New Zealand Fisheries Assessment Research Document 88/8

Barracouta

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BARRACOUTA

(Thyrsites atun)

INTRODUCTION

Since the preparation of the 1987 stock assessment paper, research on barracouta has almost ceased because of changing priorities. Research data collected prior to 1987 are being prepared for publication.

BIOLOGY

There is no new biological information relevant to stock assessment other than that given in previous stock assessment papers, In summary, barracouta are a moderately productive and fast-growing species. Some ageing has been carried out, and it is planned to put more effort into this aspect in 1988. From unvalidated age data, it appears that most barracouta recruit into the fishery at about age 3 (approx. 60cm) and that the maximum age is usually less than 10, although a few fish reach up to about 13 years. Most barracouta mature at about age 3 (60cm), although a few mature fish are found at age 2 (50cm). For estimation of yields a natural mortality of 0.3 has been assumed.

STOCK BOUNDARIES

The number of stocks is unknown. Known areas of spawning include the east coast, from Kaikoura to the Bay of Plenty, and the west coasts of the north and South Islands in August-September; Mernoo Bank and Southland in October-November and the Chatham Islands in November-December. The boundaries between these spawning areas are not clear.

Tagging results (Hurst & Bagley, ms., Hurst 1988) suggest that east coast South Island fish make extensive spawning migrations to the east coast (and a few to the west coast) of the North Island, during winter. The movements of west coast South Island spawning fish are unknown, but it may be that these fish are continuous with the Southland spawning group.

Results of two trawl surveys in 1986 off Southland suggested considerable movement of fish away from the area at spawning time, and it is possible that these fish may have moved north to the west coast S.I. spawning grounds.

Fish at the Chatham Islands appear to be a separate stock, based on the size distribution (i.e. significantly smaller than mainland fish - see Fig. 1), the level of parasite infection and the structure of the otoliths (Hurst & Bagley 1987).

Four barracouta management areas were established in 1983, based on knowledge at the time. They were, by EEZ area: E-F, G-H, B-C and D. Although there is some evidence that perhaps the Southland fish move north out of the area, it is not known whether they migrate up the east or west coasts, or both. The degree of movement between the east coast South Island and west coast North Island is also unknown (i.e. the number of tag returns were not sufficient to be able to assess this). It is therefore best to retain the stock boundaries as they are at present until this question can be examined in more detail.

FISHERY

Detailed fishery data, up to 1983-84, have been published (Hurst, in press). Some of these data, updated to 1985-86 are included in this paper.

1. Annual catch by nation (Table 1).

The annual catch of barracouta appears to fluctuate considerably. The 1985-86 catch of 18478 t was the lowest since the 1978-79. This increased significantly in 1986-87, with the Quota Monitoring System recording a figure of 27700 t, the second highest recorded annual catch since 1977. Over 99% of the catch is taken by trawlers (Hurst, in press).

New Zealand domestic and chartered vessels generally catch slightly less than 50% of the total caught. Of the foreign licensed catch, the Japanese appear to have stabilised at around 1000 - 2000 t and the Soviets continue to report zero. The Korean catch has been reduced since 1984-85 by removing the opportunity to misreport catches in Area E.

2. Catch by area (Tables 2 & 3. Fig 2)

Domestic catch by domestic fishery area is given in Fig 2, for the 3 fishing years from 1983-84 to 1985-86. (1986-87 data are not available). As with the annual catches, area catches also shown an overall decline during this period. The only areas to show on overall increase were the four areas around Tasman Bay and Cook Strait.

New Zealand chartered and foreign licensed ('deepwater') catches by EEZ area are given in Table 2. Deepwater vessels have best access to barracouta in areas F (and E(A) up until the boundary change in 1983) and G, and this is reflected in the catches. Area D is sometimes the third most important area for deepwater catches, but this is highly variable. The apparently high catches in area E(A) in 1983-84 and 1984-85 were due to the misreporting of barracouta from catches in area F.

An estimate of the catch, by all vessels, for the years 1983-84 to 1985-86, by barracouta Fishstock area (Table 3), has been made by combining domestic and deepwater data:

Barracouta Fishstock Code	Domestic areas	EEZ areas
1	1-16, 18-24, 26	B, C
4	49-52	D
5	25, 27-32	E, F
7	17, 33-48	G, H

This is only an estimate as some of the catch is not recorded by area. Figures for 1986-87 are from quota monitoring reports, and may not have included all the catch (e.g. some foreign licensed catch may be missing).

Barracouta came under quota for the first time under the Deepwater policy, on 1 October 1983. Current TAC's by barracouta fishstock area are given in Table 3.

From 1983/84 to 1985/86, annual catches by fishstock area have been lower than the quotas set in all areas except area 5 (Southern+Sub-Antarctic). There was originally no quota put on the Sub-Antarctic as there were only insignificant catches reported from this area until 1983. With the introduction of quotas, this allowed for considerable misreporting of fish caught in other areas, particularly Southland. This was not able to be rectified until the 1985-86 fishing year when the quota for Southern was combined with the Sub-Antarctic.

In the last fishing year catches have increased in all areas, in fact in three of the four areas, the catch has almost doubled. In two areas, areas 1 and 4, the catch as recorded by the Quota Monitoring System (QMS) exceeded the gazetted TAC, by 5% and 2%, respectively. In area 4 this is presumably because research quota, which was in excess of the TAC, has been carried over from previous years. In area 1, the increase in the amount recorded may be due to the poor red cod season off the east coast of the South Island resulting in increased effort on barracouta. Nevertheless, the percentage overruns are well within the 10% allowed.

3. Catch by area by month (Figs. 3-5)

The seasonality of barracouta catches by area has been described in detail by Hurst (in press). Some of these data are presented and updated in Figs. 3-5.

The domestic catch by area has only been recorded since 1983-84 (Fig. 3). Data prior to this date were recorded by port of landing, but showed

similar patterns (Hurst, in press). The main catches are in Fishstock areas 1 and 7, which have both been divided into N (N.I.) and S (S.I.), as per EEZ areas B, C, G & H. The fishing season in Fishstock areas 1 (N)(= area B) and 7 (S)(= area G) is short, usually August - October, and is based on spawning fish. A similar pattern has been apparent in area 7 (N)(=area H), but has become less obvious in recent years. The season in area 1(S)(= area C) is almost the exact opposite of area 1(N), with the declines in catch being more obvious than the peaks. These seasonal patterns tie in with the tagging observations which suggest migration of fish from area 1(S) to area 1(N), and to a lesser extent area 7(N).

The deepwater (New Zealand chartered and foreign licensed vessels) catches are given by EEZ area, back to 1978-79, in Fig. 4. Catches in area C have declined due to area restrictions and are now comparatively insignificant. Catches in area D initially seemed to peak from December to February, but in the last three fishing years (up to 1985-86), the summer peak has declined and is now not significantly greater than peaks in other seasons.

Catches in area E, F(W) and F(E) have become confused because of the E/F boundary change in 1983 and the misreporting in 1983-84 and 1984-85. Prior to 1983-84, there was a well defined spring season in area f(W), on spawning fish, and a summer season in areas F(E) and E(A)(Snares only).

In area G, the season is very short, mainly August-September, as for the domestic fishery.

The estimated catch of all vessels, by EEZ areas C, F, G and H is given in Fig 5. (Areas B and D are not included as these are exclusively domestic and deepwater, respectively, and are given in Figs. 3 & 4). The patterns observed are the same as described above.

4. C.P.U.E.

Details of C.P.U.E. analyses of the deepwater fleet, up to 1983-84 are given by Hurst (in press) and were summarised by Hurst (1986). Further analyses of this type have been complicated by misreporting of fish in areas D, E and F, as described above.

Analysis of domestic C.P.U.E. is not feasible, as it requires details of the target species on a tow by tow basis, neither of which can be extracted from the FSU database.

5. Current Maori and non-commercial fisheries.

The amount caught by Maori and non-commercial fishers is not known, but probably insignificant compared with commercial catches.

BIOMASS AND YIELD ESTIMATES

There are no new data on stock size estimation and no new analysis of age data which would enable us to review the productivity value (15%) which has been used to derive yields. For summaries of relevant biomass data and detailed discussion of previous interpretation of the results see Hurst (1985, 1986, 1988). Biomass estimates are given in Table 4.

The new approach adopted during the 1988 FAM involves the calculation of MCY, which is described in more detail below. This procedure has resulted in a few minor changes to barracouta estimated yields. Estimation of CAY is not possible because there are no current biomass estimates and the assumed mortality of 0.3 needs to be confirmed. Although some of the more recent biomass estimates (e.g. Stewart-Snares shelf, 1986) could have been projected forward to estimate CAY, there is little to be gained in adopting a CAY strategy if there is no ongoing commitment to the estimation of current biomass.

ESTIMATION OF MCY

It is not feasible to estimate MCY from catch trends as the amount of effort has varied considerably since the beginning of the fishery in the late 1960's (i.e. the foreign licensed fishery has declined; effort was encouraged by subsidies in 1979,1981; an unknown amount of fish has been and still is dumped; effort is related to availability of more preferred, higher value species, e.g. red cod, orange roughy).

CPUE data cannot be used for estimation of MCY at this stage because of the short time series (which will be improved as the masterfiles since 1983-84 become accessible), fluctuating effort with time and changing area restrictions, misreporting of fish in area E, and lack of tow by tow and target species detail in the domestic statistics. A summary of analyses of deepwater data was given by Hurst (1986).

Estimates of MCY given below are derived mainly from trawl surveys which have been carried out in most of the barracouta fishery areas (as described by Hurst 1985, 1986, 1988). There are no new biomass data since the last survey in November 1986. Therefore, estimates of CAY are not possible. In all cases the estimated biomass (the average of the wingtip and doorspread estimates) is assumed to be less than the virgin biomass; thus MCY = 0.5MB, and M = 0.3 (assumed). This gives effectively the same results as in previous stock assessments where the yield = productivity (15%) x biomass. However, for this assessment the recruited biomass (fish >60cm long) only has been used. The following is a brief summary of MCY estimates and how they compare to earlier stock assessments, by Fishstock area.:

FISHSTOCK 1: Auckland East, Central East, and South-East Coast.

History of substantial fishing effort extends back to 1968. The Japanes average annual catch of 10,000t (SD = 2,800t) was associated with a decline in CPUE from 2.3 to 0.5 t/hr from 1968 to 1975. The amount caught by Soviet and domestic vessels during this period (incl. dumped fish) is assumed to be less than 2000t, suggesting an annual yield of about 12000t was not sustainable.

Biomass estimates from trawl surveys in Canterbury Bight (9 surveys 1980-1982) varied significantly between seasons, the seasonal high and low estimated yields for 1982 being 9400t (summer) and 550t (early spring - see Table 4). (The movements of fish from tagging data are described above). As the Canterbury Bight surveys did not include the full distribution of the stock, an areal multiplier of 1.5 is used for the three annual high (summer) estimates (based on W.J Scott surveys) t estimate a yield for the total east coast S.I.

These data can be used to calculate two estimates of MCY.

Estimate 1: MCY = cY, where Y = estimated average catch from 1968-1975 and c = 0.8 to allow for variability and declining CPUE. Fishing activity is assumed to have been on the total stock, even though the entire area was not fished. Due to problems with Fishstock area boundaries not correlating with the fishing history boundaries, 500t is subtracted and added to Fishstock 7.

Hence; MCY = (0.8 x 12000) - 500 = 9100t.

Estimate 2: MCY = 0.5MB, where M = 0.3 and B = average of three summer (high) recruited biomass estimates for the Canterbury Bight (1980-1982) x 1.5 to allow for unsurveyed parts of the stock (based on W.J Scott surveys), minus 500t as in estimate 1.

Hence; MCY = (0.5 x 0.3 x 60290 x 1.5) - 500 = 13050t.

Of the two estimates, the first suggests that an MCY in excess of about 9000t may not be sustainable. The TAC was originally set at 9000t in 1983 for EEZ areas B+C, and later reduced to 8500 in order to fit in with QMA areas. This TAC aimed to keep the catch at the current fishing level at that time, as it appeared that the history of annual catches in the order of 10,000t+ had led to big declines in CPUE. Although the biomass data suggest the yield might be higher, the entire survey area was not covered and the estimates are now 6-8 years out of date. The unknown stock relationship with Southland fish also suggests that the TAC should not be increased on the east coast based on the Canterbury Bight biomass data alone.

FISHSTOCK 4. Chatham

The fishing history started in 1977 and effort has been erratic; the maximum annual catch = 8700t in 1977-78. CPUE trends are obscured by erratic effort. The TAC was set in 1983 based on the annual average catch up to that time (3000t).

The 2 trawl surveys (Dec. 1984, Dec. 1985, incl. 12 mile sea, 100mm mesh codend) aimed at estimating barracouta biomass are the most appropriate for estimation of MCY. The suggested yields of 4100 and 2570t (Hurst 1988), were reduced slightly by using the recruited biomass (fish >60cm long), rather than total biomass (see Table 4).

Hence: MCY = 0.5MB, where M = 0.3 and B = average of two recruited biomass estimates in Dec. 1984 and Dec. 1985.

MCY = 0.5 x 0.3 x 17600 = 26400t.

The MCY calculated here is slightly lower than the yield estimated previously (average = 3300t) because only the recruited biomass is used. (N.B. no allowance has been made for unsurveyed areas of foul ground as the catch rate of barracouta appeared to be lower in areas of foul which were encountered). The biomass estimate for the Chatham Islands part of the July 1986 *Shinkai Maru* survey was not used as only 9 trawls were made in the area.

FISHSTOCK 5. Southern - Sub-Antarctic.

Substantial fishing effort began in 1977-78 and averaged 4650t (SD = 2800t) up until 1982-83. CPUE has shown a small decline up to 1983-84, but trends since then have not been analysed and would be obscured by the misreporting of significant quantities of fish in 1983-84 and 1985-86. The fishery takes place mainly in summer/autumn.

The 1983 TAC of 9000t was based on trawl surveys data from Feb. 1981 and Mar. 1982 which suggested yields of 9300t and 9560t (average 9430t). At this time barracouta in Fishstock area 5 were considered to be a separate stock. Since then, 4 more trawl surveys have been done, 2 of which were specifically designed to estimate barracouta biomass (Hurst 1988). The two barracouta surveys in 1986 (June, November) indicated that there could be significant movement out of the area in late winter/spring to spawning grounds (up the west and perhaps east coast of the south island?). Thus, the average of the 1986 seasonal surveys probably gives the best estimate of MCY for Fishstock area 5, rather than using the summer high estimates as was done previously.

Hence: MCY = 0.5MB, where M = 0.3 and B = the average of two seasonal barracouta surveys (June, November) in 1986. The amount of recruited biomass has not been calculated yet and is estimated as 66% of the total (from length frequency graphs - see Fig. 1).

MCY = 0.5 x 0.3 x 63130 = 9500t.

FISHSTOCK 7. Challenger, Central West, and Auckland West.

The main fishery began in the 1970's and averaged about 4000t until 1977 when an estimated 25000-30000t were caught. Catch and CPUE dropped significantly, with a slight recovery in 1981-82, when 8300t were caught. However, this was followed by a decline in the next 2 years. Fishing effort has been too erratic to use these data to estimate MCY.

Estimation of MCY used biomass survey data, as in previous stock assessments. Surveys in the Challenger area suggested that the bulk of the fish in the area during the spawning season were adult fish, and fits in with the suggestion that fish may migrate to the area from the south. We may therefore have counted the same fish twice if they are part of the same stock.

Hence: MCY = 0.5MB, where M = 0.3 and B = the average of two barracouta recruited (= total, see Fig. 1) biomass estimates on the west coast S.I., (August-October, 1983, 1984) plus the total estimate (recruited biomass unknown) from the area to the north by Shinkai Maru in October/November 1981. An allowance was made for the area of the east coast which was not in the survey area, but is in the fishstock area (i.e. 500t - see Fishstock 1).

MCY = (0.5 x 0.3 x 64850) + 500 = 10230t.

The TAC was originally set at 10000t for areas G+H, based on these data and increased to 10500t when the QMA's were introduced, to allow for boundary discrepancies. It has not been caught since it was introduced.

If Fishstocks 5 and 7 are the same, or part of the same stock, then the average of the summer/autumn (seasonal high) surveys in Fishstock 5 (Feb. 81, Mar. 82, Apr. 83 - see Table 4) could be used to estimate MCY for both areas, i.e. 15200t, which includes some, as yet unestimated, unrecruited component (probably <20%). This is less than the combined TAC's for QMA's 5 and 7 of 19520t. However, there is some evidence, from tagging returns, that at least some of the fish on the west coast N.I. may have migrated into the area from the east coast S.I. There are also substantial amounts of barracouta caught as jack mackerel bycatch in area H during summer, which suggest 15200t would be an underestimate.

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TABLE 1: Annual catches* (t) of barracouta from the New Zealand EEZ# from 1967

Fishing year@	New Zealand	Japan	Korea	U.S.S.R.	Joint venture	Total
1967	232	2 276		-§	-	2 508
1968	569	10 744		-	-	11 313
1969	643	13 613		-	-	14 256
1970	755	16 191		-	-	16 946
1971	1 100	14 421		-	-	15 521
1972	1 428	17 118		-	-	18 546
1973	2 850	9 981		-	-	12 831
1974	3 375	18 219		-	-	21 594
1975	2 503	10 560		-	-	13 063
1976	3 673	10 151		-	-	13 824
1977	4 697	34 357	8 109	-	-	47 163
1978-79	5 335	4 781	2 481	-	58	12 655
1979-80	7 748	4 339	3 879	47	6 979	22 992
1980-81	10 058	4 227	15	60	4 995	19 355
1981-82	12 055	2 813	373	-	11 077	26 318
1982-83	10 814	1 746	1 888	31	7 110	21 589
1983	7 763	803	1 115	-	2 961	12 642
1983-84	12 390	1 786	4 355	-		28 757
1984-85	7 869	1 430	5 252	-	10 425	24 976
1985-86	8 427	1 371	815	-	7 865	18 478
1986-87	?	?	?	?	?	27 700ƒ

* Domestic statistics and all figures since 1978-79 are from New Zealand sources. Foreign data before 1978-79 were provided by each nation.

\# 200 n. mile Exclusive Economic Zone.

@ Since the introduction of the EEZ in 1978, annual statistics are from 1 Apr-31 Mar. The fishing year changed to 1 Oct-30 Sep from Oct 1983, which resulted in a 6 month changeover period 1 Apr-30 Sep in 1983.

§ Not recorded.

ƒ Data from Quota Monitoring Reports - may be an underestimate.

TABLE 2: Foreign and joint venture (JV) barracouta catches (t), 1975-76 to 1983-84

		EEZ area						
Year*	Nation	B	C	D	E#	F#	G	H	Total
1975-76	Japan	8	4 130	-@	462	309	2 943	1 574	9 427
1976-77	Japan	36	8 979	5	106	331	2 208	2 106	13 770
1977-78	Japan	4	2 380	8 732	3	1 590	18 442	4 693	35 843
	Korea						6 657§		8 109
	Total						25 099		43 952
1978-79	Japan	25	2 403	-	439	603	646	666	4 781
	Korea	-	-	16	-	-	2 113	352	2 481
	JV	-	22	-	35	1	-	-	58
	Total	25	2 425	16	474	604	2 759	1 018	7 320
1979-80	Japan	8	-	722	3 085	240	-	284	4 339
	Korea	-	-	2 490	309	836	-	244	3 879
	U.S.S.R.	-	-	-	2	28	17	-	47
	JV	3	1 716	2 136	1 378	1 313	318	113	6 979
	Total	11	1 716	5 348	4 774	2 147	335	641	15 244
1980-81†	Japan	-	-	1 441	2 127	280	18	360	4227
	Korea	-	-	-	15	-	-	-	15
	U.S.S.R.				60				60
	JV	55	435	467	665	1 414	1 484	410	4 995
	Total	55	435	1 908	2 867	1 694	1 502	770	9 296
1981-82	Japan	-	-	96	1 404	234	8	1 071	2 813
	Korea	-	-	27	162	153	-	31	373
	JV	-	842	253	1 493	4 329	3 033	1 129	11 077
	Total	-	842	376	3 059	4 716	3 041	2 231	14 266
1982-83	Japan	-	4	194	589	326	-	630	1 746
	Korea	-	-	482	1 268	132	-	6	1 888
	U.S.S.R.	-	-	-	31	-	-	-	31
	JV		37	2 267	570	2 769	650	780	7 110
	Total	-	41	2 943	2 458	3 227	650	1 415	10 776
1983	Japan	-	-	430	4	98	-	271	803
	Korea	-	-	256	710	31	-	117	1 115
	U.S.S.R.	-	-	-	-	-	-	-	-
	FCDƒ	-	467	285	12	26	1 970	201	2 961
	Total	-	467	971	726	155	1 970	589	4 879
1983-84	Japan	-	-	151	5	1 214	-	417	1 786
	Korea	-	-	225	3 800	298	-	31	4 354
	U.S.S.R.	-	-	-	-	-	-	-	-
	FCD	-	190	1 367	619	5 203	1 869	978	10 266
	Total	-	190	1 643	4 424	6 175	1 869	1 426	16 366
1984-85	Japan	-	-	121	28	918	-	363	1 430
	Korea	-	-	251	4 780	216	-	5	5 252
	U.S.S.R.	-	-	-	-	-	-	-	-
	FCD	-	250	1 537	988	5 537	835	1 098	10 425
	Total	-	250	1909	5 796	6 671	835	1 466	17 107^
1985-86	Japan	-	-	147	87	1 106	-	32	1 371
	Korea	-	-	250	233	328	-	5	815
	U.S.S.R.	-	-	-	-	-	-	-	-
	FCD	-	494	1 113	47	4 577	1 350	285	7 865
	Total	-	494	1 510	367	6 011	1 350	322	10 051

* Years before 1983 are 1 Apr-31 Mar; 1983, 1 Apr-30 Sep; from 1983-84, 1 Oct-30 Sep.
\# The areas F-E boundary changed on 1 Oct 1983.
@ Not recorded.
§ Only area G catch is known. The rest came from other areas, but was unspecified.
† 1980-81 data are unedited.
ƒ Foreign chartered (previously joint venture) vessels.
^ 179 t undefined by area.

Table 3. Estimated catch of barracouta, by all vessels, by Fishstock areas, 1983-84 to 1986-87.

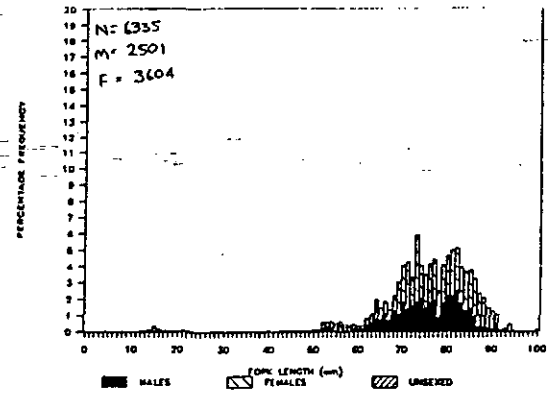
Fishstock code	Catch (t) 1983-84	1984-85	1985-86	1986-87	TAC (t) 1986-87
1	7805	5442	5395	8930	8510
4	1743	1909	1509	3072	3010
5	11291	12487	6380	7653	9010
7	7222	4425	4536	8046	10510
10	0	0	0	0	10

TABLE 4: Barracouta biomass estimates. (Data used for estimation of MCY are indicated by an asterisk; recruited fish are ≥ 60 cm; c.v. : coefficient of variation; N.A.: data not available.)

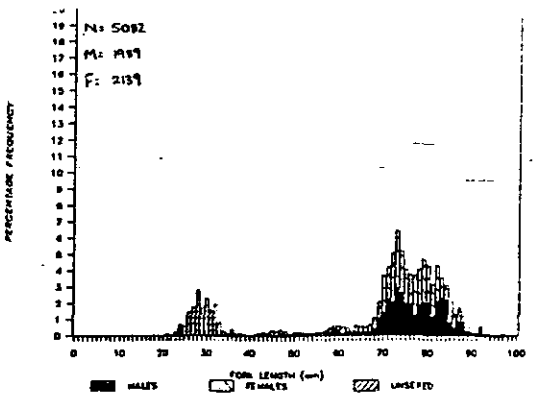
Fishstock	Survey area	Vessel	Date	Biomass (t) Total	Biomass (t) Recruited	c.v. (%)
1	Canterbury Bight	James Cook	* Mar 80	66 150	66 150	23
			Dec 80	47 910		46
			* Feb 81	52 040	52 040	38
			May 81	25 170		12
			Dec 81	29 060		72
			* Jan 82	62 685	62 685	56
			May 82	55 755		19
			Sep 82	3 770		68
			Dec 82	11 675		24
4	Chatham Is.	Akebono Maru 73	* Dec 84	27 300	22 200	17
			* Dec 85	17 120	12 930	9
		Shinkai Maru	Jul 86	29 660		32
5	Stewart-Snares Shelf	Shinkai Maru	* Feb 81	61 860	N.A.	23
			* Mar 82	63 760	N.A.	50
			* Apr 83	124 740	N.A.	25
			Oct/Nov 83	10 360		30
			* Jun 86	155 750	102 795 est.	20
		Akebono Maru 3	* Nov 86	35 600	23 495 est.	15
(N.B. Recruited biomass estimated as total x 0.66 from length frequency data for 1986)						
7	West Coast S.I.	James Cook	* Sep/Oct 83	24 510	24 510	34
			* Aug/Sep 84	30 160	30 160	18
	West Coast	Tomi Maru	Dec 80-Feb 81	15 930	N.A.	10
		Shinkai Maru	* Oct/Nov 81	37 510	N.A.	13

i. CANTERBURY BIGHT SURVEYS

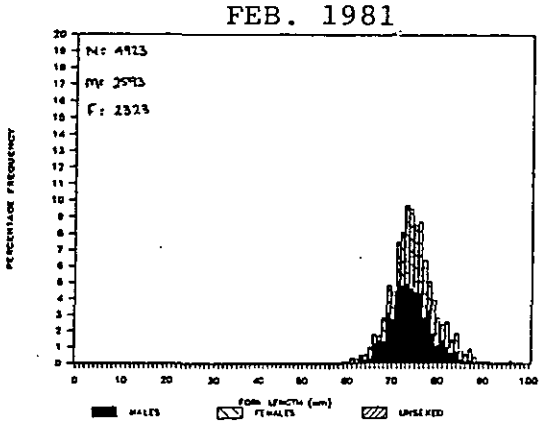
MAR. 1980



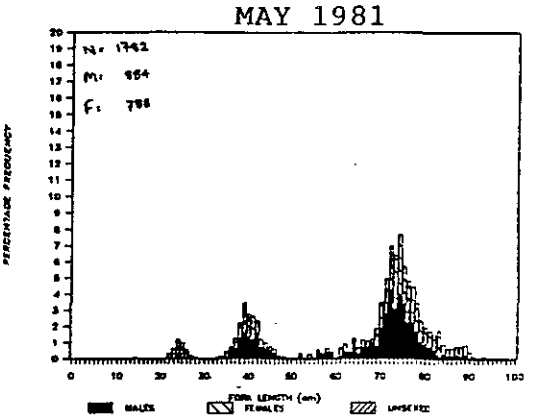
DEC. 1980



FEB. 1981



MAY 1981



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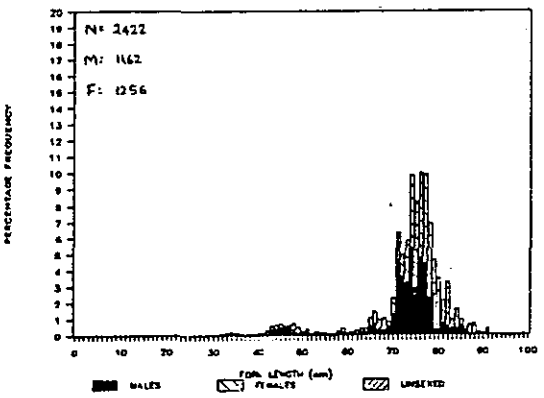

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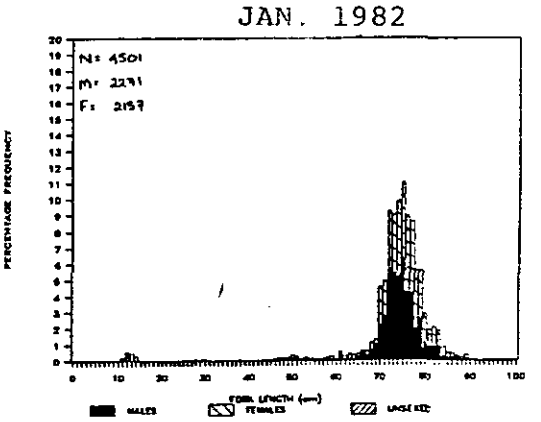

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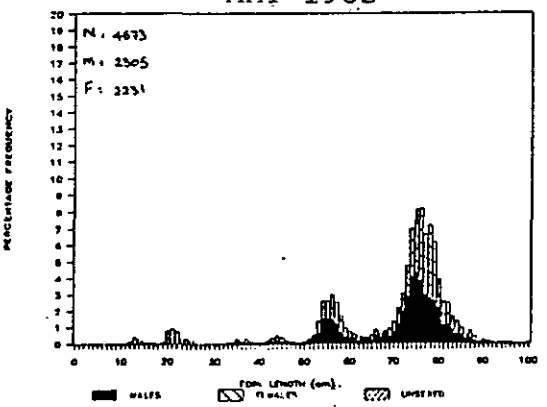

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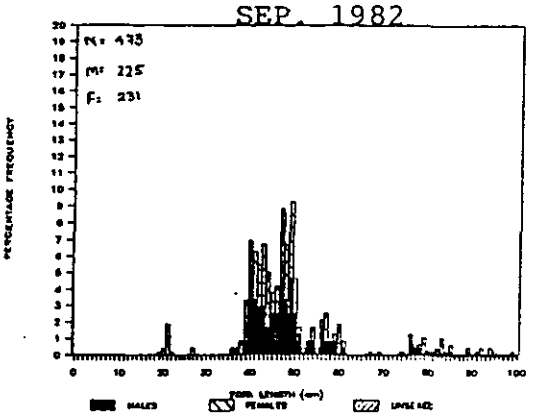

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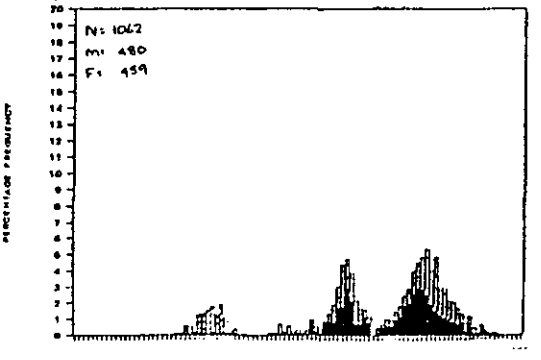


Figure 1. Barracouta Length Frequencies

i. (ctd) EAST COAST NORTH ISLAND SURVEY

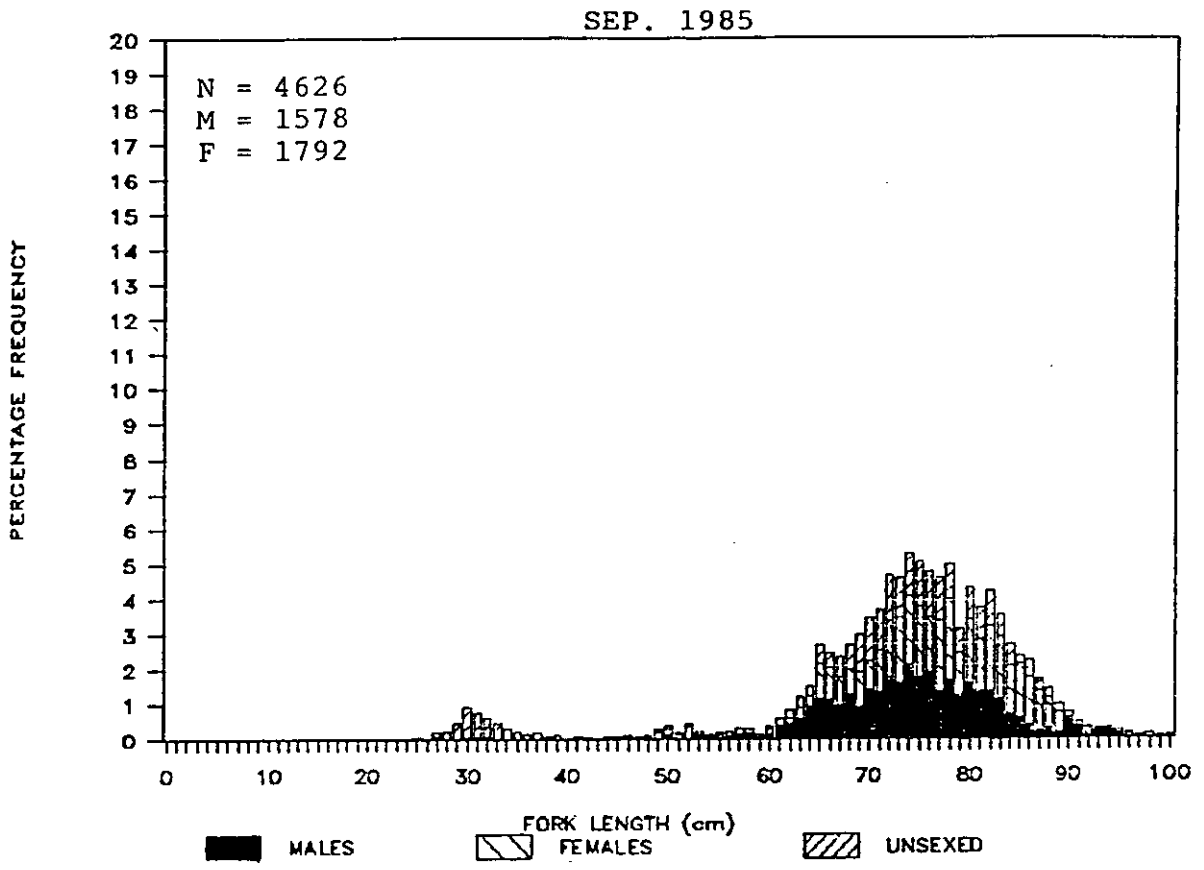
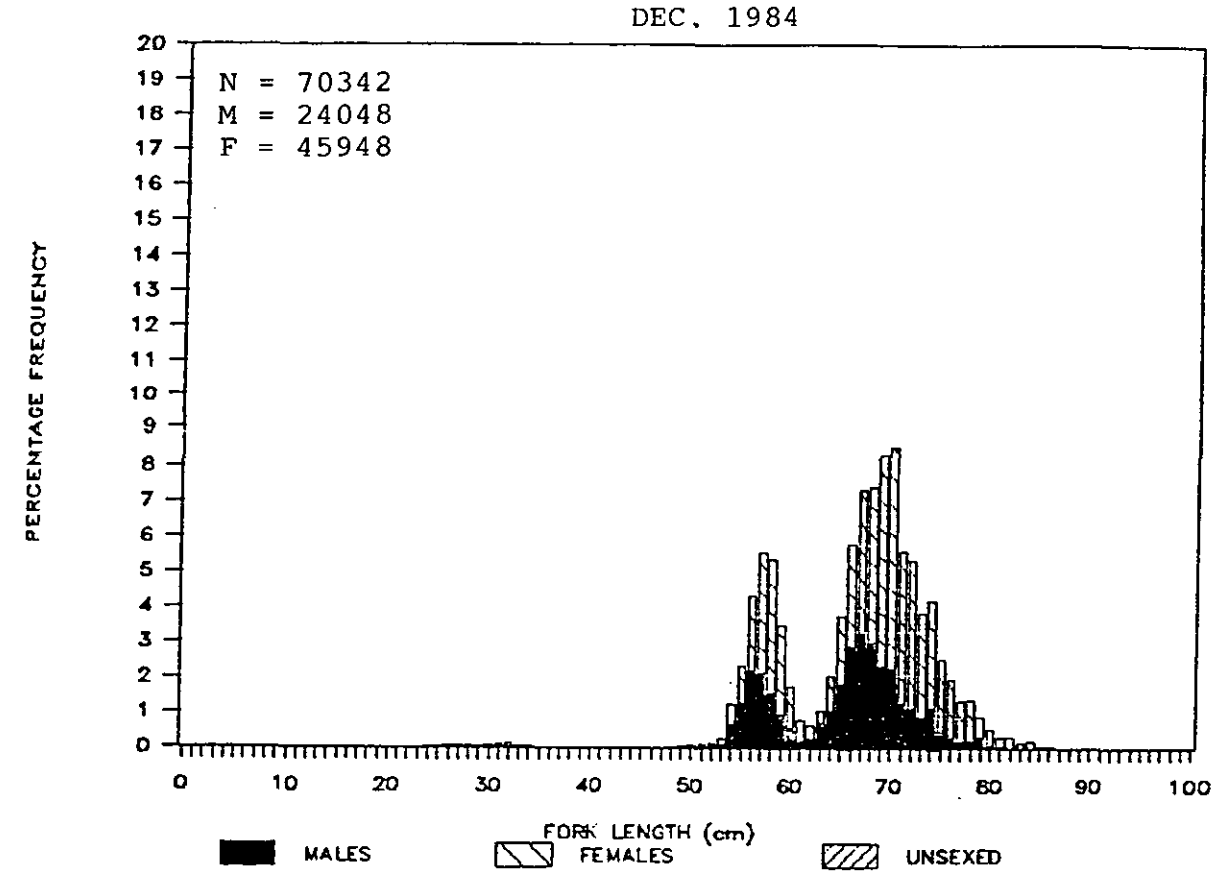


Figure 1. Barracouta Length Frequencies

ii. CHATHAM IS. SURVEYS



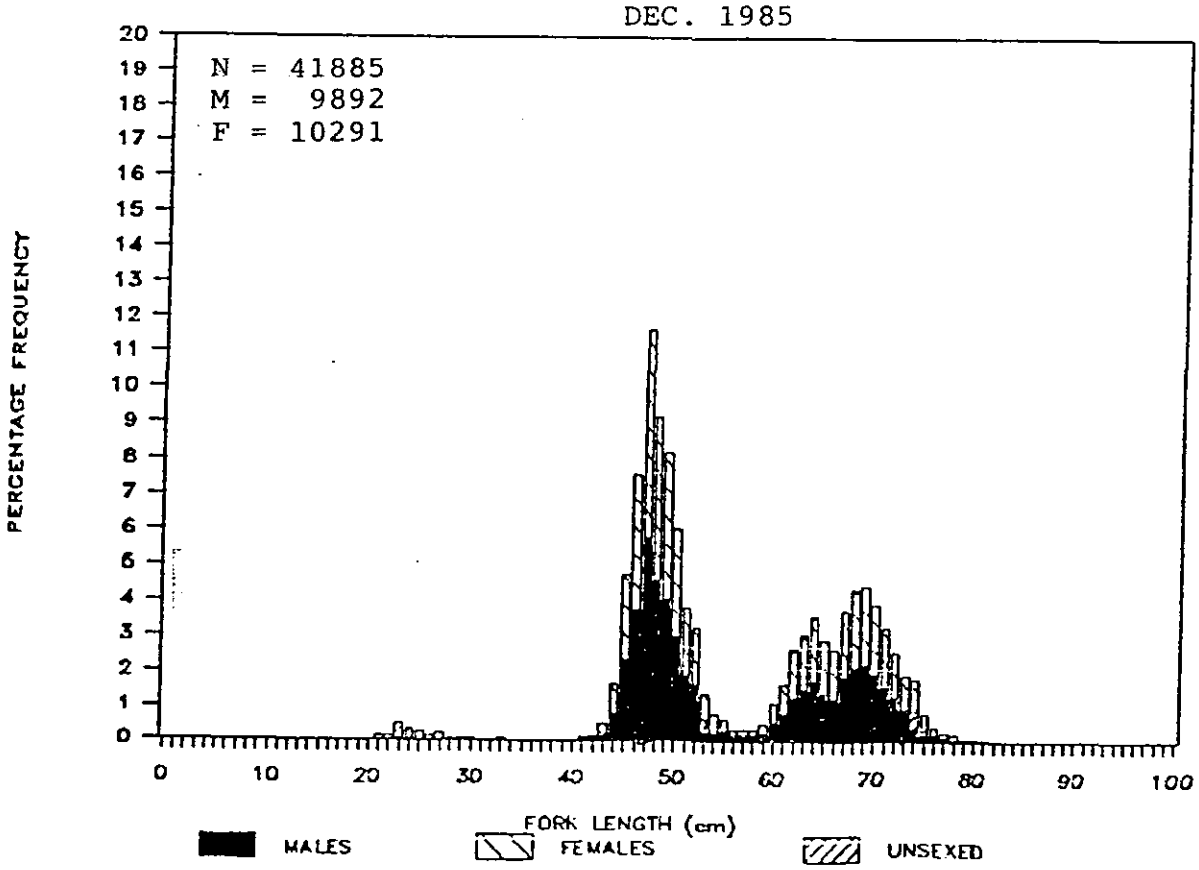
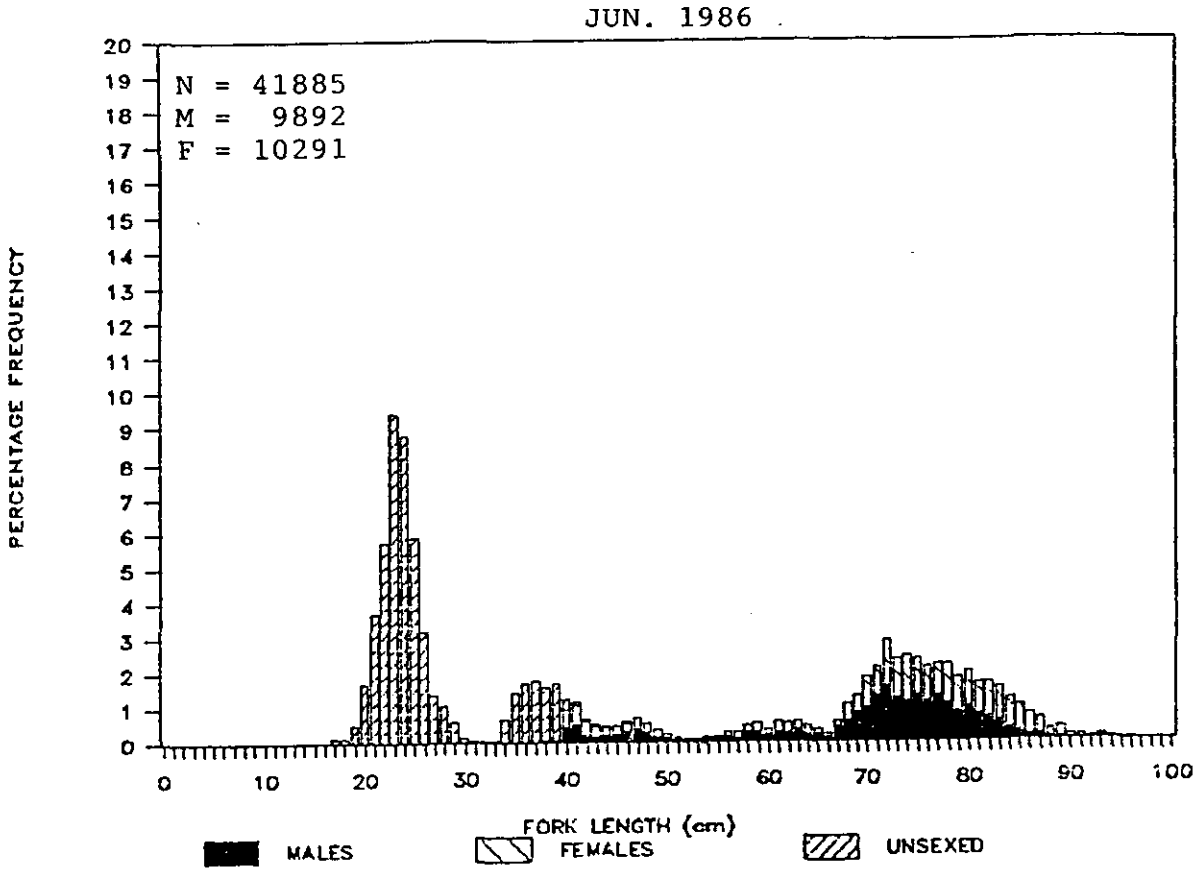


Figure 1. Barracouta Length Frequencies

iii. STEWART/SNARES IS. SURVEYS



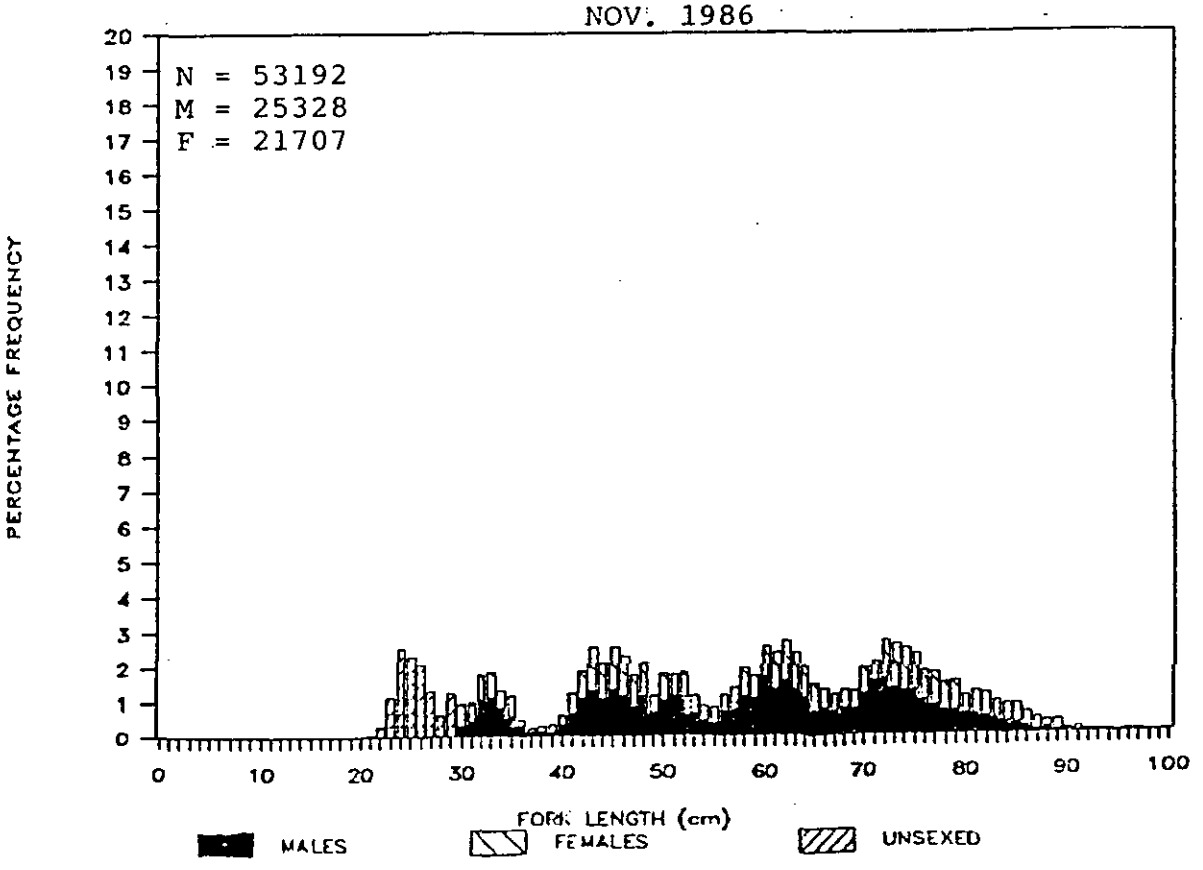
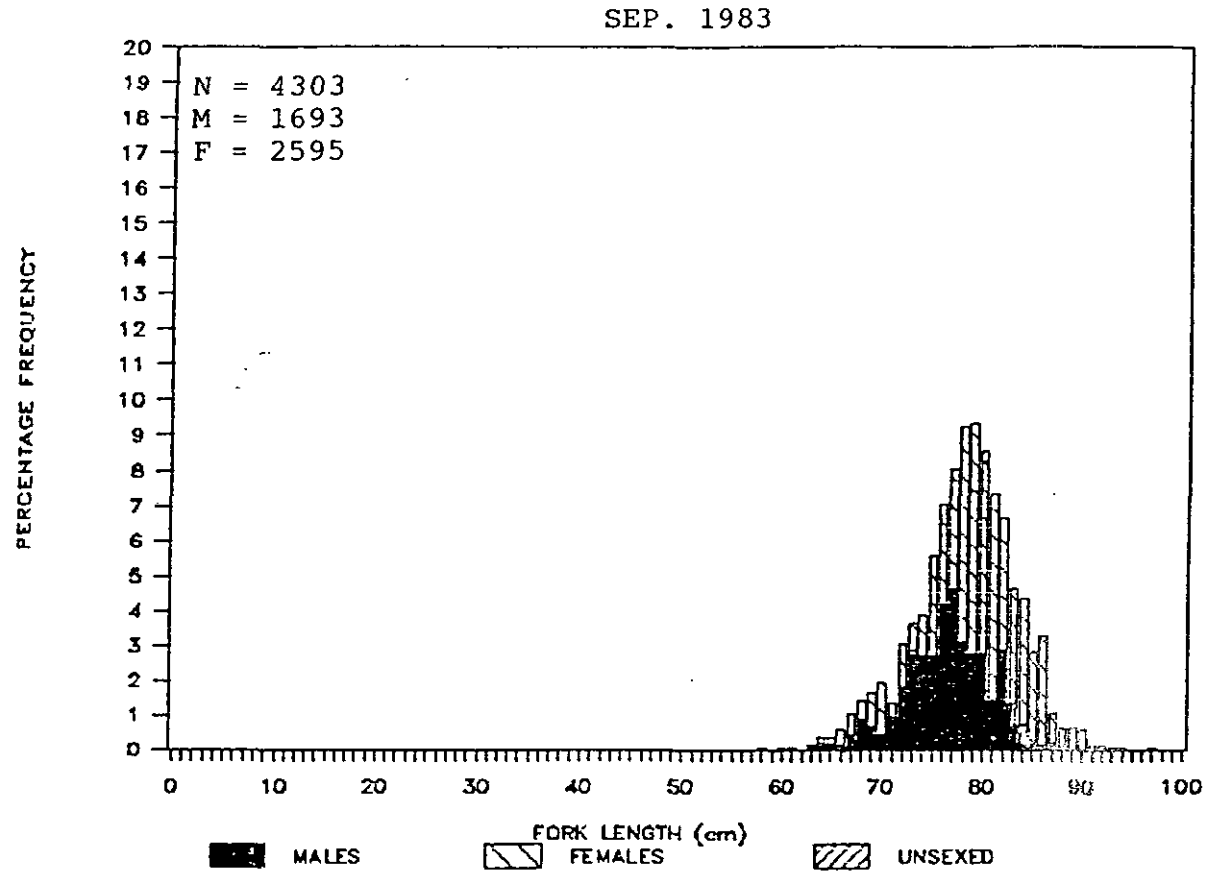
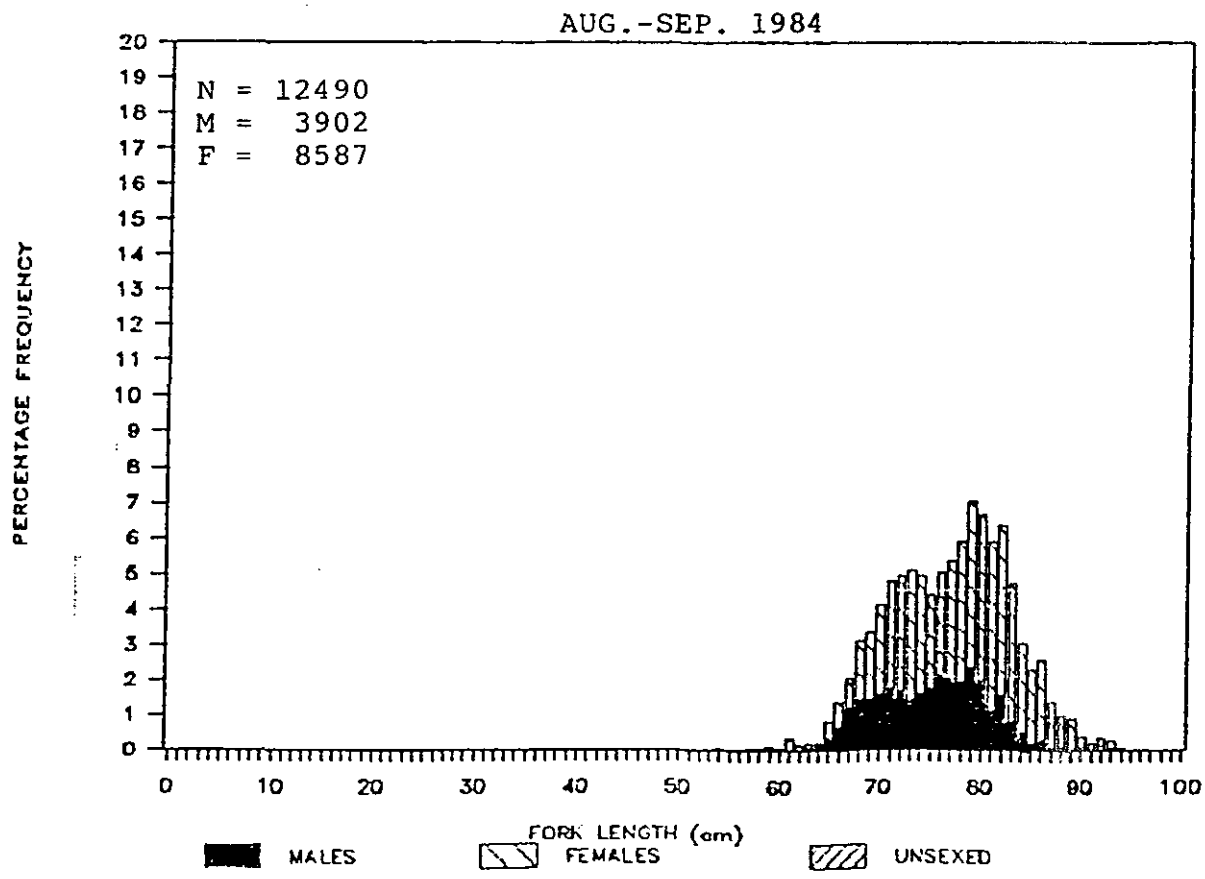


Figure 1. Barracouta Length Frequencies

iv. WEST COAST SOUTH ISLAND





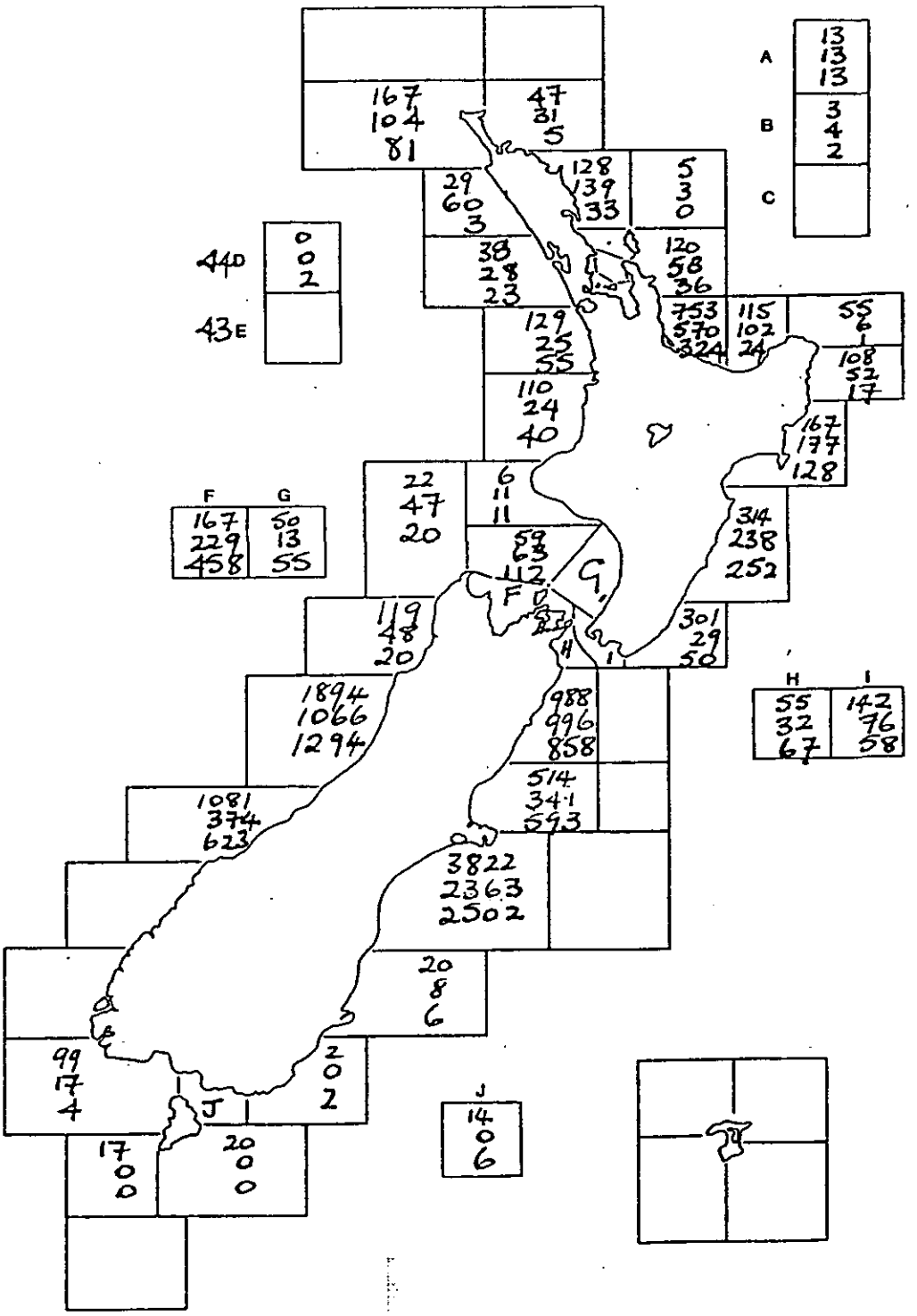
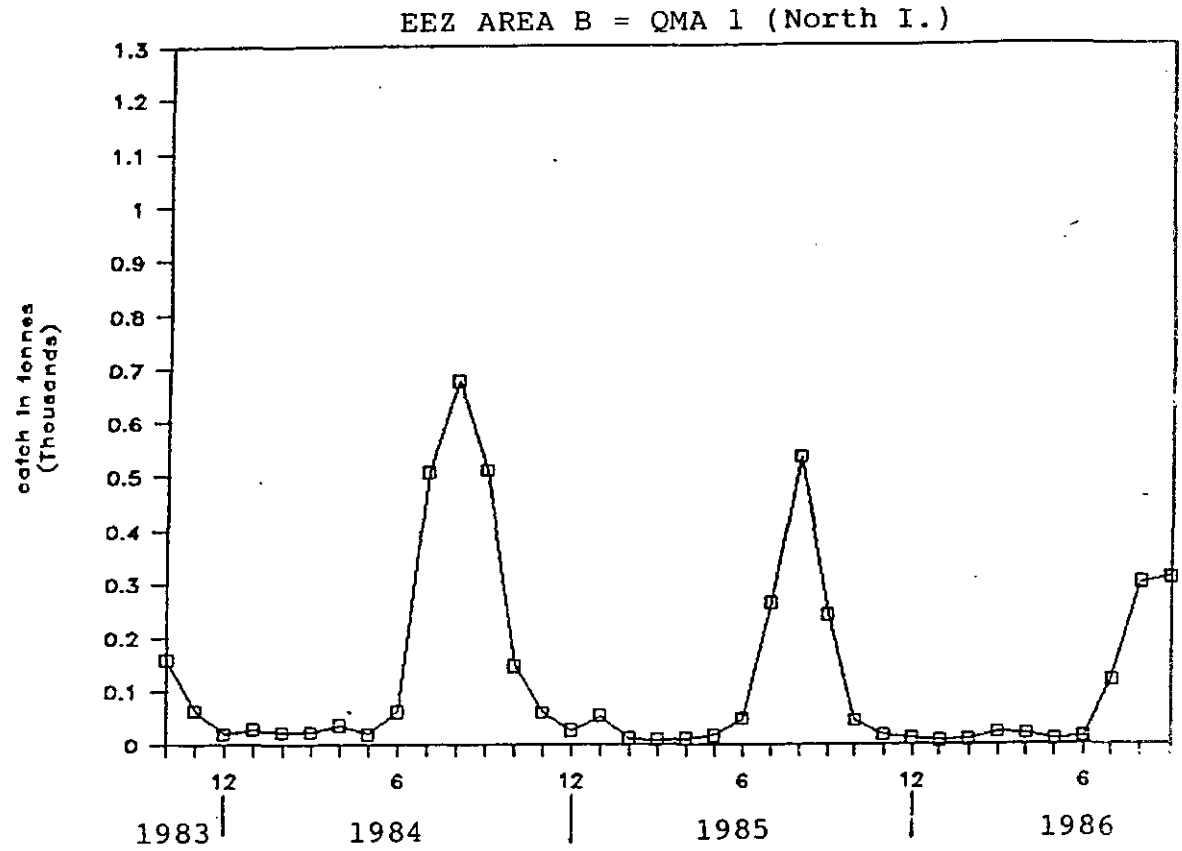


Fig. 2. Domestic landings (t) of barracuta for 1983-84, 1984-85, 1985-86 (October - September) by fishing return area where the total reported catch exceeded 1t (Area not known 1983-84 = 700t, 1984-85 = 522t, 1985-86 = 646t).

Figure 3. Barracouta catch by domestic vessels, by month, 1983-84 to 1985-86.

(N.B. Catch in EEZ area F (= QMA 5) was insignificant)



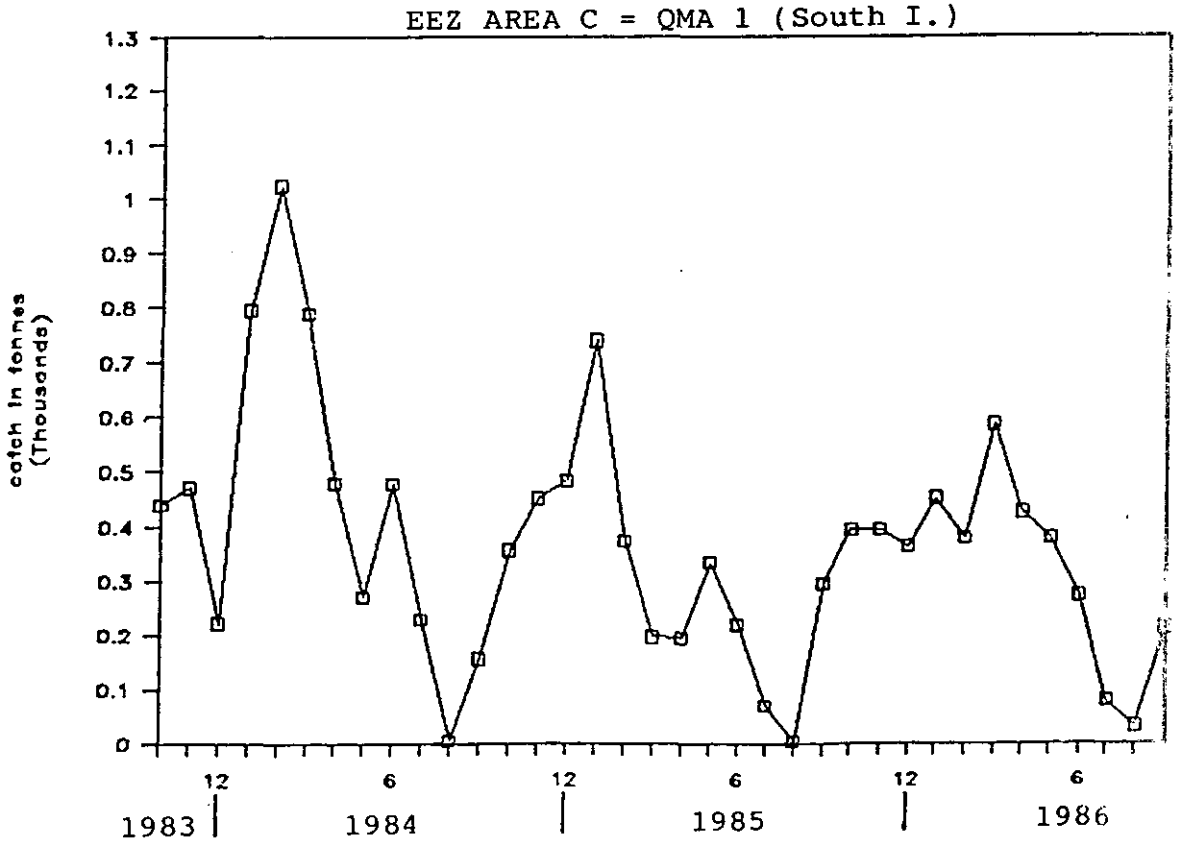
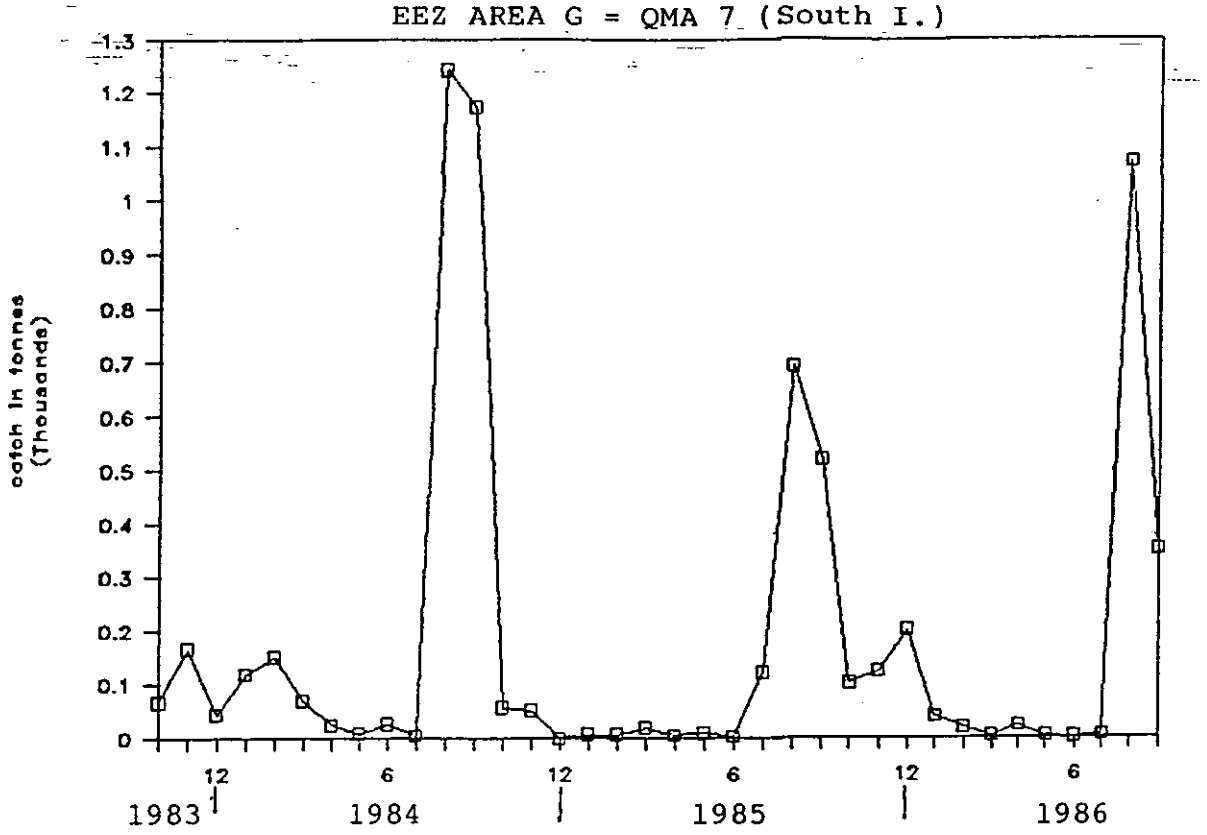


Figure 3 (ctd): Domestic vessels.



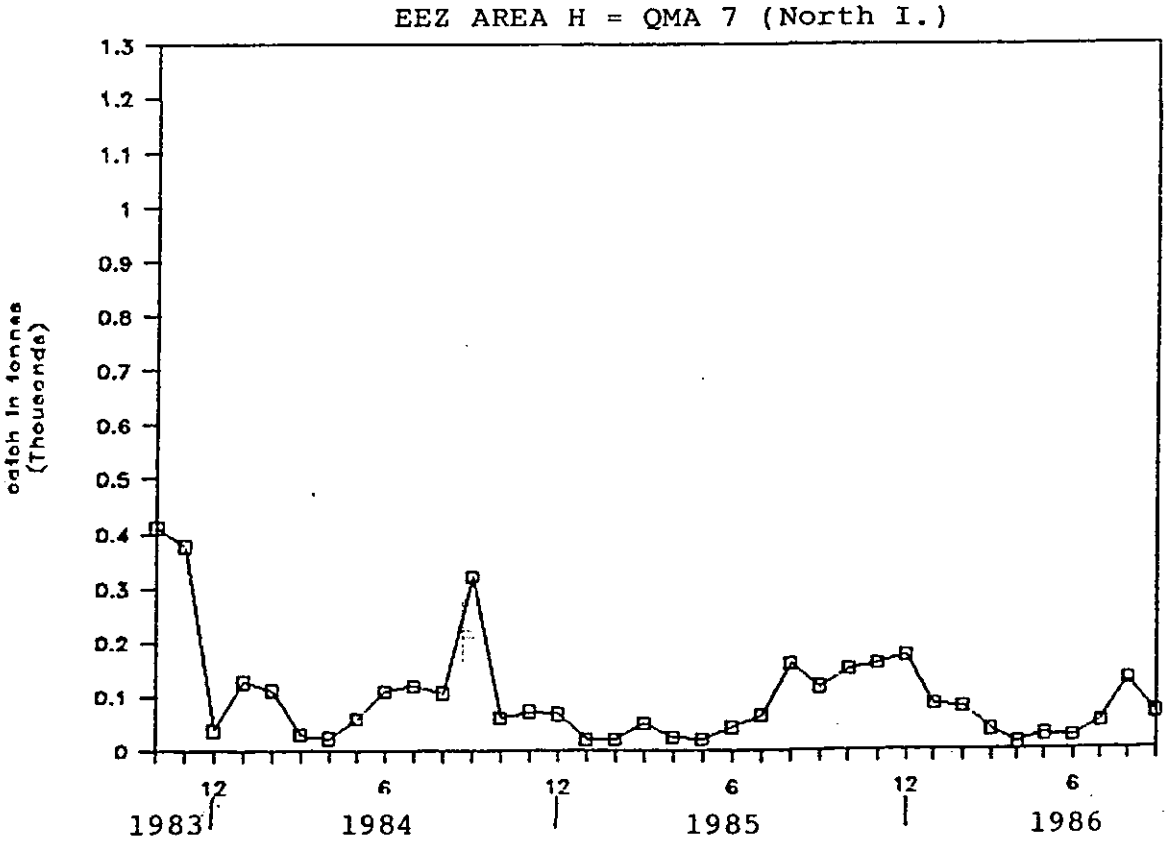
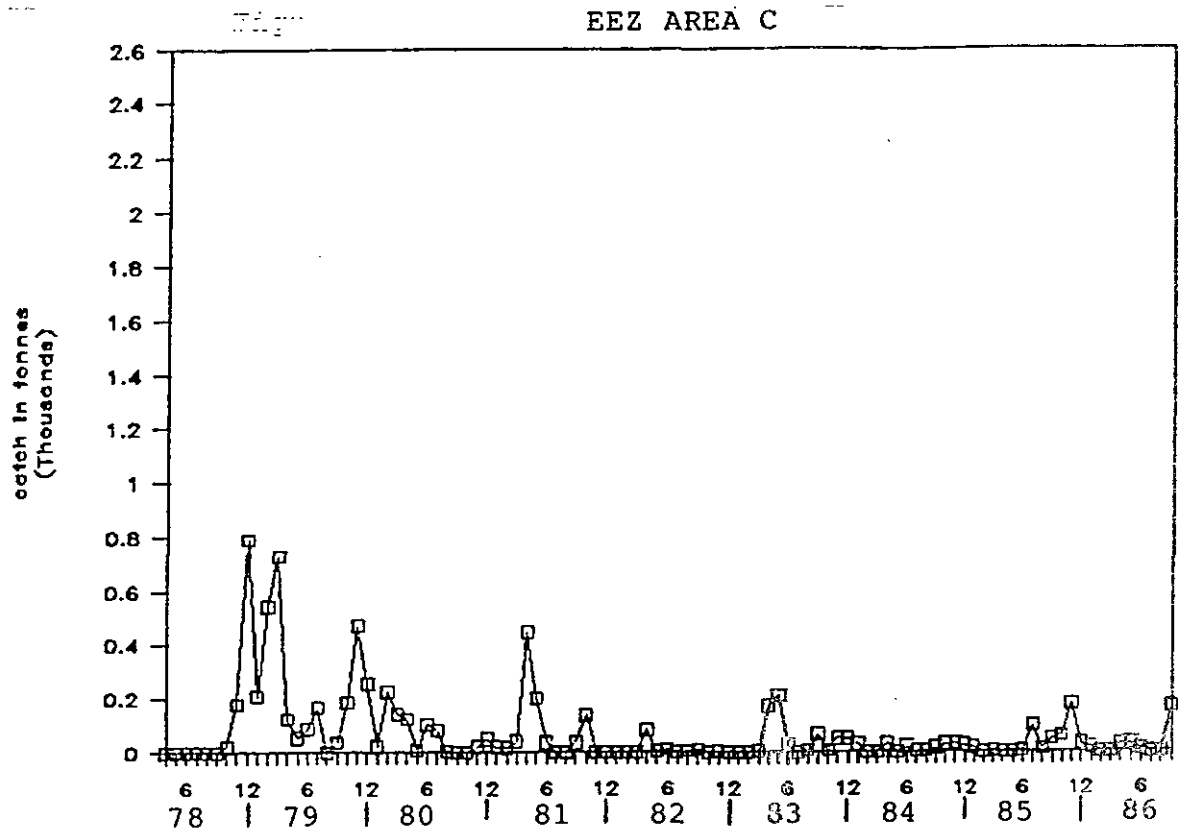


Figure 4. Deepwater (L.I.C. + F.C.D) barracouta catch, by month, 1978/79 - 1985/86



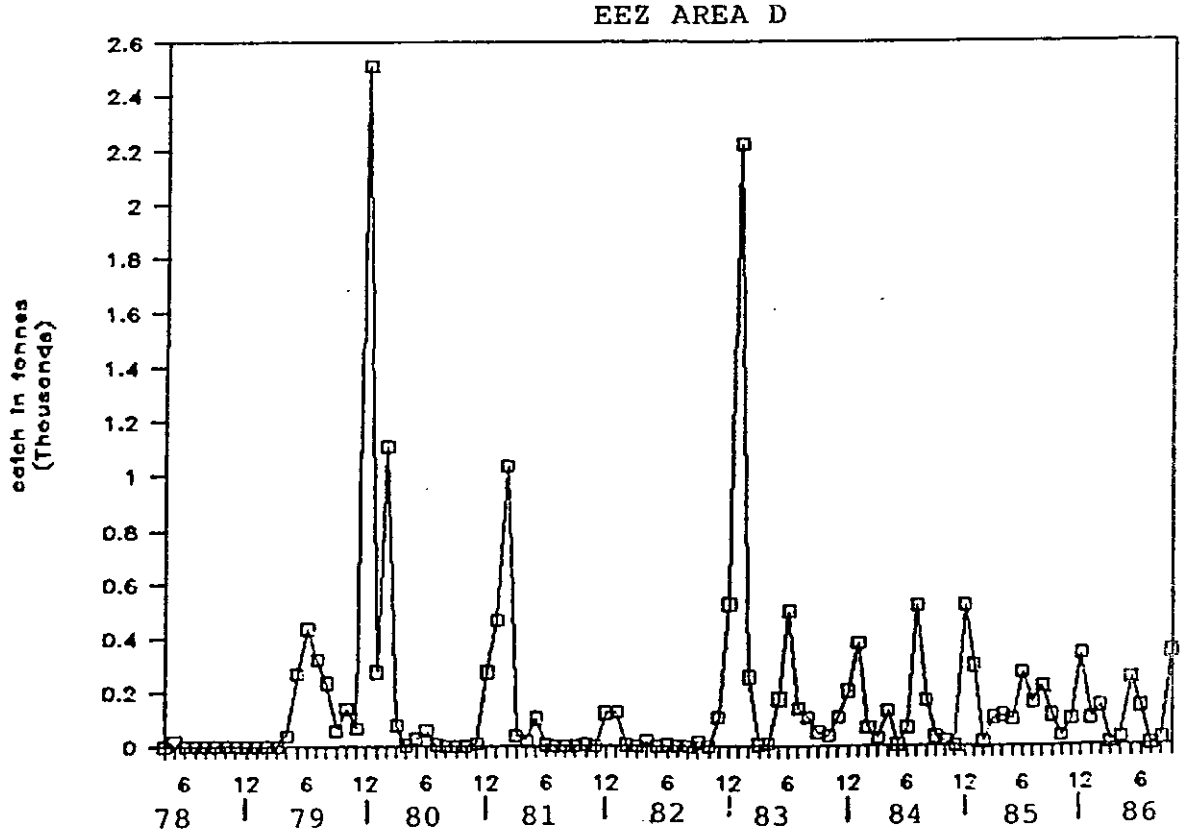
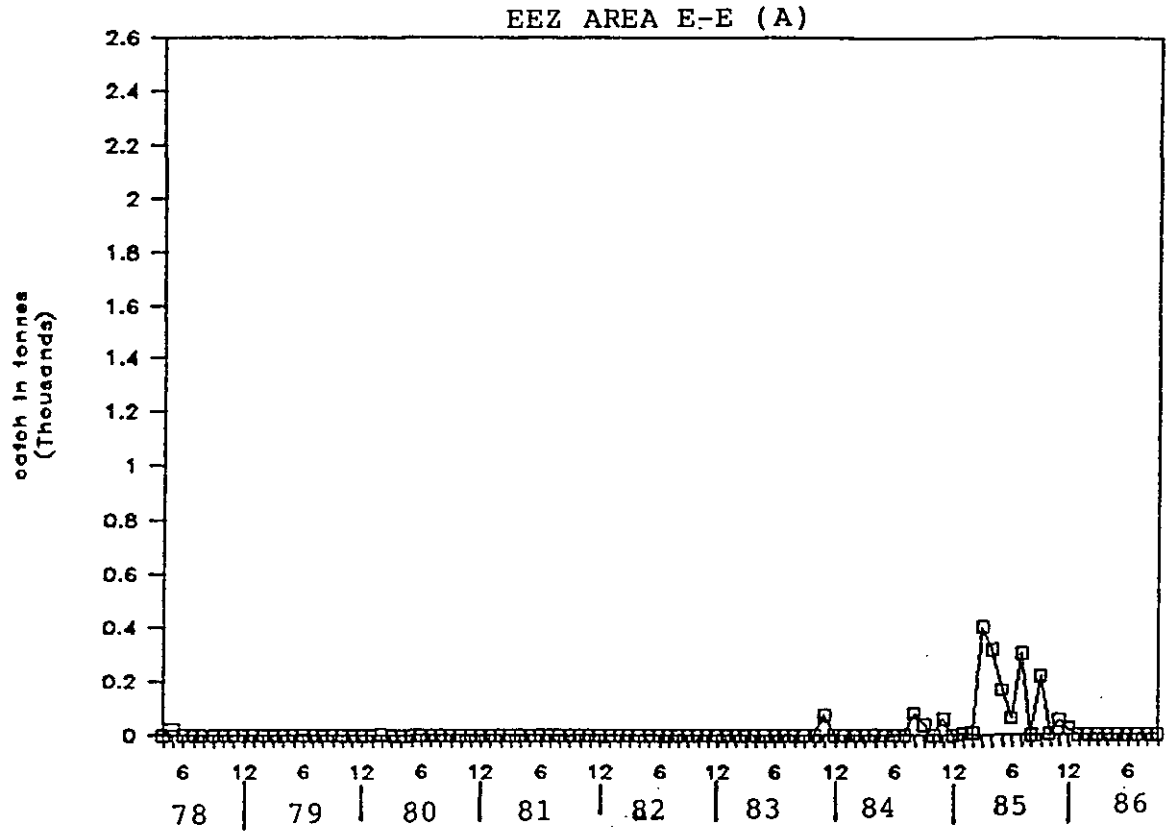


Figure 4 ctd. Deepwater vessels.



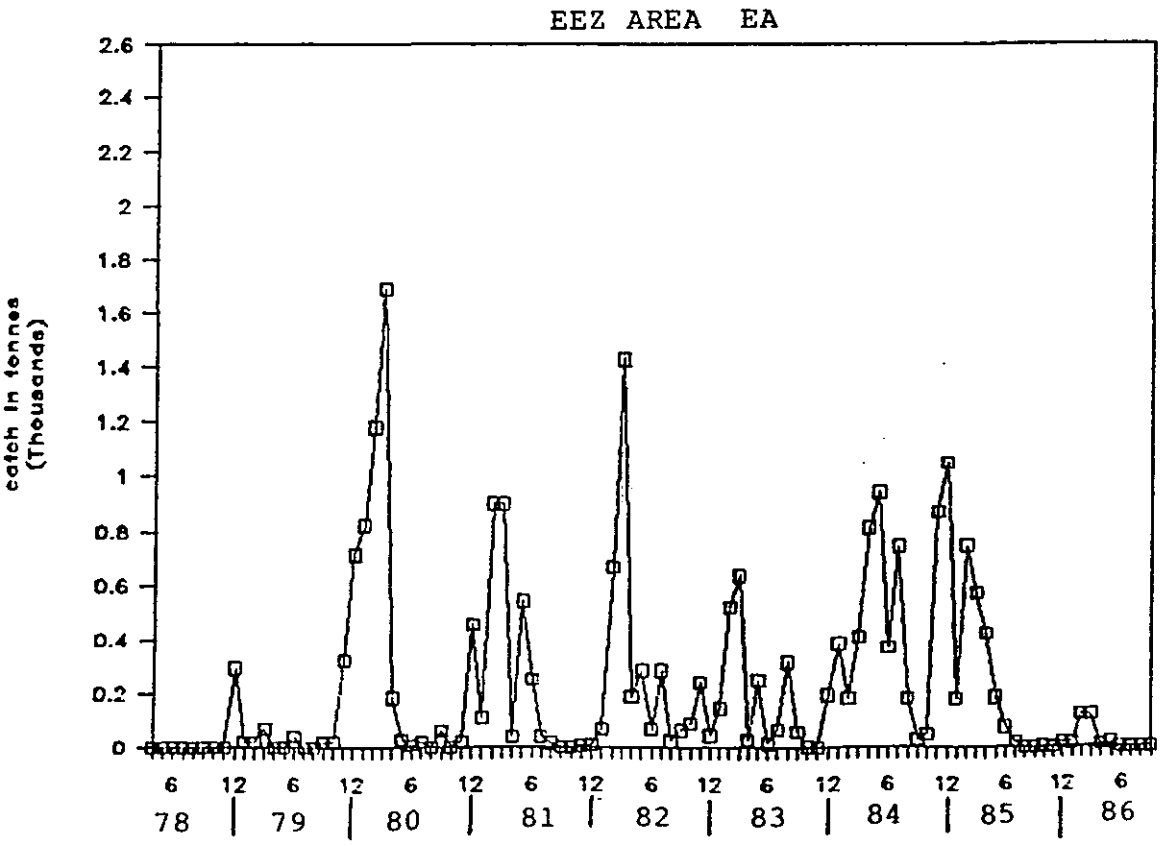
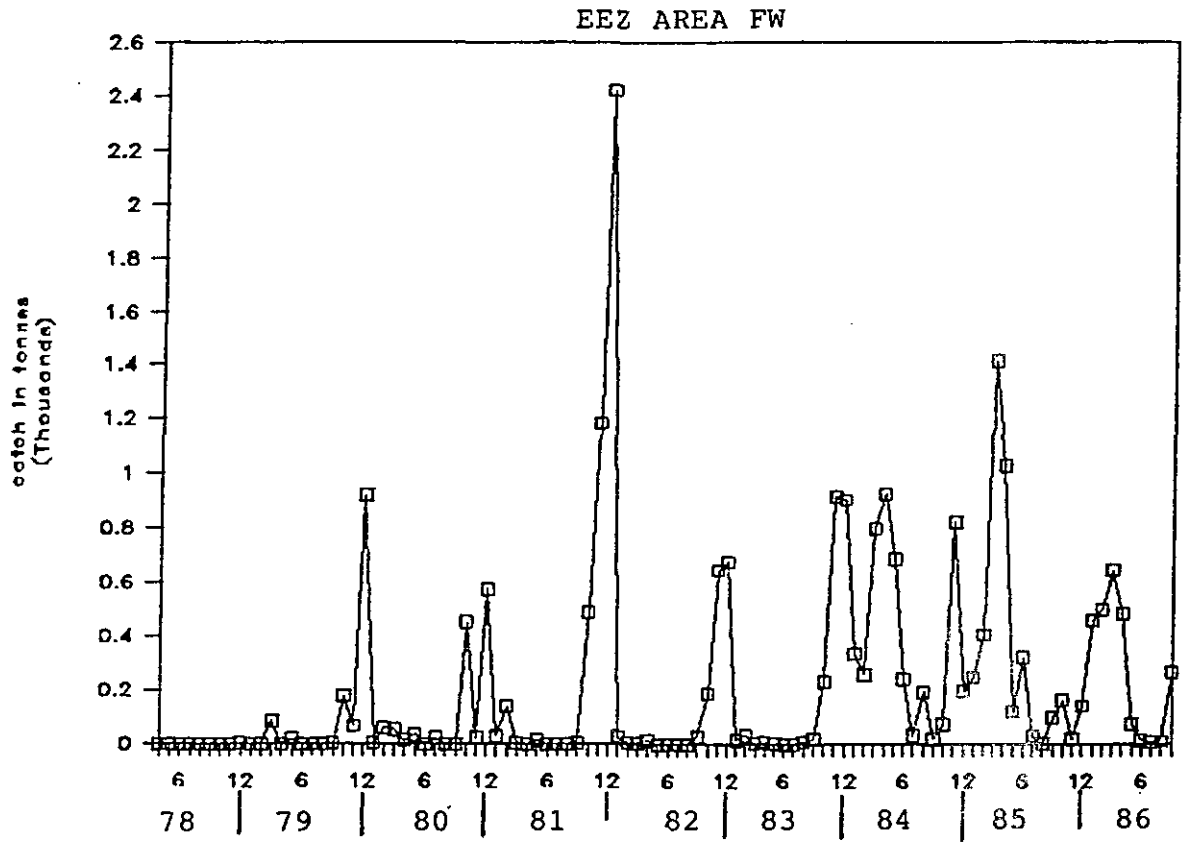


Figure 4 ctd. Deepwater vessels



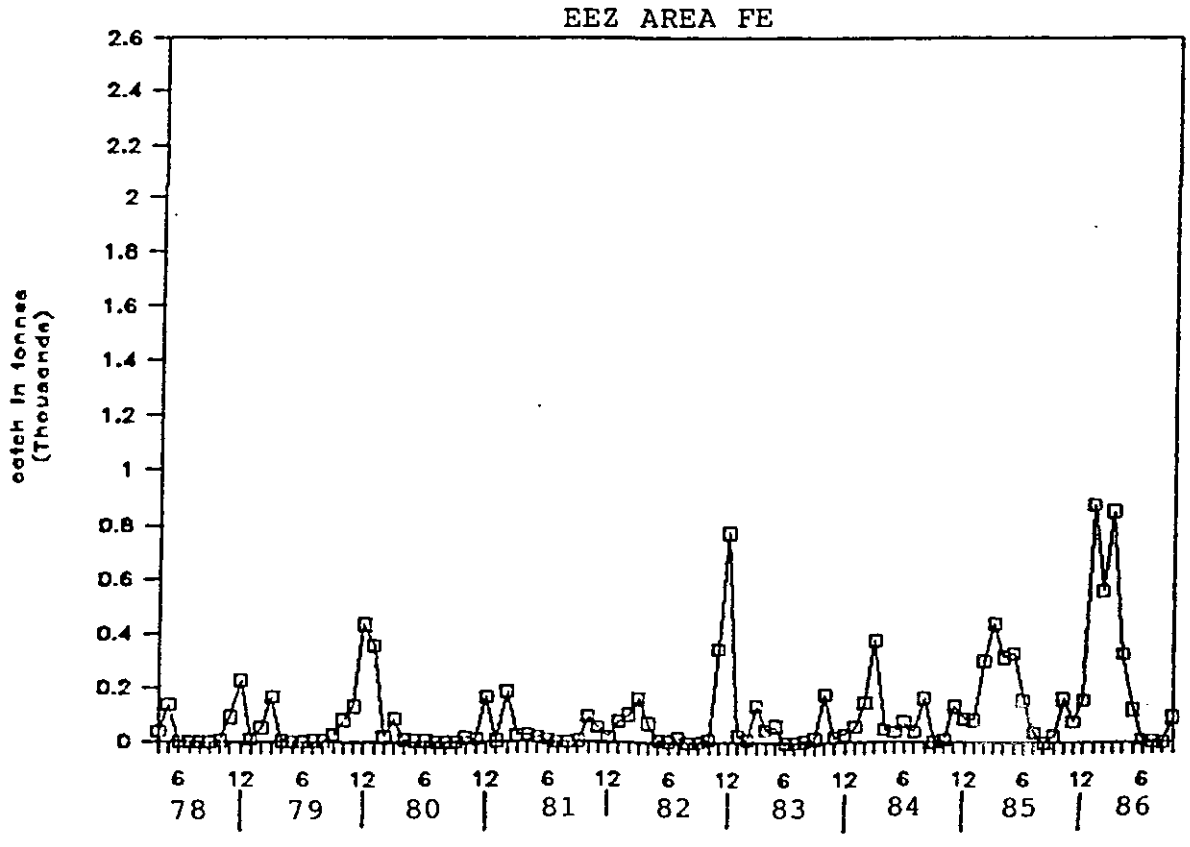


Figure 4 ctd. Deepwater vessels

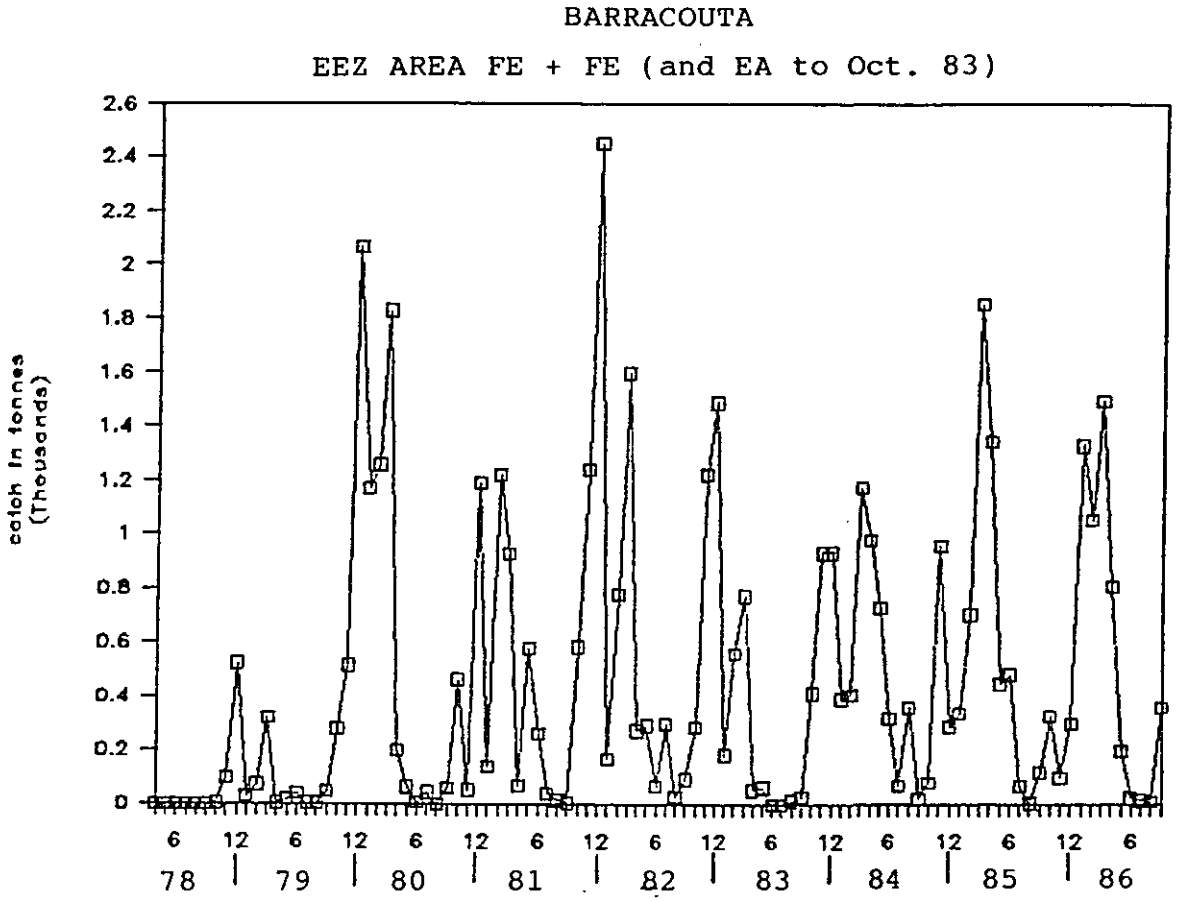
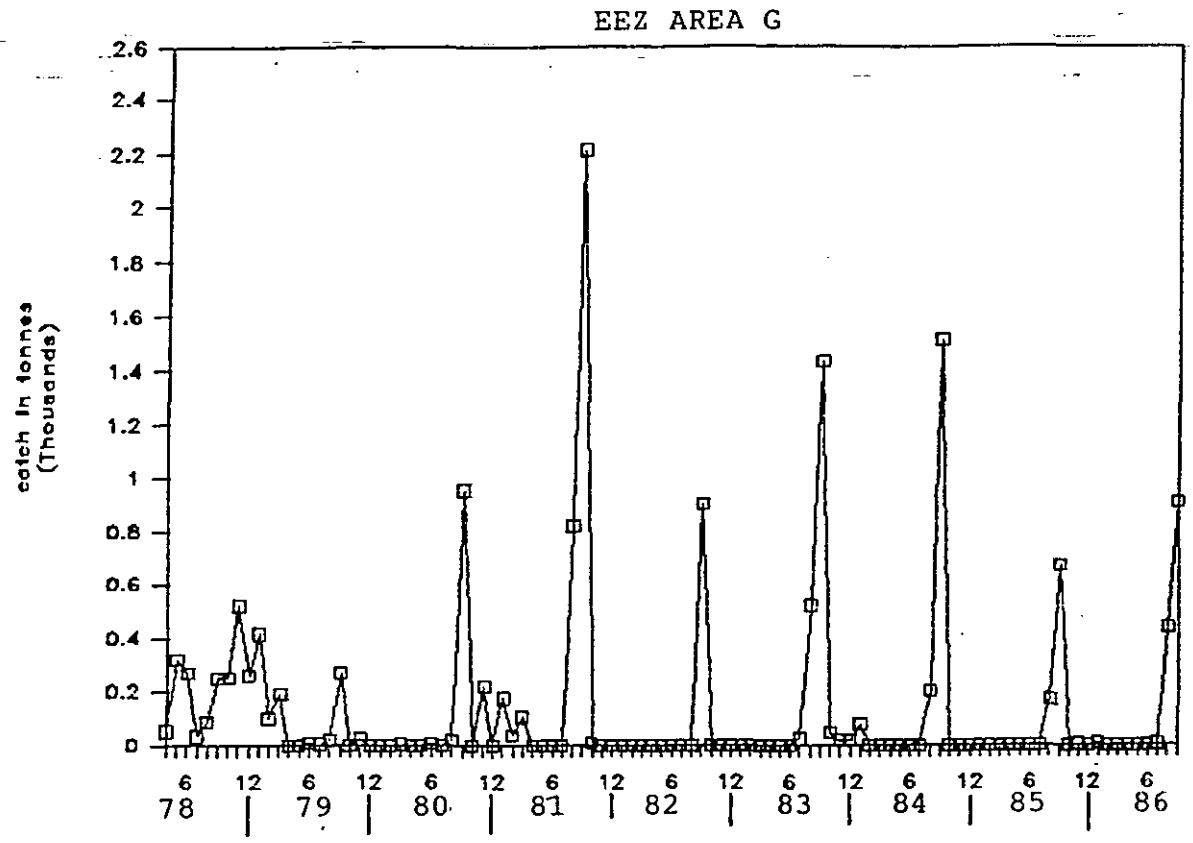


Figure 4 ctd. Deepwater vessels



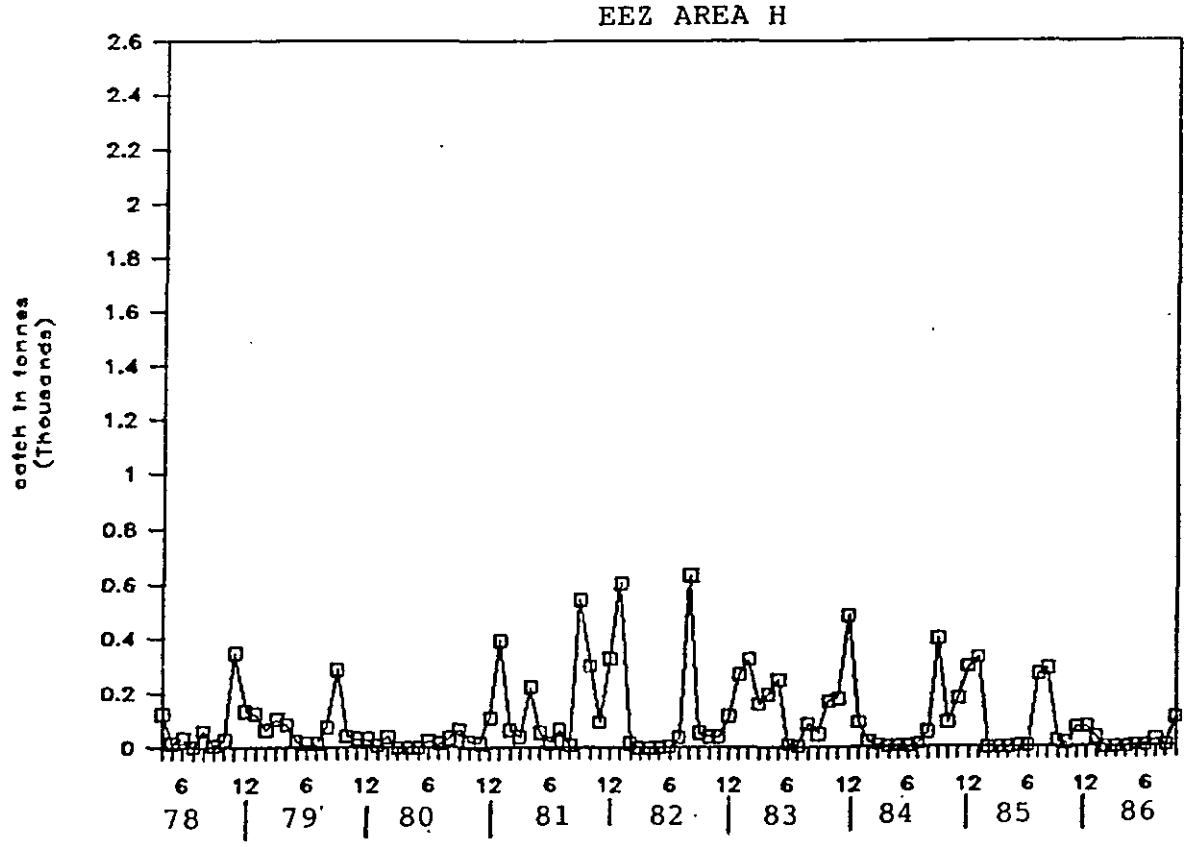
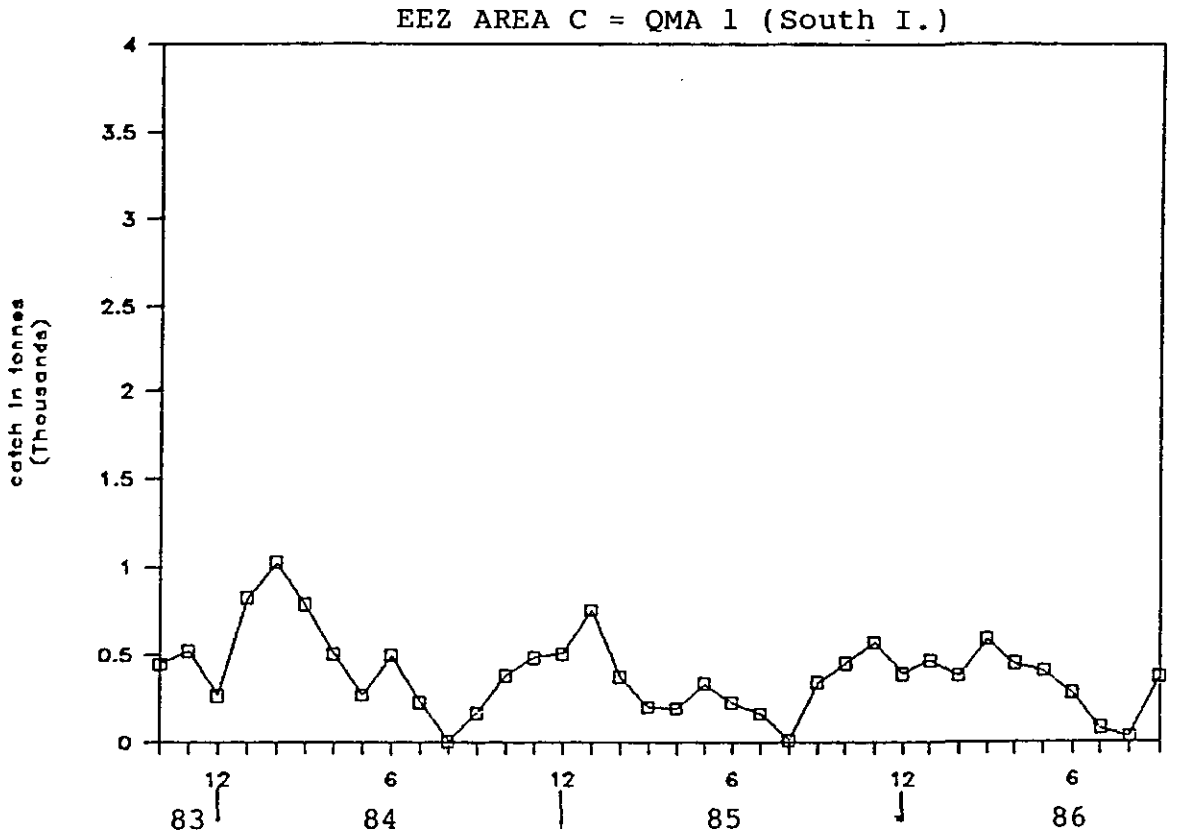


Figure 5. Barracouta catch, by all vessels, by month, 1983-84 to 1985-86



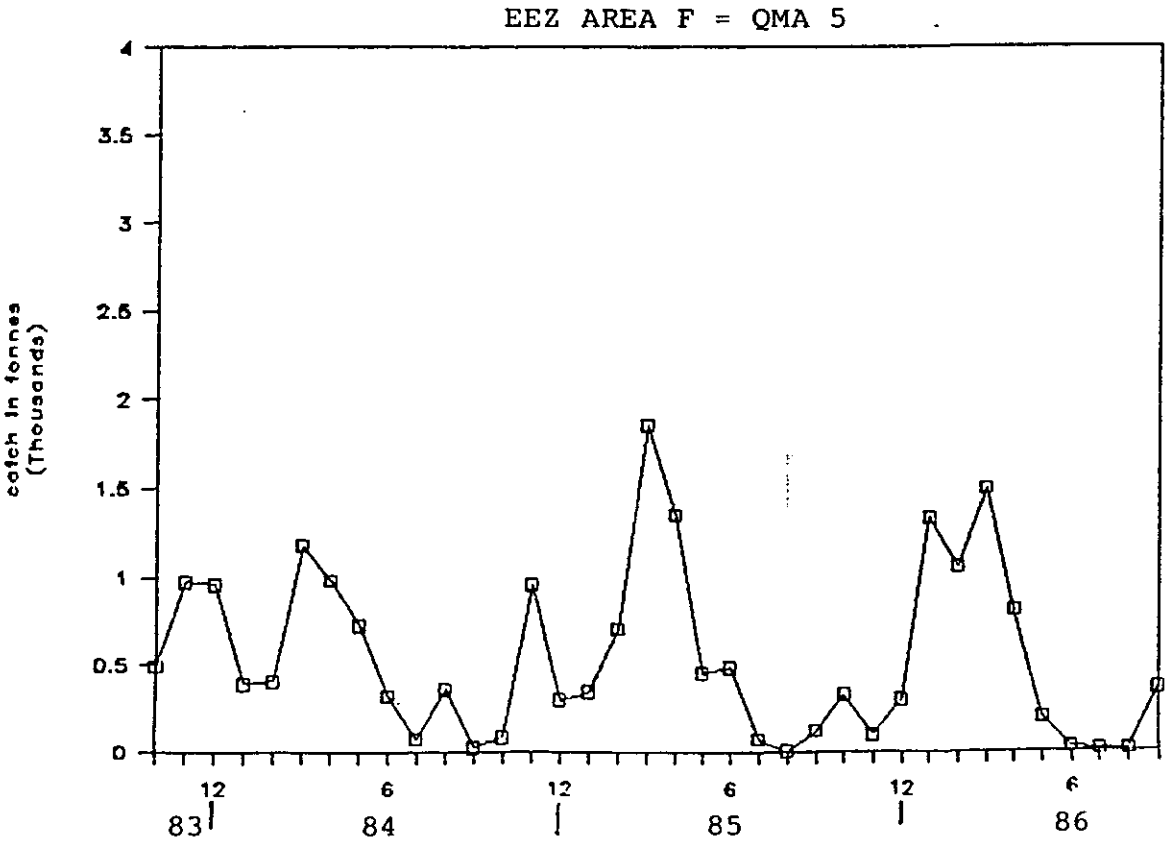
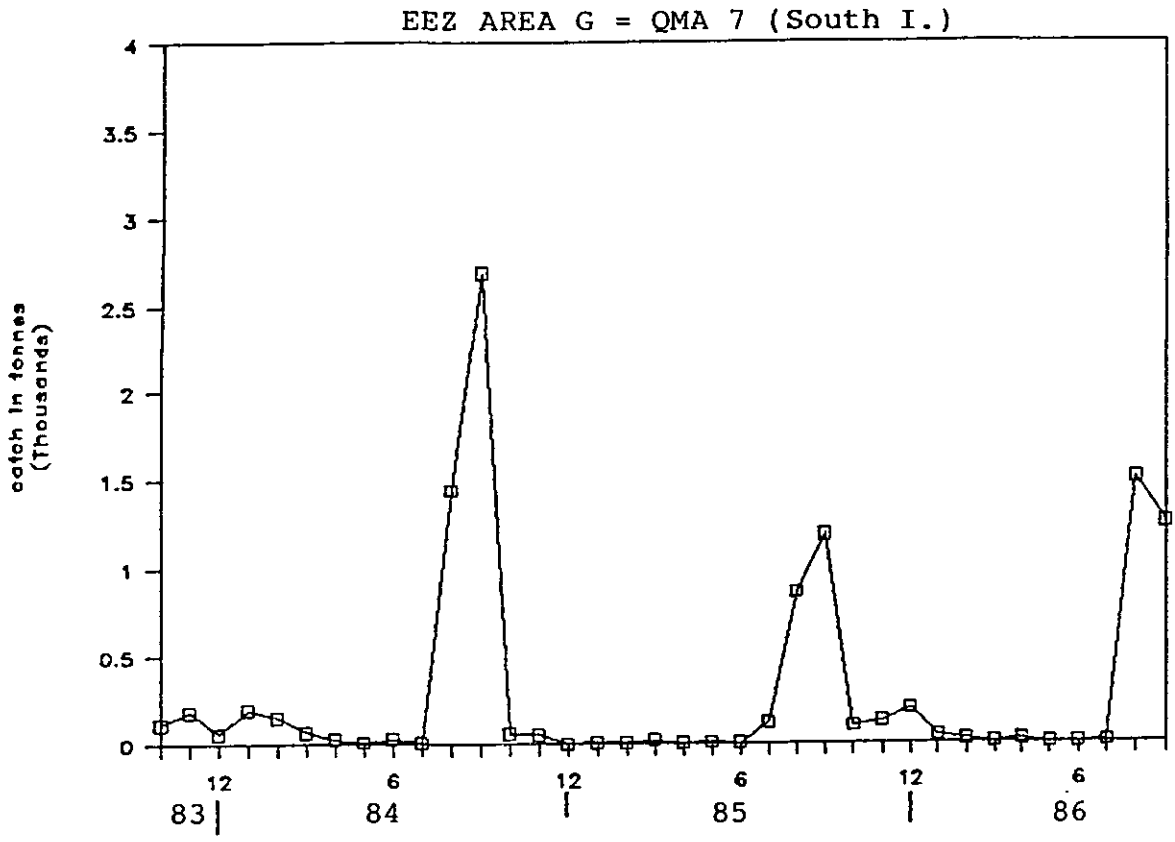
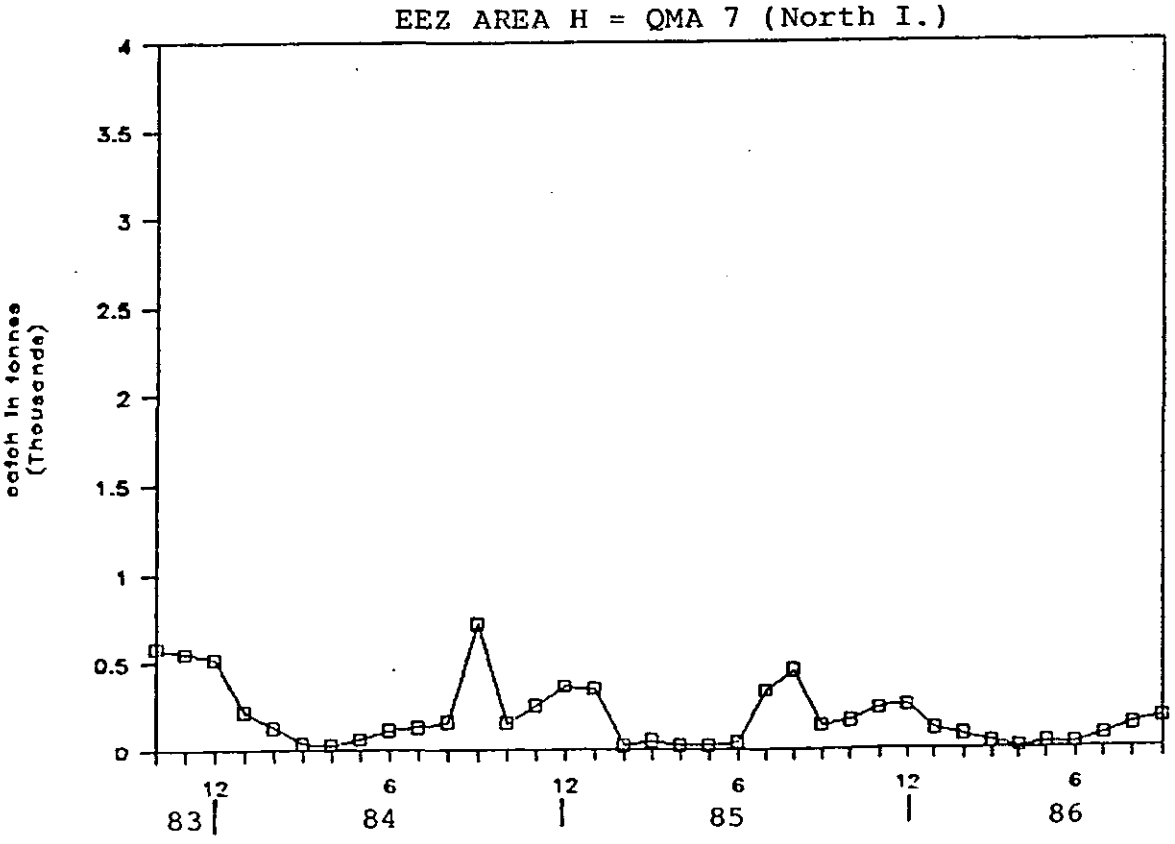
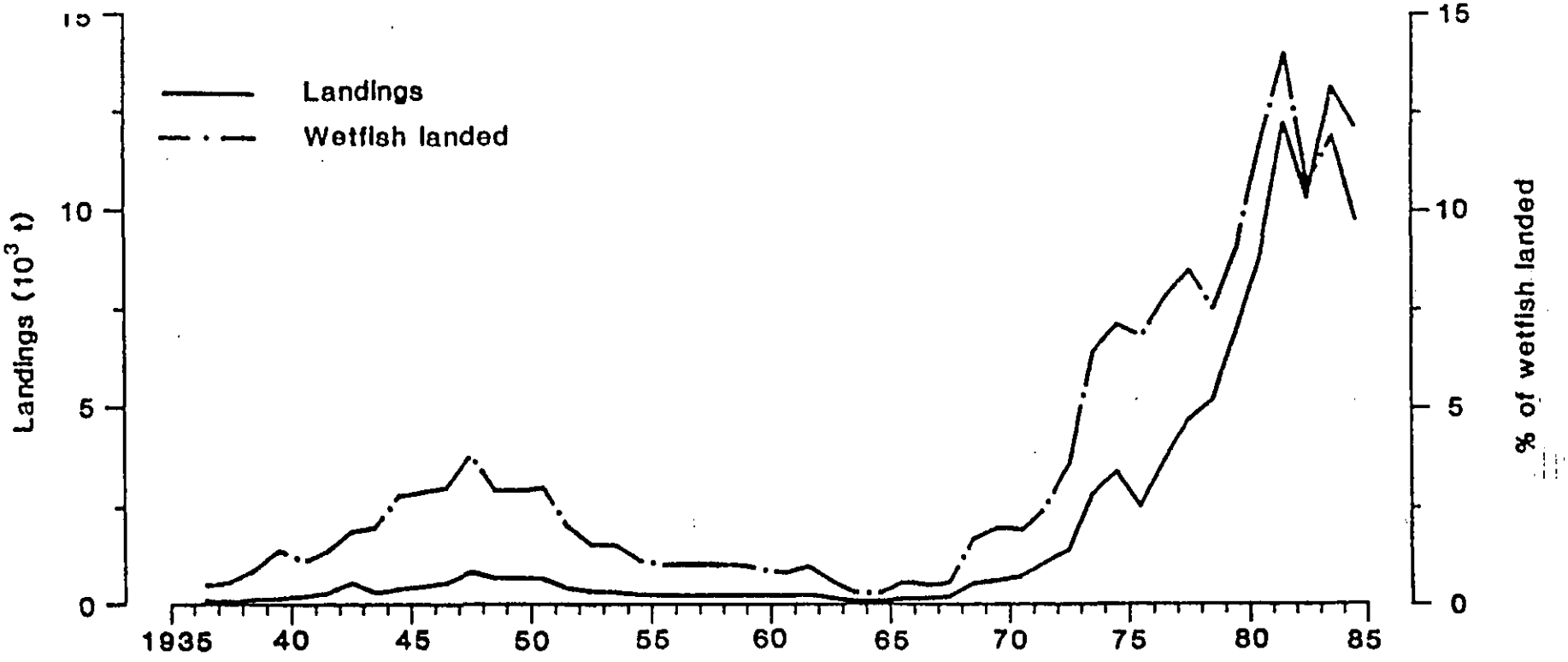


Figure 5 ctd. All vessels.







Domestic barracouta landings and relative importance in the total wetfish landings from 1937–38 (April-March) to 1984.

Appendix 1. From Hurst (1988).