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An Assessment of the Greenland Halibut Stock Component in NAFO Subareas 0+1

by

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1. TAC, Description of the Fishery and Nominal Catches

TAC has remained unchanged at 25,000 tons since 1979.

In the period 1982-1989 nominal catches of Greenland halibut in Subareas 0+1 have been rather stable with an annual average of 9,000 tons. Since 1989 catches have increased considerably to the highest historic level in 1992 of 26,627 tons, but decreased to 24,038 tons in 1993. The increase in catches from 1989 to 1992 was mainly due to a new trawl fishery by Canada and Norway in Division 0B.

In 1982 and 1983 annual catches in Division 0B were at a level at about 4,000 tons. They then dropped to a level at 1,000 tons or lower were they remained until they increased from 907 tons in 1989 to 14,513 tons in 1990, followed by a decrease to 7,613 tons in 1993. The fisheries took place in July-December and all catches were taken by Canadian trawlers and longliners (Table I).

In Subarea 1 catches were at a level around 5,500 tons in the first part of the 1980s. In 1985 the catch increased to about 9,000 tons and catches remained at that level until 1990. Then they increased to 10,961 tons in 1991 and further to 15,156 tons (including 1,457 tons non-reported catches) in 1992 (Table II). In 1993 catches increased to 16.425 tons.

In Subarea 1 catches from the inshore areas amounted to 12,136 tons of which 99% derived from Div. 1A. The bulk of the fishery in Div. 1A is located to three areas: Ilulissat, Uummannaq and Upernavik where catches are 5,207 tons, 3,728 tons and 2,408 tons, respectively. Traditionally the Greenland fishery was a longline fishery carried out either by boats below 20 GRT or by means of dog sledges, typically in the *inner parts of the fjords at depths of 500-800 meters.* Since the middle of the 1980s gillnets were used more commonly in the inshore fishery and till 1989 gillnets and longlines accounted equally for the catches in Div. 1A. Since then the annual proportion of catches from each gear has varied considerably, but in 1993 longline catches comprised about 76% of the total inshore catches, due to regulations in use of fishing gear. In recent years catches in the inshore fishery in Subarea 1 has been rather evenly distributed throughout the year.

The offshore catches in Subarea 1 (Divisions 1C+1D) amounted to 4,240 tons which is a minor increase from 3,517 tons in 1992. 1775, 1434, 855 and 49 tons were taken by Norwegian, Japanese, Greenland and German trawlers, respectively; while 113, 8 and 6 tons were taken by Faroese, Greenland and Norwegian longliners, respectively.

2. Input data

2.1 Research trawl surveys

Since 1987 bottom-trawl surveys have been conducted in Subarea 1 jointly by Japan and Greenland. In 1993 a survey was conducted, in August/September (SCR Doc. 94/31). The survey covered Division 1B to 1D at depths between 400 and 1500 m. The trawlable biomass was estimated to be 37,700 tons, which is remarkably lower than in 1992 (64,500 tons) and 1991 (79,100 tons) when Division 1A was included. The biomass was, however, estimated to only 2,500 tons in Division 1A in these two years. The decrease was mainly due to a decline in the estimated biomasses for depth stratum 600-1000 m in Div. 1C and depth stratum 1000-1500 m in Div. 1D. Abundance estimates for Divisions 1CD for the period 1988-1993 are given in Table VI. Total abundance fluctuated between 35 mill. and 53 mill. from 1988 to 1991, and

declined from 53 mill. in 1991 to 30 mill. in 1993. Apart from age 2, the decline is seen for all age groups from 1991 to 1993.

From July to August 1993 a trawl survey was conducted with a commercial shrimp trawler off West Greenland between 59°N and 72°30'N from the 3-mile limit to the 600 m depth contour line. (SCR Doc. 94/9). Estimated trawlable biomass increased from 1991 to 1992 and has remained stable until 1993, where it was estimated to 9,600 tons. Abundance index was estimated to 239 mill. compared to 84 mill. and 283 mill. in 1991 and 1992, respectively. The length distributions of the catches in NAFO Divisions 1A and 1B showed modes at 11-12 cm and 17-18 cm representing the age groups 1 and 2. The inshore area Disko Bay in Div. 1A was surveyed at depths between 150 and 500 m in August/September. The biomass of Greenland halibut was estimated to 2,100 tons, 4,000 tons and 2,400 tons for 1991 to 1993, respectively. Abundance estimates decreased from 69 mill. in 1992 to 30 mill. in 1993. The length distributions were dominated by 20 cm fishes supposedly representing year-class 2.

2.2 Research longline fishery

In 1993 longline surveys for Greenland halibut was initiated for the inshore areas of Ilulissat, Uummannaq and Upernavik. The survey is to be conducted annually covering two of the three areas alternately, in order to obtain a CPUE index series for Greenland halibut in the inshore areas. In August 1993 the fjord areas of Ilulissat and Uummannaq were covered by the research longline vessel 'Adolf Jensen'. A total of 52 linesettings with 50,000 hooks were carried out. Mean length as well as CPUE of Greenland halibut for both areas were below values obtained in 1985-1987 by trial longline fisheries by Greenland Fisheries Research Institute (not reported).

A trial longline fishery was conducted offshore in Division 1AB between 66°N and 73°N in August 1993 by the Norwegian vessel SKARHEIM (SCR Doc. 94/10). The fishery was directed towards resources down to 1400 m. Highest CPUE values of Greenland halibut was obtained at depths between 800-1200 m. Mean length of Greenland halibut increased with depth. Length distributions of the catches ranged between 35 cm and 100 cm, with the majority being between 45 cm and 75 cm.

2.3 Commercial fishery data

Length frequency samples were obtained from the Norwegian factory trawler 'Kongsfjord' from the offshore fishery in Divisions 1CD, from catches taken deeper than 600 m by the Japanese vessel 'Shinkai Maru' in Divisions 1CD and from the trial fishery of the Norwegian longliner 'Skarheim' in Division 1A.

In SCR Doc. 93/80 is presented catch-at-age for 1987-1992 for the commercial catches in Subarea 0+1, based on catch data from Subarea 1. For 1993 catch-at-age data in Subarea 1 were available from the offshore fishery in Subarea 1. Catch-at-age data for Division 0B from the period 1988-1993 were this year provided by Canada. Catch weight-at-age in Subarea 1 was calculated of data from the Greenland/Japan survey and from Norwegian trial longline fishery in 1993. No maturity data were available. In Table VII is given comprised catch-at-age data for the offshore part of Subarea 0+1. Fig. 2 and 3 gives catch in numbers-at-age separately for Division 0B and Subarea 1 offshore.

From data collected by observers of the otter trawl fisheries in Subareas 0B 1988-1993, standardized catch rate series were calculated by means of country, tonnage, month and year (SCR. Doc. 94/47). From 1990 to 1991 standardized catch rates were fairly constant, but they declined from 1991 throughout 1992 to 1993. Catch rates for the Japanese trawler Shinkai Maru were available for the period 1987-1992 (Table IV). No values were obtained from 1993, as there was no commercial fishery by this vessel in Greenland waters this year. Average catch rates from the Norwegian trawl fishery in Divisions 0B and 1CD and from Russian trawl fishery in Division 0B were provided by the two nations for the period 1991-1993 (Table V and Fig. 1). Catch rates in all divisions decreased during the period with a factor of about 0.5.

Catch-at-age for the inshore areas in Subarea 1 were based on sampling from the commercial fishery with gillnets and longlines. Due to insufficient sampling from the fishery in 1991 and 1992, length samples for these years were pooled. Mean weight-at-age and the age-length data were pooled for the period 1986-1988 and used to raise catch-at-age for the period 1988-1992. Otoliths sampled in 1993 were read by another otolith reader than did otoliths sampled during 1986-1988. Catch-at-age for the period 1988-1993 (Table VIII, Fig.5) should therefore not be given to much weight in the interpretation.

2.4 Tagging experiments

Tagging experiments were carried out 1986-1992 in Greenland waters, inshore and offshore, in West and East Greenland (SCR Doc. 94/18). Recaptures at Iceland from releases in the southwest Greenland fjords and from releases in East Greenland fjords means that the Greenland halibut components in these fjord areas do have a connection with the Icelandic spawning stock and possibly originate from there. Recaptures of releases in the northwest Greenland fjords, however, were all recorded at the tagging sites showing a stationarity of adult Greenland halibut in these fjords. Recapture records from offshore tagging in Divisions 1CD were mostly in the tagging area, a few records were in Div. 0B and a single recapture was recorded at Flemish Pass in Div. 3L. This suggest that the adult offshore component of Greenland halibut in Subareas 0, 1, 2 and 3 do intermingle to some extent.

3. Assessment

Mean estimates of Z-at-age were established for the period 1988/89-1992/93 (Fig. 4), based on abundance estimates from surveys of Greenland halibut in Divisions 1CD (Table VI), where the main part of the offshore Greenland fishery takes place. The mesh size in cod-end of the survey gear is 30 mm, therefore negative values of Z for the younger age groups increasing to Z=1.4 at age 9 suggests that the younger age groups have not been recruited to the area surveyed. Assuming a constant catchability in

the survey for age groups older than 9 years, the decline in mean Z values from age 9 to age 14, may be explained by an emigration of age groups 8-11. Should the catchability decline with age following $q=\exp(-\alpha * age)$ this result still stands. A rough estimate of this emigration, is given by the difference between the mean levels of Z for ages 8-11 and ages 12-14, which is approximately 0.5 per year.

A sequential population analysis was considered on the Greenland halibut offshore stock component in Subarea 0+1. Catch-at-age data is given in Table VII. Natural mortality was set to 0.15 per year. For ages 8-11 0.5 was added to the natural mortality of 0.15 to account for an assumed emigration. Abundance estimates from RV 'Shinkai Maru' for the age groups 9-15, for the period 1988-1993 were used to tune the catch-at-age data using a XSA (Extended Survivors Analysis). The XSA results showed that the survey data do not match the catch data as shown by very high log-catchability residuals. The exploitation pattern have changed drastically in the offshore fishery in Subarea 0+1 from 1989 to 1990, therefore a separable SPA was inappropriate. It was therefore not possible to perform an analytical assessment.

4. The biological status of the inshore stock component in SA 1

In respect to a recommendation by STACFIS on the suballocation of a possible total TAC by geographical areas within Subareas 0, 1, 2 and 3 (Sci. Coun. Rep. 1993), and to a 1994 request by Denmark (Greenland) on the allocation of the TAC for Subarea 1 into inshore and offshore areas, the biological status of the inshore stock component in Subarea 1 is to be reviewed.

In its 1990 report,p. 87, the Scientific Council presents a review of the biological information on Greenland halibut in the Northwest Atlantic. Studies on stock delimitation in the area (including meristic, genetic variation, parasite infestations and tagging experiments) leads to the suggestion that the Greenland halibut stock component in the fjords of West Greenland is mainly recruited from the spawning component in the Davis Strait area. Further the fjord component (in Division 1A) was not suggested to contribute to the spawning component in the Davis Strait area, as adult fish seems to be very stationary in the fjords. The information presented were not considered conclusive and the management status of the stock component was kept unchanged.

Since then other studies on the population dynamics of Greenland halibut have been carried out. Extensive tagging experiments are reported in SCR. Doc. 94/18. Migration of adult fish have never been recorded between the fjords and the offshore areas in West Greenland although considerable numbers of Greenland halibut have been released both inshore and offshore until 1992. Recaptures of Greenland halibut released offshore have been reported from a trawl fishery developed offshore in Subarea 0+1. Studies on sexual maturity (SCR Doc. 94/42) suggest that Greenland halibut in the fjords do only spawn there sporadically. As catch compositions are shown to be unchanged during the year it implies that the mature component is stationary.

Thus the recent information support the information provided by the Scientific Council in 1990, that the Greenland halibut stock component in the northern fjords of Subarea 1 is mainly recruited from the Davis Strait spawning component and that Greenland halibut after entering the fjords are stationary.

5. Prognosis

Subareas 0-3

1. The Greenland halibut in Subareas 0-3 is considered a single stock as discussed in NAFO Sc.C. Rep. 90. Fishing on one component affects the catch possibilities on other components and therefore all components of the Greenland halibut stock should be regulated. This applies particularly to the new fisheries in the Flemish Pass Divisions 3LMN.

2. The yield taken of the Greenland halibut populations in recent years affects the populations significantly in all subareas as is seen from declining catch rates and trawlable biomass. The same pattern is seen all throughout the off shore range.

3. There is concern about the impact of the present fishery on the stock, Greenland halibut being a deep water slow growing species is likely unable to sustain high exploitation levels.

4. The length of first maturity of Greenland halibut is around 60 cm and the trawl fisheries in all subareas mainly catch fish below this size, hence the trawl fisheries exploit mainly immature Greenland halibut.

5. STACFIS maintains (Sc.C. Report 1993 p. 104) that a single TAC for the entire stock area without consideration of effort distribution could lead to excessive effort being concentrated in different areas of distribution and this could lead to the collapse of important fisheries. STACFIS therefore advises that separate TACs be maintained for different areas of the distribution of Greenland halibut.

6. Because of uncertainty in evaluating the magnitude of declines in survey results and cpue series STACFIS is not able accurately to calculate appropriate TAC levels. This applies to all subareas. However STACFIS considers that the offshore effort levels in all subareas are in excess of what the Greenland halibut stocks can sustain and STACFIS advises that the effort and catches throughout subareas 0-3 in 1995 should be reduced compared to recent years. This is further discussed below under the headings of the Subareas 0+1 and 2+3.

Subareas 0+1

7. There has been collected a significant amount of information which suggests that Greenland halibut in the Northern West Greenland fjords (Div. 1A) do not contribute to the spawning stock in the off shore areas in Davis Strait. There is very little fishery off shore in Div. 1A (less than 100 tons) and therefore tagging cannot conclusively test a possible link with Greenland halibut occurring inshore and offshore in Div. 1A. STACFIS advises that a separate TAC be established for the inshore areas of Division 1A. There is ongoing research which will allow STACFIS to review this position after some few years.

8. There is no information available suggesting that Greenland halibut in Cumberland Sound and coastal areas of Baffin Island is isolated from the occurrence offshore in Division 0B. STACFIS advises that a TAC to be established combined for all of Division 0B and Divisions 1BCDEF.

9. Catch rates and survey trawlable biomass have decreased since 1991 and both the commercial and survey catch-at-age estimates showed a shift towards younger fish. Trawlable biomass estimates for Divisions 1BCD decreased from 62,000 tons in 1992 to 38,000 tons in 1993. The decline was seen over the entire age range. This decline is much larger than the actual catch which occurred between these two surveys.

10. After 1989 the offshore fishery in subareas 0+1 has expanded considerably. This increased exploitation is expected to cause a change in the stock composition in the area towards younger fish and with a lower total biomass. The decline both in the commercial catch rates and in the survey biomass are however marked and suggests a high exploitation level. STACFIS therefore advises that the TAC for 1995 be set below the offshore catch level of 11-15,000 tons seen in most recent years. This implies a TAC for 1995 for the total area of Division 0B and Divisions 1BCDEF combined be set below 11,000 tons. The catch inshore i Division 1A is expected to be around 12,000 tons in 1995.

6. References

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TABLE I. Greenland halibut landings (metric tons) by year and country for Subarea 0 from 1982 to 1992.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991[a]	1992[a]	1993[a]
Can-M	-	-	-	-	-	-	-	-	-	256[b]	336	7613[b]
Can-N	-	-	-	-	-	-	2	-	589	-	3490	-
E/DEU	-	-	-	335	-	-	-	-	-	-	-	-
FRO	337	765	370	525	240	388	963	596	2252	2350	476	-
JPN	-	-	-	-	-	-	-	-	113	911	-	-
NOR	-	-	-	-	-	-	-	282	10031	3959	-	-
RUS	3468	3772	109	179	32	-	59	29	1528	3203	7169	-
Total	3805	4537	479	1039	272	388	1024	907	14513[c]	10679	11471	7613

[a] Provisional data
[b] Canada M+N+Q
[c] Total catch under revision

TABLE II. Greenland halibut landings (metric tons) by year and country for Subarea 1 from 1982 to 1992.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991[a]	1992[a]	1993[a]
E/DEU	9	14	15	-	-	-	-	-	-	3	-	49
E/GRL	5397	4136	6509	9127	8333	8385	7003	7492	8352	10209	12171	13054
FRO	-	-	-	-	-	-	-	-	54	73	213	113
JPN	-	-	26	5	-	907	1581	1300	988	676	-	1434
NOR	-	-	2	-	-	-	-	-	-	-	1309	1775
RUS	-	-	-	-	-	-	-	-	-	-	6	-
Div.1A inshore	5397	4136	6509	9127	8333	8385	7003	7492	8352	10200	12171	12136
Div.1BCDEF offshore	9	14	43	5	0	907	1581	1300	1042	761	2985[b]	4289
Total	5406	4150	6552	9132	8333	9292	8584	8792	9394	10961	15156[b]	16425[a]

[a] Provisional data
[b] Including 1457 tons non-reported catches.

TABLE III. Biomass estimates (000' tons) from Greenland/Japanese surveys and USSR(RUS)/DDR(FRG) surveys for the years 1987-1993 in Subareas 0+1.

	USSR(RUS)/DDR(FRG) Survey		Japan/Greenland Survey		
Year	0B	1BCD	1ABCD	1BCD	0B+1ABCD
1987	37	56	58[a]	54[a]	91
1988	55	47	63	53	118
1989	79	-	-	63[c]	142
1990	72	88	56[b]	53[b]	128
1991	46	-	79	77	125
1992	38	-	64	62	102
1993	-	-	-	38	-

- no survey
[a] In 1987 the survey did not cover the depth stratum 1000-1500 m
[b] Average values of two surveys
[c] Estimate only for Division 1CD

TABLE IV. CPUE in Div. 1C+D by the Japanese trawler Shinkai Maru in the period 1987- 1992.

Year	min.	Catch (tons)	CPUE tons/hour
1987	39,285	877	1.34
1988	75,878	1,566	1.24
1989	61,845	1,298	1.30
1990	52,020	963	1.11
1991	42,210	657	0.93
1992	16,000	328	1.23

TABLE V. CPUE in Div. 0B and 1C+D by Norwegian factory trawlers 1991-1993 and by Russian trawlers in Div. 0B 1990-1993.

Division		1990	1991	1992	1993
0B Norwegian trawlers	min.		236,259		
	catch (t)		3032		
	CPUE		0.77		
0B Russia and Baltic	min.	255,660	241,980	964,680	615,600
Baltic States trawlers	catch (t)	1,332	1,438	5,731	3,361
	CPUE	0.31	0.36	0.36	0.33
1C (NOR)	min.		12,279	19,702	17,778
	catch (t)		176	243	160
	CPUE		0.86	0.74	0.54
1D (NOR)	min.		42,495	207,802	182,830
	catch (t)		687	2459	1615
	CPUE		0.97	0.71	0.53

Table VI. Abundance estimates for Divs. 1CD from RV 'Shinkai Maru' (000s).

AGE	1988	1989	1990	1991	1992	1993
2	234	1	40	81	177	247
3	825	33	181	204	603	830
4	905	136	381	476	1.176	804
5	1.150	852	939	1.450	1.422	1.346
6	3.528	5.344	3.425	6.430	5.400	4.360
7	9.682	14.410	9.447	15.945	13.675	8.827
8	11.514	15.879	11.313	16.536	14.700	7.951
9	6.012	8.368	5.835	7.490	6.838	3.598
10	1.964	3.123	1.681	1.985	1.629	1.033
11	1.108	1.876	859	1.049	852	547
12	528	952	343	491	380	238
13	348	640	190	326	230	154
14	304	473	175	321	210	146
15	212	351	136	222	164	109
16	81	56	66	53	72	44
17	103	61	72	90	79	38
18	62	18	50	62	53	25
19	16	0	13	6	11	2
20	5	0	6	6	4	1
21	0	0	2	5	0	0
22	8	0	0	0	0	0
TOTAL	38.591	52.572	35.153	53.230	47.675	30.301

TABLE VII. Catch-at-age data for Greenland halibut offshore in Subareas 0+1.

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,
AGE							
5,	2,	1,	1,	4,	457,	43,	255,
6,	31,	24,	36,	89,	2159,	581,	667,
7,	182,	156,	244,	606,	3523,	2472,	2426,
8,	296,	292,	408,	1755,	2148,	3510,	2313,
9,	193,	203,	212,	1393,	911,	2128,	1027,
10,	77,	98,	75,	732,	330,	790,	584,
11,	40,	70,	47,	369,	224,	312,	227,
12,	18,	56,	48,	201,	178,	190,	133,
13,	10,	56,	44,	195,	89,	130,	73,
14,	9,	44,	42,	119,	60,	70,	63,
15,	6,	34,	26,	69,	11,	36,	37,
16,	3,	14,	12,	17,	1,	15,	29,
17,	4,	4,	2,	3,	1,	2,	5,
+gp,	2,	1,	0,	0,	0,	0,	2,
0 TOTALNUM,	873,	1053,	1197,	5552,	10092,	10279,	7841,
TONSLAND,	1294,	2324,	2207,	10862,	11437,	14988,	11853,
SOPCOF %,	101,	97,	101,	104,	100,	100,	97,

Table 2 Catch weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,
AGE							
5,	.2890,	.2890,	.2890,	.3680,	.3550,	.3210,	.4160,
6,	.5080,	.5080,	.5080,	.5570,	.5470,	.5560,	.6710,
7,	.7390,	.7390,	.7610,	.8060,	.8150,	.8090,	.9820,
8,	1.0780,	1.0780,	1.0800,	1.0960,	1.1360,	1.1410,	1.3490,
9,	1.4100,	1.4300,	1.4840,	1.5210,	1.6150,	1.6240,	1.9180,
10,	1.9650,	2.6000,	2.0440,	2.1070,	2.3060,	2.3140,	2.4900,
11,	2.5820,	2.8300,	2.7030,	2.9240,	3.3360,	3.2000,	3.2520,
12,	3.5220,	3.9100,	3.6430,	3.8780,	4.3040,	4.1250,	4.0920,
13,	4.6430,	5.0200,	4.7590,	4.9530,	5.5460,	5.3440,	5.2190,
14,	5.7890,	6.1800,	5.9870,	6.2290,	6.9390,	6.8540,	6.4510,
15,	6.6050,	7.4800,	7.1110,	7.9110,	8.5330,	8.2780,	7.6730,
16,	7.9870,	8.9500,	8.7670,	10.1270,	7.9900,	9.7350,	9.0430,
17,	9.5570,	9.9100,	10.5420,	12.4930,	9.5570,	11.9500,	10.6330,
+gp,	11.3340,	11.3340,	11.3340,	16.1870,	11.3340,	11.8300,	14.0630,
0 SOPCOFAC,	1.0085,	.9731,	1.0093,	1.0399,	1.0014,	.9959,	.9734,
1							

TABLE VIII. Catch-at-age data for Greenland halibut inshore in Subarea 1.

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,
AGE						
5,	0,	0,	0,	9,	11,	8,
6,	2,	0,	0,	50,	59,	27,
7,	9,	0,	2,	231,	276,	192,
8,	69,	42,	35,	615,	735,	491,
9,	231,	166,	213,	1085,	1298,	632,
10,	276,	241,	335,	1053,	1260,	561,
11,	328,	321,	439,	936,	1119,	447,
12,	285,	299,	374,	357,	427,	349,
13,	248,	255,	285,	95,	114,	294,
14,	219,	239,	233,	54,	65,	424,
15,	116,	139,	135,	23,	27,	290,
16,	53,	71,	65,	9,	11,	133,
17,	30,	47,	43,	5,	5,	47,
+gp,	9,	22,	15,	0,	0,	24,
TOTALNUM,	1875,	1842,	2174,	4522,	5407,	3919,
TONSLAND,	7003,	7492,	8352,	10200,	12200,	12136,
SOPCOF %,	100,	100,	100,	100,	100,	100,

Table 2 Catch weights at age (kg)

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,
AGE						
5,	.4100,	.4100,	.4100,	.4100,	.4100,	.6600,
6,	.5100,	.5100,	.5100,	.5100,	.5100,	.8600,
7,	.8700,	.8700,	.8700,	.8700,	.8700,	1.1600,
8,	1.1800,	1.1800,	1.1800,	1.1800,	1.1800,	1.5100,
9,	1.6700,	1.6700,	1.6700,	1.6700,	1.6700,	2.0500,
10,	2.1800,	2.1800,	2.1800,	2.1800,	2.1800,	2.4600,
11,	3.0200,	3.0200,	3.0200,	3.0200,	3.0200,	2.7400,
12,	3.6600,	3.6600,	3.6600,	3.6600,	3.6600,	3.4200,
13,	4.5000,	4.5000,	4.5000,	4.5000,	4.5000,	3.9600,
14,	5.6700,	5.6700,	5.6700,	5.6700,	5.6700,	4.4300,
15,	6.6600,	6.6600,	6.6600,	6.6600,	6.6600,	5.2600,
16,	7.8000,	7.8000,	7.8000,	7.8000,	7.8000,	6.4100,
17,	8.6300,	8.6300,	8.6300,	8.6300,	8.6300,	8.4800,
+gp,	9.4300,	9.4300,	9.4300,	9.4300,	9.4300,	9.4800,
SOPCOFAC,	1.0006,	.9974,	1.0007,	1.0003,	1.0009,	1.0002,

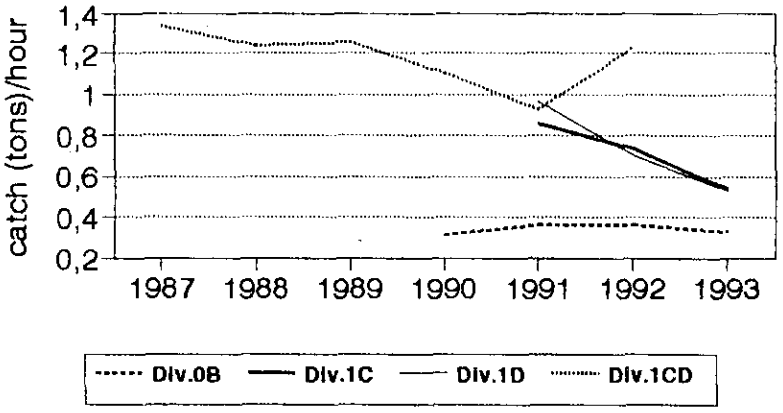

Fig. 1. Reported catch rates from Norwegian (Div. 1C and 1D) and Russian trawlers (Div.0B) and from the Japanese trawler Shinkai Maru in Div. 1CD combined (see Table V).

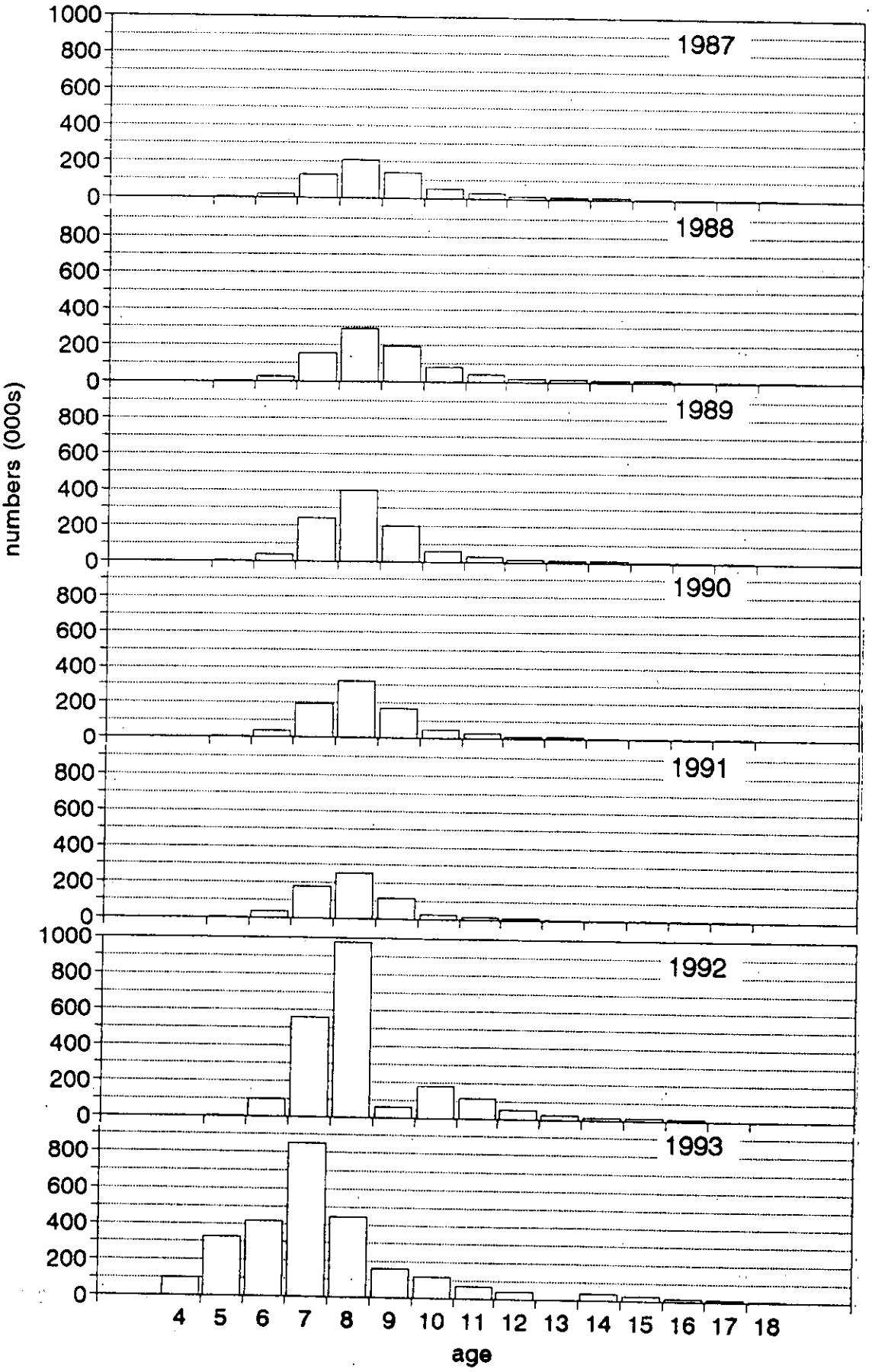

Fig. 2. Catch in numbers at-age for the offshore catch in Subarea 1.

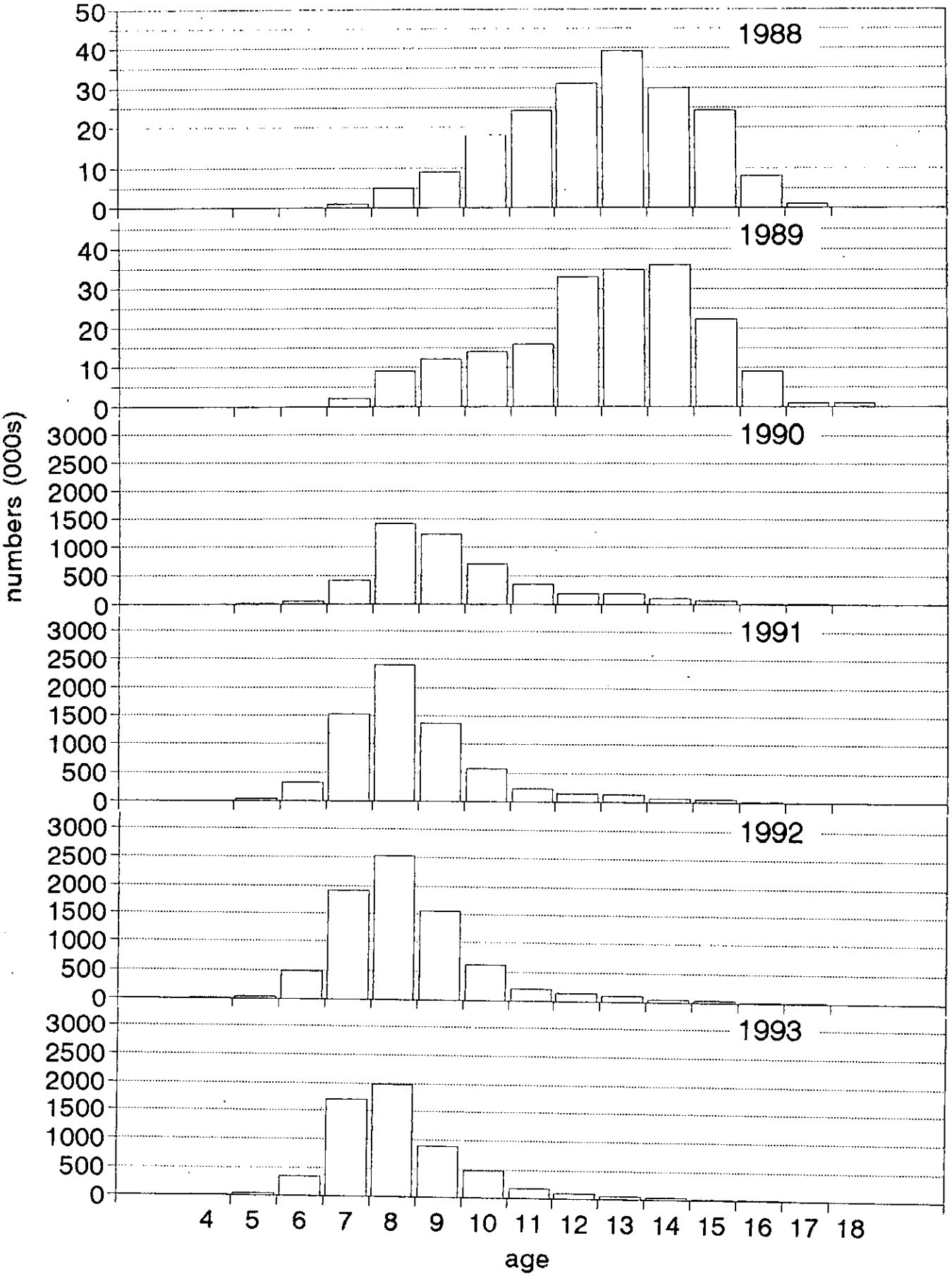

Fig. 3. Catch in numbers at-age for Division 0B.

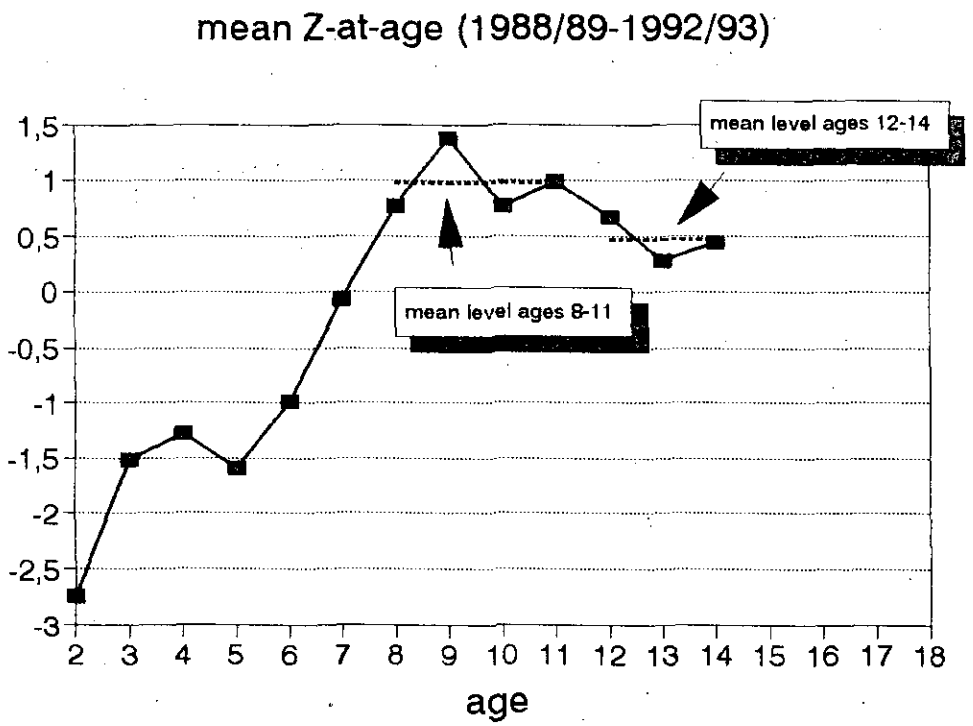

Fig. 4. Z-at-age estimates from RV surveys in Divs. 1CD.

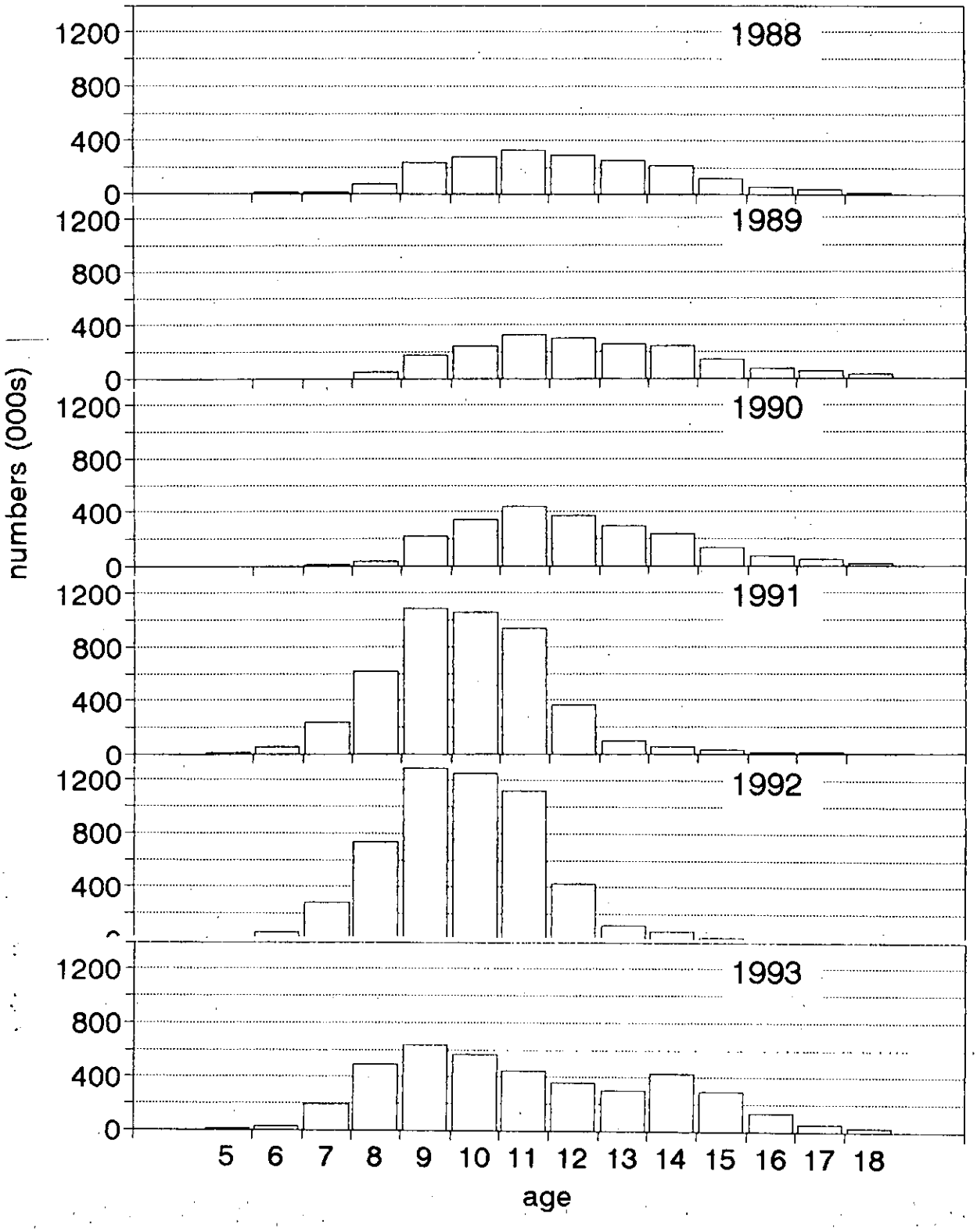

Fig. 5. Catch in numbers at-age for the inshore catches in Subarea 1.