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Redfish in Unit 2 (Laurentian Channel Management Unit)

by

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## ABSTRACT

The implementation of this new management unit in 1993 caused a change in fishing pattern from that generally in place under the former 3P, 4RST and 4VWX units. Fishing pattern has also been impacted more recently by seasonal closures and a small fish protocol. Catches have steadily increased from about 8,100 t in 1984 to 27,000 metric tons in 1993 and have declined subsequently to 12,000 metric tons in 1995 closely matching reductions in TACs over the same period. Summer research surveys that cover most of Unit 2 indicate that stock size remained stable between 1995 and 1996, slightly below the 1994 level. Current commercial catches are composed primarily of the early 1980s year-class(es) which have been fished for about seven years. Accordingly, this stock is probably lower than it has been in recent years. Its immediate future is dependent on the abundance of the next anticipated pulse of recruitment (the 1988 year-class) which was partly exploited in 1995. However, their contribution is likely to be less than that of the year-class(es) of the early 1980s. It is not possible to provide an estimate of the absolute size of this stock; therefore, it is not possible to estimate fishing mortalities for the past. The ratio of catch to estimated exploitable biomass index derived from the 1996 summer suggests that a catch of 10,000 t would generate an exploitation rate of about 10% in 1997. There are no signs of good recruitment subsequent to the 1998 year-class.

## RÉSUMÉ

La création de cette nouvelle unité de gestion en 1993 a entraîné un changement dans le régime de pêche par rapport à celui pratiqué généralement dans les anciennes unités 3P, 4RST et 4VWX. Le régime de pêche a en outre été modifié plus récemment par les fermetures saisonnières et par un protocole sur les petits poissons. Les captures ont augmenté régulièrement, passant d'environ 8 100 t en 1984 à 27 000 t en 1993, puis ont diminué pour n'être plus que de 12 000 t en 1995, un reflet de la réduction des TAC au cours de la même période. Les relevés de recherche estivaux qui couvrent la majeure partie de l'unité 2 indiquent que la taille des stocks est demeurée stable entre 1995 et 1996, soit légèrement inférieure au niveau de 1994. Les prises commerciales actuelles se composent essentiellement des classes d'âge du début des années 80, exploitées depuis environ 7 ans. On comprend donc que ce stock soit probablement moins gros qu'il ne l'était au cours des dernières années. Son avenir immédiat dépend de l'abondance de la prochaine poussée de recrutement anticipée (la classe de 1988), qui a été exploitée en partie en 1995. Toutefois, la contribution de cette classe sera probablement inférieure à celle des classes d'âge du début des années 80. Comme il n'est pas possible de fournir une estimation de la taille absolue de ce stock, il est impossible d'estimer les mortalités par pêche antérieures. Le rapport des captures sur l'indice de la biomasse exploitable estimée, dérivé des données de l'été de 1996, suggère qu'une capture de 10 000 t entraînerait un taux d'exploitation de quelque 10 % en 1997. On n'a noté aucun signe de bon recrutement postérieur à la classe d'âge de 1988.

## Introduction

Prior to 1993 redfish in Divisions 3P4RST4VWX were managed as three units: Div. 3P, Div 4RST and Div. 4VWX. In 1989 the integrity of these units as separate management areas was questioned and an examination of applicable data and pertinent published studies ensued. This resulted in the proposal of new management units believed to have a firmer biological basis than the former units (see CAFSAC (1991); Atkinson and Power (1990, 1991)). Allocations and regulatory measures under these new management units were first implemented in 1993. This paper presents information relevant to the provision of advice for the Laurentian Channel unit (Unit 2) which comprises Subdiv. 3Ps4Vs4Wfgj and Subdiv. 3Pn4Vn (Jun-Dec).

## Description of management regulations and the fishery

### Management regulations

As an interim measure in 1991, the former CAFSAC suggested the TAC total of the three former management areas be divided among the new management units based on the average percent caught in each of the new units during 1981-1990. This suggested a TAC of 25,000 t for Unit 2 in 1992. However, the new management units were not implemented until 1993 and a TAC of 28,000 t was set for Unit 2. Since then TACs have been reduced each year as a conservation measure. The 1996 TAC is 10,000 t.

In addition to catch regulation, there were seasonal/area closures implemented in 1995 and maintained in 1996 to (i) minimize possible overlaps with Unit 1 redfish given a lack of understanding of redfish migration patterns (3Pn/4Vn closed November and December), and (ii) to allow for a period when peak spawning of females is likely to occur (Unit 2 closed May and June). A small fish protocol at 25cm was imposed for 1996 aimed at protecting the 1988 year class as it appears this may be the major contributor to the fishable population in the near future given the current exploitation pattern in the fishery.

### Nominal Catches

From 1960-1968 landings were about 20,000 t, increased to an average of 43,000 up to 1975 mainly due to increases by foreign fleets, then subsequently declined to the lowest on record in 1984 at 8,100 t (Table 1, Fig. 1). Catches then steadily increased to 27,000 metric tons in 1993 and have declined subsequently to 12,000 metric tons in 1995 matching reductions in TACs. Up to the middle of September 1996 approximately 7,000 t of a 10,000 t TAC had been taken. Since the implementation of the 200-mile Exclusive Economic Zone in 1977, catches have been primarily by Canadian fleets. The larger catches in the 1990s relative to the mid to late 1980s is mainly due to renewed interest in redfish because of depletion of other groundfish resources.

Prior to 1980 most of the catch was taken in 3Ps and 4Vs. Since then a larger proportion of the catch has been taken from 3Pn and 4Vn. Since 1991, increases in total landings have been primarily due to removals from 3Ps, 3Pn and 4Vn while there was a substantial decrease in landings from 4Vs for 1992-1993 (Table 2). Maritime vessels generally account for the majority of landings in Subdivisions 4Vs and 4Vn while Newfoundland vessels concentrate in Subdivisions 3Ps and 3Pn.

Monthly catches since 1981 indicate prosecution of the fishery occurs throughout the year in all Subdivisions (Table 3). From 1991-1993, a higher proportion of landings were taken during the fall/winter fishery in 3Pn/3Ps respectively, while the greatest activity in 4Vn/4Vs occurred around the summer season. The implementation of this new management unit in 1993 caused a change in fishing pattern from that generally in place under the former 3P, 4RST and 4VWX units. There was a 10,000 t increase from the 1992 total catch (17,000 t) and this was almost totally accounted for by landings from 3Pn during October to December. It has been suggested that catches in November and December were probably of Unit 1 redfish which moved into the area earlier in 1993 (see Power et al, 1995; Morin et al, 1994). To avoid possible overlap with fish from Unit 1, fishing in 3Pn and 4Vn has been closed from November to December in 1995 and 1996.

Otter trawling is the predominant method of fishing, primarily with bottom trawls (Table 4). Since 1986 there has been an increase in the proportion of catch taken with midwater trawls.

For 1996, most of the 7,000 metric tons catch to date had been taken in the first quarter. About 2,500 tons of this had been taken from statistical area 3Psd adjacent to Burgeo Bank. Catch rates in this area were high in 1996 relative to the recent past.

### **Available Data**

#### **Commercial Index of Abundance**

Catch and effort data from 1960 to 1992 from ICNAF/NAFO Statistical Bulletins were combined with provisional 1993-1994 NAFO data, 1995 Atlantic region data compiled by various DFO regional statistics branches and Maritime Region data for 4Wfgj from 1970-1995. Initially selected from this database were observations where redfish comprised more than 50% of the total catch and were therefore considered to represent redfish directed fishing.

These data were analysed with a multiplicative model (Gavaris 1980) to derive a standardised catch rate series. Effects included in the model were a combination country-gear-tonnage class category type (CGT), NAFO division, month, and a category type representing the amount of bycatch associated with each observation. For this effect five groups were arbitrarily established : ( >50 <=60 ), ( >60 <=70 ), ( >70 <=80 ), ( >80 <=90 ) and ( >90 ) where each group corresponds to the percentage of redfish relative to the total catch associated with each observation.

In the usual practise, catch or effort data of less than 10 units were eliminated prior to analysis as were data where there was less than five samples from any one category type except year.

The model explained 51% of the variability in the catch rates (Table 5a). All category types are highly significant. Estimated coefficients from the regression show catch rates are generally higher during the first half of the year. The standardised catch rate series based on hours fished (Table 5b, Fig. 2) shows a steady increase from 1960 to 1966 followed by a decrease to a relatively low rate in 1979. The rate increased again until 1983 to about the same magnitude of the 1960 catch rate. From 1983 to 1985 catch rate declined slightly to about the level of the 1979-1980 rates and remained stable to 1988. Large increases occurred in 1989 and again in 1990 to the highest rate observed over the time series. Over the next five years catch rate declined sharply to the lowest rate on record in 1995.

The standardised commercial catch rate series generally shows fluctuations which are coincident with the passage of strong year-classes through the fishery (1956-58 and early 1970s). Successive large increases in 1989 and 1990 can be partly attributed to the recruitment to the fishery of the relatively strong year classes of the early 1980s, but the magnitude of the increases and subsequent decreases over this short time period is unlikely to reflect changes in abundance of this stock. Power et al. (1995) postulated that the introduction of the efficient "turbo" midwater trawl into the fishery may have accounted for these trends, but, further investigation found that a series derived for bottom trawl only also showed a similar trend. It is clear that further work is required to address this issue. In the Nfld. region discrepancies between actual fishing logbook records and comparable effort data in the zonal interchange file (ZIF) format has led to the establishment a working group to investigate data transcribing practises. The results of these findings will be important for future considerations in the catch rate analysis of this management unit. It has also been suggested by some of the participants in the fishery that the catch rates in recent years may be artificially lower because of the seasonal regulations and the small fish protocol.

### Catch at length

Length distributions sampled from 1994-1996 fisheries from port sampling and observer data were weighted by the monthly landings by subdivision to derive a combined catch-at-length for Unit 2. For 1996, only the Nfld. catch at length could be compiled in time for the assessment in September.

The length-weight relationships used were:

$$WT \text{ (males)} = 0.01659 \text{ Forklength}^{2.9548}$$

$$WT \text{ (females)} = 0.013272 \text{ Forklength}^{3.0210}$$

The data (Fig. 3.) suggest a bi-modal distribution in 1994 for males and females with a predominant mode at 28-30 cm and another at 23 cm, with the majority of the catch between 27-34cm. Sampling

of the 1995 fishery again shows a bi-modal distribution for males and females with a predominant mode at 29-31 cm and another at 23-26 cm, with the bulk of the catch between 28-33 cm. In 1994 and to a greater extent in 1995, the sampling shows that the 1988 year-class was present in the catches. The sampling of the Nfld. fleet in 1996 suggest a unimodal distribution for each sex with the peak at 30 cm for males and 32 cm for females. A small fish protocol of 25 cm was implemented in 1996 which is reflected in the catch size distribution relative to 1994-1995.

### Research survey data

#### **3Ps Winter-Spring Groundfish Surveys**

Stratified-random groundfish surveys have been conducted since 1973 in Subdiv. 3Ps generally in the February to April period. Station allocation is applied proportionally based on stratum area. These surveys usually cover the extent of the area of Subdiv. 3Ps to a maximum of 730m. A Yankee 41-5 otter trawl was used from 1973 to 1982 (1.75 n. mi. standard tow), an Engels 145 otter trawl was used from 1983 to 1995 (1.75 n. mi. standard tow) and a Campelen 1800 shrimp trawl (0.75 n. mi. standard tow) was used for the 1996 survey. No attempt has been made to apply conversion factors to the data for the different type of trawls.

The historical series of mean numbers and weights per standard tow for 3Ps show some rather dramatic fluctuations between some years (Tables 6-9, Fig. 4). The changes in relative abundance throughout the series are too dynamic to reflect year to year changes in stock abundance. These surveys only cover part of the management unit and consequently may not be reflective of changes in stock size throughout the entire unit, but may reflect fish movements into and out of the survey area. Therefore, the 3Ps winter/spring survey series has limited value in determining current stock status in Unit 2. The stratification scheme from which the stratified-random design of the surveys is based has been revised several times in recent years. The first revision affected certain strata boundaries along the southern slope edge of St. Pierre Bank for the 1994 survey (see Bishop (1994)). The second revision was necessary to account primarily for a correction to the 3P/4V boundary in the Laurentian Channel (see Murphy (1996)). The data for 1994-1996 (Tables 7 and 9) are presented separately to avoid any confusion. Generally the series indicates a higher level of relative abundance prior to 1983 compared to the period from 1983 to 1996. Geographical distribution plots (Fig. 5-6) of catches in 3Ps and 3Pn since 1986 (considered to be part of management Unit 1 at this time of year), indicate generally two clusters of relatively higher density apparent throughout the time series. One cluster is in an area encompassing the northwest corner of St. Pierre Bank which extends into 3Pn. The second cluster generally occurs along the southern slopes of St. Pierre Bank in the proximity of Div. 3O.

Size composition (mean per tow at length) from the 3Ps surveys (Fig. 7) show the relatively strong year-class(es) of the early 1980s that were first captured in the 1981 survey and could be tracked reasonably well through to the current surveys (generally at 30 cm length). In the Engels series (up to 1995 inclusive) there was also a much smaller pulse of recruitment detected first

during the 1988 survey (at 11 cm, perhaps the 1984 or 1985 year-class), and a larger pulse observed at 10 cm in the 1991 survey corresponding to the 1987 or 1988 year-class. In the 1995 survey, the early 1980s dominated year-classes comprised a much greater proportion of the research catch than those of either 1984-85 or 1987-88 suggesting that it is much stronger. The Engels data have not yet been converted into Campelen equivalents and therefore are not directly comparable with the 1996 survey. The 1996 size distribution indicates three peaks, one at 7 cm corresponding to the 1994 year class, one at 21 cm corresponding to the 1987/88 year class and one between 27 cm - 32 cm corresponding to the predominant early 1980s year classes and those up to about 1984.

## **Unit 2 Summer Redfish Surveys**

Stratified-random research surveys were conducted in subdivisions 3Ps, 3Pn, 4Vs and 4Vn during the summers of 1994-1996 utilizing a Campelen 1800 shrimp trawl. Station allocation is applied based on proportion of stratum area. Although there are only three years of data, results from these surveys are considered a better indicator of relative stock size (compared to the winter-spring survey series) because they cover most of the area comprising Unit 2 and are conducted at a time when it is believed that there is no mixing of Unit 1 and Unit 2 fish.

Although there are some fluctuations, particularly in 4Vs, caused by the occurrence of a large set which is not uncommon for redfish, the confidence limits around the estimates derived from the surveys are relatively well behaved (Table 10). The biomass index derived from the surveys suggest that stock size remained stable between 1995 and 1996, slightly below the 1994 level. Geographical distribution plots of the surveys (Fig. 8) illustrate the reduction in the density in subdivision 4Vn from 1994 to 1995. The plots also show the large 1995 catch (about 1.5 t) taken on the southeast slope of the scotian shelf in the vicinity of the "Stone Fence" area of Banquereau Bank that was poorly sampled in 1994 and 1996, which resulted in the doubling of the biomass in 4Vs between 1994 and 1995.

Size composition (Fig. 9) from the surveys generally show bi-modal distributions from 1994 to 1996 within each subdivision. For the 1996 survey, the distributions display modes at about 21-22 cm (1988 year class) and 31-33 cm (1980s year classes). It is also clear that there are differences in distributions between subdivisions, the most striking being the relatively poor representation of fish around 21 cm in all except subdivision 3Ps. For subdivision 4Vs, the reason may simply be poor sampling in the slope areas. In subdivision 3Ps there was a tri-modal distribution in 1994 with modes at 18 cm, 23 cm and 31 cm and bi-modal distributions in 1995 and 1996 which, allowing for growth, correspond only to the 18 cm and 31 cm modes from 1994. A similar pattern was observed in the winter-spring surveys in subdivision 3Ps from 1994 to 1995 although a different net was used. In both surveys it was the central mode that disappeared in 1995. These observations suggest that a finer analysis of the data is warranted to determine whether these observations are consistent over the fishing stations or are influenced by only a few fishing stations.

Total abundance at length estimated for the total area from the summer survey (Fig. 10) were dominated by two modes, the peaks of which were 21-22 cm and 31-33 cm in 1996. The estimated abundance index of the 1988 year-class is substantially less than the estimate derived from the 1995 survey. However, this decline may prove to be no more than interannual variation in the survey estimates rather than an actual decline in abundance. Relatively few redfish smaller than 17 cm were observed in the last two surveys. There is still a substantial proportion of the research catch comprised of the early to mid 1980s year-classes, which have been fished for about 7 years now, again suggesting that the 1988 year class is weaker than that of the early 1980s.

#### **4VsW Spring Cod Surveys**

Stratified-random surveys had been conducted during spring in subdivision 4Vs and division 4W from 1986 to 1996 directed towards cod. The stratification scheme on which the surveys were based was a revision of the standard Scotian Shelf strata based on distribution of cod. Earlier surveys covered down to 366 m but coverage was expanded in 1993 to include the Laurentian Channel out to the boundary with Div. 3P. The Alfred Needler conducted the surveys using a Western IIA otter trawl (1.75 n. mi. standard tow).

As seen with the 3Ps survey series, the historical series of mean number and weight (Table 11-12, Fig 11) per standard tow show large annual fluctuations both between year and between strata within each year. The changes in relative abundance throughout the series are too dynamic to reflect year to year changes in stock abundance. These surveys only cover part of the management unit and are directed to cod which likely results in reduced number of stations along the slopes and in deeper water where redfish reside. Each survey year is dominated by one or two large sets. Therefore, the 4VsW spring survey series has limited value in determining current stock status in Unit 2.

Size composition (mean number per tow at length) from the surveys (Fig. 12) generally indicate the majority of fish captured range from 6 cm to 21 cm. There are larger fish captured in the later surveys that covered the Laurentian Channel. A few modes can be tracked in the surveys from 1987 to 1991 but these distributions are more than likely just reflective of the larger sets taken during the surveys as indicated previously.

#### **4VW Summer Groundfish Surveys**

Stratified-random groundfish surveys have been conducted in the since 1970 in Division 4VW generally in the early summer period. In the more recent period, station allocation has been weighted by the abundance of cod, haddock and pollock while previously the allocation had been proportional to stratum area. These surveys cover to a maximum of 366 m. The A. T. Cameron conducted the surveys from 1970 to 1981 with a Yankee 36 otter trawl. The Alfred Needler continued the surveys in 1982 and used a Western IIA trawl. Both used a standard tow of 1.75 n.



mi. No attempt has been made to apply conversion factors to the data for the different type of trawls.

As seen with the 3Ps and the 4VsW cod survey series, the historical series of mean number and weight (Table 13-14, Fig 11) per standard tow show large annual fluctuations both between year and between strata within each year. Again, these surveys only cover part of the management unit and do not include areas beyond 366 m within each division surveyed. Therefore, the 4VW spring survey series has limited value in determining current stock status in Unit 2. Generally the series indicates a higher level of relative abundance since 1982 compared to the period from 1970 to 1981. This is coincident with the change in vessel and gear but whether this is reflective of general patterns for redfish in this area cannot be determined without attempting to convert the earlier data into Western Ila equivalents. It is interesting that this is the complete opposite of the long term general trends described for the 3Ps survey.

Size composition (mean per tow at length) from the 4VW summer surveys (Fig. 13) show the relatively strong year-class(es) of the early 1970s and 1980s which were generally strong in a number of different redfish stocks. The early 1980s year classes did not appear relatively strong in the distributions until 1984 at 14-15cm which may be reflective of the better selectivity of the Western Ila trawl compared to the Yankee 36. In addition, incoming modes are more easily tracked in the Western Ila data. The data series from 1984 on show three modes which can be tracked for a number of years and have also been identified in the 3Ps winter/spring series: the relatively strong 1980s year classes (at 14-15 cm in 1984), a pulse corresponding to the 1984/85 year class (at 9 cm in 1987 ) and the 1988 year class (at 9 cm in 1990). There has been no other good sign of recruitment since.

### **Industry Perspectives**

Because of the change in fishing pattern that resulted from the implementation in 1995 and 1996 of seasonal closures in May-June (for all of Unit 2) and November-December (for 3Pn and 4Vn), the major stakeholders in the fishery could not relate their past experiences to the current. To date the 1996 fishery has been conducted primarily in areas 3Psd and 4Vsc. One stakeholder has reported a substantial increase in catch rates compared to 1995 (at 1.4 metric tons per hour about a 230% increase from 1995). This catch rate was the result of the detection of a relatively large body of fish in 3Psd during the first quarter of the year. Fish were large in this area and the small fish protocol was not restrictive. One other stakeholder also experienced similar catch rates and fish sizes but was concerned about the recent recurrence of the parasite problem based on company production records.

### **Prognosis**

It is currently not possible to provide an estimate of the absolute size of this stock. It is also not possible to estimate actual fishing mortality rates. Application of selectivity curves for 90 mm and 130 mm mesh codends (Lisovsky et al, 1995) to the abundance-at-length derived from the 1996

summer survey (which covers the main stock area) enables estimation of an exploitable biomass index. The ratio of catch to this exploitable biomass, suggests that a catch of 10,000 metric tons in 1997 would generate an exploitation rate of about 10%. It must be cautioned however, that the survey results are only minimal estimates of biomass so the actual exploitation rate is likely to be lower than estimated above.

Current commercial catches are composed primarily of the early 1980s year-class(es) which have been fished for about seven years. Accordingly, this stock is probably lower than it has been in recent years. Its immediate future is dependent on the abundance of the next anticipated pulse of recruitment (the 1988 year-class) which was partly exploited in 1995. However, their contribution is likely to be less than that of the year-class(es) of the early 1980s. If a management objective is still to protect this year-class, the small fish protocol should be increased from the current level of 25 cm to 27 cm. There are no signs of good recruitment subsequent to the 1988 year-class.

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Table 1 : Summary of Nominal Catches (t) of Redfish in Unit 2.

Year	3Pn (Jun-Dec)	3Ps	4Vn (Jun-Dec)	4Vs	4Wfgi	4Wfgi (assigned)	Total	3P4V (Unknown)	4W (Unknown)	3Pn/4Vn (Nov-Dec)	TAC
1960	14	9211	5277	8122	-	663	23287		-	72	
1961	1058	8340	4157	4170	-	604	18329	356	8	148	
1962	2127	11306	2710	4372	-	780	21295	52	3870	989	
1963	2154	11150	2166	6270	-	550	22290		12005	591	
1964	4445	9119	1849	7629	80	70	23192		3005	2937	
1965	5570	9931	2097	3319	733	184	21834	11	1326	2712	
1966	2444	16543	6022	3067	242	74	28392		8720	5128	
1967	3531	28465	7976	1989	78	131	42170		55	3641	
1968	1974	11764	4097	2222	16	96	20169	522	210	2608	
1969	1412	29460	4726	10241	-	437	46276		1387	1657	
1970	2169	33581	2849	6694	2101	2013	49407		8744	1170	
1971	373	26534	4762	23698	1334	1499	58200		11921	1070	
1972	511	25398	2390	14580	1346	976	45201		8609	192	
1973	2133	14714	2709	11213	495	563	31827		5484	1526	
1974	2759	17894	4898	8112	357	18	34038		4018	2899	
1975	4722	20345	6548	6791	37	28	38471		3944	896	
1976	1409	13235	3832	4718	317	198	23709		315	126	
1977	1713	14678	4763	7123	245	228	28750			307	
1978	1975	12203	3661	7856	593	260	26548			1016	
1979	1975	6459	4500	4979	666	192	18771			1642	
1980	1845	5192	3713	5431	817	131	17129			1140	
1981	3283	4685	6134	6789	430	430	21751			1421	
1982	3757	2090	6350	4585	128	115	17025			2328	
1983	2607	2996	3559	3758	489	64	13473			1301	
1984	1460	2005	2129	2367	140	40	8141			664	
1985	1587	1854	3143	4502	194	214	11494			756	
1986	958	3651	3347	2736	15	58	10765			662	
1987	1348	2169	6423	3651	195	170	13956			1940	
1988	484	2386	4856	2725	156	121	10728			581	
1989	1953	2874	5236	4990	81	252	15386			1206	
1990	189	5438	2471	6325	73	296	14792			390	
1991	1050	4390	8746	8537	100	382	23205			2226	
1992	766	6629	7348	1727	474	224	17168			3029	
1993 <sup>a</sup>	10940	7314	7810	1193	108	-	27365			5739	28000
1994 <sup>a</sup>	4180	7892	6335	5590	267	-	24264			1571	25000
1995 <sup>a</sup>	1558	2571	3535	4244	159	-	12067			43	14000
1996 <sup>b</sup>	9	4470	980	1174	12	-	6882 <sup>b</sup>			-	10000

NOTE: Portions of Catches identified only as "4W" were assigned to 4Wfgi based on :

- (1) Information of other catches that could be split between the "Laurentian Channel" and "Scotia Shelf" Units
- (2) USSR and "others" fishing since 1977 (see Power MS 1992)

a - Provisional

b - to Sept 11, 1996 (Canadian Atlantic Quota Reports)

Table 2a: Nominal catches of Redfish by country from Subdiv. 3Pn (Jun.-Dec.) (1993 to 1995 are provisional).

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Canada (M)	311	502	65	325	143	577	39	825	0	346	213	4915	1209	74
Canada (N)	3446	2105	1395	1262	815	770	445	1128	189	704	548	5537	2996	1484
Canada (Q)	-	-	-	-	-	1	-	-	-	-	5	488	5	-
Total	3757	2607	1460	1587	958	1348	484	1953	189	1050	766	10940	4180	1558

Table 2b: Nominal catches of Redfish by country from Subdiv. 3Ps (1993 to 1995 are provisional).

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Canada (M)	515	670	396	313	606	421	836	1038	1252	377	2648	3545	3957	499
Canada (N)	1553	2316	1608	1529	2915	1645	1441	1823	4186	4013	3981	3745	3935	2072
Canada (Q)	-	-	-	-	88	-	-	-	-	-	-	24	-	-
France (M)	5	-	-	-	-	67	95	-	-	-	-	-	-	-
France (SPM)	17	-	-	-	42	36	14	13	-	-	-	-	-	-
France	-	10	1	12	-	-	-	-	-	-	-	-	-	-
Total	2090	2996	2005	1854	3651	2169	2386	2874	5438	4390	6629	7314	7892	2571

Table 2c: Nominal catches of Redfish by country from Subdiv. 4Vn (Jun.-Dec.) (1993 to 1995 are provisional).

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Canada (M)	2356	2710	1133	1368	1237	2544	2327	3245	1874	7453	5871	6757	3865	2076
Canada (N)	3993	849	153	1677	1790	3682	2345	1909	579	1076	1255	603	1971	1459
Canada (Q)	-	-	-	38	63	-	-	1	-	217	222	450	500	-
France (SPM)	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Japan	-	-	843	60	257	197	184	81	18	-	-	-	-	-
Total	6350	3559	2129	3143	3347	6423	4856	5236	2471	8746	7348	7810	6335	3535

Table 2d: Nominal catches of Redfish by country from Subdiv. 4Vs (1993 to 1995 are provisional).

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Canada (M)	4109	3208	1735	2924	1081	2279	2111	3452	3997	5864	1621	1125	4897	3985
Canada (N)	476	539	148	724	465	428	335	1139	1852	1911	106	68	693	259
Canada (Q)	-	-	-	-	-	-	-	-	-	263	-	-	-	-
USSR	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	-	10	-	-	-	-	-	-	-	-	-	-	-	-
Japan	-	-	484	854	1190	944	279	399	475	499	-	-	-	-
Total	4585	3758	2367	4502	2736	3651	2725	4990	6324	8537	1727	1193	5590	4244

Table 3a: Nominal catches of Redfish in Subdiv. 3Pn by month (1993 to 1995 are provisional).

Year	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1982	153	502	288	923	652	959	280	3757
1983	217	294	622	791	144	356	183	2607
1984	87	305	258	173	435	130	72	1460
1985	131	272	527	206	135	122	194	1587
1986	69	169	94	84	188	282	72	958
1987	77	97	242	74	13	45	800	1348
1988	120	39	123	74	40	69	19	484
1989	7	44	153	878	611	131	129	1953
1990	4	36	64	55	8	4	18	189
1991	10	59	44	42	250	310	335	1050
1992	19	6	11	21	394	79	236	766
1993	332	353	131	889	3552	3022	2661	10940
1994	16	212	5	1521	1196	882	347	4179
1995	-	243	326	374	615	-	-	1558

Table 3b: Nominal catches of Redfish in Subdiv. 3Ps by month (1993 to 1995 are provisional).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	4	5	27	127	154	133	220	580	193	398	205	44	2090
1983	8	11	25	28	82	61	133	462	667	957	168	394	2996
1984	9	126	179	39	114	470	804	141	40	37	22	24	2005
1985	32	27	102	50	126	127	361	413	367	150	63	36	1854
1986	13	37	685	281	499	433	754	213	343	111	186	96	3651
1987	41	94	110	139	172	268	439	244	189	92	74	307	2169
1988	73	557	208	129	135	180	128	179	200	97	126	374	2386
1989	263	174	353	356	116	402	185	376	522	60	37	30	2874
1990	140	2161	1104	370	59	277	298	435	357	159	50	28	5438
1991	210	1234	378	678	79	80	365	361	393	450	51	111	4390
1992	92	763	3716	911	113	110	106	272	261	122	87	76	6629
1993	111	1504	1373	777	628	50	78	182	244	819	895	653	7314
1994	1528	255	81	382	2222	756	542	184	399	787	606	151	7893
1995	401	49	249	248	6	6	357	523	400	195	136	2	2572

Table 3c: Nominal catches of Redfish in Subdiv. 4Vn by month (1993 to 1995 are provisional).

Year	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1982	737	608	1579	1420	917	685	404	6350
1983	688	412	768	792	137	577	185	3559
1984	393	375	295	164	440	63	399	2129
1985	705	517	1123	244	114	197	243	3143
1986	480	1502	474	428	155	162	146	3347
1987	2041	1611	941	603	132	327	768	6423
1988	1339	1285	799	656	284	325	168	4856
1989	1700	857	881	602	250	42	904	5236
1990	696	822	353	176	56	33	335	2471
1991	4181	1627	620	555	182	737	844	8746
1992	1658	1126	909	488	453	769	1945	7348
1993	4178	1692	1367	337	180	52	4	7810
1994	2765	2460	574	454	70	12	0	6335
1995	-	2144	687	568	93	35	8	3535

Table 3d: Nominal catches of Redfish in Subdiv.4Vs by month (1993 to 1995 are provisional).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	11	30	68	136	224	309	1450	738	402	912	191	114	4585
1983	9	86	176	31	131	300	564	561	446	1255	17	182	3758
1984	10	105	595	86	138	91	418	290	91	353	48	142	2367
1985	98	510	242	207	187	469	940	615	126	410	341	357	4502
1986	34	62	209	206	233	357	409	256	356	236	319	59	2736
1987	35	27	187	477	330	806	529	616	304	115	150	75	3651
1988	9	34	94	77	580	331	425	138	617	257	103	60	2725
1989	30	31	170	35	800	2651	388	376	248	191	68	2	4990
1990	40	71	120	454	1714	2040	81	778	177	182	514	154	6325
1991	89	52	67	1315	5845	243	387	19	260	20	224	16	8537
1992	33	28	105	68	73	666	92	26	4	28	410	194	1727
1993	1	6	223	377	108	325	32	6	0	27	86	2	1193
1994	325	962	526	293	934	1412	508	12	4	113	410	91	5590
1995	696	654	547	1306	119	1	276	29	0	210	284	123	4245

Table 3e: Nominal catches of Redfish in Subdiv. 4Wfgi by month (1993 to 1995 are provisional).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	0	0	2	5	66	3	7	25	1	0	18	1	128
1983	0	0	2	26	4	26	20	169	106	116	16	4	489
1984	0	1	0	42	2	8	30	11	43	3	0	0	140
1985	6	1	2	3	0	0	139	10	1	12	2	18	194
1986	0	0	1	1	4	0	2	0	0	0	7	0	15
1987	0	1	16	17	5	60	55	1	1	32	7	0	195
1988	0	0	1	0	4	5	24	34	67	5	16	0	156
1989	1	6	5	0	11	10	16	9	11	3	9	0	81
1990	6	8	20	3	10	0	2	3	0	0	21	0	73
1991	0	11	3	5	14	0	37	13	2	5	2	6	98
1992	13	12	3	9	6	72	30	4	1	12	152	160	474
1993	0	0	22	2	16	5	20	17	1	25	0	0	108
1994	0	2	28	44	59	112	3	15	0	2	0	2	267
1995	23	31	39	6	1	0	2	0	0	34	22	0	158

Table 4a: Nominal catches (t) of Redfish in Division 3P by gear (1993 to 1995 are provisional).

Year	3Pn				3Ps			
	Bottom trawl	Midwater trawl	Other	Total	Bottom trawl	Midwater trawl	Other	Total
1982	3755	-	2	3757	1777	-	313	2090
1983	2591	-	16	2607	2630	-	377	3007
1984	1445	-	15	1460	1130	-	275	1405
1985	1584	-	3	1587	1533	-	321	1854
1986	953	5	-	958	2920	152	579	3651
1987	1057	285	6	1348	1311	35	823	2169
1988	413	62	9	484	1389	467	530	2386
1989	1440	499	14	1953	1527	747	600	2874
1990	147	40	2	189	933	3162	1343	5438
1991	402	570	78	1050	1641	1599	1150	4390
1992	196	537	33	766	1137	4639	853	6629
1993	4740	6172	28	10940	2287	4583	444	7314
1994	2882	1268	30	4180	3017	4794	81	7892
1995	1282	252	24	1558	1643	820	108	2571

Table 4b: Nominal catches (t) of Redfish in Division 4V by gear (1993 to 1995 are provisional).

Year	4Vn				4Vs			
	Bottom trawl	Midwater trawl	Other	Total	Bottom trawl	Midwater trawl	Other	Total
1982	6345	-	5	6350	4585	-	-	4585
1983	3557	-	2	3559	3743	1	14	3758
1984	1811	315	3	2129	2267	100	-	2367
1985	3131	-	12	3143	4502	-	-	4502
1986	3153	182	12	3347	2731	5	-	2736
1987	5338	1049	36	6423	3615	35	1	3651
1988	4506	314	36	4856	2720	5	-	2725
1989	2853	2350	33	5236	2911	2075	4	4990
1990	1923	444	104	2471	3530	2789	6	6325
1991	5060	3619	67	8746	2308	6223	6	8537
1992	4128	3030	190	7348	1112	612	3	1727
1993	3727	4072	11	77810	754	431	8	1193
1994	3178	3060	97	6335	4391	1170	29	5590
1995	2352	1040	143	3535	4235	4	5	4244

Table 5a. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for UNIT 2 redfish.

REGRESSION OF MULTIPLICATIVE MODEL					20114	27	0.623	0.074	44
MULTIPLE R.....					20127	28	1.453	0.082	34
MULTIPLE R SQUARED.....					20157	29	1.495	0.141	11
					27114	30	0.388	0.044	169
					27122	31	0.044	0.124	15
					27123	32	0.011	0.088	33
					27124	33	0.514	0.050	113
					27125	34	0.698	0.037	373
					27154	35	0.773	0.101	23
					27155	36	0.784	0.057	96
					27156	37	1.025	0.190	6
					27157	38	1.021	0.177	7
					28124	39	0.394	0.205	5
					28154	40	0.657	0.098	24
					2	1	0.177	0.062	64
					2	42	0.290	0.053	97
					3	43	0.110	0.044	155
					4	44	0.059	0.045	147
					5	45	0.080	0.042	168
					6	46	0.105	0.030	424
					8	47	0.065	0.030	444
					9	48	0.048	0.031	399
					10	49	0.098	0.031	387
					11	50	0.150	0.033	329
					12	51	0.026	0.035	275
					3	36	0.044	0.027	493
					4	44	0.032	0.023	833
					4	45	0.124	0.023	814
					4	71	0.219	0.050	116
					4	55	0.648	0.045	120
					4	65	0.454	0.039	161
					5	75	0.332	0.030	298
					5	85	0.225	0.024	533
					5	61	0.015	0.132	27
					5	82	0.213	0.128	31
					5	63	0.170	0.123	39
					5	64	0.216	0.125	36
					5	65	0.471	0.123	40
					5	66	0.533	0.114	66
					5	67	0.527	0.113	81
					5	68	0.397	0.114	66
					5	69	0.387	0.111	89
					5	70	0.297	0.109	115
					5	71	0.195	0.108	139
					5	72	0.103	0.108	133
					5	73	0.088	0.108	127
					5	74	0.119	0.107	148
					5	75	0.098	0.107	147
					5	76	0.268	0.110	101
					5	77	0.188	0.108	134
					5	78	0.148	0.107	151
					5	79	0.325	0.109	143
					5	80	0.230	0.110	120
					5	81	0.280	0.111	106
					5	82	0.064	0.112	99
					5	83	0.011	0.114	82

ANALYSIS OF VARIANCE				
SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	5.868E2	5.868E2	
REGRESSION	94	7.025E2	7.474E0	36.689
Country;Gear;TC	40	2.752E2	6.880E0	33.775
Month	11	2.750E1	2.500E0	12.275
Division	4	1.607E1	4.016E0	19.716
Bycatch PCT	4	7.317E1	1.829E1	89.804
Year	35	2.237E2	6.393E0	31.383
RESIDUALS	3272	6.665E2	2.037E-1	
TOTAL	3367	1.956E3		

REGRESSION COEFFICIENTS					
CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
Country;Gear;TC	3114	INTERCEPT	0.629	0.102	3367
Month	7				
Division	37				
Bycatch PCT	95				
Year	60				
1	2114	1	0.084	0.033	311
	2124	2	0.057	0.061	65
	2125	3	0.364	0.050	107
	2154	4	0.289	0.064	61
	2155	5	0.661	0.071	46
	3121	6	0.350	0.151	10
	3123	7	0.368	0.103	23
	3124	8	0.108	0.043	154
	3125	9	0.212	0.031	404
	3126	10	0.159	0.113	19
	3144	11	0.416	0.087	30
	3153	12	0.505	0.150	10
	3154	13	0.436	0.068	51
	3155	14	0.515	0.048	128
	3156	15	0.768	0.097	27
	9114	16	0.133	0.064	58
	9125	17	0.255	0.078	38
	11115	18	0.335	0.149	10
	11116	19	0.604	0.146	10
	11126	20	0.710	0.109	19
	11127	21	0.744	0.207	5
	14124	22	0.480	0.165	8
	14125	23	0.594	0.141	11
	14126	24	0.529	0.093	27
	14127	25	0.906	0.062	65
	16127	26	0.373	0.110	18



Table 5a (continued).

84	83	0.156	0.120	53
85	84	0.209	0.111	111
86	85	0.236	0.111	112
87	86	0.227	0.112	103
88	87	0.225	0.112	102
89	88	0.220	0.114	86
90	89	0.624	0.118	65
91	90	0.470	0.114	102
92	91	0.319	0.115	97
93	92	0.035	0.113	124
94	93	0.432	0.113	100
95	94	0.625	0.117	71

Table 5b. Standardized catch rate series for UNIT 2 redfish from a multiplicative model utilizing hours fished as a measure of fishing effort.

YEAR	LN TRANSFORM		RETRANSFORMED		CATCH	EFFORT
	MEAN	S.E.	MEAN	S.E.		
1960	0.8288	0.0104	0.587	0.080	23287	39645
1961	0.6442	0.0083	0.579	0.053	18329	31656
1962	0.4156	0.0072	0.728	0.062	21295	29249
1963	0.4588	0.0059	0.698	0.054	22290	31946
1964	0.4130	0.0083	0.730	0.058	23192	31755
1965	0.1579	0.0059	0.943	0.072	21834	23159
1966	0.0959	0.0038	1.004	0.062	28392	28276
1967	0.1016	0.0037	0.998	0.060	42170	42236
1968	0.2320	0.0039	0.876	0.054	20169	23016
1969	0.2421	0.0032	0.868	0.049	46276	53329
1970	0.3321	0.0027	0.793	0.041	49407	62283
1971	0.4334	0.0025	0.717	0.036	58200	81175
1972	0.5260	0.0025	0.654	0.033	45201	69167
1973	0.5409	0.0025	0.644	0.032	31827	49430
1974	0.7477	0.0024	0.524	0.025	34038	65004
1975	0.7270	0.0023	0.535	0.026	38471	71961
1976	0.8968	0.0029	0.451	0.024	23709	52574
1977	0.8164	0.0024	0.489	0.024	28750	58813
1978	0.7771	0.0023	0.508	0.024	26548	52211
1979	0.9533	0.0025	0.426	0.021	18771	44035
1980	0.8586	0.0026	0.469	0.024	17129	36554
1981	0.9088	0.0029	0.446	0.024	21751	48816
1982	0.6930	0.0031	0.553	0.031	17025	30794
1983	0.6395	0.0036	0.583	0.035	13473	23105
1984	0.7845	0.0049	0.504	0.035	8141	16152
1985	0.8382	0.0029	0.478	0.026	11494	24037
1986	0.8651	0.0029	0.465	0.025	10765	23126
1987	0.8553	0.0031	0.470	0.026	13956	29692
1988	0.8535	0.0031	0.471	0.026	10728	22783
1989	0.4090	0.0038	0.734	0.045	15386	20957
1990	0.0045	0.0046	1.100	0.075	14792	13451
1991	0.1592	0.0037	0.943	0.058	23205	24619
1992	0.3093	0.0040	0.811	0.051	17167	21165
1993	0.5935	0.0036	0.611	0.036	27365	44820
1994	1.0610	0.0035	0.383	0.023	24264	63424
1995	1.2534	0.0045	0.315	0.021	12067	38255

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.061

Table 6. Mean number of redfish caught per standard tow in Division 3Ps during Canadian research surveys 1973-1993 (Numbers in brackets are number of successful sets, \* indicates those strata estimated with a multiplicative model utilizing data to 1991.)

Stratum	Depth range (m)	Area (sq.n.mi.)	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
			ATC 207 Mar 12-25	ATC 221 Apr 19-30	ATC 234 Jun 2-13	ATC 247-248 May 11-Jun 6	ATC 261 Apr 14-26	ATC 275 Apr 4-14	ATC 287 Feb 16-Mar 5	ATC 302 Mar 19-Apr 2	ATC 316 Mar 7-26	ATC 330 May 28-Jun 9	AN 9 Apr 22-May 8
306	185-274	419	844.56 *	573.67(6)	3198.00(6)	2284.67(6)	2159.20(6)	2177.33(6)	408.40(5)	1051.50(2)	1830.67(3)	934.67(3)	421.50(4)
307	93-183	395	288.80(5)	200.71(7)	4067.03(4)	1861.25(4)	1252.50(4)	234.25(4)	20.50(4)	83.50(2)	924.67(3)	150.00(4)	121.25(4)
309	185-274	296	3647.00(3)	1386.75(4)	8421.66(6)	5836.57(7)	1955.48(6)	1019.33(6)	2540.33(6)	24599.00(2)	7772.50(2)	522.00(2)	981.33(3)
310	185-274	170	95.00(1)	175.00(3)	2981.52(6)	5497.80(5)	110.50(6)	622.33(6)	316.00(6)	240.00(2)	252.50(2)	5677.00(3)	547.00(3)
311	93-183	317	3.78(9)	495.00(8)	7.00(4)	805.67(6)	1022.00(4)	0.00(4)	19.50(4)	0.00(2)	6.50(2)	7.67(3)	0.00(3)
313	185-274	165	1.50(2)	133.00(5)	1010.33(3)	990.50(6)	78.90(10)	130.00(2)	80.00(5)	95.50(2)	187.00(2)	4397.00(2)	829.33(3)
316	185-274	189	228.33(3)	150.00(6)	1471.00(1)	1368.25(4)	86.42(6)	119.00(6)	110.67(3)	384.00(2)	175.00(2)	457.00(1)	653.75(4)
317	93-183	193	1.57(7)	217.62(8)	558.00(4)	466.50(4)	691.37(4)	3.25(4)	16.33(3)	3.50(2)	1.00(2)	112.00(3)	7980.66(3)
318	185-274	123	999.00(1)	169.50(2)	2034.29(4)	2087.00(7)	228.00(6)	480.50(2)	292.50(2)	1403.50(2)	807.29 *	6077.00(2)	1688.33(3)
319	93-183	984	174.20(5)	411.00(2)	432.43(4)	92.25(4)	83.17(6)	1241.00(4)	156.00(2)	3.00(4)	8455.00(2)	260.57(7)	27.29(7)
705	275-366	195	476.50(2)	56.75(4)	154.94(2)	256.20(5)	79.50(4)	251.67(3)	73.50(4)	161.00(2)	162.00(2)	644.00(2)	5.67(3)
706	275-366	476	640.00(2)	226.57(7)	165.00(1)	73.75(4)	112.28(4)	71.00(2)	312.00(3)	97.00(2)	86.00(2)	118.00(4)	77.80(5)
707	275-366	93	568.73 *	590.00(2)	785.25(4)	1893.67(6)	210.01(4)	649.50(2)	740.50(2)	211.00(2)	554.88 *	221.53 *	306.33(3)
708	367-549	117	444.99 *	574.52 *	185.00(3)	520.33(3)	364.21(4)	473.00(1)	592.50(2)	89.00(2)	434.29 *	173.32 *	722.00(2)
709	550-731	96	7.07 *	9.27 *	14.03 *	102.50(2)	8.80 *	7.26 *	4.83 *	1.39 *	6.89 *	2.46 *	0.50(2)
710	550-731	36	6.73 *	8.83 *	13.37 *	10.34 *	8.38 *	6.91 *	4.59 *	1.30 *	6.56 *	2.32 *	3.75(3)
711	367-549	961	202.08 *	260.97 *	388.34 *	169.50(2)	248.46 *	207.22 *	142.21 *	25.50(2)	32.50(2)	11.50(2)	68.13(8)
712	367-549	973	182.57 *	235.78 *	350.89 *	151.50(2)	224.48 *	187.24 *	104.00(2)	71.00(2)	150.50(2)	23.00(3)	67.86(7)
713	367-549	950	132.38 *	171.01 *	39.43(3)	87.50(2)	162.81 *	135.76 *	93.11 *	15.00(2)	65.33(6)	11.50(2)	23.71(7)
714	367-549	1195	228.90 *	295.59 *	439.79 *	248.50(2)	281.43 *	127.00(2)	145.00(1)	64.00(2)	50.50(8)	39.67(6)	62.30(10)
715	275-366	132	588.00(1)	62.75(4)	318.00(2)	811.40(5)	124.00(4)	343.75(4)	717.00(3)	2417.50(2)	1015.50(2)	20.00(2)	71.33(3)
716	275-366	539	412.00(1)	108.00(3)	1367.39 *	252.00(3)	127.50(6)	473.50(4)	173.00(4)	43.00(2)	207.75(4)	122.00(2)	54.50(4)
<b>Stratified Analysis:</b>													
Upper			1113.7	1499.3	2576.9	1009.5	746.4	1157.1	415.8	9026.0	14082.20	698.3	843.1
Mean			563.1	357.4	1561.4	750.2	585.0	566.7	313.0	978.9	1459.9	432.1	339.7
Lower			12.5	-784.6	545.9	490.8	423.7	-23.6	210.2	-7068.2	-11162.5	165.9	-163.8
<b>Multiplicative Analysis:</b>													
Mean			385.3	303.9	987.3	747.2	417.0	432.6	244.8	964.6	1407.0	420.8	339.7
Total (x 10 <sup>-6</sup> )			260.7	205.6	668.0	505.6	282.2	292.7	165.7	652.7	952.0	284.7	229.8

Table 6. (Cont'd.)

Stratum	Depth range (m)	Area (sq.n.mi.)	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1993
			AN 26 Apr 9-18	WT 26 Mar 7-26	WT 45 Mar 5-24	WT 55-56 Feb 12-Mar 23	WT 68 Jan 26-Feb 15	WT 81 Jan 31-Feb 17	WT 91 Jan 31-Feb 20	WT 103 Feb 2-20	WT 118 Feb 6-24	WT 133 Feb 6-23	WT 135 Apr 2-20
306	185-274	419	15.50(2)	313.00(2)	623.67(3)	231.25(4)	493.50(4)	137.33(3)	819.33(3)	870.75(4)	65.50(2)	367.50(4)	357.75(4)
307	93-183	395	127.00(2)	53.33(3)	17.00(3)	36.33(3)	44.50(4)	14.33(3)	37.67(3)	6.00(3)	1.50(2)	6.50(4)	7.67(3)
309	185-274	296	50.50(2)	453.00(3)	618.50(2)	1142.50(2)	535.00(3)	398.50(2)	363.00(2)	1898.67(3)	32.50(2)	46.00(3)	2929.00(2)
310	185-274	170	70.50(2)	1225.33(3)	303.00(2)	33.50(2)	801.33(3)	326.00(2)	85.50(2)	8716.00(2)	3.50(2)	79.00(2)	910.50(2)
311	93-183	317	41.00(2)	11.00(4)	0.00(3)	0.00(3)	1.50(4)	2.67(3)	0.00(3)	0.00(3)	1.00(2)	3.67(3)	0.00(2)
313	185-274	165	35.00(2)	1033.50(2)	988.00(2)	150.50(2)	181.00(2)	507.50(2)	61.50(2)	4682.50(2)	757.00(2)	35.00(2)	452.00(2)
316	185-274	189	127.00(2)	140.00(3)	57.50(2)	313.67(3)	210.00(3)	76.40(3)	151.00(2)	731.50(2)	661.00(2)	0.01(1)	196.67(3)
317	93-183	193	882.50(2)	0.00(2)	0.00(2)	0.00(3)	2.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)
318	185-274	123	138.00(2)	216.16 *	958.00(2)	5547.50(2)	58.50(2)	658.50(2)	410.35 *	564.00(2)	216.80(2)	52.50(2)	962.50(2)
319	93-183	984	11.67(6)	0.00(2)	15.88(8)	9.11(9)	99.38(8)	11.50(8)	37.65 *	7.33(9)	2.60(10)	0.89(9)	3.83(6)
705	275-366	195	28.50(2)	78.00(2)	424.00(2)	247.50(2)	121.00(2)	30.00(2)	22.00(2)	54.00(2)	178.00(2)	20.00(2)	235.00(2)
706	275-366	476	75.00(2)	465.25(4)	308.25(4)	181.92(5)	429.75(4)	91.00(4)	38.50(4)	201.00(4)	69.20(5)	17.67(3)	44.20(5)
707	275-366	93	226.00(2)	148.46 *	265.50(2)	200.50(2)	634.00(2)	302.13(2)	281.98 *	1389.50(2)	2203.50(2)	1306.50(2)	1148.25(2)
708	367-549	117	113.00(2)	116.11 *	278.75(2)	354.50(2)	432.50(2)	549.00(2)	220.65 *	435.50(2)	881.50(2)	2179.00(2)	7044.00(2)
709	550-731	96	4.50(2)	1.48 *	0.00(1)	14.29(1)	6.83 *	12.50(2)	3.26 *	18.00(2)	1.71 *	33.04(2)	4.44(2)
710	550-731	36	1.00(2)	8.00(2)	78.00(2)	2.51 *	114.50(2)	3.74 *	3.09 *	11.00(2)	34.00(1)	18.44(2)	0.00(2)
711	367-549	961	20.40(5)	121.75(8)	280.78(9)	154.00(7)	181.43(7)	315.43(7)	312.67(3)	265.88(8)	189.20(10)	240.60(5)	41.80(5)
712	367-549	973	31.85 *	44.33(6)	120.78(9)	117.00(4)	115.71(7)	347.50(8)	180.80(5)	71.75(8)	123.10(10)	50.00(7)	58.29(7)
713	367-549	950	22.98 *	55.50(8)	66.80(5)	197.00(4)	954.43(7)	212.88(8)	113.43(7)	279.19(8)	72.10(10)	76.13(8)	96.50(6)
714	367-549	1195	40.03 *	69.00(1)	89.40(5)	66.25(4)	488.33(9)	394.90(10)	301.29(7)	236.36(11)	285.14(7)	170.33(11)	127.22(9)
715	275-366	132	43.50(2)	2448.00(1)	569.00(2)	463.00(2)	307.50(2)	1542.00(2)	1476.50(2)	9797.50(2)	624.50(2)	1976.00(2)	1219.50(4)
716	275-366	539	18.67(3)	84.60(5)	207.00(4)	226.00(3)	240.80(5)	123.25(4)	45.80(5)	25.40(5)	175.67(3)	16.75(4)	42.25(4)
<b>Stratified Analysis:</b>													
Upper			238.3	225.8	282.5	1299.6	531.3	358.6	374.8	1658.2	217.5	282.00	698.32
Mean			74.0	164.0	206.8	240.6	334.4	240.1	225.4	650.9	178.0	160.46	325.18
Lower			-90.2	102.3	131.0	-818.5	137.6	121.7	76.0	-356.5	138.6	38.92	-47.96
<b>Multiplicative Analysis:</b>													
Mean			59.6	183.1	204.5	237.2	331.1	239.2	204.7	650.9	175.6	157.1	325.2
Total (x 10 <sup>-6</sup> )			40.3	123.9	138.4	160.5	224.0	161.8	138.5	440.4	118.8	106.3	220.0

Table 7. Mean number of Redfish caught per standard tow (number of sets indicated in brackets) during surveys to Subdiv. 3Ps utilizing revised stratification schemes in 1994 and 1995 (see text for details). Stratum areas in brackets denote a major revision to the stratification for the 1995 survey. The 1994-1995 surveys utilized an Engels 145 (1.75 n. mi. tows), the 1996 survey utilized a Campelen 1800 (0.75 n. mi. tows).

Stratum	Depth range (M)	Area (Sq.N.Mi)	1994	1995	1996
			WT 150-151 Apr 5-27	WT 166-167 Apr 3-29	WT 186-187 Apr10-May 1
306	185-274	419 (363)	132.50 (4)	2.33 (3)	212.04 (3)
307	93-183	395	25.00 (4)	2.22 (4)	331.34 (4)
309	185-274	296	333.67 (3)	31.33 (3)	227.00 (3)
310	185-274	170	492.00 (3)	8.50 (2)	74.50 (2)
311	93-183	317	5.00 (4)	1.33 (3)	2.67 (3)
313	185-274	165	155.50 (2)	57.00 (2)	80.44 (2)
316	185-274	189	22.50 (2)	18.50 (2)	313.50 (2)
317	93-183	193	0.00 (2)	0.00 (2)	2.00 (2)
318	185-274	129	0.00 (2)	2696.50 (2)	237.50 (2)
319	93-183	984	0.00 (9)	16.00 (8)	180.91 (8)
705	275-366	195	87.67 (3)	6546.00 (2)	99.51 (2)
706	275-366	476	79.25 (4)	138.00 (4)	232.67 (3)
707	275-366	74	2615.50 (2)	1100.00 (2)	983.30 (2)
708	367-549	126	5878.50 (2)	853.50 (2)	2718.50 (2)
709	550-731	158 (147)	59.30 (2)	17.00 (2)	3.00 (2)
710	732-914	176 (156)	0.00 (2)	-	-
711	367-549	961 (593)	52.50 (6)	183.40 (5)	84.08 (4)
712	367-549	973 (731)	134.86 (7)	153.14 (7)	143.67 (6)
713	367-549	950 (851)	148.00 (7)	187.63 (8)	139.49 (7)
714	367-549	1195 (1074)	121.75 (8)	203.50 (10)	141.05 (9)
715	275-366	132 (128)	328.25 (4)	852.50 (2)	76.28 (2)
716	275-366	539	79.40 (5)	18.40 (5)	42.30 (5)
Number per tow:					
Upper CI			500.00	2343.30	758.82
Stratified Mean			198.80	325.00	193.45
Lower CI			-102.40	-1693.20	-371.92
Total Abundance (millions)			137.50	197.80	216.00

Table 8. Mean weight (kg) of redfish caught per standard tow in Division 3Ps during Canadian research surveys, 1973-1993. (Numbers in brackets indicate number of sets; \* indicates strata estimated using a multiplicative model utilizing data to 1991.)

Stratum	Depth range (m)	Area (sq.n.mi.)	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
			ATC 207 Mar 12-25	ATC 221 Apr 19-30	ATC 234 Jun 2-13	ATC 247-248 May 11-Jun 6	ATC 261 Apr 14-26	ATC 275 Apr 4-14	ATC 287 Feb 16-Mar 5	ATC 302 Mar 19-Apr 2	ATC 316 Mar 7-26	ATC 33 May 28-Jun 9	AN 9 Apr 22-May 8	AN 26 Apr 9-18
306	185-274	419	83.09 *	56.09(6)	175.99(6)	188.85(6)	137.59(6)	298.47(6)	48.90(5)	165.71(2)	44.93(3)	54.93(3)	81.13(4)	3.51(2)
307	93-183	395	12.25(5)	8.55(7)	34.34(4)	58.91(4)	47.29(4)	17.69(4)	3.06(4)	12.38(2)	21.17(3)	4.05(4)	49.00(4)	69.25(2)
309	185-274	296	541.59(3)	135.85(4)	666.33(6)	939.79(7)	224.35(6)	108.48(6)	337.55(6)	3908.91(2)	264.50(2)	42.50(2)	101.92(3)	12.25(2)
310	185-274	170	2.27(1)	34.62(3)	256.09(6)	416.67(5)	29.22(6)	96.61(6)	59.35(6)	35.64(2)	17.50(2)	529.11(3)	34.67(3)	4.75(2)
311	93-183	317	0.30(9)	30.53(8)	0.11(4)	17.69(6)	61.12(4)	0.00(4)	3.69(4)	0.00(2)	1.50(2)	0.17(3)	0.00(3)	4.00(2)
313	185-274	165	0.90(2)	16.51(5)	153.62(3)	168.74(6)	12.60(10)	24.94(2)	11.25(5)	15.55(2)	29.00(2)	158.50(2)	44.33(3)	3.50(2)
316	185-274	189	25.71(3)	20.26(6)	48.99(1)	290.30(4)	13.61(6)	14.17(6)	10.89(3)	51.30(2)	21.00(2)	36.50(1)	55.88(4)	9.75(2)
317	93-183	193	0.52(7)	16.22(8)	49.05(4)	8.16(4)	41.94(4)	0.21(4)	1.74(3)	3.40(2)	0.25(2)	1.07(3)	110.70(3)	31.25(2)
318	185-274	123	97.07(1)	23.13(2)	373.83(4)	324.71(7)	32.51(6)	56.70(2)	22.46(2)	94.89(2)	48.53 *	148.50(2)	88.50(3)	21.25(2)
319	93-183	984	12.91(5)	64.41(2)	70.35(4)	8.96(4)	5.62(6)	86.64(4)	6.58(2)	0.79(4)	46.00(2)	3.86(7)	4.79(7)	2.90(6)
705	275-366	195	241.31(2)	19.28(4)	90.15(2)	123.38(5)	22.34(4)	115.21(3)	44.03(4)	62.65(2)	49.50(2)	317.00(2)	4.33(3)	13.50(2)
706	275-366	476	91.18(2)	53.27(7)	37.19(1)	33.90(4)	31.91(4)	28.12(2)	60.18(3)	26.33(2)	17.00(2)	42.25(4)	11.50(5)	8.50(2)
707	275-366	93	136.99 *	93.89(2)	237.12(4)	469.55(6)	58.59(4)	100.24(2)	126.60(2)	38.82(2)	77.86 *	37.05 *	80.83(3)	96.75(2)
708	367-549	117	157.57 *	189.83 *	82.25(3)	210.02(3)	124.44(4)	192.00(1)	201.03(2)	15.43(2)	89.61 *	42.68 *	358.75(2)	40.50(2)
709	550-731	96	4.52 *	5.54 *	7.42 *	96.39(2)	4.40 *	5.41 *	3.24 *	1.31 *	2.36 *	0.87 *	0.10(2)	1.75(2)
710	550-731	36	7.67 *	9.34 *	12.40 *	12.67 *	7.48 *	9.12 *	5.58 *	2.45 *	4.16 *	1.73 *	2.27(3)	0.50(2)
711	367-549	961	90.88 *	109.52 *	143.78 *	128.37(2)	88.78 *	107.05 *	67.50 *	15.66(2)	13.50(2)	5.40(2)	28.21(8)	16.10(5)
712	367-549	973	112.77 *	135.88 *	178.34 *	121.11(2)	110.17 *	132.82 *	83.91(2)	40.18(2)	112.00(2)	15.00(3)	49.50(7)	30.09 *
713	367-549	950	87.61 *	105.59 *	30.50(3)	68.04(2)	85.59 *	103.21 *	65.07 *	10.44(2)	41.33(6)	8.25(2)	16.86(7)	23.29 *
714	367-549	1195	144.85 *	174.50 *	228.98 *	206.62(2)	141.52 *	89.36(2)	110.67(1)	41.09(2)	32.69(8)	30.08(6)	49.85(10)	38.75 *
715	275-366	132	201.40(1)	26.99(4)	99.79(2)	339.65(5)	39.12(4)	70.31(4)	383.81(3)	472.84(2)	183.84(2)	11.40(2)	12.50(3)	22.00(2)
716	275-366	539	258.55(1)	25.93(3)	101.59 *	106.90(3)	32.66(6)	155.13(4)	73.26(4)	22.02(2)	22.25(4)	25.25(2)	15.50(4)	10.07(3)
<b>Stratified Analysis:</b>														
Upper			168.2	218.7	198.1	182.2	65.0	145.4	87.0	1285.3	185.7	72.6	54.1	75.3
Mean		85.2	45.7	125.2	151.8	52.4	89.2	67.6	166.7	48.8	39.6	40.1	15.8	
Lower			2.2	-127.3	52.4	121.4	39.8	33.0	48.3	-951.9	-88.1	6.7	26.0	-43.8
<b>Multiplicative Analysis:</b>														
Mean		107.8	86.9	137.3	151.3	77.1	97.4	72.1	164.3	49.0	39.0	40.1	21.1	
Biomass (t)			72952	58800	92910	102343	52193	65903	48801	111141	33130	26401	27099	14304

Table 8. (Cont'd.)

Stratum	Depth range (m)	Area (sq.n.mi.)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1993
			WT 26 Mar 7-26	WT 45 Mar 5-24	WT 55-56 Feb 12-Mar 23	WT 68 Jan 26-Feb 15	WT 81 Jan 31-Feb 17	WT 91 Jan 31-Feb 20	WT 103 Feb 2-20	WT 118 Feb 6-24	WT 133 Feb 6-23	WT 135 Apr 2-20
306	185-274	419	37.00(2)	39.67(3)	24.63(4)	190.77(4)	10.33(3)	212.48(3)	32.64(4)	1.70(2)	17.53(4)	107.15(4)
307	93-183	395	3.70(3)	2.00(3)	5.67(3)	3.95(4)	3.00(3)	25.63(3)	0.44(3)	0.04(2)	0.69(4)	0.64(3)
309	185-274	296	85.33(3)	69.25(2)	127.00(2)	86.17(3)	69.00(2)	44.80(2)	235.25(3)	2.15(2)	2.77(3)	191.30(2)
310	185-274	170	95.83(3)	43.00(2)	4.00(2)	46.17(3)	16.25(2)	2.75(2)	132.77(2)	0.85(2)	3.10(2)	50.08(2)
311	93-183	317	1.97(4)	0.00(3)	0.00(3)	0.05(4)	0.13(3)	0.00(3)	0.00(3)	0.02(2)	0.17(3)	0.00(2)
313	185-274	165	89.50(2)	93.75(2)	20.25(2)	31.00(2)	25.00(2)	1.92(2)	42.26(2)	21.14(2)	1.47(2)	25.43(2)
316	185-274	189	12.83(3)	10.50(2)	40.50(3)	24.33(3)	4.87(3)	2.65(2)	7.97(2)	25.23(2)	0.01(1)	11.27(3)
317	93-183	193	0.00(2)	0.00(2)	0.00(3)	0.20(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)
318	185-274	123	27.04 *	149.75(2)	671.00(2)	13.00(2)	105.75(2)	48.70 *	14.23(2)	7.36(2)	7.05(2)	169.25(2)
319	93-183	984	0.00(2)	1.45(8)	1.19(9)	13.82(8)	1.00(8)	4.44 *	0.28(9)	0.05(10)	0.03(9)	0.22(6)
705	275-366	195	29.50(2)	90.50(2)	102.25(2)	65.00(2)	11.00(2)	5.50(2)	4.58(2)	34.33(2)	6.78(2)	91.30(2)
706	275-366	476	60.13(4)	45.88(4)	35.10(5)	114.35(4)	23.88(4)	10.78(4)	24.70(4)	10.84(5)	7.57(3)	7.70(5)
707	275-366	93	43.51 *	61.50(2)	69.50(2)	153.25(2)	108.28(2)	78.12 *	93.25(2)	321.02(2)	185.63(2)	271.79(2)
708	367-549	117	50.11 *	73.25(2)	101.75(2)	156.00(2)	228.00(2)	89.91 *	70.72(2)	338.30(2)	322.58(2)	1666.10(2)
709	550-731	96	1.11 *	0.00(1)	5.70(1)	5.43 *	6.25(2)	2.37 *	4.65(2)	0.79 *	19.71(2)	2.21(2)
710	550-731	36	5.25(2)	53.50(2)	3.74 *	68.63(2)	4.55 *	4.18 *	4.70(2)	16.70(1)	10.93(2)	0.00(2)
711	367-549	961	31.27(8)	119.11(9)	52.71(7)	84.71(7)	149.36(7)	165.15(3)	73.04(8)	75.35(10)	115.53(5)	16.94(5)
712	367-549	973	27.97(6)	70.78(9)	77.63(4)	68.00(7)	163.06(8)	83.46(5)	29.91(8)	64.88(10)	20.28(7)	25.86(7)
713	367-549	950	41.19(8)	45.10(5)	110.13(4)	651.84(7)	119.06(8)	57.26(7)	127.50(8)	38.22(10)	36.74(8)	42.03(6)
714	367-549	1195	31.00(1)	58.60(5)	48.38(4)	312.92(9)	204.10(10)	160.49(7)	104.55(11)	138.29(7)	78.12(11)	57.58(9)
715	275-366	132	1137.00(1)	97.25(2)	127.50(2)	133.00(2)	735.43(2)	353.00(2)	4253.50(2)	105.01(2)	935.83(2)	184.81(4)
716	275-366	539	27.50(5)	71.63(4)	147.50(3)	100.06(5)	52.88(4)	17.10(5)	8.30(5)	17.37(3)	3.53(4)	14.48(4)
<b>Stratified Analysis:</b>												
Upper			38.7	72.1	116.6	301.0	245.8	133.4	915.7	65.40	256.4	223.8
Mean	30.6		54.5	65.9	163.1	98.4	87.5	117.4	50.9	51.8	62.3	
Lower			22.5	36.8	15.2	25.1	-49.0	41.6	-681.0	36.46	-152.9	-99.1
<b>Multiplicative Analysis:</b>												
Mean	46.9		53.9	65.0	161.4	98.0	76.6	117.4	50.3	50.7	62.3	
Biomass (t)			31721	36472	44002	109193	66325	51820	79423	34006	34290	42180

Table 9. Mean weight (kg) of Redfish caught per standard tow (number of sets indicated in brackets) during surveys to Subdiv. 3Ps utilizing revised stratification schemes in 1994 and 1995 (see text for details). Stratum areas in brackets denote a major revision to the stratification for the 1995 survey. The 1994-1995 surveys utilized an Engels 145 (1.75 n. mi. tows), the 1996 survey utilized a Campelen 1800 (0.75 n. mi. tows).

Stratum	Depth range (M)	Area (Sq.N.Mi)	1994	1995	1996
			WT 150-151 Apr 5-27	WT 166-167 Apr 3-29	WT 186-187 Apr10-May 1
306	185-274	419 (363)	11.53 (4)	0.49 (3)	2.57 (3)
307	93-183	395	1.86 (4)	0.45 (4)	3.84 (4)
309	185-274	296	56.53 (3)	4.68 (3)	21.01 (3)
310	185-274	170	38.57 (3)	2.30 (2)	5.40 (2)
311	93-183	317	0.45 (4)	0.06 (3)	0.20 (3)
313	185-274	165	11.23 (2)	5.05 (2)	6.36 (2)
316	185-274	189	1.75 (2)	1.17 (2)	27.61 (2)
317	93-183	193	0.00 (2)	0.00 (2)	0.03 (2)
318	185-274	129	0.00 (2)	622.97 (2)	26.88 (2)
319	93-183	984	0.00 (9)	2.00 (8)	21.49 (8)
705	275-366	195	16.30 (3)	3356.81 (2)	14.83 (2)
706	275-366	476	21.48 (4)	30.44 (4)	34.63 (3)
707	275-366	74	777.36 (2)	151.23 (2)	240.10 (2)
708	367-549	126	1036.12 (2)	351.07 (2)	781.56 (2)
709	550-731	158 (147)	38.92 (2)	3.34 (2)	0.95 (2)
710	732-914	176 (156)	0.00 (2)	-	-
711	367-549	961 (593)	18.62 (6)	84.86 (5)	32.32 (4)
712	367-549	973 (731)	58.72 (7)	71.04 (7)	72.01 (6)
713	367-549	950 (851)	64.32 (7)	89.79 (8)	66.29 (7)
714	367-549	1195 (1074)	52.43 (8)	89.01 (10)	68.20 (9)
715	275-366	132 (128)	74.05 (4)	403.97 (2)	12.01 (2)
716	275-366	539	10.19 (5)	9.24 (5)	9.12 (5)
Weight per Tow:					
	Upper CI		83.90	1174.20	204.07
Stratified	Mean		49.20	141.70	47.23
	Lower CI		14.40	-890.90	-109.61
Total Biomass (t)			33994	86210	52853

Table 10. Mean weight (kg) of redfish caught per standard 15 minute tow in Unit2 during summer research surveys for 1994-1995. (Numbers in brackets are successful sets, "-" indicates strata not sampled)

STRATUM	Depth Range (m)	Area sq. n. mi.	1994	1995	1996
<b>3Pn</b>					
303	185-274	554	63.34	43.47	14.65
304	093-183	151	463.55	234.44	105.18
305	185-274	733	45.61	75.95	46.00
Upper			694.89	171.34	64.72
Mean			96.33	80.08	40.14
Lower			-502.23	-11.18	15.55
Biomass (metric tons)			17546	14568	7311
<b>3Ps</b>					
306	185-274	363	45.37	14.50	15.57
309	185-274	296	146.39	191.88	120.2
310	185-274	170	136.20	12.70	40.95
313	185-274	165	18.01	124.95	100.55
316	185-274	189	136.11	162.04	336.98
318	185-274	129	270.81	303.17	350.96
705	275-366	195	229.86	45.25	86.1
706	275-366	476	296.88	88.19	94.62
707	275-366	74	1008.71	356.33	560.66
708	367-549	126	550.85	233.98	89.36
709	550-731	147	0.19	6.80	15.78
710	732-914	156	0.00	1.13	0
711	367-549	593	173.65	138.73	91.02
712	367-549	731	99.97	56.58	165.72
713	367-549	851	38.15	161.09	213.64
714	367-549	1047	78.86	92.97	36.13
715	275-366	128	127.28	63.03	161.13
716	275-366	539	79.08	67.41	140.7
Upper			173.06	140.77	190.2
Mean			129.70	104.29	122.64
Lower			86.34	67.81	55.09
Biomass (metric tons)			104733	84217	99037
<b>4Vn</b>					
415	367-532	2915	113.49	65.38	80.2
416	275-366	671	264.84	103.88	78.35
417	185-274	387	300.25	56.16	122.59
Upper			225.44	85.64	125.44
Mean			157.24	70.98	84.02
Lower			89.04	56.32	42.6
Biomass (metric tons)			79133	35722	42283
<b>4Vs</b>					
397	367-549	540	77.42	104.93	57.9
398	367-549	833	169.34	137.89	112.29
399	367-549	465	66.27	227.87	217.99
400	367-549	270	56.27	105.13	485.83
446	275-366	313	102.51	606.82	53.13
451	275-366	147	212.80	109.00	-
452	275-366	345	1.08	1.98	3.9
468	367-549	148	-	467.18	-
Upper			145.83	403.22	675.96
Mean			100.45	190.02	135.69
Lower			55.07	-23.18	-404.58
Biomass (metric tons)			37065	73679	47542
<b>TOTAL BIOMASS</b>			<b>238477</b>	<b>208186</b>	<b>196173</b>



Table 11. Mean number of redfish caught per standard tow and survey abundance in Division 4VW from 1986-1996 Maritime Region spring surveys.

STR	Depth (m)	Area sq. n. mi.	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
396	368 - 503	-	-	-	-	-	-	-	-	-	-	21.6	-
397	368 - 458	640	-	-	-	-	-	-	-	80.4	90.7	15.7	171.0
398	368 - 458	833	-	-	-	-	-	-	-	833.6	235.1	114.4	17.4
399	368 - 458	465	-	-	-	-	-	-	-	109.2	-	183.4	1008.1
400	368 - 458	270	-	-	-	-	-	-	-	250.1	-	50.5	258.4
401	0 - 274	2782	0.1	3.2	.0	-	3.1	4.8	2.9	0.2	0.3	1.4	1.0
402	0 - 366	3394	6.6	339.8	14.0	23.1	0.9	4.3	55.7	13.4	161.7	37.0	40.8
403	0 - 274	3401	0.9	.0	119.2	18.5	.0	3.1	54.2	3.4	.0	.0	.0
404	183 - 366	150	812.2	11.7	.0	37.1	9075.3	349.7	.0	151.4	17.2	1632.3	4779.1
405	0 - 366	454	11.0	314.1	30.9	3677.7	132.6	27.4	17.1	3.8	12.7	11.7	382.9
406	0 - 274	4650	4.6	497.2	2.5	18.9	11.7	5.7	7.9	1.4	6.7	0.1	0.2
407	0 - 274	1763	3.6	39.0	2.3	6.8	4.1	27.8	3.7	0.7	1.1	0.1	.0
408	0 - 183	3184	14.2	.0	.0	1.1	1.9	607.5	18.1	.0	0.2	0.2	184.2
409	0 - 92	1500	.0	.0	.0	.0	0.1	.0	.0	.0	.0	.0	.0
410	0 - 183	2936	.0	0.1	.0	0.1	0.3	3.6	4.7	.0	0.4	5.3	2.8
411	185 - 366	379	.0	2.1	13.9	20.2	65.4	0.9	.0	7.8	.0	9.8	-
440	185 - 366	924	-	-	-	-	-	-	-	-	-	1.0	-
441	93 - 183	1000	-	-	-	-	-	-	-	-	-	19.1	-
444	93 - 183	3925	-	-	-	-	-	-	-	-	-	2.7	-
445	185 - 366	1023	-	-	-	-	-	-	-	-	-	6.0	-
446	185 - 366	491	-	-	-	-	-	-	-	-	-	5.5	-
Abundance x 10-6			19.142	312.580	41.313	163.414	129.369	180.015	42.662	7.838	50.254	37.270	137.969

Table 12. Mean weight (kg) of redfish caught per standard tow and survey biomass in Division 4VW from 1986-1996 Maritime Region spring surveys.

STR	Depth (m)	Area sq. n. mi.	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
396	368 - 503		-	-	-	-	-	-	-	-	-	8.4	-
397	368 - 458	640	-	-	-	-	-	-	-	35.4	38.5	5.4	83.4
398	368 - 458	833	-	-	-	-	-	-	-	294.3	82.2	44.8	5.8
399	368 - 458	465	-	-	-	-	-	-	-	37.4	-	40.4	523.0
400	368 - 458	270	-	-	-	-	-	-	-	119.3	-	19.5	124.5
401	0 - 274	2782	.0	0.3	.0	-	.0	.0	0.1	.0	.0	.0	.0
402	0 - 366	3394	3.2	189.3	4.4	4.6	0.3	0.8	7.2	0.8	15.7	5.3	9.3
403	0 - 274	3401	0.1	.0	2.3	0.9	.0	.0	2.1	0.4	.0	.0	.0
404	183 - 366	150	403.5	1.9	.0	1.5	613.5	142.0	.0	19.0	2.4	431.5	1174.9
405	0 - 366	454	1.0	143.2	2.6	226.1	8.1	3.9	0.4	0.2	0.7	0.6	87.2
406	0 - 274	4650	1.1	3.2	0.7	2.2	0.4	0.9	2.0	0.3	0.5	.0	0.1
407	0 - 274	1763	0.9	2.3	0.3	0.7	0.3	0.5	0.1	.0	.0	.0	.0
408	0 - 183	3184	2.0	.0	.0	0.8	0.2	29.0	13.5	.0	.0	.0	15.4
409	0 - 92	1500	.0	.0	.0	.0	0.1	.0	.0	.0	.0	.0	.0
410	0 - 183	2936	.0	.0	.0	.0	.0	0.6	.0	.0	.0	.0	0.4
411	185 - 366	379	.0	.0	1.0	0.5	3.6	.0	.0	1.0	.0	0.8	-
440	185 - 366	924	-	-	-	-	-	-	-	-	-	.0	-
441	93 - 183	1000	-	-	-	-	-	-	-	-	-	1.0	-
444	93 - 183	3925	-	-	-	-	-	-	-	-	-	.0	-
445	185 - 366	1023	-	-	-	-	-	-	-	-	-	.0	-
446	185 - 366	491	-	-	-	-	-	-	-	-	-	0.5	-
Biomass (t)			7232	61671	2410	11530	8562	10600	7156	748	4789	7170	25255

Table 13. Mean number per standard tow in Division 4VW from 1970-1996 Maritimes Region summer groundfish surveys

STR	Depth (m)	Area	70	71	72	73	74	75	76	77	78	79	80	81	82	83
440	184 - 366	924	373.30	548.13	884.82	108.42	375.90	101.69	120.92	44.40	139.48	557.14	127.42	154.76	378.00	198.07
441	93 - 183	1000	68.51	373.63	.00	36.72	13.27	0.61	.00	6.52	.00	1.62	0.32	16.63	135.72	23.91
444	93 - 183	3925	79.81	38.28	3.27	53.60	50.78	20.27	97.22	8.09	160.18	0.67	3.56	2.70	24.85	24.89
445	184 - 366	1023	146.19	105.74	62.37	181.74	61.33	175.30	103.97	74.09	17.06	25.06	42.25	172.86	174.74	57.65
446	184 - 366	491	296.26	275.43	223.09	443.01	674.44	554.61	992.50	166.39	802.63	389.84	971.86	243.83	608.61	1002.96
449	93 - 183	144	31.02	154.58	.00	42.05	0.78	.00	0.58	.00	.00	0.55	2.92	.00	1.94	.00
450	93 - 183	383	.00	3.40	.00	.00	.00	.00	0.61	1.09	88.47	.00	.00	.00	.00	.00
451	184 - 366	147	50.31	933.92	25.47	.00	9.67	19.43	1.09	37.82	1826.03	149.72	114.17	61.25	124.24	55.03
452	184 - 366	345	553.28	275.18	441.46	112.03	8.89	17.22	14.00	1691.18	14.10	4.63	1.93	3.09	95.64	49.38
453	184 - 366	259	1730.38	496.56	328.12	232.56	120.23	164.10	3.40	3.43	15.88	15.40	22.49	6.39	17.77	1354.91
454	93 - 183	499	2.40	5.69	1.03	.00	.00	7.55	0.78	.00	17.89	0.36	.00	.00	0.88	.00
457	93 - 183	811	308.17	89.83	.00	18.04	21.62	.00	0.97	473.49	68.91	2.67	0.40	.00	4.38	1.03
Mean			193.32	174.24	125.15	87.46	101.2	68.42	109.98	121.71	155.28	76.99	67.98	48.09	112.58	123.9
Abundance (millions)			163.02	146.93	105.53	73.75	85.34	57.70	92.74	102.63	130.94	64.92	57.33	40.55	94.93	104.48
STR	Depth (m)	Area	84	85	86	87	88	89	90	91	92	93	94	95	96	
440	184 - 366	924	222.52	160.26	313.40	218.48	1075.04	1972.10	1018.35	925.70	176.21	312.67	259.54	1055.27	842.50	
441	93 - 183	1000	13.44	104.03	84.21	72.75	50.13	10.55	55.73	31.09	53.86	63.50	45.66	24.26	13.84	
444	93 - 183	3925	3.45	124.32	92.85	9.72	0.49	11.49	7.85	6.43	4.47	132.59	24.73	1.13	5.88	
445	184 - 366	1023	192.74	222.73	98.22	510.28	128.75	88.19	33.17	38.14	8.99	372.65	13.70	69.82	7.61	
446	184 - 366	491	920.56	1727.22	1886.03	362.63	1378.00	3598.70	2787.84	7891.81	5979.80	456.00	1338.34	354.17	847.57	
449	93 - 183	144	209.51	12.15	.00	.00	0.51	.00	.00	.00	.00	0.50	.00	1.57	.00	
450	93 - 183	383	0.97	.00	0.34	32.94	.00	3786.43	0.67	.00	19.44	1.67	.00	0.34	9.55	
451	184 - 366	147	724.18	1410.85	27.73	52.79	2661.25	3946.25	91.84	334.56	45.75	4709.36	6.46	1126.44	46.67	
452	184 - 366	345	100.50	135.88	926.05	407.99	2756.06	12750.81	2789.10	3209.51	4412.52	1832.82	47.96	522.70	45.60	
453	184 - 366	259	128.72	.00	9.95	27.77	752.76	9.78	17.16	1130.39	127.85	8.55	1.48	15.59	22.06	
454	93 - 183	499	.00	.00	0.69	3.75	.00	.00	.00	.00	.00	1.98	0.51	0.99	2.33	
457	93 - 183	811	9527.21	239.53	243.25	199.88	31.72	.00	58.29	954.78	0.49	18.29	1.92	6.77	15.56	
Mean			885.67	227.74	229.99	135.18	343.33	1021.7	347.5	708.39	477.29	283.52	107.87	161.33	129.14	
Abundance (millions)			746.85	192.05	193.94	113.99	289.52	861.56	293.03	597.35	402.48	239.08	90.96	136.04	108.90	

Table 14. Mean weight (kg) per standard tow and survey biomass in Division 4VW from 1970-1996 Maritimes Region summer groundfish surveys.

STR	Depth (m)	Area	70	71	72	73	74	75	76	77	78	79	80	81	82	83
440	184 - 366	924	182.81	307.50	198.64	40.63	162.82	73.99	85.40	29.50	116.67	329.37	59.29	73.54	127.62	67.58
441	93 - 183	1000	19.05	177.63	.00	8.58	1.07	.00	.00	0.69	5.00	0.32	.00	2.92	8.23	0.34
444	93 - 183	3925	21.55	21.33	0.96	14.71	29.74	8.70	48.06	2.04	71.83	.00	1.76	1.38	9.86	9.08
445	184 - 366	1023	113.52	21.32	19.21	50.59	15.57	46.64	33.97	16.39	6.91	2.56	14.35	52.50	93.57	17.50
446	184 - 366	491	136.53	95.57	83.35	170.76	185.28	118.58	326.00	73.85	180.62	167.42	253.79	85.03	264.12	162.94
449	93 - 183	144	18.30	71.94	.00	21.05	0.39	.00	.00	.00	.00	.00	1.94	.00	1.94	.00
450	93 - 183	383	.00	0.97	.00	.00	.00	.00	.00	0.36	54.44	.00	.00	.00	.00	.00
451	184 - 366	147	3.28	312.08	2.92	.00	2.30	2.60	.00	9.82	825.38	42.78	36.03	21.00	4.46	14.49
452	184 - 366	345	81.27	135.41	86.27	38.96	1.88	3.25	5.25	854.22	5.35	0.51	.00	1.54	15.05	6.99
453	184 - 366	259	472.35	220.06	188.34	80.85	46.90	69.61	.00	0.34	1.98	1.46	9.26	0.31	0.65	47.67
454	93 - 183	499	.00	.00	.00	.00	.00	1.72	.00	.00	1.56	.00	.00	.00	.00	.00
457	93 - 183	811	117.24	21.58	.00	9.40	4.80	.00	.00	129.89	21.88	0.55	.00	.00	.00	.00
Mean			70.78	79.59	32.85	28.59	39.42	22.99	46.65	49.31	65.67	39.87	21	17.63	39.85	21.43
Biomass Index (tons)			59682	67118	27700	24106	33238	19391	39336	41583	55381	33623	17709	14865	33605	18070
STR	Depth (m)	Area	84	85	86	87	88	89	90	91	92	93	94	95	96	
440	184 - 366	924	107.86	58.43	146.06	116.68	299.60	628.71	319.12	326.84	67.28	139.45	75.42	394.01	362.83	
441	93 - 183	1000	0.58	14.99	11.53	20.53	4.05	0.49	5.12	2.47	14.97	16.04	8.14	2.27	0.96	
444	93 - 183	3925	1.96	79.62	37.34	1.86	.00	5.49	1.55	0.26	0.30	10.71	2.84	0.28	0.31	
445	184 - 366	1023	102.57	85.26	57.68	313.50	56.84	13.64	8.81	7.75	0.97	95.52	1.15	20.79	1.77	
446	184 - 366	491	83.29	298.11	362.82	113.77	371.92	921.95	257.43	1024.95	686.79	188.50	242.29	160.98	344.08	
449	93 - 183	144	165.28	5.35	.00	.00	.00	.00	.00	.00	.00	.00	.00	0.73	.00	
450	93 - 183	383	0.97	.00	.00	7.21	.00	229.99	.00	.00	2.27	.00	.00	.00	2.62	
451	184 - 366	147	141.15	462.92	12.48	2.09	753.40	904.38	1.61	138.46	3.60	969.27	0.49	117.27	3.08	
452	184 - 366	345	17.63	15.44	230.36	18.53	119.09	579.56	185.10	268.23	524.89	119.88	3.10	244.08	2.76	
453	184 - 366	259	10.99	.00	0.34	1.03	449.71	0.49	1.03	53.05	8.75	.00	.00	1.76	1.60	
454	93 - 183	499	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	0.62	
457	93 - 183	811	506.47	24.06	102.08	4.10	1.09	.00	2.44	25.22	.00	0.49	.00	.09	1.29	
Mean			72.19	71.22	69.78	52.79	79.47	149.8	51.03	96.85	60.43	56.42	21.13	57.27	51.49	
Biomass Index (tons)			60874	60060	58843	44514	67017	126325	43035	81669	50954	47578	17817	48290	43420	

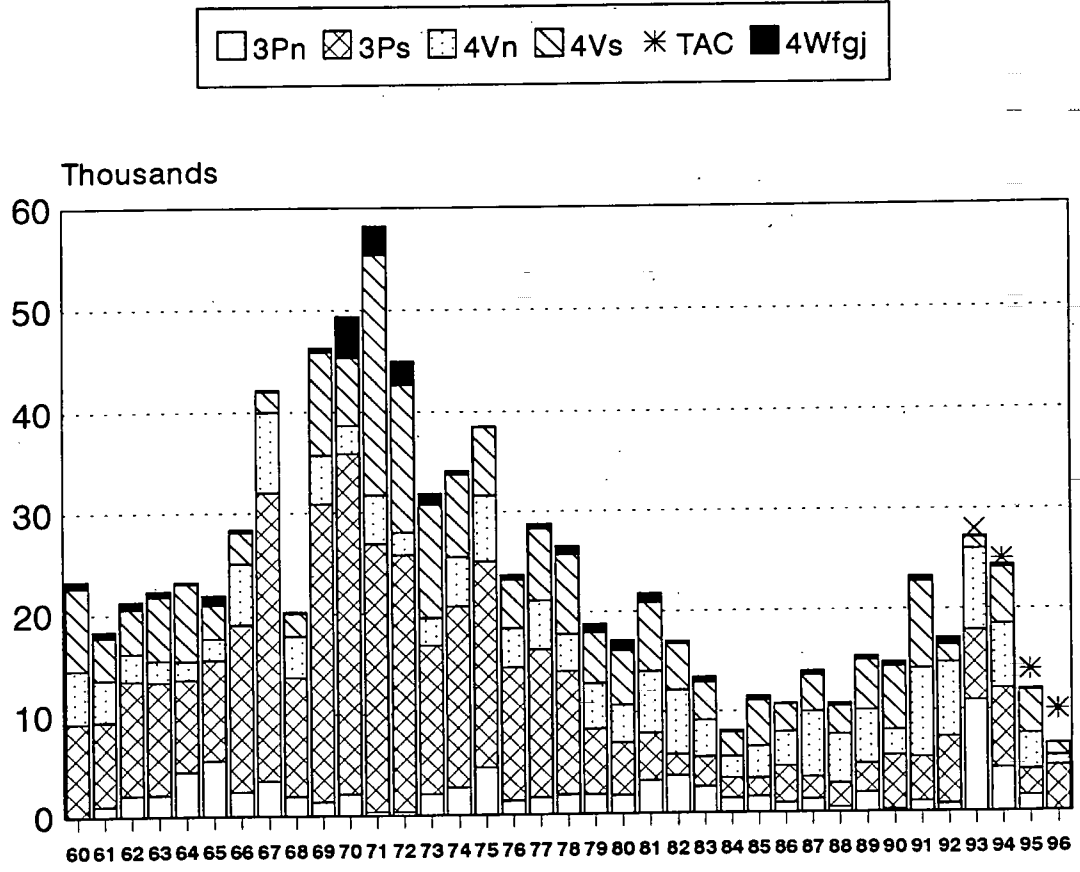


Fig. 1. Nominal catches of redfish from the "Laurentian Channel" management unit for 1960-1996 (1996 provisional to Sept. 11/96).

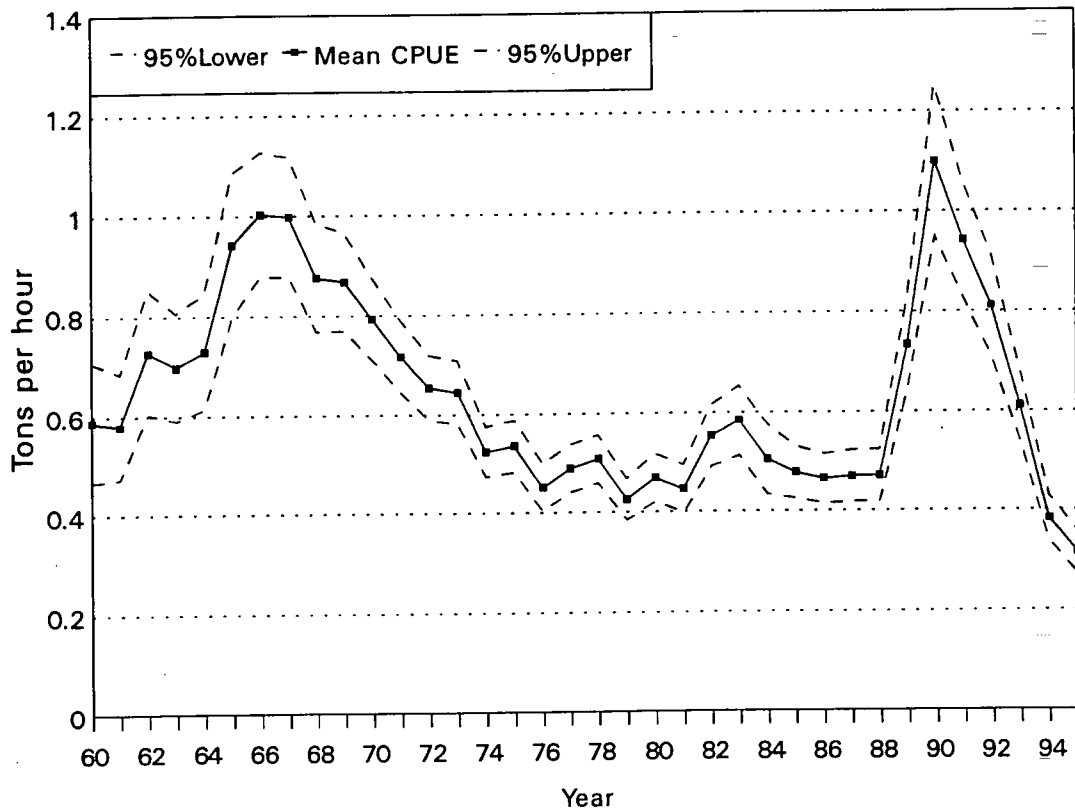


Fig. 2. Standardized CPUE for redfish in Unit 2 from 1960-95 utilizing all gears and tonnage classes.

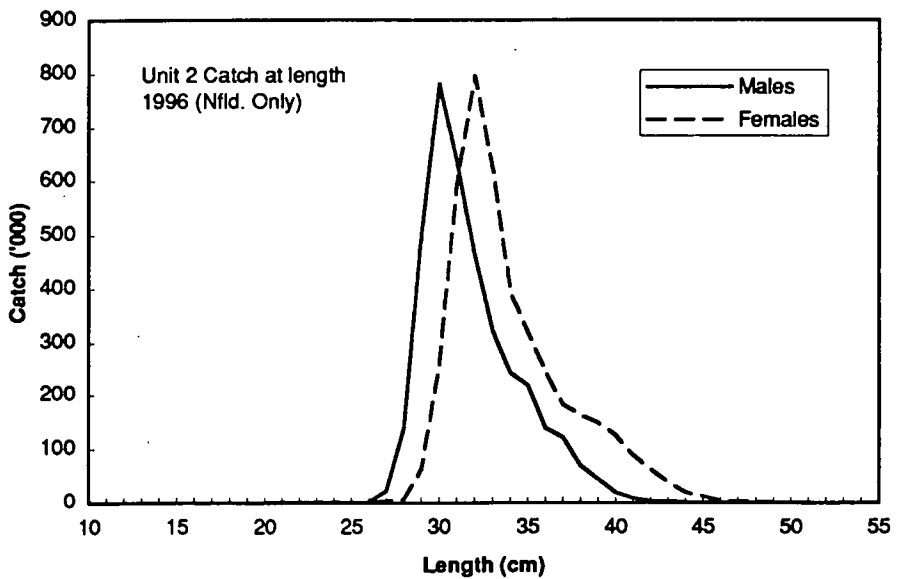
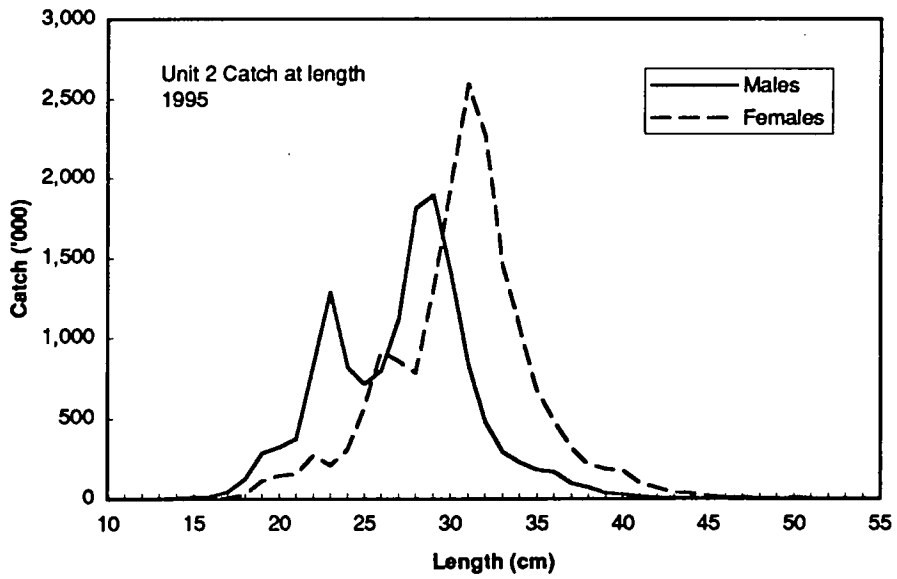
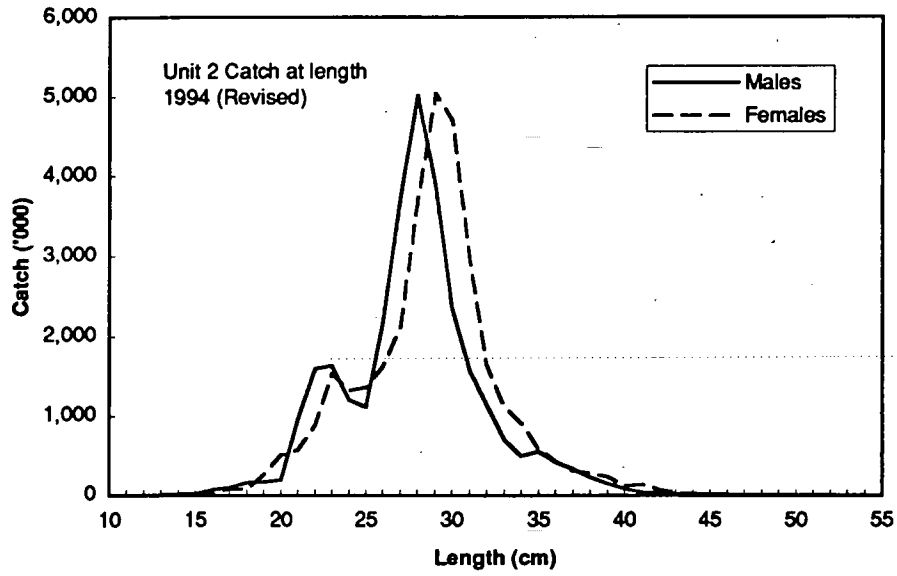


Figure 3. Estimated commercial catch-at-length of Unit 2 redfish

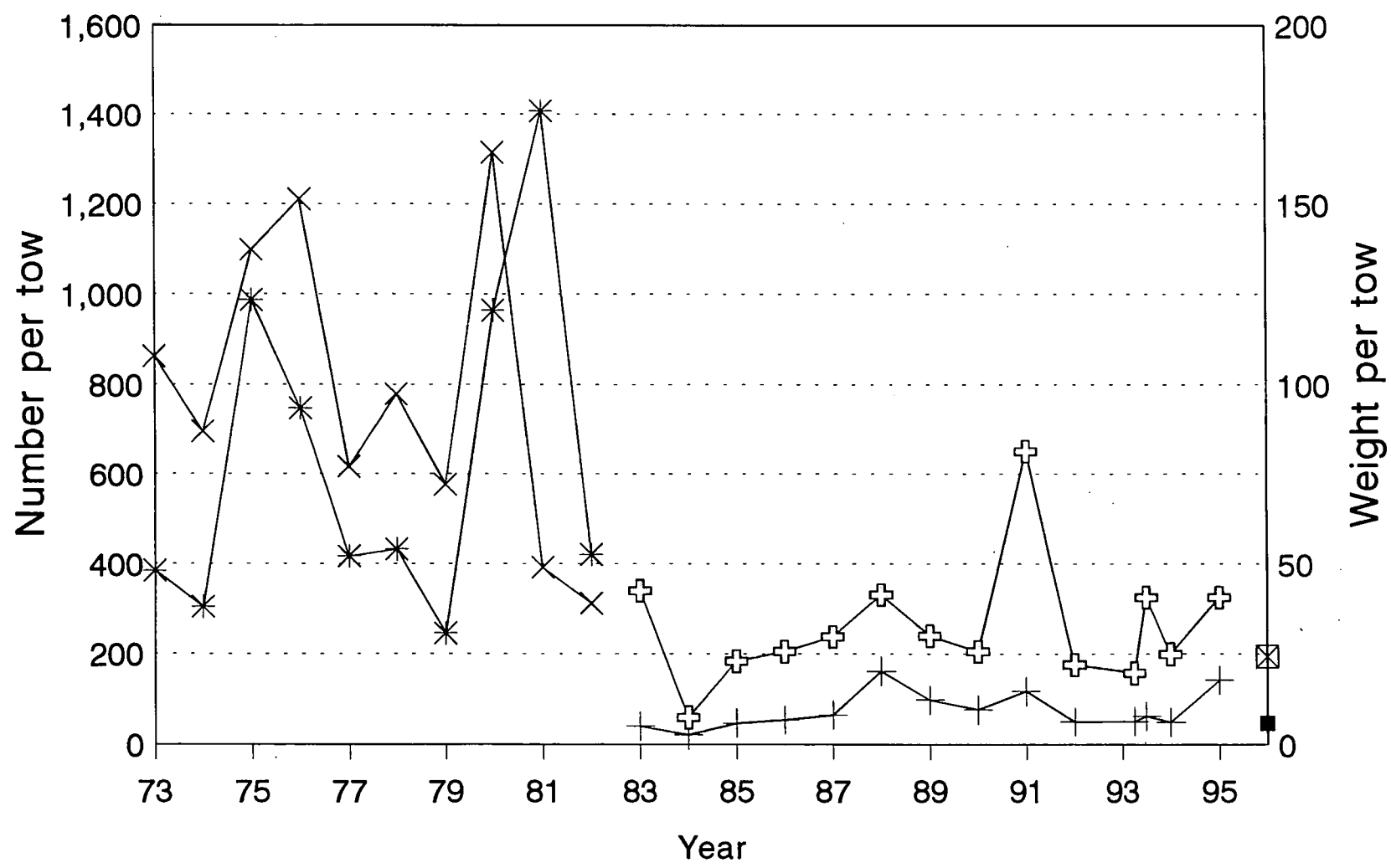
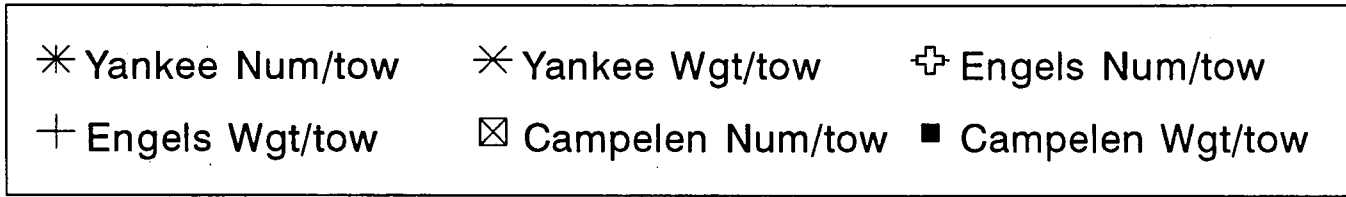


Fig. 4. RV mean numbers and weights per standard tow for 3Ps spring surveys. There were various trawls and standard tows used throughout the series: 1973-1982 (Yankee), 1983-1995 (Engels), 1996 (Campelen) (see text)

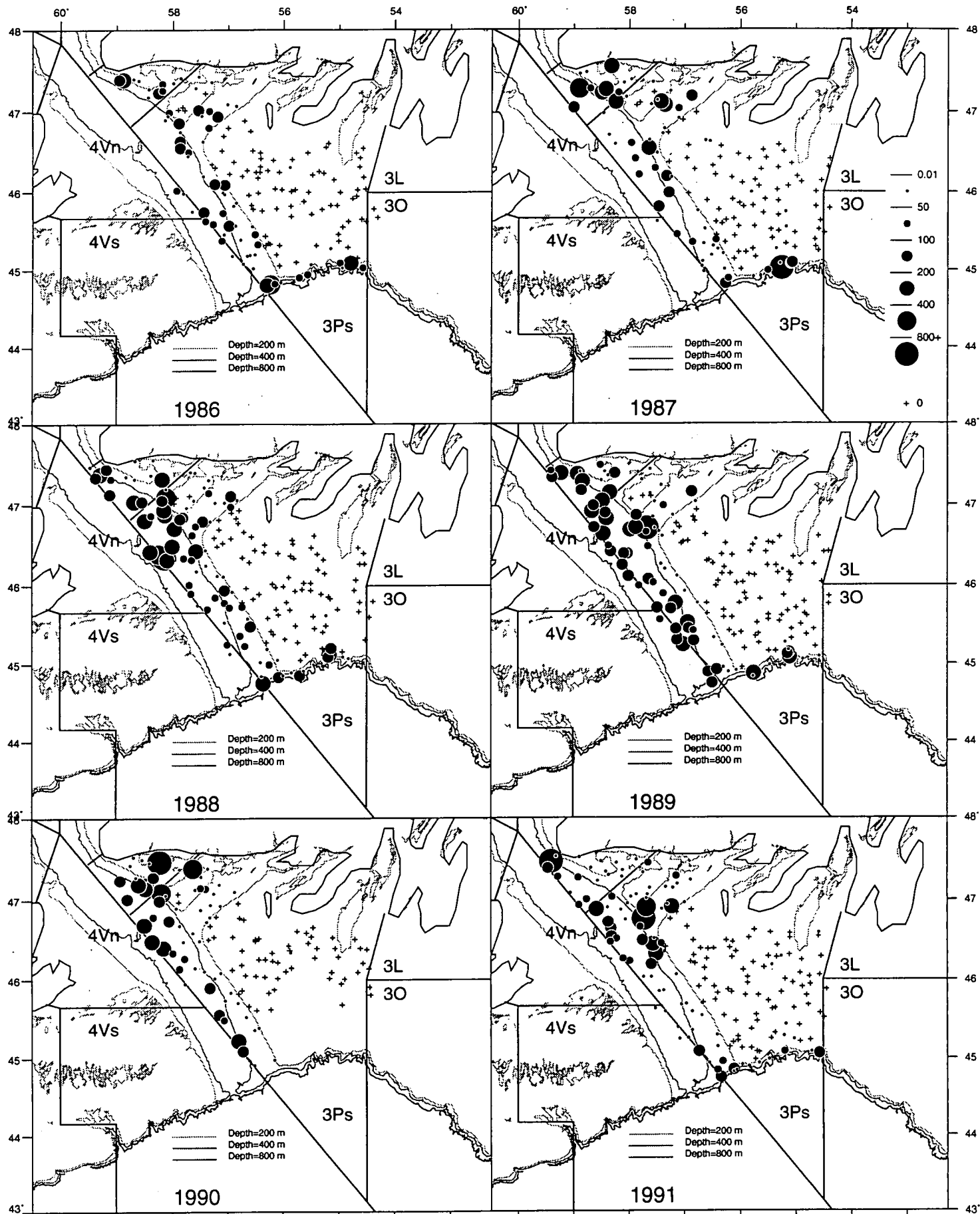


Fig. 5. Distribution of Redfish catches (Kg./ standard tow) from 1986-1991 spring surveys to Div. 3P. The surveys utilized an Engels 145 trawl (1.75 n. mi. tow).



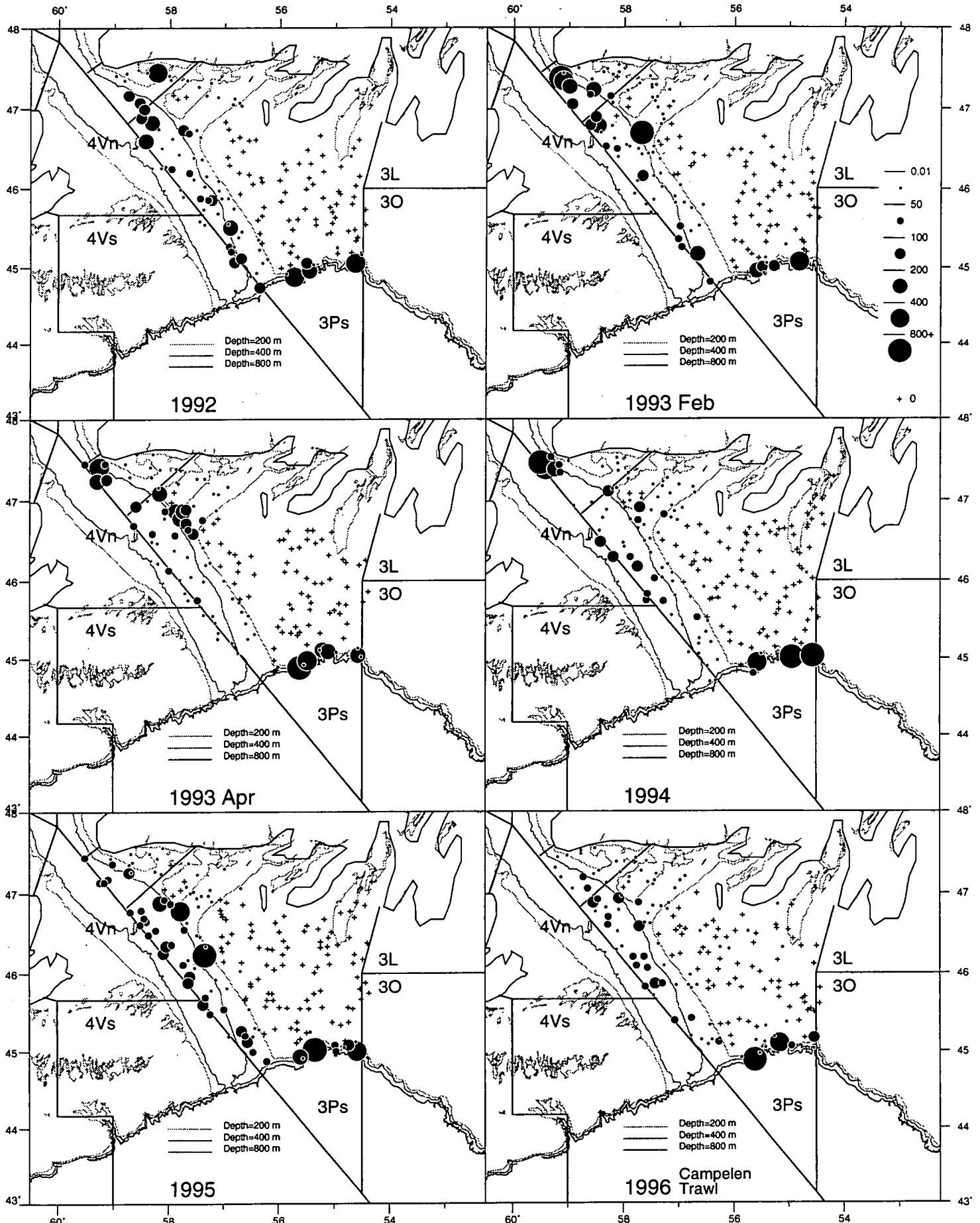


Fig. 6. Distribution of Redfish catches (Kg./ standard tow) from 1992-1996 spring surveys to Div. 3P. The surveys utilized an Engels 145 trawl (1.75 n. mi. tow) up to 1995 and a Campelen trawl (0.75 n. mi. tow) for 1996.

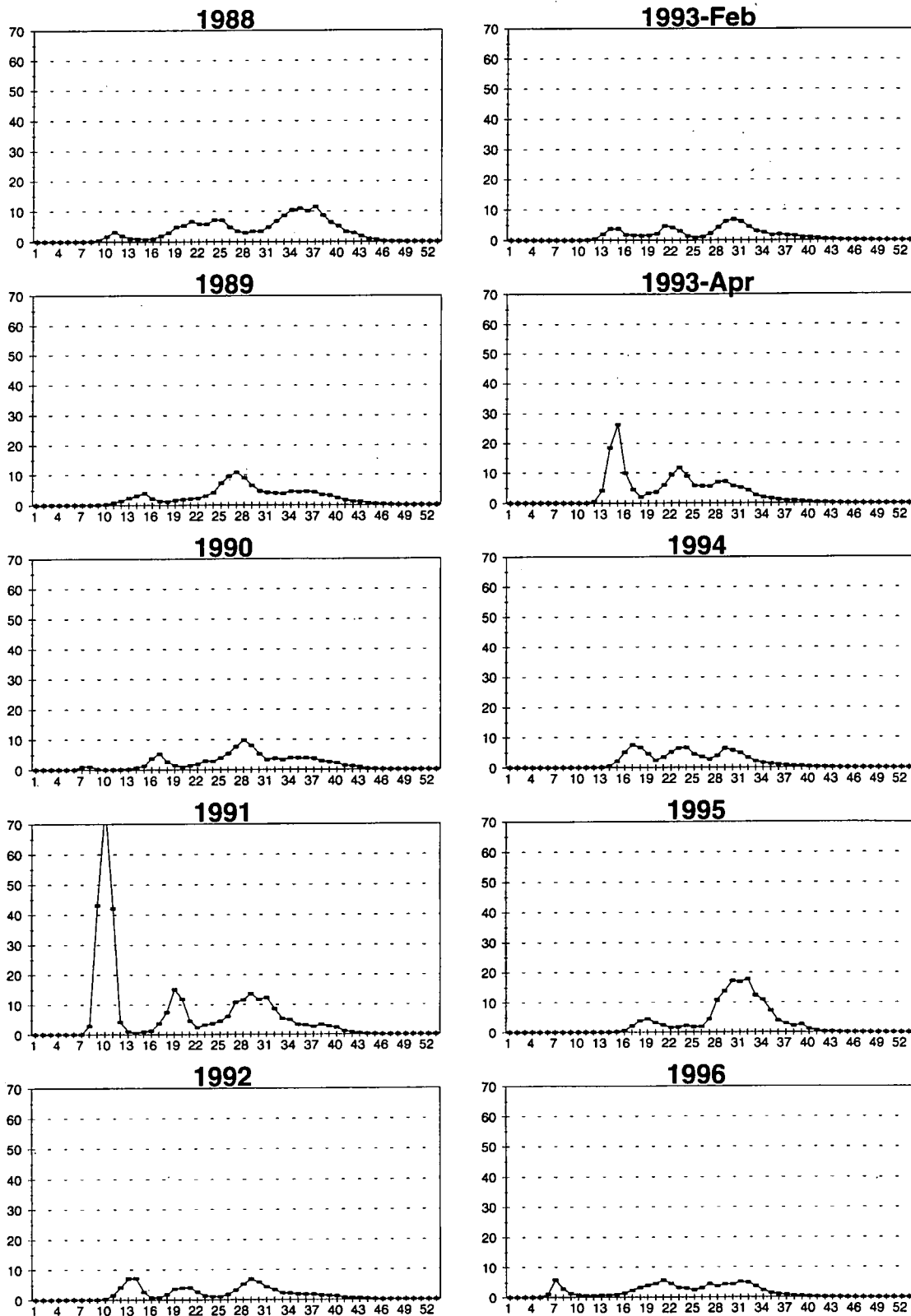


Fig. 7. Length distributions from stratified-random research surveys to Div. 3Ps in spring/winter from 1988-1996. Plotted are mean number per standard tow. X-axis is forklength in centimetres. From 1988 to 1995 and Engels trawl was used (1.75 n. mi. tow) and in 1996 a Campelen shrimp trawl was used (0.75 n. mi. tow). 1988-95 have not been converted to Campelen unit equivalents.

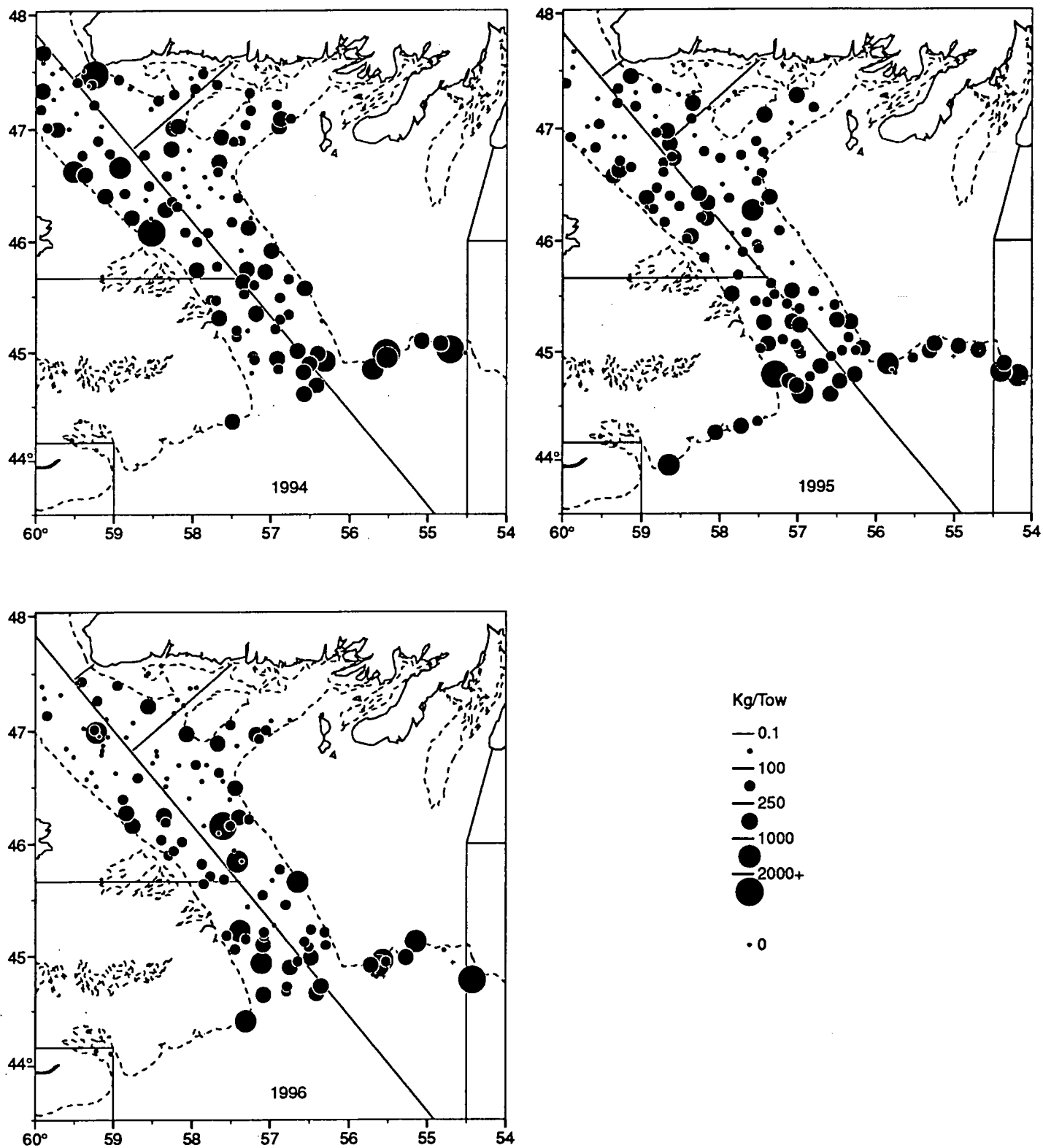


Fig. 8. Distribution of redfish catches (kg/0.75 n. mi. tow) from summer RV redfish directed surveys to UNIT2.

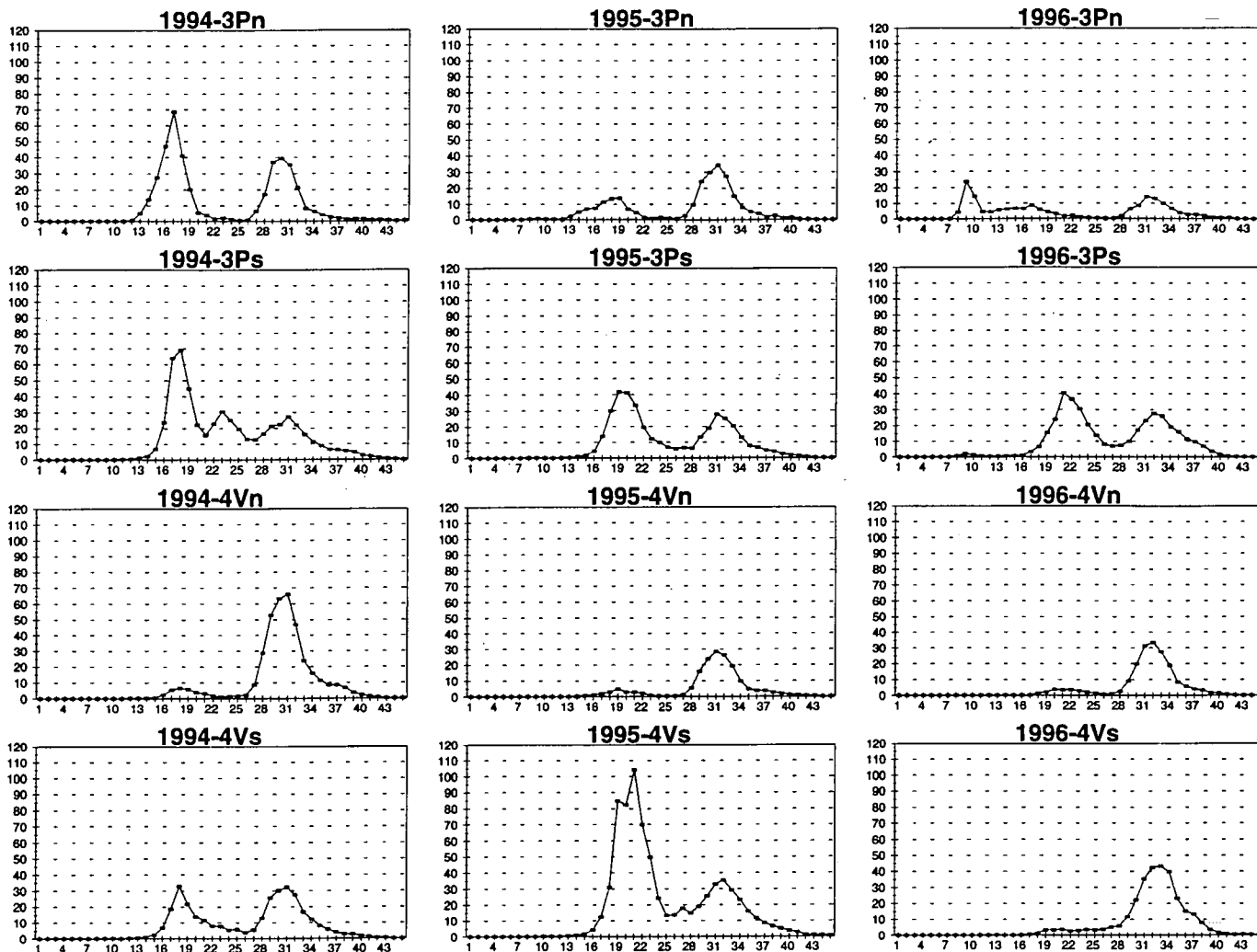


Fig. 9. Length distributions from stratified-random research surveys to UNIT2 for 1994-1996. Plotted are mean number per standard (0.75 n. mi.) tow. X-axis is centimetres. The 1994 survey was conducted by the MV Gadus Atlantica and the 1995-1996 surveys were conducted by the CSS Teleost. All surveys were conducted with a Campelen 1800 shrimp trawl.

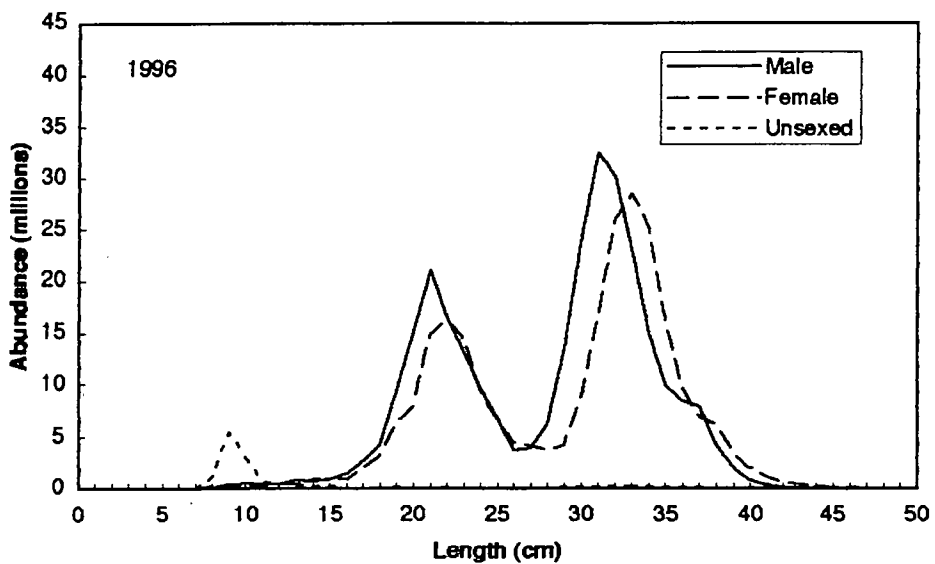
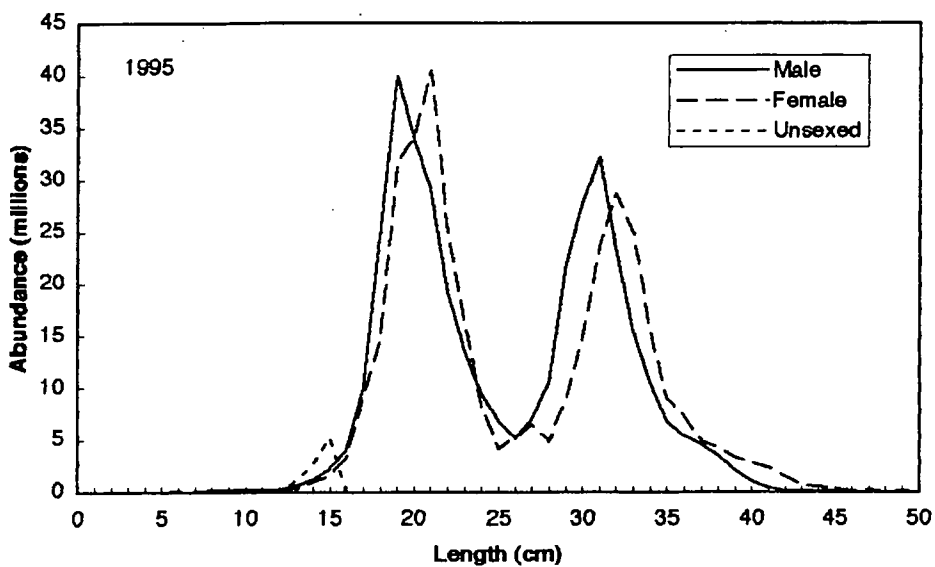
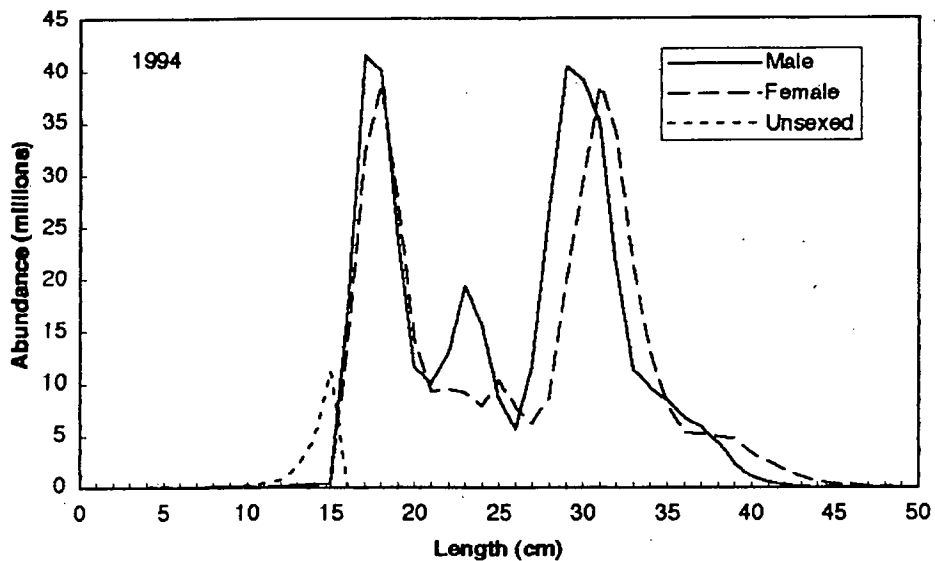


Figure 10 Length distribution from summer RV surveys of Unit 2 redfish.

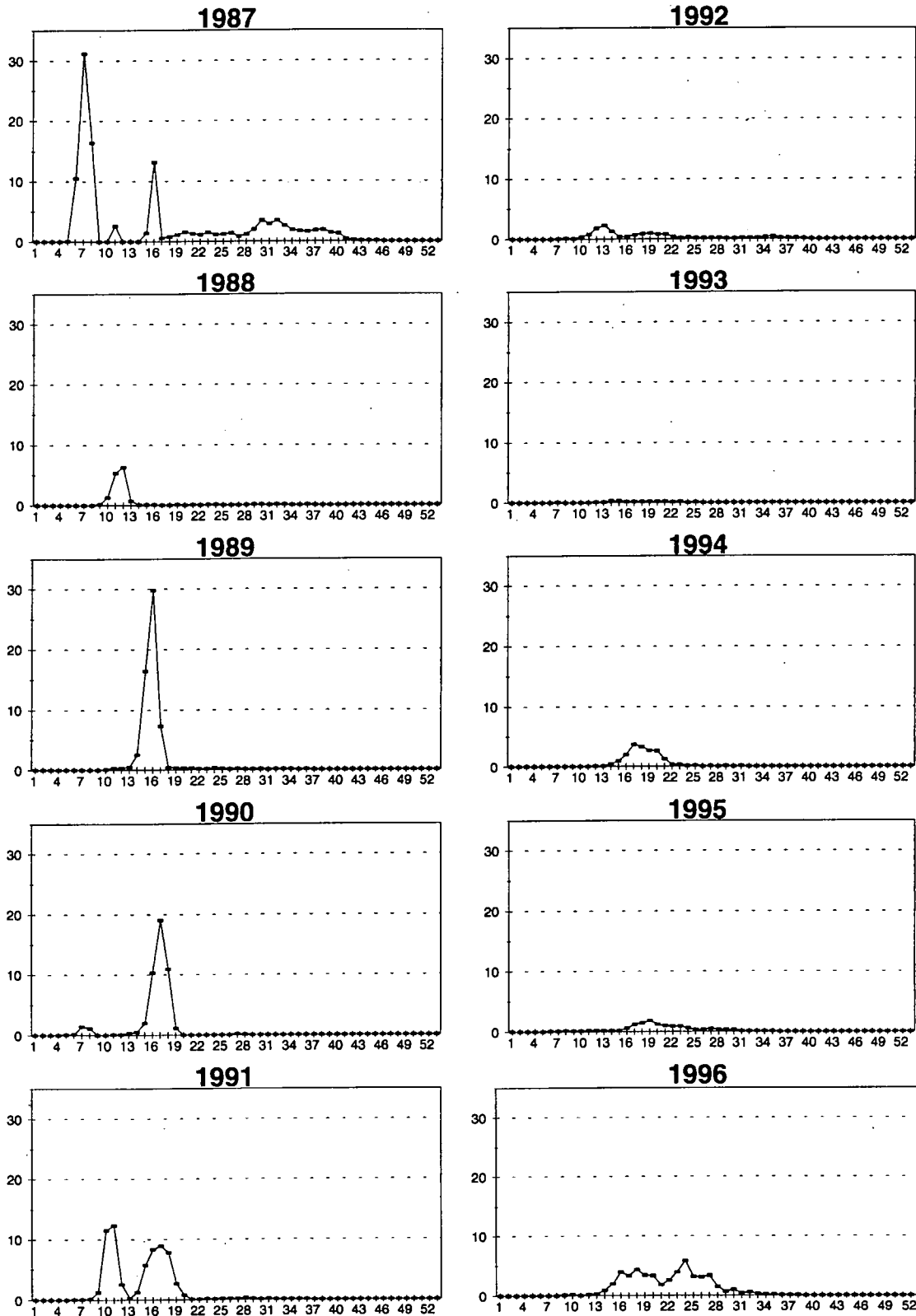


Fig. 11. Redfish length distributions from stratified-random Cod directed research surveys conducted by the Maritime Region in Div. 4VsW in the spring from 1987-1996. Plotted above are mean number per standard tow. X-axis is forklength in centimetres.

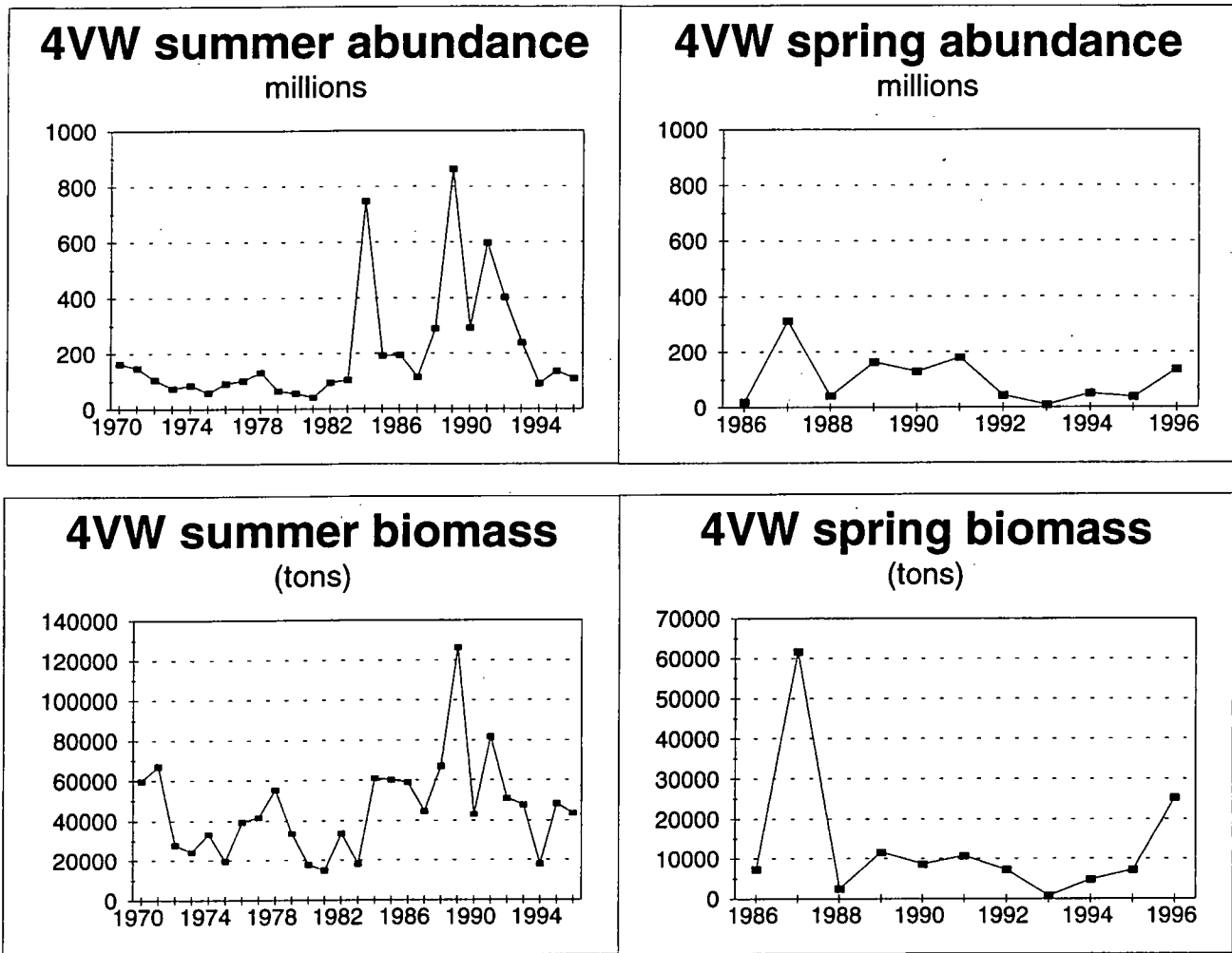


Fig. 12. Redfish abundance and biomass estimates for 4VsW Cod directed spring (1986-1996) and 4VW groundfish directed summer (1970-1996) surveys conducted by the Maritimes Region. The surveys utilize a Western Ila trawl.

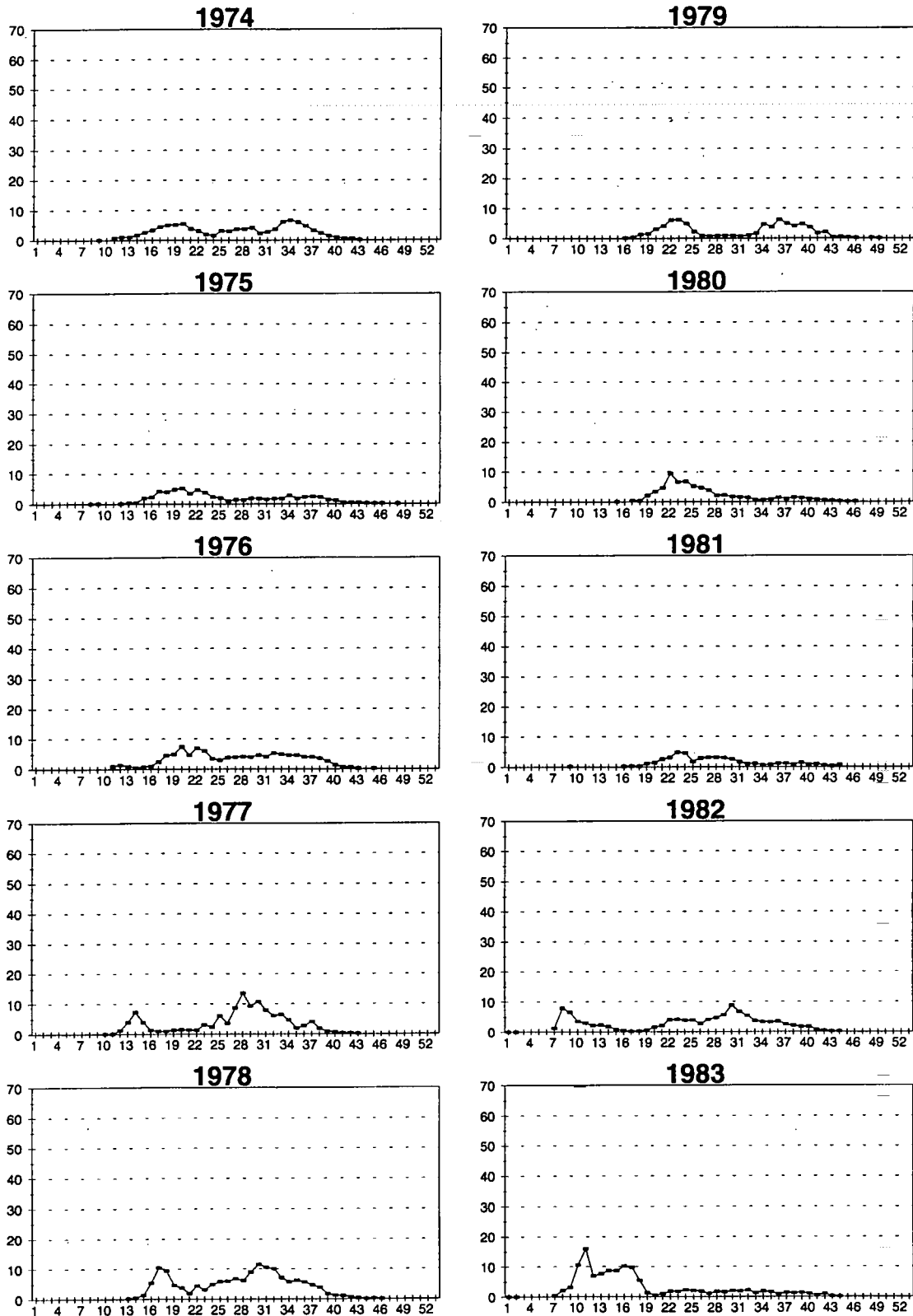


Fig. 13. Redfish length distributions from stratified-random groundfish directed research survey conducted by the Maritime Region in Div. 4VW in the summer from 1974-1996. Plotted above are mean number per standard tow. X-axis is forklength in centimetres.



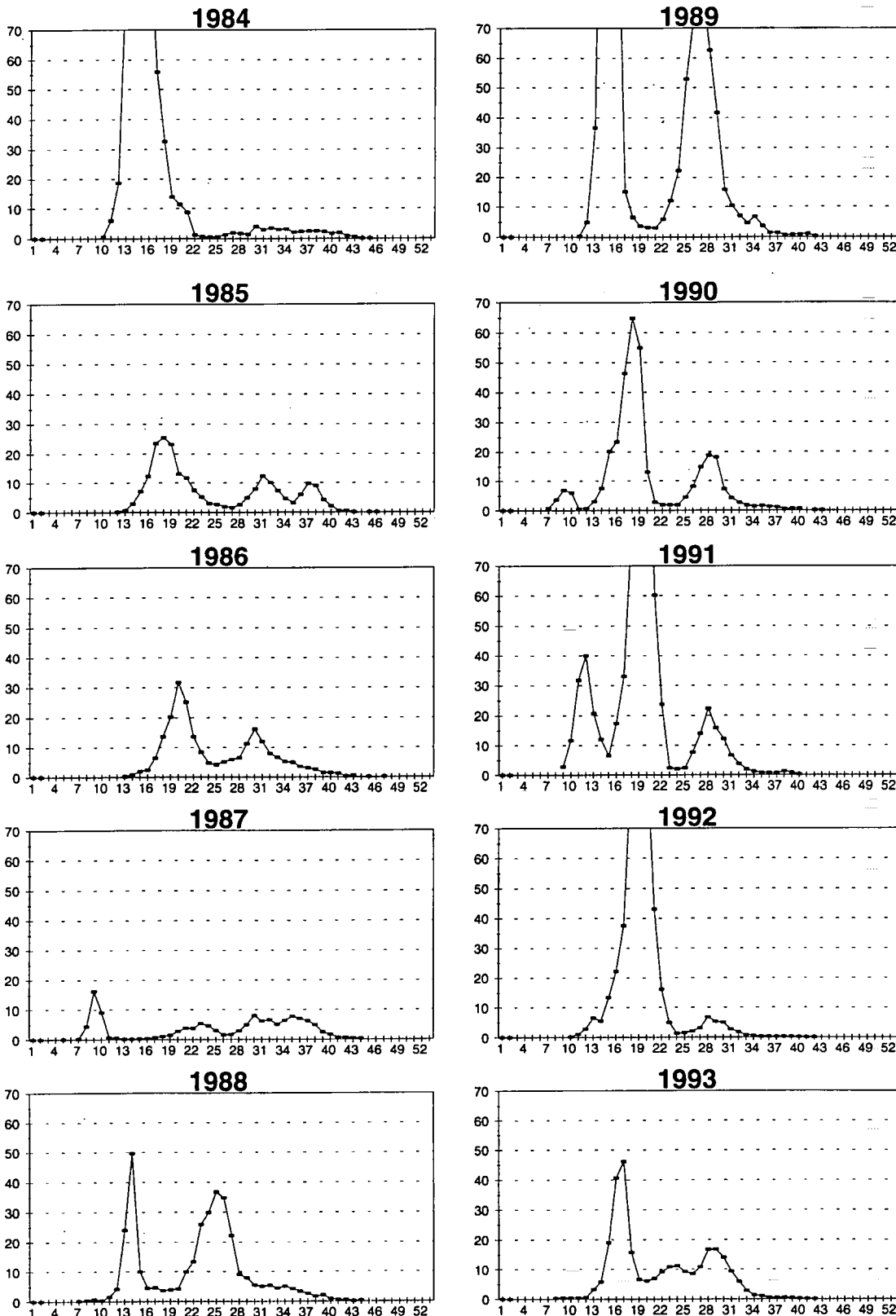


Fig. 13 (continued) 4VW summer 1984-1993

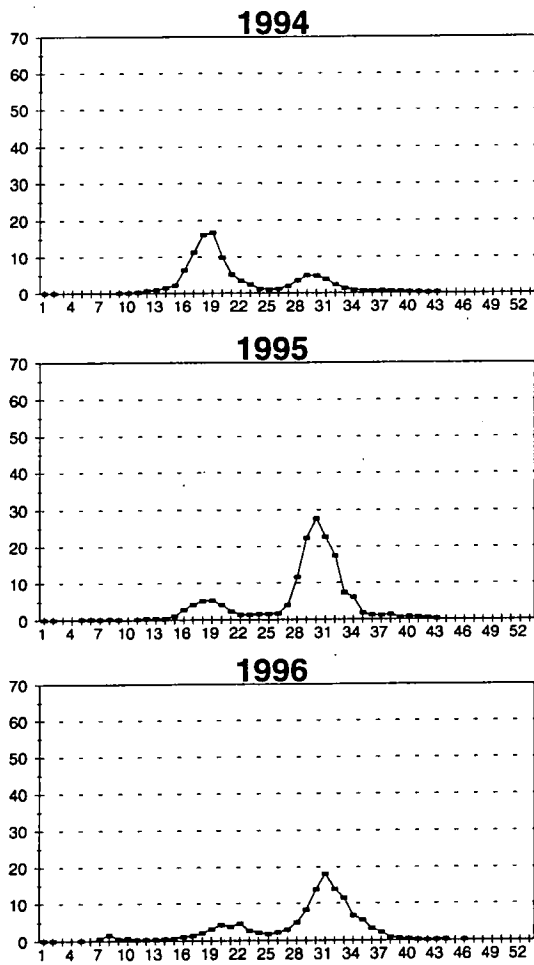


Fig. 13(continued) 4VW summer 1994-1996