-	-	-	-	-	-	-	-	-	-	-
201-300	735	20,417	-	-	-	-	-	-	-	-	-	-	0.0(2)	-	-
301-400	736	13,136	-	-	-	-	-	-	-	-	-	-	-	-	-
Biomass ('000 t)			64.5	9.2	9.2	1.4	1.5	8.5	11.0	4.9	7.8	10.2	2.9	8.8	15.1

Table 13. (Cont'd.)

Depth (fm)	Stratum	1985 AN 28-30	1986 WT 48	1987 WT 59, 60	1988 WT 70, 71	1989 WT 82, 83	1990 WT 95-96	1991[a] WT 106, 107
51-100	328	0.0(4)	0.0(9)	0.0(7)	0.0(2)	0.0(8)	0.1(7)	
51-100	341	0.01(9)	0.0(9)	0.1(6)	0.0(6)	0.0(8)	0.0(4)	
51-100	342	0.0(3)	0.0(3)	0.2(2)	0.0(2)	0.1(3)	0.0(2)	
51-100	343	0.0(3)	0.0(4)	0.0(3)	0.0(3)	0.0(3)	0.2(3)	
101-150	344	0.0(5)	0.0(8)	0.0(4)	0.0(6)	0.0(7)	0.0(6)	
151-200	345	0.0(5)	0.0(7)	0.0(4)	0.0(8)	0.0(9)	0.0(4)	
151-200	346	0.0(2)	0.0(5)	0.0(5)	0.0(4)	0.0(4)	0.0(4)	
101-150	347	0.0(5)	0.0(5)	0.0(3)	0.0(5)	0.0(6)	0.0(4)	
51-100	348	0.0(18)	0.0(12)	0.1(8)	0.0(11)	0.0(9)	0.0(11)	
51-100	349	0.1(14)	1.3(14)	0.1(11)	0.1(8)	0.0(11)	0.0(9)	
31-50	350	3.7(12)	2.3(11)	0.6(11)	1.6(8)	0.6(11)	0.2(7)	
31-50	363	15.2(8)	8.3(10)	7.6(9)	4.9(7)	1.5(9)	3.4(7)	
51-100	364	0.0(17)	0.0(17)	0.0(15)	0.0(10)	0.0(16)	0.0(12)	
51-100	365	0.0(7)	0.0(5)	0.0(5)	0.0(4)	0.0(6)	0.0(4)	
101-150	366	0.0(6)	0.0(8)	0.0(7)	0.0(6)	0.0(8)	0.0(6)	
151-200	368	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(2)	
101-150	369	0.0(5)	0.0(6)	0.0(5)	0.0(4)	0.0(6)	0.0(5)	
51-100	370	0.0(8)	0.0(8)	0.0(7)	0.0(5)	0.0(8)	0.0(7)	
31-50	371	0.4(7)	0.3(6)	0.0(7)	0.1(5)	0.1(6)	0.0(6)	
31-50	372	56.5(12)	36.3(14)	13.9(13)	7.0(11)	12.7(13)	4.7(7)	
31-50	384	4.6(6)	1.6(6)	1.1(7)	0.2(5)	0.1(6)	0.0(4)	
51-100	385	0.0(15)	0.0(13)	0.0(11)	0.0(10)	0.0(12)	0.0(11)	
101-150	386	0.0(5)	0.0(6)	0.0(5)	0.0(4)	0.0(6)	0.0(5)	
151-200	387	0.0(6)	0.0(4)	0.0(4)	0.0(4)	0.0(5)	0.0(4)	
151-200	388	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	
101-150	389	0.0(5)	0.0(5)	0.0(6)	0.0(3)	0.0(5)	0.0(4)	
51-100	390	0.3(9)	0.0(8)	0.0(7)	0.0(5)	0.0(8)	0.0(5)	
101-150	391	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	
151-200	392	0.0(2)	0.0(2)	0.2(2)	0.0(2)	0.0(3)	0.0(2)	
201-300	729	0.0(2)	-	-	-	-	-	
301-400	730	0.0(2)	-	-	-	-	-	
201-300	731	0.0(2)	-	-	-	-	-	
301-400	732	0.0(2)	-	-	-	-	-	
201-300	733	0.0(3)	-	-	-	-	-	
301-400	734	0.0(2)	-	-	-	-	-	
201-300	735	0.0(2)	-	-	-	-	-	
301-400	736	0.0(2)	-	-	-	-	-	
Biomass ('000 t)		13.5	8.5	3.8	2.2	2.7	1.4	0.6

[a]Preliminary analysis.

Table 14. Mean weight of yellowtail per 30 minute tow, by stratum, from research vessel surveys in Division 3N. Numbers in parentheses are the number of successful sets in each stratum. The stratified mean weight per tow and the biomass estimates are given at the bottom of the table.

Depth (fm)	Stratum	No. of trawlable units	Year-Trip 1971 ATC 187	1972 ATC 199	1973 ATC 207-9	1974 ATC 222	1975 ATC 233	1976 ATC 245-6	1977 ATC 262-3	1978 ATC 276-7	1979 ATC 289-91	1980 ATC 303-5
151-200	357	12,317	-	-	0.0(2)	-	-	-	0.0(2)	-	0.0(3)	0.0(3)
101-150	358	16,899	-	0.0(4)	0.0(3)	-	-	-	0.0(2)	-	0.0(2)	0.0(3)
51-100	359	31,620	-	0.0(3)	0.0(3)	-	-	0.0(3)	0.0(2)	-	0.0(4)	0.0(4)
31-50	360	224,717	-	58.3(4)	-	-	12.1(4)	128.6(4)	55.9(4)	43.5(4)	27.6(9)	83.8(11)
31-50	361	139,171	45.8(2)	115.8(3)	93.4(4)	151.5(4)	105.3(4)	113.0(5)	141.5(3)	122.8(4)	92.3(8)	128.4(7)
31-50	362	189,267	140.2(2)	132.8(4)	22.1(5)	38.9(4)	33.3(3)	44.1(5)	62.4(5)	28.8(4)	40.3(12)	53.6(11)
31-50	373	189,267	73.6(4)	135.1(4)	26.7(4)	24.2(4)	-	23.3(5)	74.5(4)	50.5(5)	22.1(11)	48.1(8)
31-50	374	69,924	67.8(2)	42.4(2)	115.4(4)	16.1(2)	62.1(2)	-	22.4(3)	22.0(3)	24.8(4)	39.0(3)
< 30	375	119,644	60.0(3)	69.0(3)	121.9(3)	94.5(3)	80.3(3)	-	62.7(4)	30.6(5)	66.1(5)	57.8(4)
≤ 30	376	112,584	-	45.4(2)	10.3(3)	-	82.1(2)	126.4(3)	78.3(3)	4.6(2)	86.4(4)	125.3(3)
51-100	377	7,511	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	-	0.0(2)	0.0(2)	0.0(3)	0.0(4)
101-150	378	10,440	0.0(2)	0.0(2)	0.0(2)	0.2(3)	-	-	0.0(2)	1.4(2)	0.0(3)	0.0(2)
151-200	379	7,961	-	-	0.0(2)	0.0(3)	-	-	0.0(2)	0.3(2)	0.0(3)	0.0(3)
151-200	380	8,712	-	0.0(2)	0.0(3)	0.0(2)	-	-	0.0(2)	-	0.0(2)	0.0(3)
101-150	381	13,669	0.0(4)	0.5(4)	0.0(3)	0.0(4)	0.0(2)	-	0.0(2)	0.0(3)	0.0(3)	0.5(4)
51-100	382	48,594	0.0(3)	0.0(4)	0.0(3)	0.0(3)	-	0.0(2)	0.0(3)	0.0(3)	0.0(3)	0.0(4)
31-50	383	50,621	18.6(2)	7.3(2)	0.1(2)	0.0(2)	-	0.0(3)	2.7(3)	0.0(2)	0.0(3)	0.5(4)
201-300	723	-	-	-	-	-	-	-	-	-	-	-
301-400	724	-	-	-	-	-	-	-	-	-	-	-
201-300	725	-	-	-	-	-	-	-	-	-	-	-
301-400	726	-	-	-	-	-	-	-	-	-	-	-
201-300	727	-	-	-	-	-	-	-	-	-	-	-
301-400	728	-	-	-	-	-	-	-	-	-	-	-
Mean (no. sets)			71.9(24)	78.4(45)	44.8(48)	53.2(37)	53.5(22)	72.7(30)	60.8(48)	40.2(41)	40.1(82)	63.6(81)
Biomass ('000 t)			59.7	96.6	46.0	45.4	46.8	71.6	76.2	47.6	50.2	79.7

Depth (fm)	Stratum	Year-Trip 1981 ATC 317-9	1982 ATC 327-9	1984 AN 27-28	1985 WT 29	1986 ATC 245-6	1987 WT 58-60	1988 WT 70	1989 WT 82	1990 WT 95-96	1991 WT 106
151-200	357	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)
101-150	358	0.3(3)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
51-100	359	0.0(3)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
31-50	360	78.4(6)	36.7(7)	142.1(7)	54.0(16)	14.1(13)	9.2(15)	2.4(12)	30.9(15)	6.6(15)	10.4(12)
31-50	361	-	118.9(6)	139.9(5)	67.1(7)	44.1(10)	73.8(8)	88.7(7)	48.6(10)	125.2(9)	92.3(8)
31-50	362	104.2(5)	47.2(8)	95.1(7)	36.6(11)	73.2(14)	47.8(13)	43.8(10)	30.5(13)	35.3(10)	30.5(10)
31-50	373	58.4(5)	23.7(5)	63.5(7)	32.0(9)	17.9(4)	23.1(13)	23.8(10)	14.8(13)	0.9(10)	8.9(11)
31-50	374	71.7(3)	19.1(14)	35.5(3)	25.3(4)	11.6(6)	5.7(5)	2.3(5)	0.1(5)	0.9(5)	0.2(5)
< 30	375	69.3(4)	61.1(5)	176.1(5)	97.8(8)	231.7(8)	142.8(8)	68.1(6)	23.2(8)	102.7(8)	14.9(6)
≤ 30	376	74.3(4)	63.0(7)	32.5(4)	78.5(7)	88.2(90	59.4(8)	4.3(6)	72.6(8)	40.3(7)	113.8(7)
51-100	377	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.5(2)	0.0(2)	0.0(2)	0.0(2)
101-150	378	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)
151-200	379	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
151-200	380	0.0(3)	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
101-150	381	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
51-100	382	0.0(2)	0.0(2)	0.0(3)	0.0(4)	0.0(4)	0.0(3)	0.0(2)	0.0(3)	0.0(3)	0.0(2)
31-50	383	1.3(3)	10.0(2)	1.8(3)	0.0(3)	0.0(4)	0.1(3)	0.0(2)	0.0(3)	0.0(2)	0.0(3)
201-300	723	-	-	-	-	-	-	-	-	-	0.0(2)
301-400	724	-	-	-	-	-	-	-	-	-	0.0(2)
201-300	725	-	-	-	-	-	-	-	-	-	0.0(2)
301-400	726	-	-	-	-	-	-	-	-	-	0.0(2)
201-300	727	-	-	-	-	-	-	-	-	-	0.0(2)
301-400	728	-	-	-	-	-	-	-	-	-	0.0(2)
Mean (No. sets)		63.0(54)	43.8(60)	83.5(60)	45.3(85)	51.9(101)	40.2(91)	27.5(77)	26.5(94)	34.1(85)	28.4(93)
Biomass ('000 t)		70.1	54.4	104.6	56.7	65.0	49.9	34.4	33.3	42.6	37.2

Table 15. Mean weight of yellowtail per 30-minute tow, by stratum, from research vessel surveys in Division 3Ø. Numbers in parentheses are the number of successful tows in each stratum. The stratified mean weight per tow and the biomass estimates are given at the bottom of the table.

			Year-Trip										
Depth (fm)	Stratum	No. of trawlable units	1973 ATC 207, 208, 209	1975 ATC 233	1976 ATC 245, 246	1977 ATC 262, 263	1978 ATC 276, 277	1979 ATC 289, 290, 191	1980 ATC 303, 304, 305	1981 ATC 317, 318, 319	1982 ATC 327, 328, 329	1984 AN 27, 28	1985 AN 43
51-100	329	129,257	0.0(2)	-	0.0(2)	0.0(3)	0.2(5)	0.0(6)	0.0(2)	0.0(2)	0.0(6)	0.0(5)	0.0(8)
31-50	330	156,896	0.1(6)	1.1(3)	0.2(3)	2.0(3)	5.6(6)	10.0(7)	0.0(2)	0.1(4)	1.9(7)	0.5(4)	7.8(10)
31-50	331	34,248	33.6(2)	0.4(2)	9.2(2)	-	7.3(2)	6.0(3)	3.5(2)	-	4.0(4)	23.8(3)	36.7(3)
51-100	332	78,636	-	3.2(2)	2.0(3)	11.5(3)	2.6(3)	2.0(4)	0.0(2)	-	0.3(4)	0.0(2)	0.3(5)
101-150	333	11,341	-	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	-	0.0(4)	0.0(2)	0.0(2)
151-200	334	6,910	-	-	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	-	0.0(4)	0.0(2)	0.0(2)
151-200	335	4,356	0.0(2)	-	0.0(3)	-	0.0(2)	0.0(2)	0.0(3)	-	0.0(2)	0.0(2)	0.0(2)
101-150	336	9,088	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(4)	0.0(2)	-	0.0(2)	0.0(2)	0.0(2)
51-100	337	71,200	0.2(3)	1.3(3)	4.5(2)	6.6(2)	0.0(2)	0.6(4)	0.0(3)	-	0.3(3)	0.0(2)	0.0(5)
31-50	338	142,551	33.7(5)	7.5(2)	9.1(3)	23.8(4)	2.3(5)	54.1(7)	23.0(5)	-	1.0(5)	15.8(5)	11.1(9)
51-100	339	43,937	1.4(2)	0.0(2)	-	-	0.7(2)	0.4(3)	-	0.0(2)	0.1(4)	0.4(2)	0.1(3)
31-50	340	128,882	-	0.6(3)	2.4(6)	22.2(3)	10.2(3)	32.8(7)	1.3(2)	15.0(3)	3.9(6)	3.0(4)	7.2(9)
31-50	351	189,267	31.2(5)	29.3(4)	15.7(4)	80.6(5)	26.4(6)	78.5(11)	68.2(10)	51.0(4)	34.2(9)	40.5(6)	42.3(9)
31-50	352	193,773	47.5(5)	55.5(4)	62.0(4)	76.6(5)	92.2(4)	79.7(12)	67.3(11)	-	40.3(7)	30.5(7)	29.7(11)
31-50	353	96,286	0.5(3)	43.9(3)	9.1(2)	41.7(3)	8.5(3)	68.6(5)	0.4(4)	-	4.5(3)	1.0(2)	56.3(6)
51-100	354	35,600	0.0(3)	-	4.8(3)	3.6(2)	-	0.0(4)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.5(3)
101-150	355	7,736	0.0(2)	0.0(2)	0.0(2)	-	-	0.0(4)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
151-200	356	4,581	0.0(2)	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
201-300	717	-	-	-	-	-	-	-	-	-	-	-	-
301-400	718	-	-	-	-	-	-	-	-	-	-	-	-
201-300	719	-	-	-	-	-	-	-	-	-	-	-	-
301-400	720	-	-	-	-	-	-	-	-	-	-	-	-
201-300	721	-	-	-	-	-	-	-	-	-	-	-	-
301-400	722	-	-	-	-	-	-	-	-	-	-	-	-
Mean (No. sets)			19.0(45)	19.1(34)	14.2(45)	33.8(39)	20.6(51)	37.8(90)	22.7(59)	16.7(21)	11.8(74)	12.8(56)	18.0(93)
Biomass ('000 t)			21.2	22.2	18.4	42.1	26.7	50.8	29.5	11.6	15.8	17.2	24.2

Table 15. (Cont'd.)

Depth (fm)	Stratum	1986 WT 47	1987 WT 58-60	1988 WT 70	1989 WT 82	1990 WT 94-95	1991 WT 105, 106
51-100	329	0.0(8)	0.0(9)	0.0(7)	0.0(9)	0.0(7)	0.2(9)
31-50	330	3.3(9)	0.7(11)	0.7(9)	1.2(11)	0.6(10)	4.8(11)
31-50	331	3.6(4)	16.0(2)	6.0(2)	18.7(2)	-	0.7(2)
51-100	332	9.8(6)	5.9(5)	0.1(4)	12.7(5)	0.8(5)	0.8(6)
101-150	333	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
151-200	334	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
151-200	335	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)
101-150	336	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
51-100	337	0.6(5)	0.7(6)	1.3(4)	1.7(5)	0.0(2)	0.0(5)
31-50	338	6.8(9)	2.4(9)	23.0(8)	7.2(10)	6.1(8)	5.4(10)
51-100	339	0.1(3)	0.1(3)	0.0(3)	0.0(3)	0.4(3)	0.0(3)
31-50	340	8.3(7)	21.4(9)	5.8(7)	3.4(9)	9.7(9)	2.7(9)
31-50	351	39.1(14)	19.3(13)	36.5(10)	21.9(13)	27.3(12)	13.2(12)
31-50	352	34.9(14)	51.4(13)	24.8(11)	27.0(13)	36.0(13)	49.4(14)
31-50	353	21.8(7)	106.3(6)	2.2(5)	6.0(7)	12.0(6)	17.6(7)
51-100	354	0.0(3)	0.0(2)	0.0(2)	0.1(2)	0.0(2)	1.8(3)
101-150	355	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
151-200	356	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
201-300	717	-	-	-	-	-	0.0(2)
301-400	718	-	-	-	-	-	0.0(2)
201-300	719	-	-	-	-	-	0.0(2)
301-400	720	-	-	-	-	-	0.0(2)
201-300	721	-	-	-	-	-	0.0(2)
301-400	722	-	-	-	-	-	0.0(2)
Mean (No. sets)		14.7(102)	20.9(100)	12.2(84)	9.9(101)	11.9(93)	11.4(116)
Biomass ('000 t)		19.7	28.1	16.3	13.4	15.6	15.8

Table 16. Comparison of yellowtail biomass (000 t) from different strata in Division 3N from surveys in 1984-90.

	Stratum 360[a]	Stratum 376[b]	Total 360+376	Total all other strata in Div. 3N	Total 3N
1984	27.9	3.7	31.6	73.0	104.6
1985	12.1	8.8	20.9	35.8	56.7
1986	3.2	9.9	13.1	51.9	65.0
1987	2.1	6.7	8.8	41.1	49.9
1988	0.5	0.5	1.0	33.4	34.4
1989	6.9	8.2	15.1	18.2	33.3
1990	1.5	4.5	6.0	36.6	42.6
1991	2.3	12.8	15.1	22.1	37.2

[a] 93% of area outside 200-mile limit.
[b] 89% of area outside 200-mile limit.

Table 17. Abundance (millions) of yellowtail at age, as measured by Canadian groundfish surveys in NAFO Div. 3LNO.

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.1	0.1
3	7.2	8.5	0.7	1.7	0.8	3.9	0.2	2.9	0.9	5.0
4	84.4	63.5	9.9	14.6	12.7	16.5	3.1	9.9	6.0	11.1
5	189.6	125.3	65.5	47.1	63.8	73.8	18.6	38.2	12.6	37.9
6	357.2	143.9	84.6	80.8	92.1	100.7	45.5	70.4	50.3	97.7
7	323.4	77.6	86.4	40.8	106.8	92.5	121.7	73.1	129.2	140.0
8	43.5	24.7	33.1	4.9	26.0	18.7	99.5	38.2	61.8	45.4
9	13.9	2.6	11.3	0.7	2.9	0.4	27.7	4.0	7.2	3.1
10	0.2	0.2	1.0	0.0	0.2	0.0	4.2	0.1	0.9	0.1
11	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0
1+	1019.4	446.3	292.5	190.8	305.3	306.6	320.8	237.0	269.1	340.3
2+	1019.4	446.3	292.5	190.8	305.3	306.6	320.8	237.0	269.1	340.3
3+	1019.4	446.3	292.5	190.6	305.3	306.6	320.8	236.8	269.0	340.2
4+	1012.2	437.8	291.8	189.0	304.5	302.7	320.6	233.9	268.1	335.2
5+	927.8	374.3	281.9	174.3	291.8	286.2	317.5	224.0	262.1	324.1
6+	738.2	249.0	216.4	127.2	228.0	212.4	298.9	185.8	249.5	286.2
7+	380.9	105.1	131.8	46.4	135.9	111.7	253.4	115.4	199.2	188.5
8+	57.6	27.5	45.3	5.6	29.1	19.2	131.7	42.3	69.9	48.6
9+	14.1	2.8	12.3	0.7	3.1	0.5	32.2	4.1	8.1	3.2

AGE	1981	1982	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	1.4	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1
3	1.1	5.5	0.3	0.7	0.1	0.1	0.1	2.4	0.8	0.4
4	2.0	18.8	3.5	2.5	1.8	0.5	1.2	23.8	7.9	5.6
5	8.8	38.6	26.4	12.9	11.8	6.4	1.6	25.9	22.1	27.0
6	37.9	56.1	94.0	52.8	30.3	20.2	9.5	27.3	29.3	39.3
7	97.3	87.4	131.0	90.9	93.7	56.5	31.8	33.5	45.6	39.3
8	101.8	56.7	56.5	42.1	45.7	76.3	45.8	17.2	38.6	19.6
9	19.6	13.9	4.4	3.3	6.6	7.6	9.1	1.7	4.9	2.8
10	5.3	2.0	0.1	0.3	0.5	0.6	0.4	0.1	0.4	0.0
11	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1+	273.9	280.8	316.2	205.5	190.5	168.2	99.7	132.2	149.5	134.2
2+	273.9	280.7	316.2	205.5	190.5	168.2	99.7	132.2	149.5	134.2
3+	273.9	279.3	316.2	205.5	190.5	168.2	99.6	132.0	149.5	134.1
4+	272.8	273.8	315.9	204.8	190.4	168.1	99.5	129.6	148.7	133.7
5+	270.8	255.0	312.4	202.3	188.6	167.6	98.3	105.8	140.9	128.1
6+	262.0	216.4	286.0	189.4	176.8	161.2	96.7	79.9	118.8	101.0
7+	224.1	160.3	192.0	136.6	146.5	141.0	87.1	52.5	89.5	61.7
8+	126.7	72.9	61.0	45.7	52.8	84.5	55.3	19.0	43.9	22.4
9+	24.9	16.2	4.5	3.6	7.1	8.2	9.5	1.8	5.3	2.8

Table 18. **A comparison of average numbers and weights of yellowtail per 30-minute set for Div. 3LNO from juvenile surveys in 1985-90.**

Div.	Stratum	Category	1985	1986	1987	1988	1989	1990
3Ø	330	No. of sets	-	-	-	2	7	7
		Av. no./set				10.99	6.87	37.14
		Av. wt./set				5.50	3.54	18.20
3Ø	331	No. of sets	-	-	-	2	2	2
		Av. no./set				0.50	12.50	19.00
		Av. wt./set				0.25	7.75	10.56
3Ø	340	No. of sets	-	-	-	3	6	7
		Av. no./set				7.59	33.50	6.71
		Av. wt./set				2.85	15.33	3.16
3Ø	338	No. of sets	-	3	-	6	6	4
		Av. no./set		86.67		18.99	48.50	9.25
		Av. wt./set		41.17		9.58	20.12	3.89
3L	350	No. of sets	5	6	-	5	8	4
		Av. no./set	59.00	7.83		37.97	0.88	0.00
		Av. wt./set	25.50	3.58		3.70	0.49	0.00
3Ø	351	No. of sets	3	9	-	7	8	9
		Av. no./set	166.00	175.78		85.93	69.38	99.42
		Av. wt./set	63.67	66.00		28.68	29.31	43.95
3Ø	352	No. of sets	-	13	1[a]	11	14	16
		Av. no./set		210.77	134	164.78	206.93	158.95
		Av. wt./set		73.68	65.35	58.81	77.43	66.01
3Ø	353	No. of sets	-	5	-	4	3	4
		Av. no./set		118.00		19.24	21.67	0.00
		Av. wt./set		68.75		9.19	10.33	0.00
3N	360	No. of sets	3	14	19	20	19	21
		Av. no./set	57.67	259.14	192.22	112.51	373.03	392.00
		Av. wt./set	26.83	19.96	12.75	22.73	46.28	58.37
3N	361	No. of sets	6	8	8	6	9	10
		Av. no./set	99.83	188.50	399.94	162.38	286.33	379.63
		Av. wt./set	33.58	61.78	174.37	62.29	107.86	133.26
3N	362	No. of sets	9	7	2	6	8	9
		Av. no./set	166.89	109.14	38.00	129.29	103.13	79.40
		Av. wt./set	59.50	43.14	16.75	57.64	45.31	40.37
3L	363	No. of sets	5	5	-	6	7	4
		Av. no./set	53.80	48.89		42.47	13.71	7.25
		Av. wt./set	21.00	22.77		19.65	7.54	3.39
3L	371	No. of sets	4	-	-	5	4	3
		Av. no./set	2.25			1.20	6.50	4.00
		Av. wt./set	1.88			0.70	3.70	1.95
3L	372	No. of sets	9	8	-	8	8	4
		Av. no./set	93.06	101.00		64.83	41.00	78.75
		Av. wt./set	39.49	48.13		34.31	20.21	40.21
3N	373	No. of sets	10	7	-	8	8	9
		Av. no./set	160.80	112.93		29.85	32.25	14.78
		Av. wt./set	75.60	49.60		15.74	15.38	8.67
3N	374	No. of sets	4	4	-	4	3	4
		Av. no./set	16.00	12.00		5.25	0.33	0.75
		Av. wt./set	7.50	6.38		3.63	0.17	0.15

Table 18. (Cont'd.)

Div.	Stratum	Category	1985	1986	1987	1988	1989	1990
3N	375	No. of sets	7	5	7	9	8	11
		Av. no./set	228.29	236.65	407.26	146.44	284.88	266.65
		Av. wt./set	104.14	115.19	43.22	25.67	88.88	73.25
3N	376	No. of sets	2	4	10	12	9	11
		Av. no./set	148.50	325.75	1015.22	363.72	916.22	1505.36
		Av. wt./set	47.75	150.46	58.55	38.79	160.04	206.24
3N	383	No. of sets	4	-	-	4	3	3
		Av. no./set	0.00			2.00	0.00	0.00
		Av. wt./set	0.00			0.32	0.00	0.00
3L	384	No. of sets	4	-	-	5	4	2
		Av. no./set	35.25			1.00	0.25	0.50
		Av. wt./set	22.88			0.18	0.13	0.47
3L	328	No. of sets	3	-	-	-	-	-
		Av. no./set	0.00					
		Av. wt./set	0.00					
3O	329	No. of sets	4	-	-	-	-	-
		Av. no./set	0.00					
		Av. wt./set	0.00					
3O	332	No. of sets	4	-	-	-	-	2
		Av. no./set	6.50					7.00
		Av. wt./set	0.00					1.88
3O	337	No. of sets					2	3
		Av. no./set					0.00	10.67
		Av. wt./set					0.00	2.82
3O	339	No. of sets					2	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	341	No. of sets					4	5
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	342	No. of sets					2	-
		Av. no./set					0.00	-
		Av. wt./set					0.00	-
3L	343	No. of sets					2	-
		Av. no./set					0.00	-
		Av. wt./set					0.00	-
3L	348	No. of sets					7	4
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	349	No. of sets					5	7
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3O	354	No. of sets					2	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3N	359	No. of sets					2	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	364	No. of sets					11	5
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00

Table 18. (Cont'd.)

Div.	Stratum	Category	1985	1986	1987	1988	1989	1990
3L	365	No. of sets					4	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	370	No. of sets					6	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	382	No. of sets					2	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	385	No. of sets					5	4
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
3L	390	No. of sets					4	3
		Av. no./set					0.00	0.00
		Av. wt./set					0.00	0.00
Total		No. of sets	75	98	46	134	215	195
		Av. no./set	104.92	147.90	342.59	78.77	82.46	106.2
		Av. wt./set	43.35	53.05	53.55	24.37	22.17	26.0
Abundance (million nos.)			286.1	448.0	318.0	298.9	516.9	616.6
3L Biomass			22.9	22.7	-	13.6	7.2	11.4
3N Biomass			78.2	85.4	59.6	56.10	92.7	103.2
3O Biomass			17.1	52.5	-	28.8	38.9	36.3
Total biomass (000 t)			118.2	160.7	59.6	92.5	138.9	150.9

Table 19. A comparison of average numbers and weights of yellowtail flounder per 30-minute tows from day and night and combined surveys. Selected strata in Div. 3NØ used. Abundance and biomass are given at the bottom of the table.

Stratum	Category	1985 Day	1985 Night	1985 Combined	1986 Day	1986 Night	1986 Combined	1987 Day	1987 Night	1987 Combined	1988 Day	1988 Night	1988 Combined	1989 Day	1989 Night	1989 Combined	1990 Day	1990 Night	1990 Combined
352	No. of sets	-	-	-	7	6	13	-	-	-	6	5	11	4	10	14	11	5	16
	Av. no./set				78.29	365.33	210.77				60.67	290.00	164.91	115.25	243.6	206.93	184.47	102.80	158.95
	Av. wt./set				37.86	115.47	72.68				26.75	97.37	58.85	48.88	88.85	77.43	81.04	32.95	66.01
360	No. of sets	3	-	3	7	7	14	7	12	19	11	8	20	12	7	19	11	10	21
	Av. no./set	57.67		57.67	20.57	497.71	259.14	24.57	290.25	192.22	39.18	227.63	112.60	540.72	85.55	373.03	152.00	656.00	392.00
	Av. wt./set	26.83		26.83	5.50	34.43	19.96	2.72	18.61	12.75	10.89	41.89	22.75	61.42	20.31	46.28	25.80	94.20	58.37
361	No. of sets	4	2	6	4	4	8	4	4	8	2	4	6	6	3	9	3	7	10
	Av. no./set	58.50	182.50	99.83	160.00	217.00	188.50	146.75	653.75	399.94	137.00	175.25	162.50	197.33	464.33	286.33	404.75	368.86	379.63
	Av. wt./set	26.13	63.50	36.58	72.81	50.75	61.78	69.25	279.75	174.37	77.00	55.00	62.33	93.25	137.07	107.86	177.94	114.12	133.26
375	No. of sets	4	3	7	2	3	5	3	4	7	6	3	9	5	3	8	4	7	11
	Av. no./set	60.50	452.00	228.29	4.10	391.69	236.65	29.33	691.25	407.26	19.33	401.00	146.56	161.20	491.00	284.88	47.50	391.89	266.65
	Av. wt./set	36.50	194.33	104.14	1.40	191.05	115.19	14.75	64.63	43.22	9.69	57.70	25.69	70.10	120.17	88.88	14.69	106.70	73.25
376	No. of sets	-	-	2	3	1	4	3	7	10	7	5	12	5	4	9	5	6	11
	Av. no./set	-		148.50	69.67	-	325.76	109.67	1404.23	1015.22	148.57	665.60	364.00	456.20	1491.25	916.22	1076.20	1863.0	1505.36
	Av. wt./set	-		47.75	19.70	-	150.46	22.00	74.27	58.22	16.13	50.59	38.82	69.50	273.22	160.04	154.47	249.38	206.24
Total	No. of sets	11	5	18	23	20	44	17	27	44	32	25	58	32	27	59	34	35	69
	Av. no./set	59.00	344.20	118.91	67.36	385.95	240.92	70.12	692.37	439.31	74.24	322.28	175.20	306.31	452.83	381.08	320.4	601.73	472.35
	Av. wt./set	30.09	142.00	49.04	28.55	85.50	73.53	24.31	78.55	65.24	26.99	64.30	41.32	66.42	108.87	87.44	82.8	106.70	96.77
Abundance (000s)		40.0	112.4	100.3	71.1	367.3	269.3	59.1	561.9	370.9	83.0	360.4	195.8	342.4	506.2	426.0	358.2	672.7	528.1
Biomass (000s t)		19.7	45.50	41.3	57.8	84.7	82.2	20.5	83.8	55.0	30.2	71.9	46.1	74.2	121.7	97.7	92.6	119.3	108.2

Table 20. Average numbers per tow at age from selected strata in juvenile flatfish surveys of NAFO Division 3NØ (strata 352, 360, 361, 375, and 376) 1985-90.

Age	1985[a]	1986	1987[a]	1988	1989	1990
1	4.72	21.48	30.48	5.67	3.68	4.33
2	2.76	16.95	113.11	15.01	17.88	42.22
3	1.43	27.29	88.50	40.07	40.20	76.71
4	7.29	10.05	80.17	27.81	125.86	90.74
5	9.98	18.99	20.09	17.27	62.01	139.22
6	14.67	41.41	19.05	18.19	43.82	54.33
7	35.32	53.87	37.65	31.45	58.22	38.43
8	35.45	41.66	46.10	17.47	24.57	22.25
9	7.10	8.07	4.40	2.37	2.87	2.71
10	0.36	0.62	0.12	0.02	0.09	0.15
11	0.00	0.08	0.00	0.00	0.01	0.04
Av. no./tow	119.08	240.47	439.67	175.33	379.21	471.12

[a]Incomplete survey, stratum 352 not surveyed.

Table 21. Abundance (Nos. x 10^{-3}) at age of yellowtail from selected strata in Division 3NO juvenile flatfish surveys (strata 352, 360, 361, 375, and 376) 1985-90.

Age	1985[a]	1986	1987[a]	1988	1989	1990
1	3,978	24,015	25,718	6,343	4,113	4,840
2	2,330	18,944	95,432	16,781	19,992	47,194
3	1,209	30,511	74,667	44,793	44,941	85,758
4	6,151	11,238	67,634	31,092	140,700	101,442
5	8,420	21,225	16,951	19,309	69,326	155,635
6	12,377	46,289	16,073	20,337	49,002	60,733
7	29,801	60,226	31,764	35,159	65,089	42,964
8	29,906	46,568	38,897	19,528	27,468	24,872
9	5,989	9,016	3,714	2,654	3,212	3,028
10	301	688	99	18	96	168
Unknown	0	88	698	70	432	39
Totals 1+	100,462	268,720	370,949	196,091	432,939	526,673
4+	92,945	195,250	175,132	128,174	354,893	388,881
7+	65,997	116,498	74,474	57,429	95,865	71,072
1 - 4	13,668	84,708	263,451	99,009	209,746	239,235

[a]Incomplete survey; Stratum 352 not surveyed.

Table 22. Percentage distribution of the 1985 year-class, in the selected strata as it relates to the total abundance (10^{-3}) of this age class in Div. 3LNO. (Div. 3LNO age-length key used here.)

Age yrs	Survey year	% Div. 3N - Strata				% Div. 3Ø - Strata		Div. 3LNO abundance
		360	361	375	376	352	Total %	
5	1990	30	8	6	50	3	97	158,664
4	1989	48	6	6	36	4	100	142,531
3	1988	26	10	8	45	8	97	46,388
2	1987	24	1	30	45	–	100	95,484
1	1986	94	2	0	2	2	100	24,305

Table 23. Percentage distribution of the 1986 year-class, in the selected strata as it relates to the total abundance (10⁻) of this age class in Div. 3LNO. (Div. 3LNO age-length key used here.)

Age yrs	Survey year	% Div. 3N - Strata 360	361	375	376	% Div. 3Ø - Strata 352	Total %	Div. 3LNO abundance
4	1990	29	6	6	56	3	100	102,391
3	1989	32	9	10	41	6	98	45,665
2	1988	15	14	31	27	11	98	17,218
1	1987	19	1	21	58	-	99	25,718

Table 24. Age composition of yellowtail flounder in Division 3N outside the 200-mile limit (strata 360 and 376), expressed as a percent of total abundance (millions) from research vessel surveys in 1989, 1990, and 1991.

	Juvenile - 1989		Spring - 1990		Juvenile - 1990		Spring - 1991[a]	
Age	Total abundance	Outside %	Total abundance	Outside %	Total abundance	Outside %	Total abundance	Outside %
1	4.1	63.4	0	-	4.6	65.2	0.0	-
2	18.2	63.3	0	-	50.2	76.8	0.1	100
3	42.1	79.6	0.7	57.1	83.5	86.1	0.4	100
4	135.3	87.8	7.0	70.0	106.6	93.7	5.4	89
5	65.9	81.8	19.2	67.7	147.5	83.4	25.8	76
6	38.2	65.2	24.1	36.5	48.5	59.3	34.9	61
7	40.6	31.5	27.5	15.3	24.1	16.1	24.2	33
8	20.8	21.6	23.2	1.7	15.6	7.0	10.6	10
9	2.7	18.5	3.6	0	2.2	9.0	1.9	11
10	0	-	0.3	0	0.2	0	0.0	-
Total	367.9		105.7		483.0		103.5	

[a]Preliminary analysis.

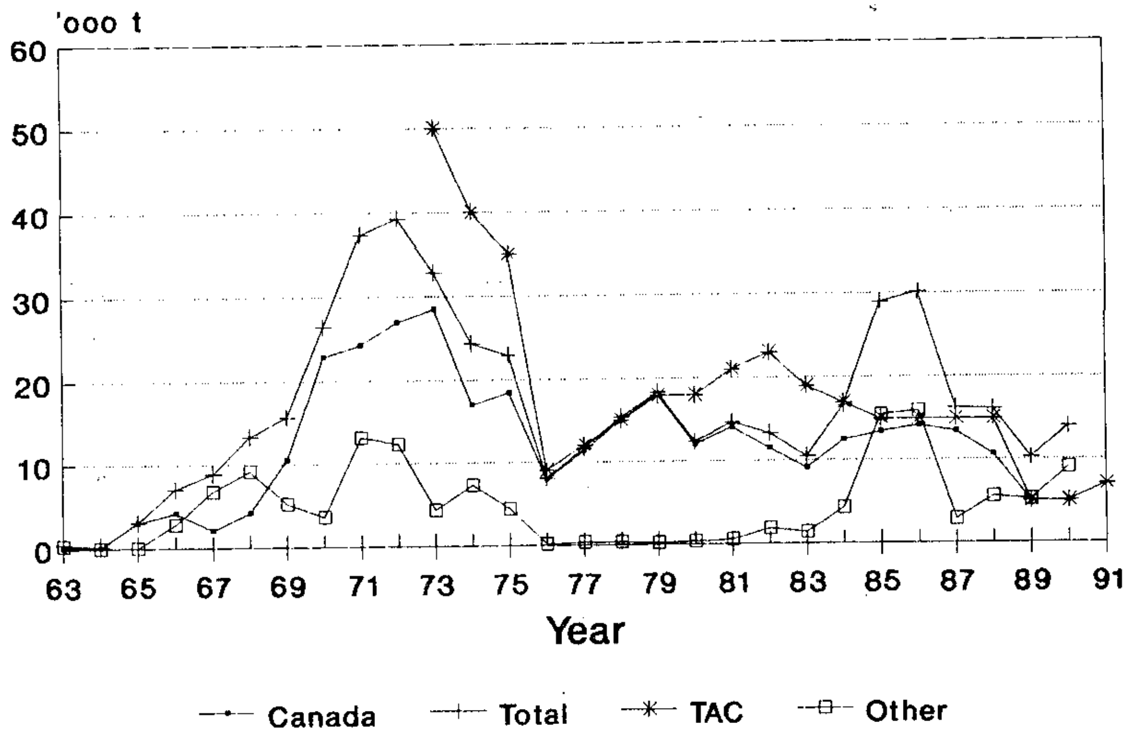


Fig.1. Catches and TAC's of yellowtail flounder in NAFO Div. 3LNO.

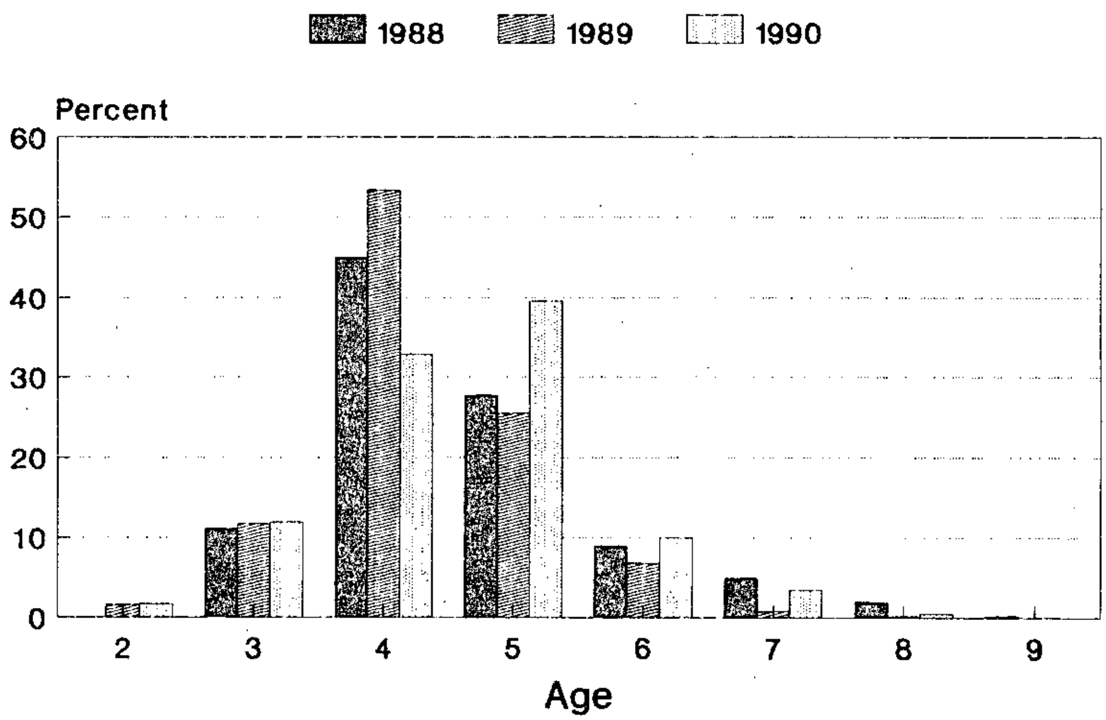


Fig.2 **Age composition of Spanish catches of yellowtail in 1988-1990.**

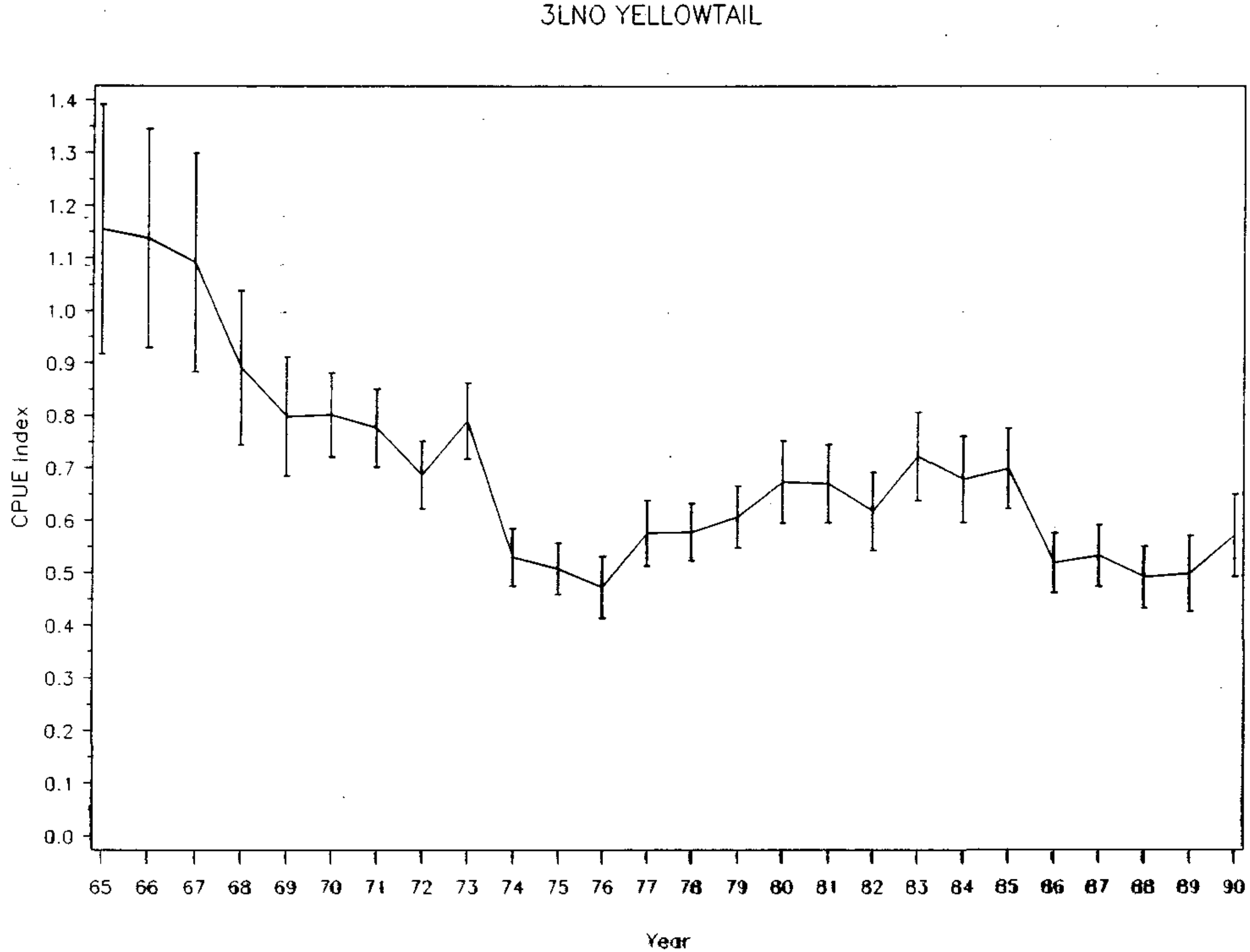


Fig.3.Trends in C/E of yellowtail in the Canadian fishery,Div.3LNO.

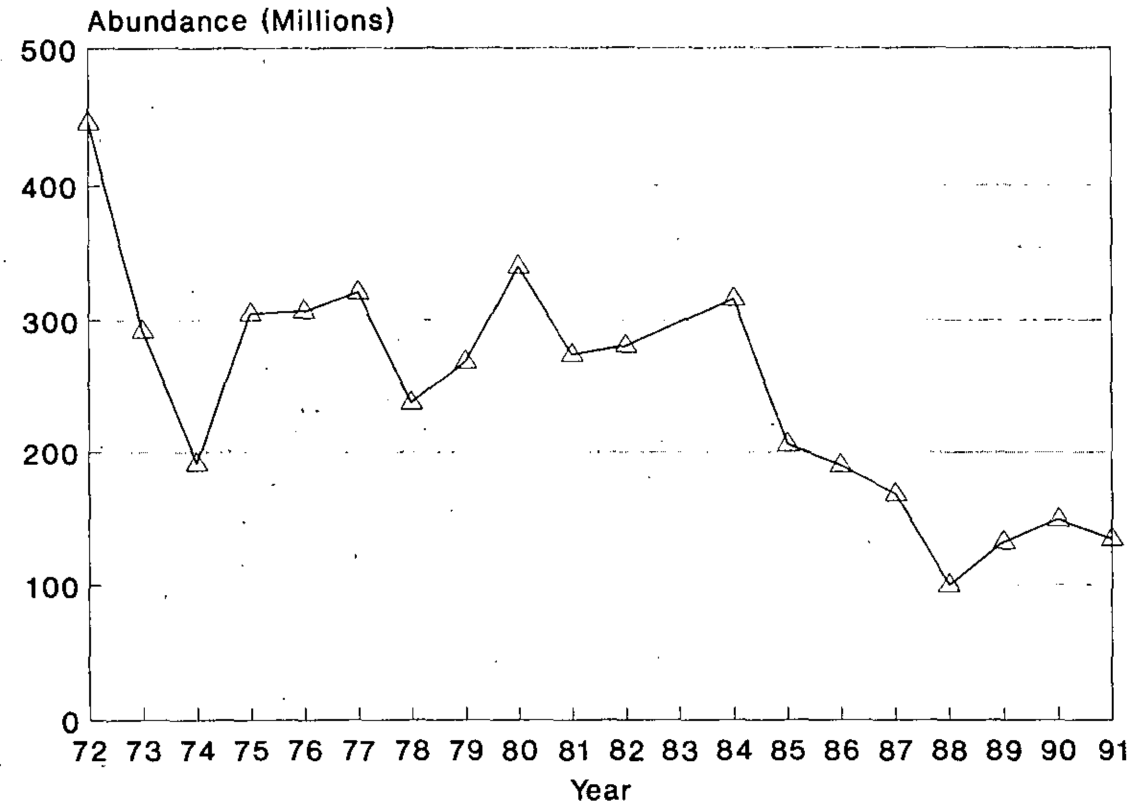


Figure 4. Age 1+ abundance of Yellowtail from Canadian spring RV in Div 3LNO.

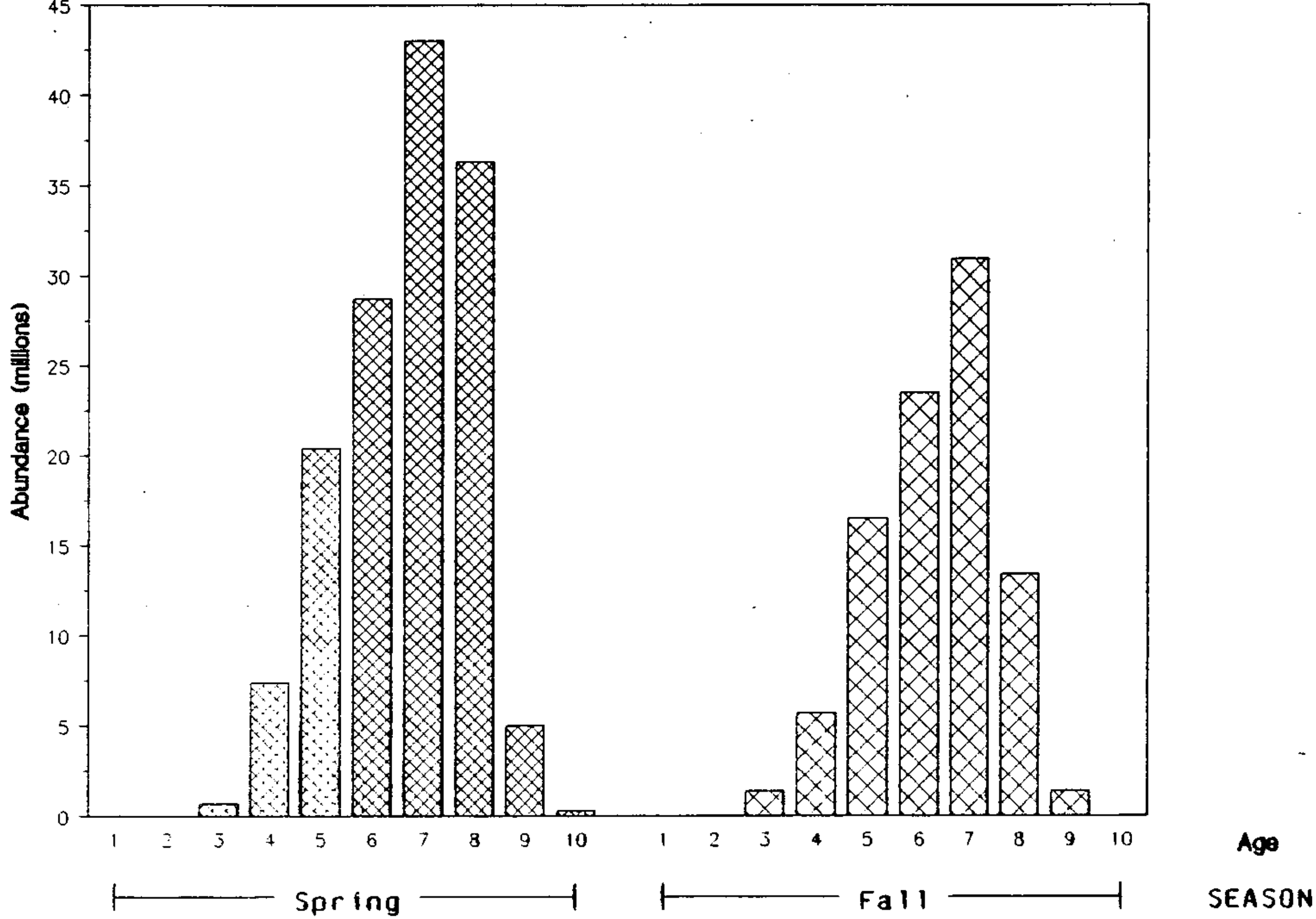


Figure 5. Abundance of Yellowtail from Spring and Fall RV Surveys in 1990 in 3LNO

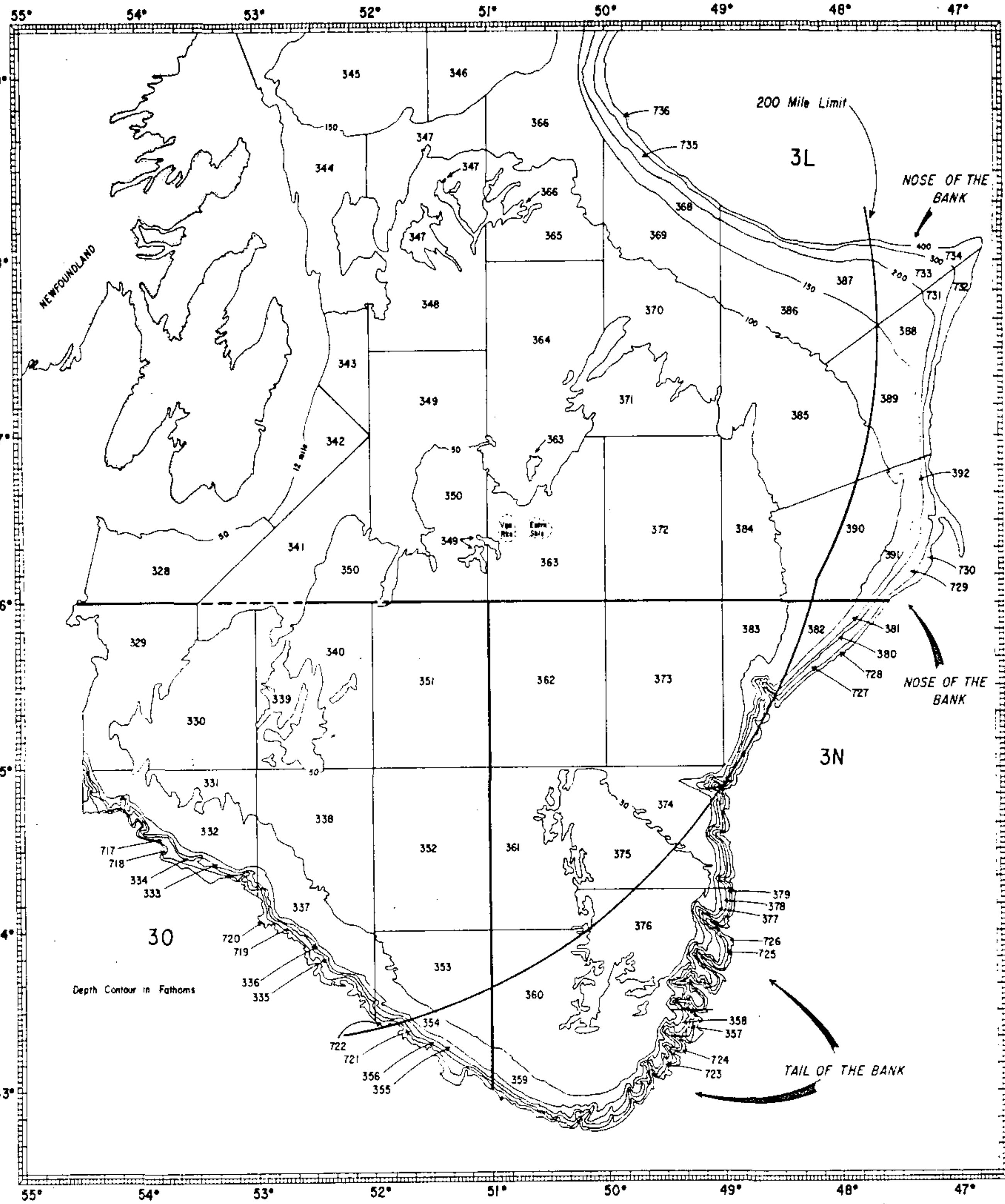


Fig.6. Stratification scheme used in stratified random surveys of NAFO Div. 3LNO.

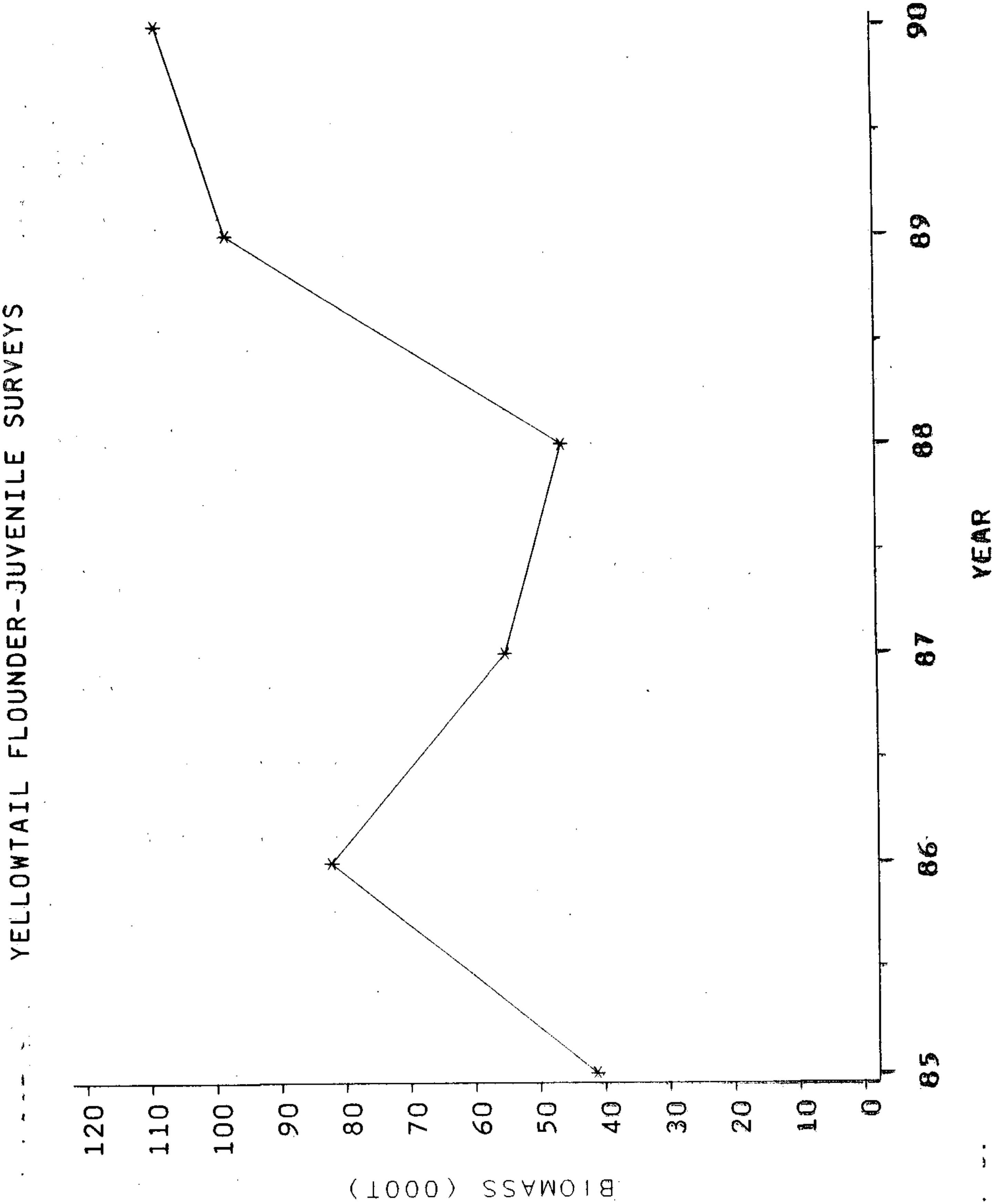


Fig. 7 Trends in biomass of yellowtail flounder from selected strata, NAFO Division 3NO in the 1985-90 surveys.

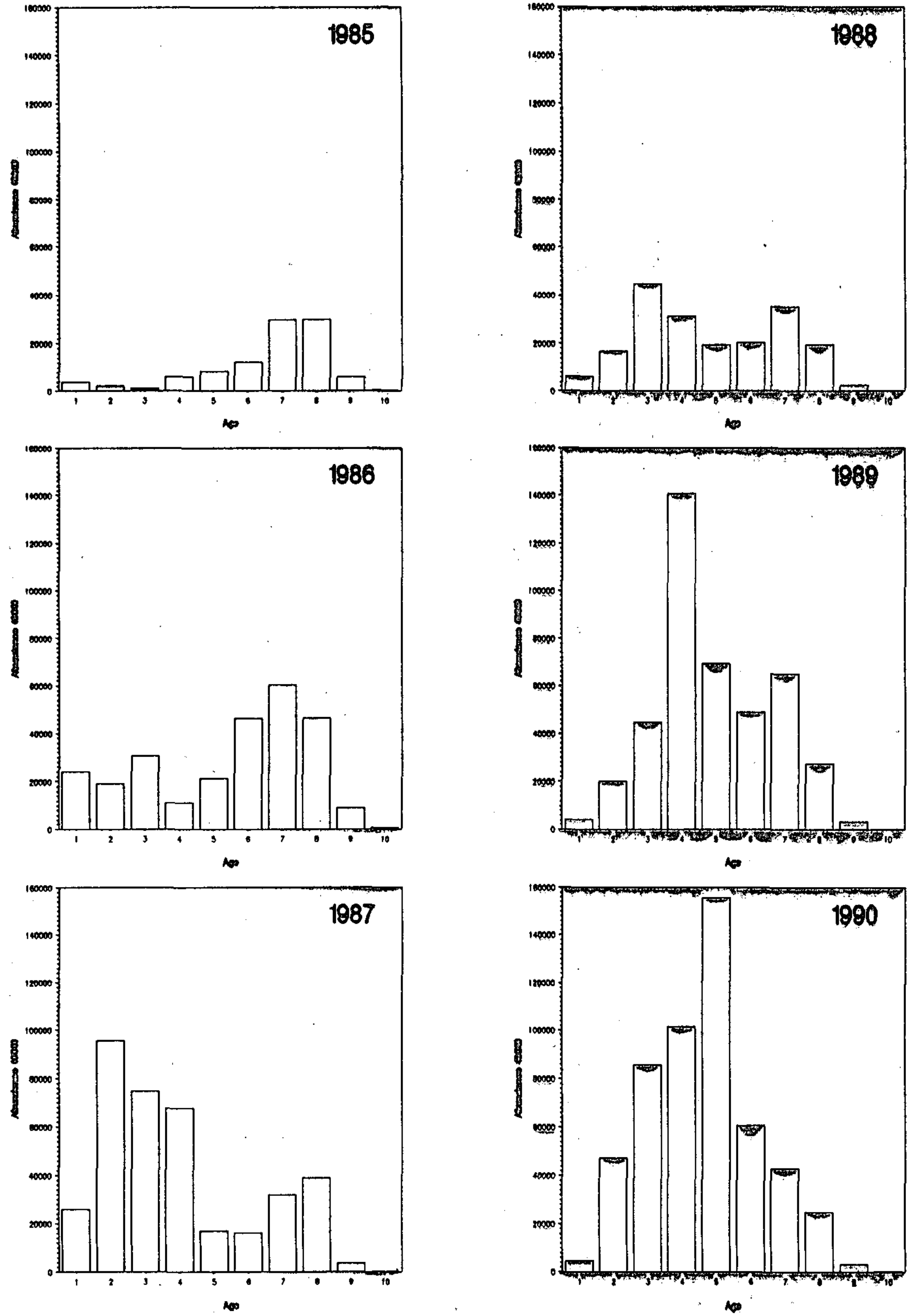


Fig.8 Abundance of yellowtail flounder from selected strata in Div. 3NO derived from juvenile surveys in 1985-90.

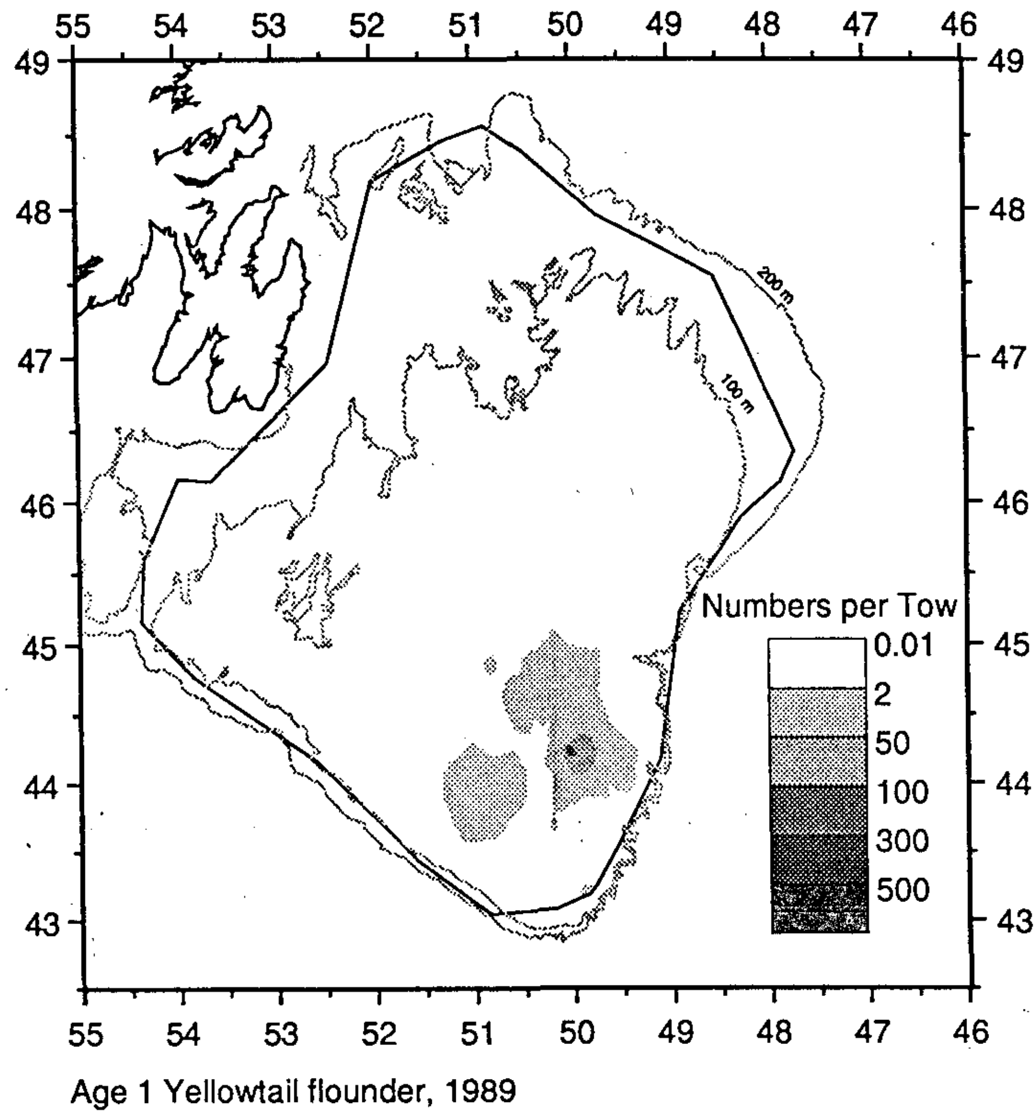
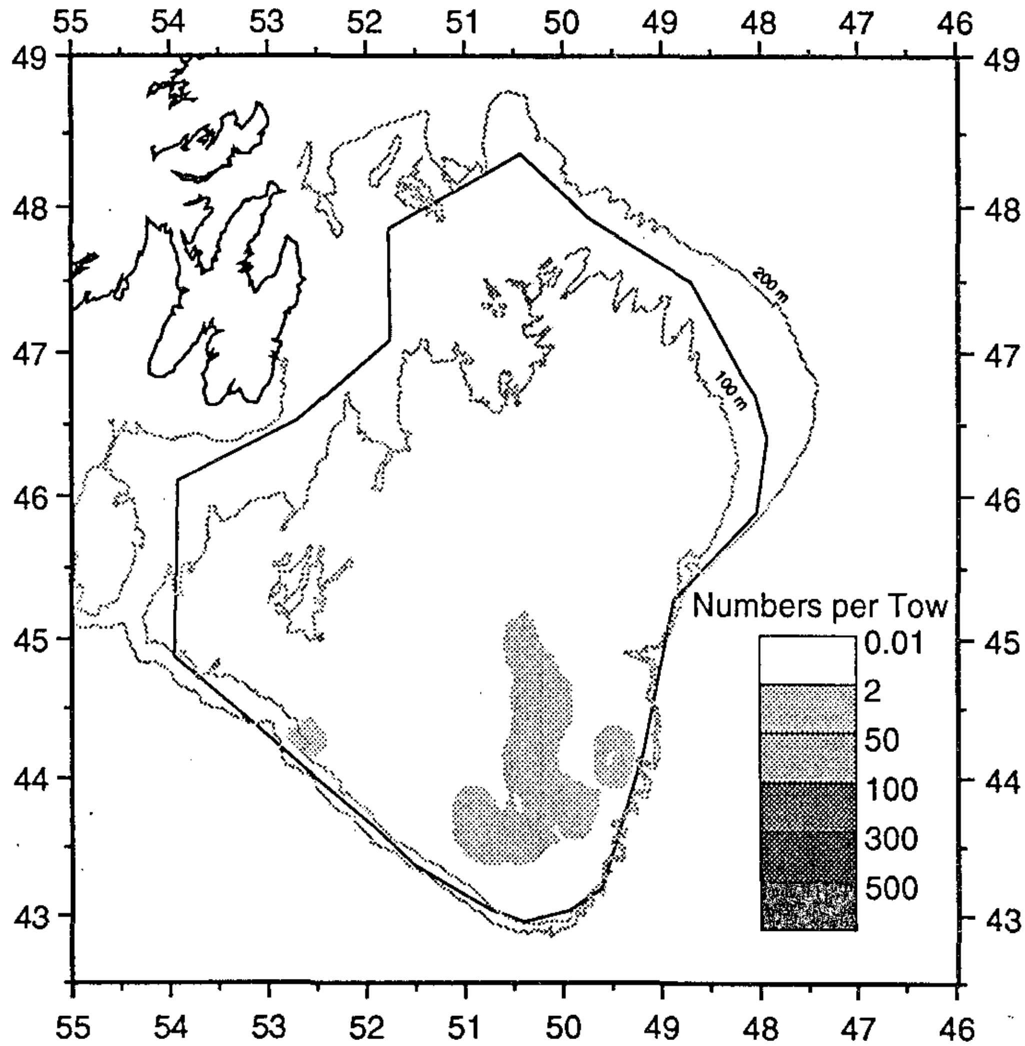


Fig.9 Distribution of 1-year old yellowtail flounder on the Grand Banks from the 1989 survey in Div. 3LNO.



Age 1 Yellowtail flounder, 1990

Fig.10 Distribution of 1-year old yellowtail flounder on the Grand Banks from the 1990 survey in Div. 3LNO.

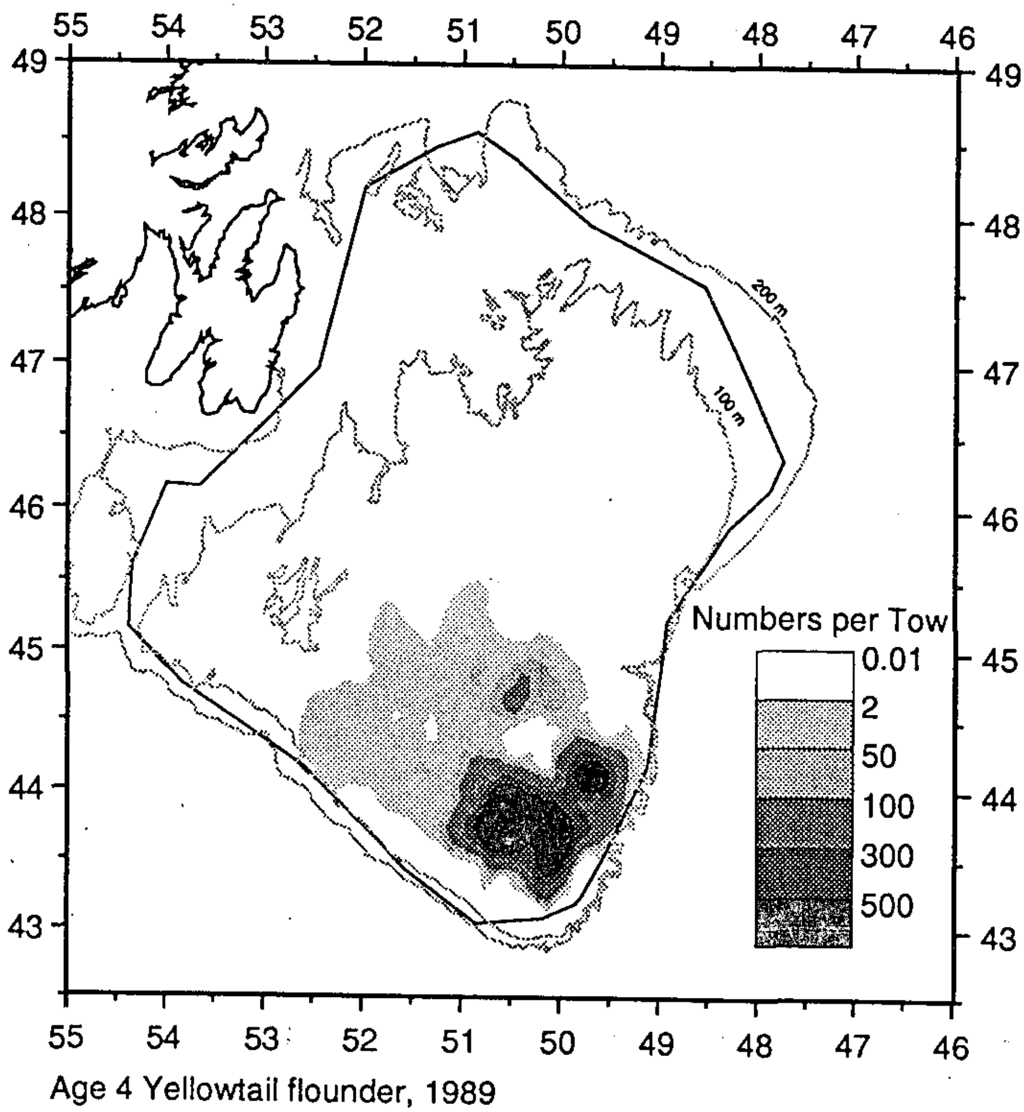


Fig.11 Distribution of 4-year old yellowtail flounder on the Grand Banks from the 1989 survey in Div. 3LNO.

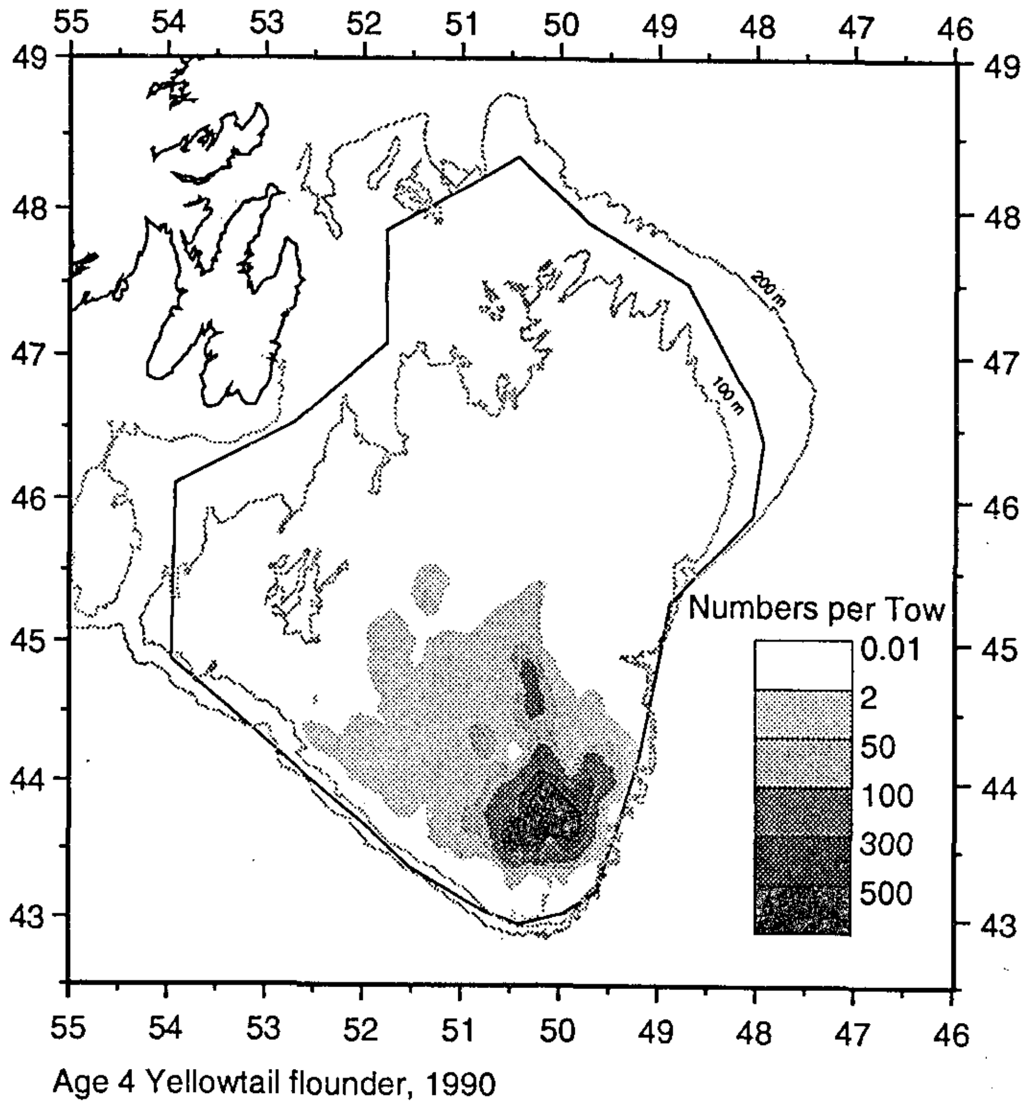


Fig.12 Distribution of 4-year old yellowtail flounder on the Grand Banks from the 1990 survey in Div. 3LNO.

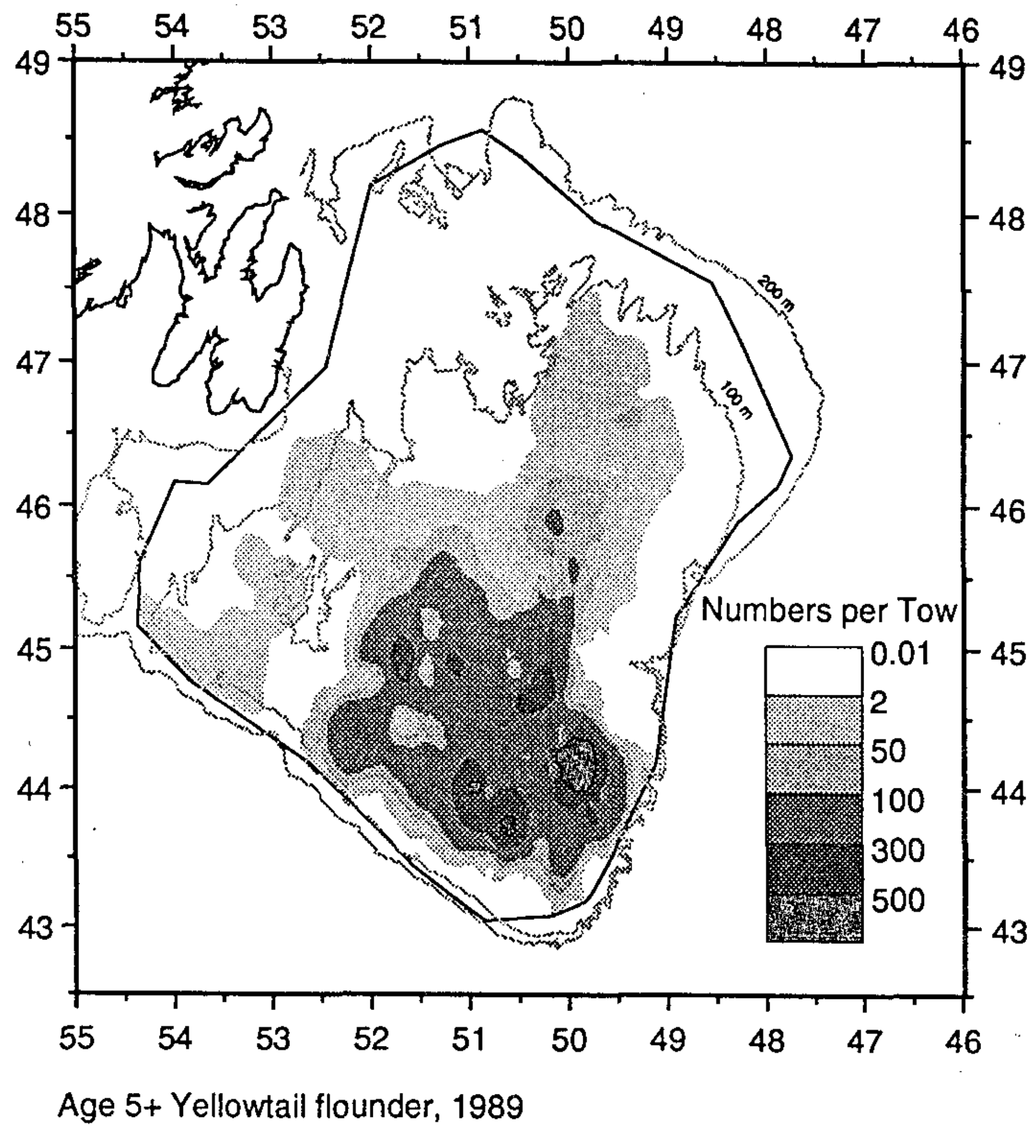


Fig.13 Distribution of 5+ year old yellowtail flounder on the Grand Banks from the 1989 survey in Div. 3LNO.

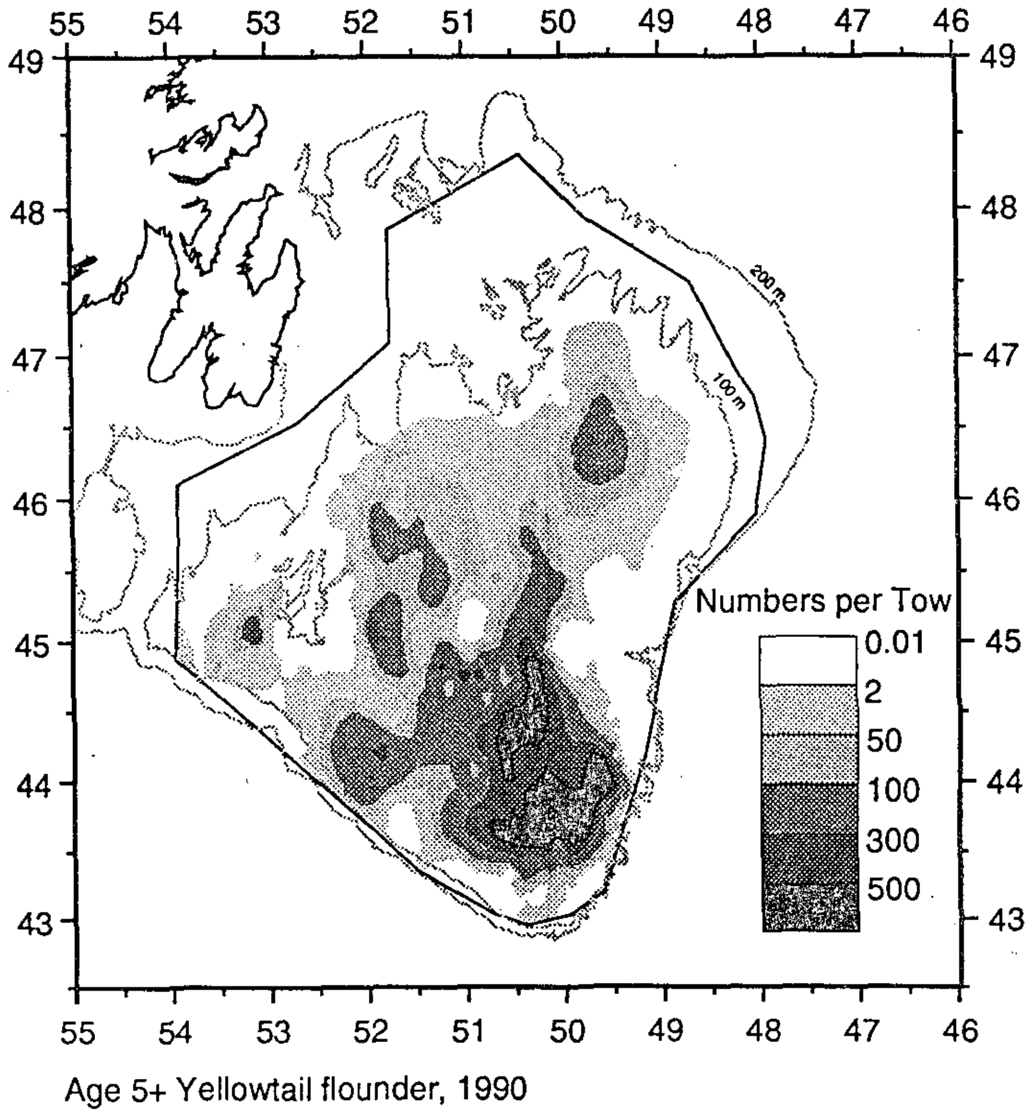


Fig.H Distribution of 5+ year old yellowtail flounder on the Grand Banks
from the 1990 survey in Div. 3LNO.

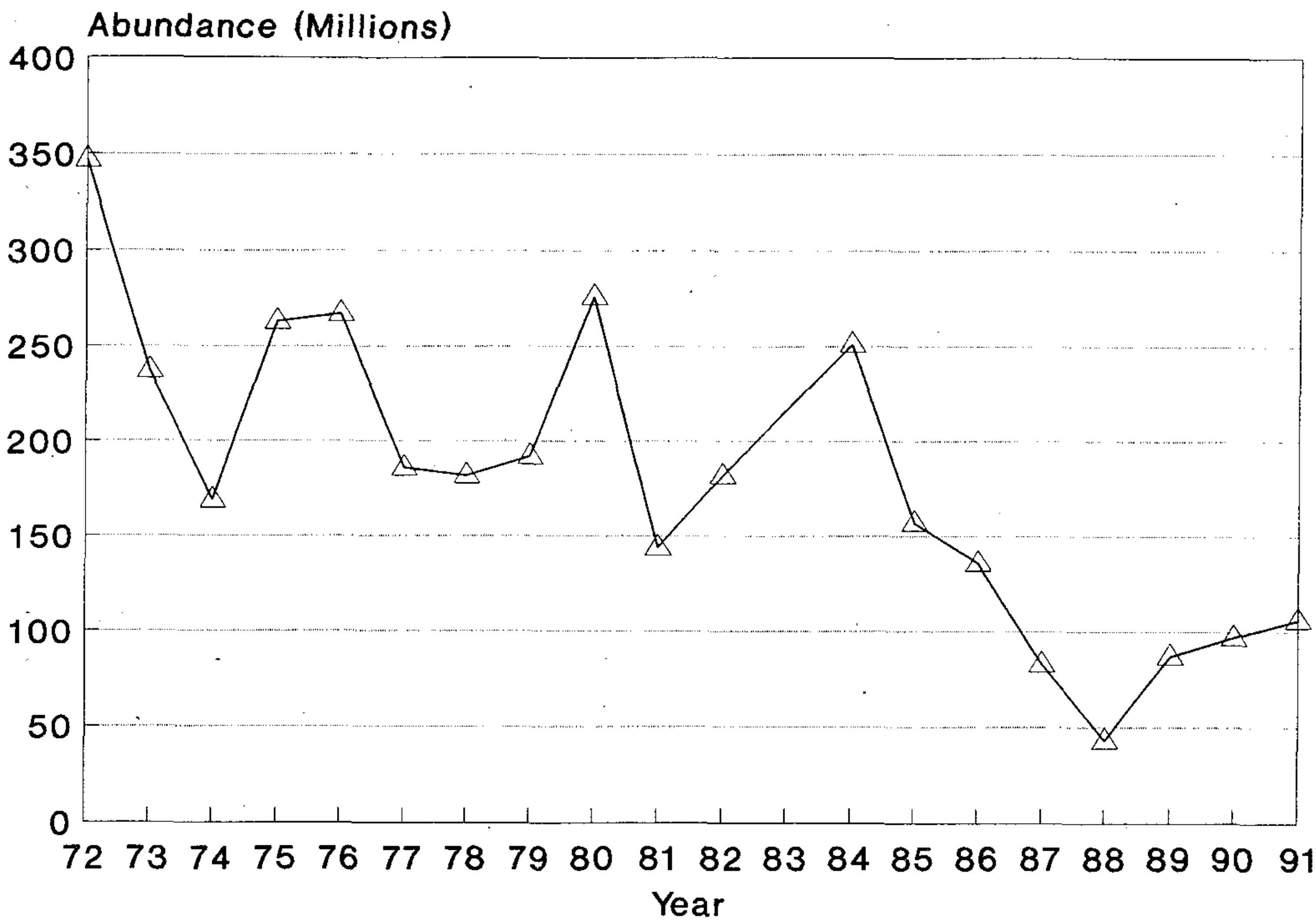


Figure 15. Ages 5-7 abundance of Ytail from Canadian spring RV in Div 3LNO.