

Redfish in the Gulf of St. Lawrence, on St. Pierre Bank,  
and on the Scotian Shelf (Units 1,2,3) -  
Review of Stock Status and Stock Structure.

Executive Summary

Reports from the fishing industry that indicated increasing difficulty in catching redfish in the Gulf of St. Lawrence, and catches close to the boundaries of management units, together with a further marked decline in the estimate of biomass from the 1993 summer research surveys in the Gulf of St. Lawrence led to a request by the Fisheries Resource Conservation Council for a review of stock status and stock structure.

It was not possible to provide quantitative estimates of stock abundance in any of the three management units. Information was most complete for Unit 1 (4RST and 3Pn-4Vn [Jan.-May]). The estimates of biomass from research surveys declined in 1993 for the third year in a row by 40% between 1992 and 1993, and by 70% overall since 1990, although there are wide confidence limits about the annual estimates. A decline was expected, but the observed decline is greater than would be expected on the basis of catches alone and is particularly marked in 1993 for the 1988 year-class which had earlier appeared to be strong and was expected to recruit to the fishery in the late 1990s. This information suggests that the conclusions in the 1993 Stock Status Report (SSR) are too optimistic and that maintaining catches at current levels will result in a rapid increase in the exploitation rate.

Little information is available on trends in abundance in Units 2 and 3, but there does not appear to be reason to expect major changes in stock status in the near future.

With respect to stock structure, the distribution of catches over time in the area of Cabot Strait suggests that redfish of the Unit 1 stock (Gulf of St. Lawrence) may migrate as far as Subdivision 3Pn (and perhaps 4Vn) earlier than the end of the year, may extend as far south as northern Subdivision 3Ps in March and may linger in Subdivisions 3Pn and 4Vn through the early summer. The southward movement in the late fall appears to have been earlier in 1992 and 1993 than usual. In 1993 fishing was located close to the 4R/3P border by October.

Further study of stock structure will require more detailed information on the location of the fleets over time, and in particular, for the Newfoundland vessels fishing Unit 1 and Unit 2 redfish. It will also be necessary to examine fleet distribution and catch rates by vessel size. Most of the groundfish research surveys with bottom trawls are not fully satisfactory for redfish, but plans for 1994 include more investigation of areas adjacent to those traditionally surveyed, and in particular a trawl survey of Divisions 3P and 4VW in August.

A meeting of a Fisheries Oceanography Working Group next spring will address the interrelationship between cod and redfish migration and oceanographic conditions in the area of Cabot Strait.

## Introduction

The Fisheries Resource Conservation Council held a number of consultations with the Fishing Industry and with DFO scientific staff during the summer and autumn. Many industry representatives expressed concern about the status of the redfish stocks, particularly that in Unit 1 (Gulf of St. Lawrence), and about the appropriateness of the time/area separation between the Units. DFO science staff reported declines in the estimates of abundance particularly for Unit 1 that appeared to be greater than expected. The Council requested on September 24 that DFO undertake a review of stock status and stock structure for Units 1, 2, and 3. This rapid review was undertaken by staff from the four DFO Atlantic Regions and from the National Capital Region (see Appendix)

## Background

Until 1993, redfish were managed on the basis of the Gulf of St. Lawrence (4RST), St. Pierre and Burgeo Banks (3P) and the Scotian Shelf (4VWX). During the late 1980's however, evidence accumulated that suggested these management units did not represent the actual stock structure. In particular, redfish distribution between the eastern Scotian Shelf and St. Pierre Bank appeared to be continuous in the summer and redfish from the Gulf of St. Lawrence appeared, in some years, to occur in 4Vn and 3Pn during the early months. CAFSAC, in 1991, undertook a review of redfish distribution and recommended that the management units be the western Scotian Shelf (4VsW d e h l ; X), the eastern Scotian Shelf (4W f g j) and St. Pierre Bank combined, and the Gulf of St. Lawrence. Subdivisions 4Vn and 3Pn were considered "swing" areas, with catches in January to May likely to be from the Gulf of St. Lawrence stock, but in other months to be from the eastern Scotian Shelf stock St. Pierre Bank (Figures 1-3).

CAFSAC was unable to assess the population status of the units but recommended that the sum of the existing TACs be redistributed among the new units on the basis of the average proportion of the catches during 1981-90. This proportion was:

- 66% in Unit 1 (3Pn [Jan-May] 4Vn [Jan-May] 4RST)
- 24% in Unit 2 (3Pn [June-Dec] 4Vn [June-dec] 3Ps 4W f g j)
- 10% in Unit 3 (4VsW d e h k l X)

These units were not fully introduced as management measures until 1993.

Analytical assessments are still not possible, but information from the commercial fisheries and from research surveys has provided indications of trends in stock status, particularly for Unit 1, (Gulf of St. Lawrence stock) which has yielded most of the catches. The most important information has been data on catch rates and size distribution.

#### Review of Stock Status

##### Unit 1-(3Pn [Jan-May]+4Vn [Jan-May]+4RST)

Catches from this Unit (Figure 4) increased fairly steadily from 36,000t in 1986 to 77,000t in 1992. The 1992 TAC was 57,000t for Divisions 4RST alone with some flexibility to fish in Subdivisions 3Pn. The 1993 TAC for Unit 1 is 60,000t and catches to October 6 are reported to be 44,223t. Gulf-based vessels apparently started the summer fishery later than in earlier years, whereas non-Gulf-based vessels took their allocation in the winter fishery. The rate at which total catches have accumulated is slower than in 1992 but the catch-per-hour for Gulf-based vessels appears only slightly lower than in 1992. There are reports, however, that vessels are requiring more days to catch a "full trip" which may indicate that catch-per-day is less.

The commentary on stock status provided in the Stock Status Report (SSR) of this summer indicated that the population was dominated by the 1981 and 1988 year-classes, with the fishery being supported mainly by the 1981 year-class. Prior to these year-classes, those of the 1970-72 period had been the main support to the fishery. These early 1970s year-classes and that of 1981 supported substantial increases in catch rates (Figure 5).

Results of research surveys (Figure 6) in 1990-92 suggest that the total population had been declining. In terms of biomass, the reduction between 1990 and 1991 was 40%, and between 1991 and 1992 was 20%. On the basis of this information, it was concluded that "if TACs remain at the 60,000t level, the exploitation rate will increase as the remaining biomass decreases. Catch rates will also drop as they did earlier when strong year-classes were taken up in the 1980s. However, current landings are roughly double the catches in that period; if the year-class supporting this fishery is roughly equal to the last big year-class, the biomass will decline faster this time around, because the catches are higher".

Since the 1993 Stock Status Report was prepared, the annual survey was undertaken in late August, early September. The results are preliminary, but it appears that biomass declined by a further 40% between 1992 and 1993. The overall decline between 1990 and 1993 was 70% but there are wide confidence limits about the annual estimates. The decline was seen in all sizes, but most markedly in the 1988 year-class for which the 1993 estimate of total numbers is less than one-third of what it was in 1992, which itself was only one-third of the 1991 estimate. The trends in the separate biomass estimates for the three divisions 4R, 4S and 4T have varied, but some of the areas of aggregation that have been detected have been close to the dividing lines, so small changes in location from year-to-year might account for this. The survey extended into Subdivision 3Pn in 1993 but very little redfish biomass was detected.

Other groundfish research surveys in the Gulf indicate declines in redfish abundance but they generally are not conducted at depths below 400 metres and would not be expected to consistently sample redfish.

The research survey data indicate declines in abundance that are faster than were expected, yet commercial catch rates when measured in terms of fishing time, show much less reduction. This contradiction would be explained if redfish schools retain the same density of fish, even when total abundance declines. It might be expected that, if this occurs, the schools would be smaller and/or more scattered, thus requiring more searching time and hence catch-per-day fishing would be lower. Trip length might therefore be longer in order to catch the target amount in weight. This appears to be the situation for Gulf-based vessels in 1993, but requires further analysis.

The declines in the estimates of abundance from research surveys, and particularly the relative disappearance of the 1988 year-class (which is reported also by industry) are cause for concern and would strengthen the conclusions in the 1993 SSR. Thus, not only will exploitation rates increase more rapidly, and biomass decline more rapidly than after the peak in abundance in the early 1980s, for any given harvest level, but the declines appear to be faster than would be expected on the basis of the fishery alone. Furthermore,

recruitment to the fishery in the late 1990s of a strong 1988 year-class can no longer be anticipated. The cause(s) of the decline are not known and further investigation is warranted.

Unit 2-3Pn (June-Dec)+4Vn (June Dec)+3Ps+4W f g j  
(Figure 2)

Landings increased slowly between 1984-1991, from about 10,000t to 20,000t and were about 18,000t in 1992 (Figure 7). The TAC for 1993 is 28,000t and catches as of October 6 are close to 15,000t. Fishing captains report no apparent decline in abundance and commercial catch rates appear similar, for Newfoundland vessels to those in 1992, although somewhat below 1990-91 levels(Figure 8).

Research surveys have either not extended deep enough (4V) or the results have been too variable from year-to-year (3Ps) to permit conclusions about abundance trends. The survey results (Figure 9) do however give qualitative information about relative year-class strength. Stronger year-classes were produced in 1981, 1985, and 1988 compared to other years.

Based on the commercial catch rates, the abundance of larger fish increased with the recruitment of the 1980-81 year-classes at the beginning of the 1990s. There does not, however, appear to be reason for expecting a significant change in abundance in the near future under current catch levels.

Unit 3 - 4VsW d e h k l X (Figure 3)

Landings were 6,000-7,000t in 1985-87 but decreased to about 2,000t in 1990-92 (Figure 10). In 1993, landings to the end of September were about 4,000t from a TAC of 10,000t.

The increase in landings in 1993 is almost entirely a result of increase in fishing effort. Catch rates increased only slightly between 1992 and 1993.

Research vessel survey abundance estimates vary greatly from year-to-year and no clear trends are discernable in the 1980s and early 1990s (Figure 11). Size compositions for the 1990-93 surveys give no indication of significant recruitment to the population.

In summary, there is no indication in either research survey or commercial catch rate data that there has been a significant change in stock status in 1993.

#### Review of Stock Structure

Area of capture by 10-minute rectangles as provided by the Regional Statistical Branches, was plotted for catches by Scotia-Fundy, Gulf and Quebec vessels in 1991-93 (illustrated for early 1993 in Figure 12). Information for Newfoundland vessels was not available on a geographic breakdown smaller than DFO statistical unit areas. The information refers mainly to Units 1 and 2. The redfish in Unit 1 are considered to be highly migratory and to overwinter in the southern Gulf and Cabot Strait area before moving north during the spring and early summer. Thus catches in the winter (Jan-May) have come predominantly from southern Division R and from Subdivision 3Pn. There have been high catches along the 3Pn3Ps border in some months, and there were catches in northern 3Ps in March of 1992 and 1993. Beginning in May, directed redfish catches increased in Division 4V. Redfish fishing progressed in a northwesterly direction along the southern edge of the Laurentian Channel in Division 4TV during May-August. There was a continuous distribution of catches along the Channel edge in Division 4T and Subdivision Vn during the months of July and August. Directed catches increased in the deeper water areas of the Gulf, south and east of Anticosti island in July and August. In September, directed redfish fishing in the northern part of 3Pn was greatly reduced and the fishery moves southward in subsequent months. There was little redfish catch along the Laurentian Channel edge in Division 4T in September and the main catches within the Gulf came from southern Division 4R and Subdivision 3Pn in October and November, and these extended into the centre of the Laurentian Channel in Division 3P and Subdivision 4Vn in December. More redfish were taken in Subdivision 4Vn in 1993 during the summer than in 1992.

The commercial fleet has reported that the area of fishing has moved southwards earlier in 1992, and particularly in 1993, than in previous years. In 1993, fishing in October is already at the 4R3Pn border.

Research surveys in Division 4RST have shown that the southward extent of the winter movement of Gulf redfish is variable from year-to-year and may possibly extend into SubDivision 3Ps. The spring surveys in Division 3P show most catches are made in the northeast (Burgeo Bank) and along the southern edge of St. Pierre Bank (Figure 13). The catches near Burgeo Bank straddle the 3Ps/3Pn border in some years,

It is, thus, possible, particularly in the most recent years, that Gulf redfish may extend into Subdivision 3Pn in November-December, may migrate as far as northern Subdivision 3Ps, and may linger in Subdivision 3Pn in June to possibly as late as August. These conclusions must be regarded as very preliminary since they are based on an initial examination of catches without examining abundance or fleet fishing patterns. Further study of this requires more detailed information on fleet locations, and particularly for Newfoundland vessels. It will also be necessary to analyze fleet operating strategies, incorporating vessel size, the effects of regulations (seasonality, by-catch, etc.). A meeting of scientists concerned with environmental influences on redfish and cod is to be held in spring 1994 and should provide insight on migrations in the southern Gulf of St. Lawrence.

#### Research Surveys

In general, research vessel surveys are designed to investigate a number of species and utilize otter trawls of various designs. Acoustic surveys for redfish in 3P/4V, conducted from 1989 to 1992 were discontinued in 1993 because the data were not amenable to assessing stock size. Plans for research surveys in 1994 that will provide information on redfish are:

January	3Pn-4R-4S-4T with some sets in 4Vn
March	4Vsw
March-April	3P
July	Scotian Shelf
August	3P, 4VW
August-Sept.	4RST 3Pn

The August survey will be dedicated to redfish, and will be conducted using an otter trawl.



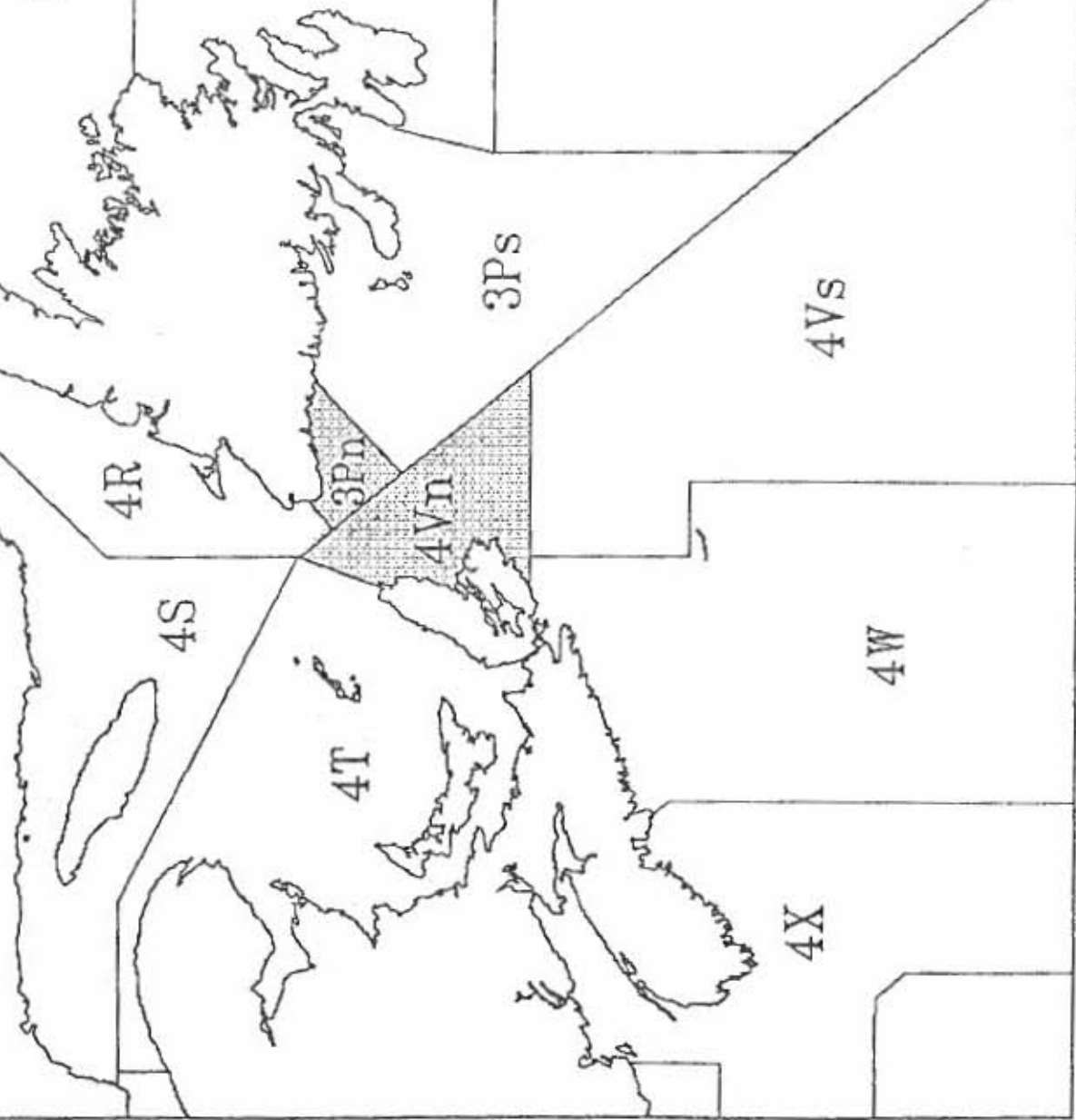
## Appendix

Scotia-Fundy: R O'Boyle, R.G. Halliday, R.Branton  
Newfoundland: B. Atkinson, D. Power  
Gulf: A. Sinclair  
Québec: B. Morin  
NCR: J.S. Beckett (Chair).

Gulf of St. Lawrence Redfish Stock

Unit 1

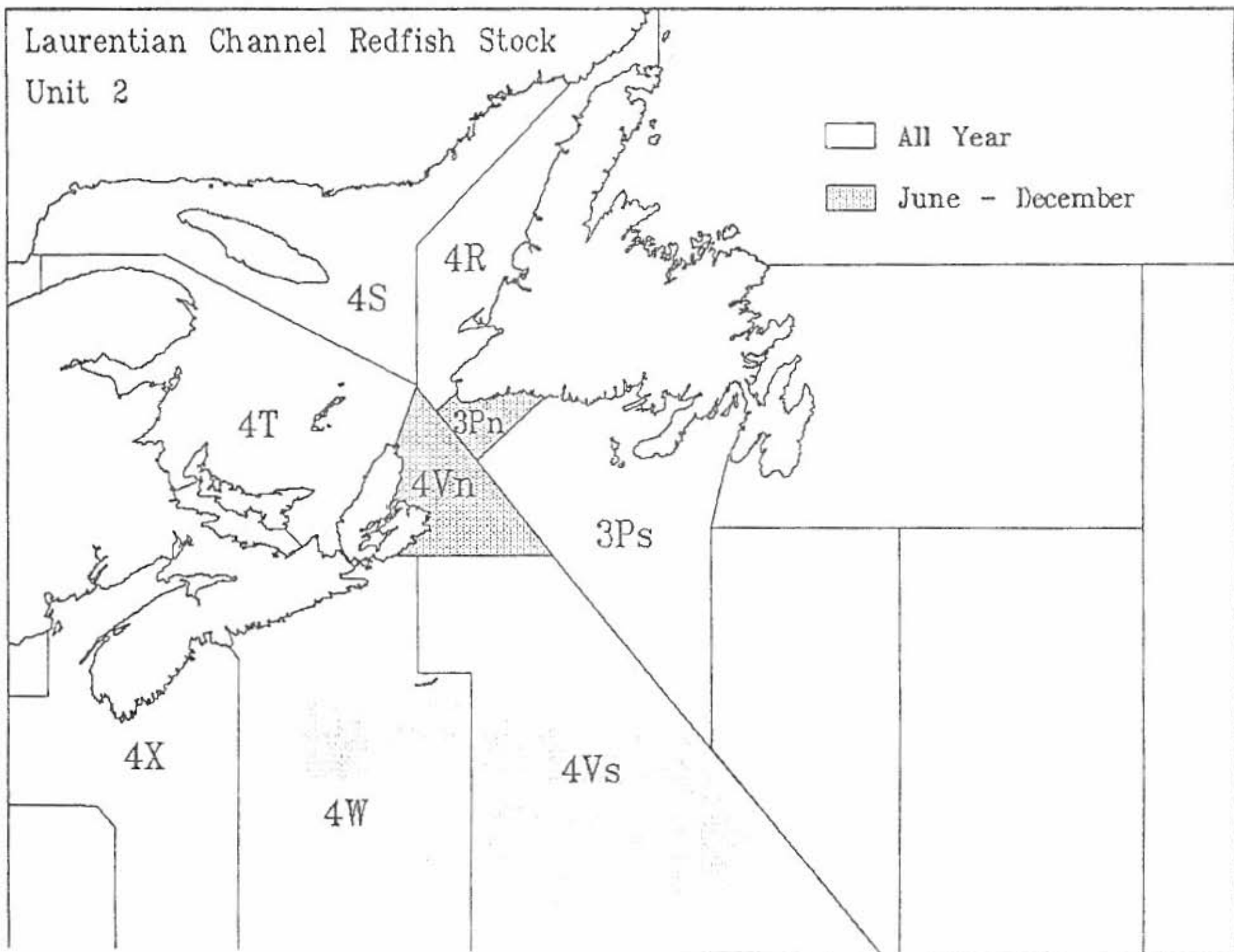
- All Year
- ▨ January - May



Laurentian Channel Redfish Stock  
Unit 2

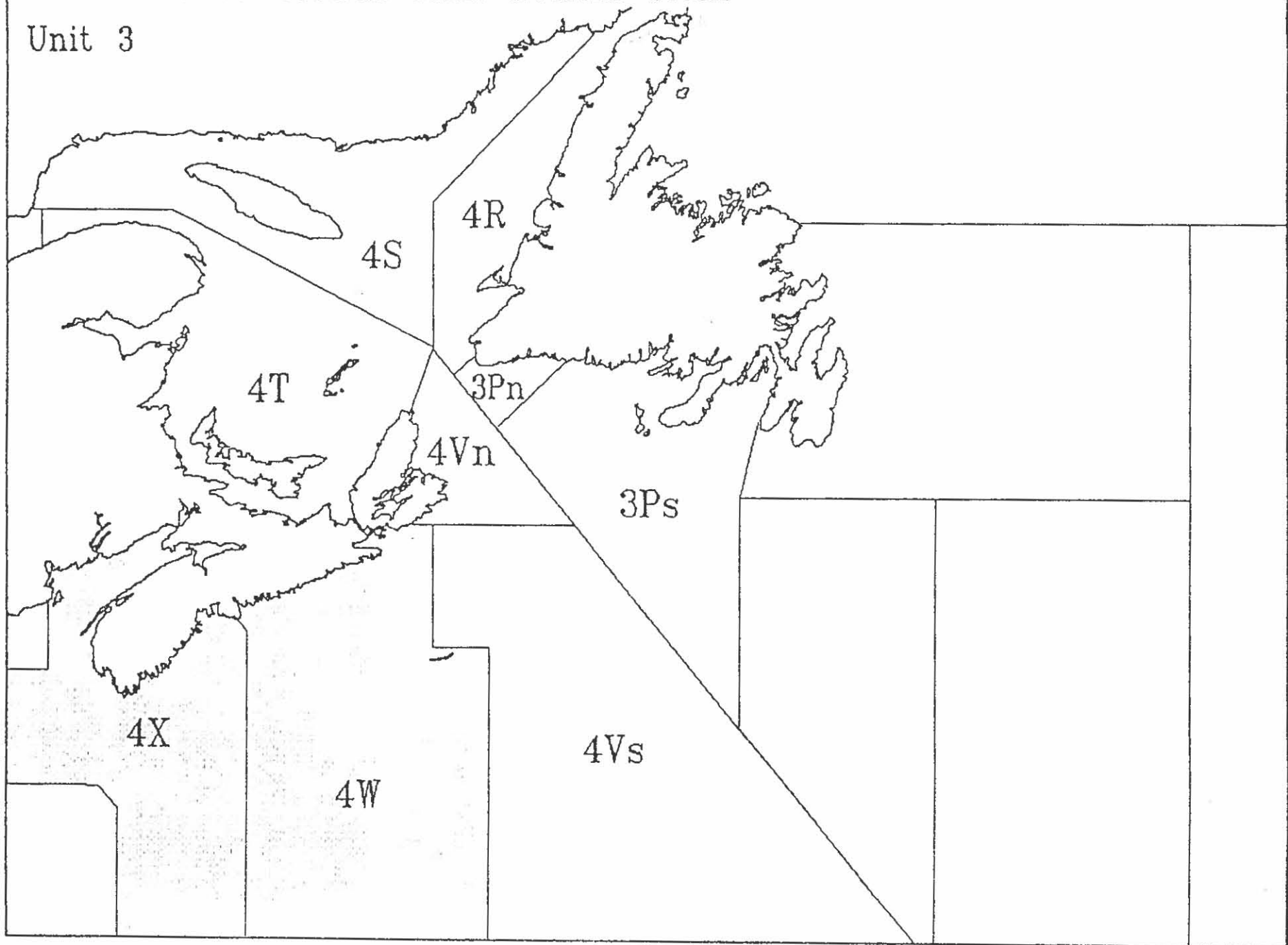
□ All Year

▨ June - December



South Western Scotian Shelf Redfish Stock

Unit 3



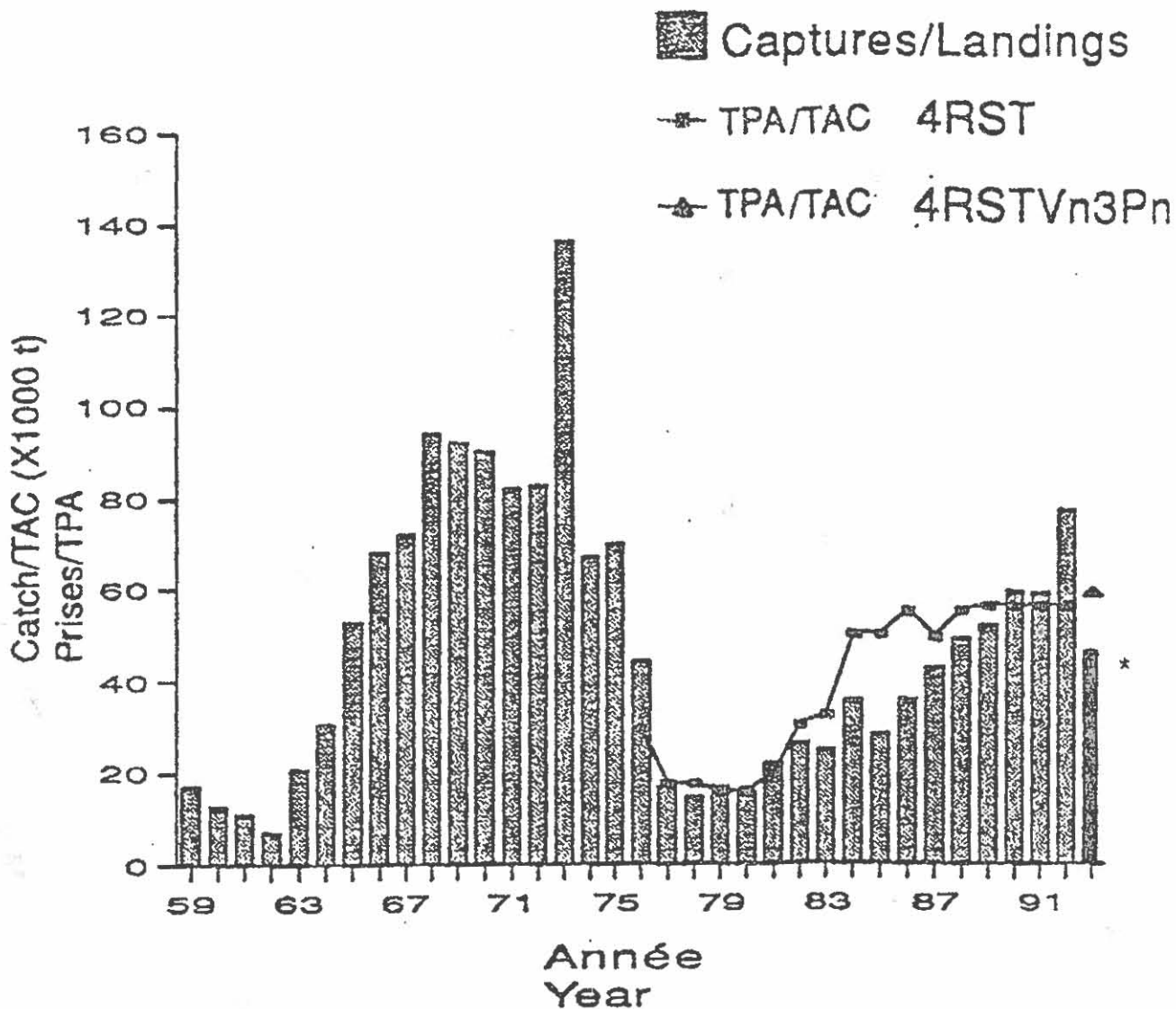


Figure. 4. Série historique des débarquements de la pêche commerciale du sébaste du golfe du Saint-Laurent (4RSTVn3Pn).  
 Historical commercial landings of redfish in the Gulf of St. Lawrence (4RSTVn3Pn).

\* Données préliminaires (jan.-oct.) / Preliminary data (Jan-Oct)

OTB Bateaux du Golfe (mai-octobre)  
OTB Gulf based vessels (May-October)

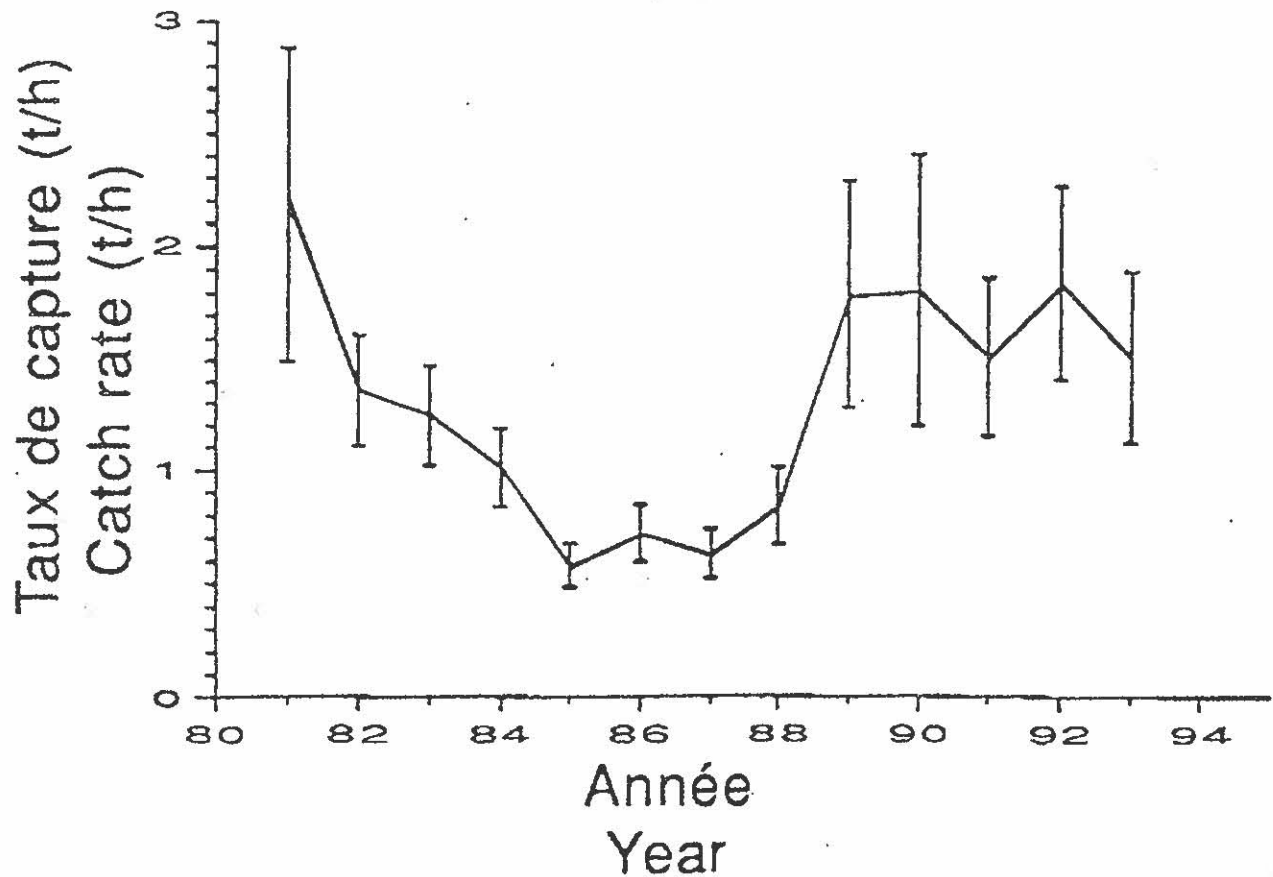


Figure 5. Taux de capture standardisés des chalutiers des classes de tonnage 4 et 5 pêchant du sébaste de l'unité 1 et utilisant des chalut de fond (OTB). (1993= mai à septembre)

Standardized catch rates of bottom trawlers (OTB) of tonnage classes 4 and 5 fishing unit 1 redfish. (1993= May to september)

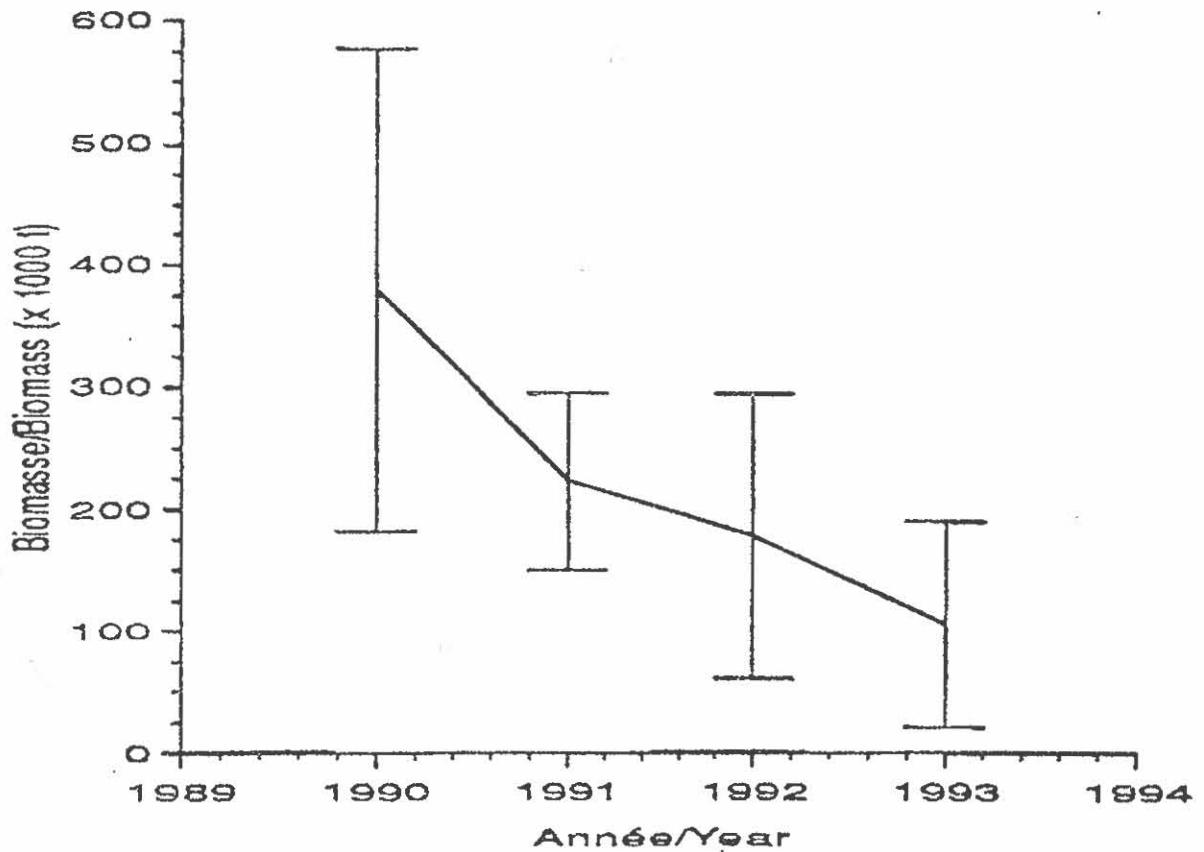


Figure 6. Biomasse exploitable minimale ( $\pm$  IC 95 %) de sébaste estimée à partir des relevés de recherche d'été.

Minimum exploitable biomass ( $\pm$  CI 95 %) of redfish as estimated from the summer RV survey.

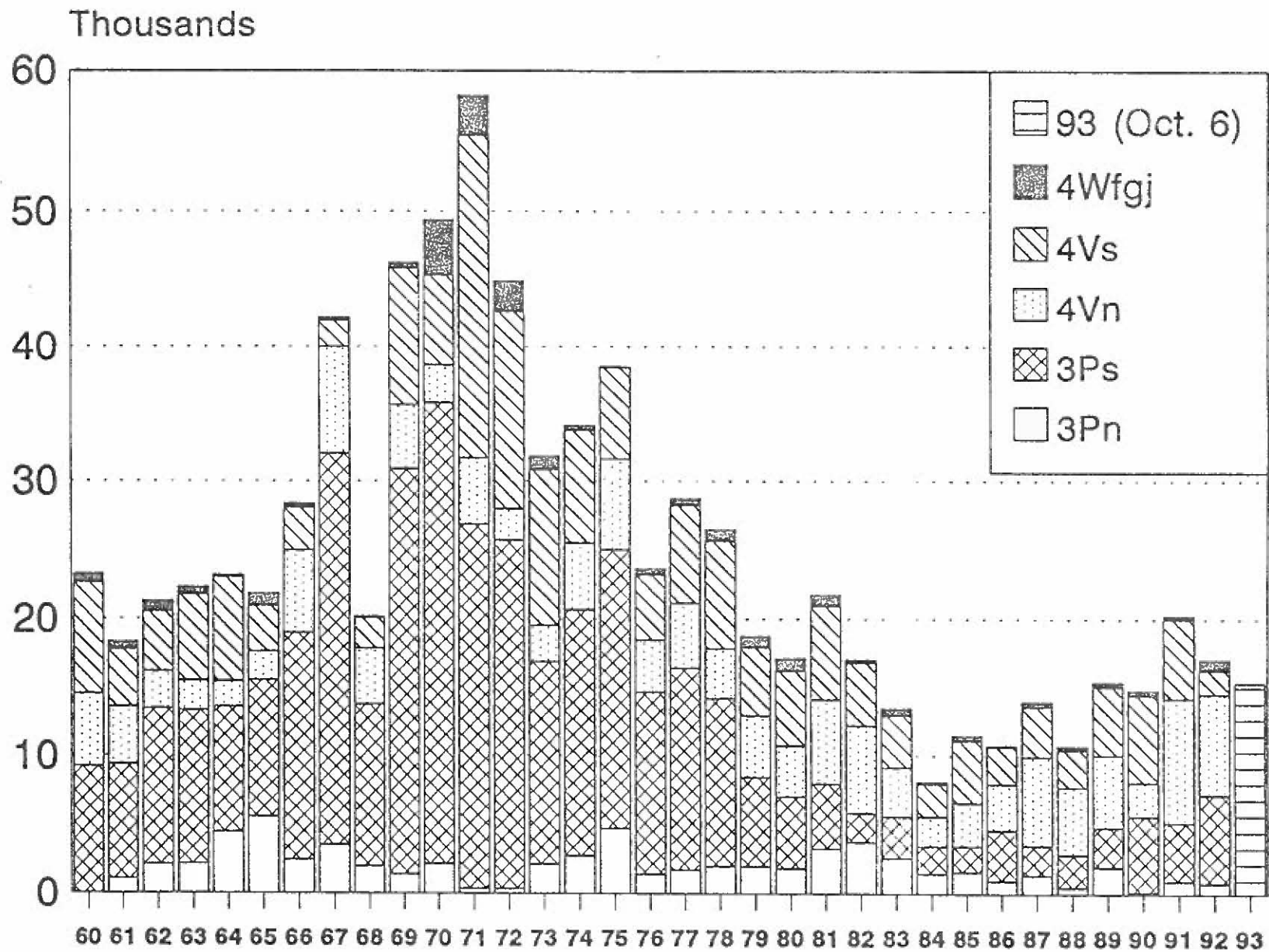


Fig. 7. Nominal catches ('000 t) of redfish from the "Laurentian Channel" management unit for the period 1960-1993(3Pn and 4Vn from Jun-Dec).



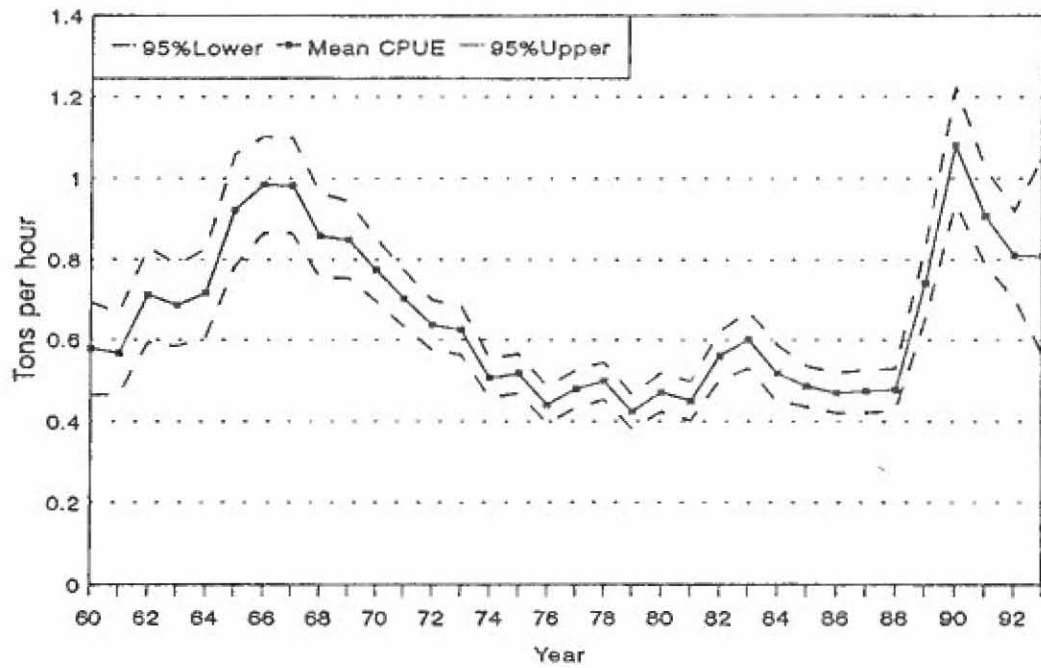


Fig. 8. Standardized CPUE for redfish in Unit 2 from 1960-93. (1993 only contain provisional Nfld. data)

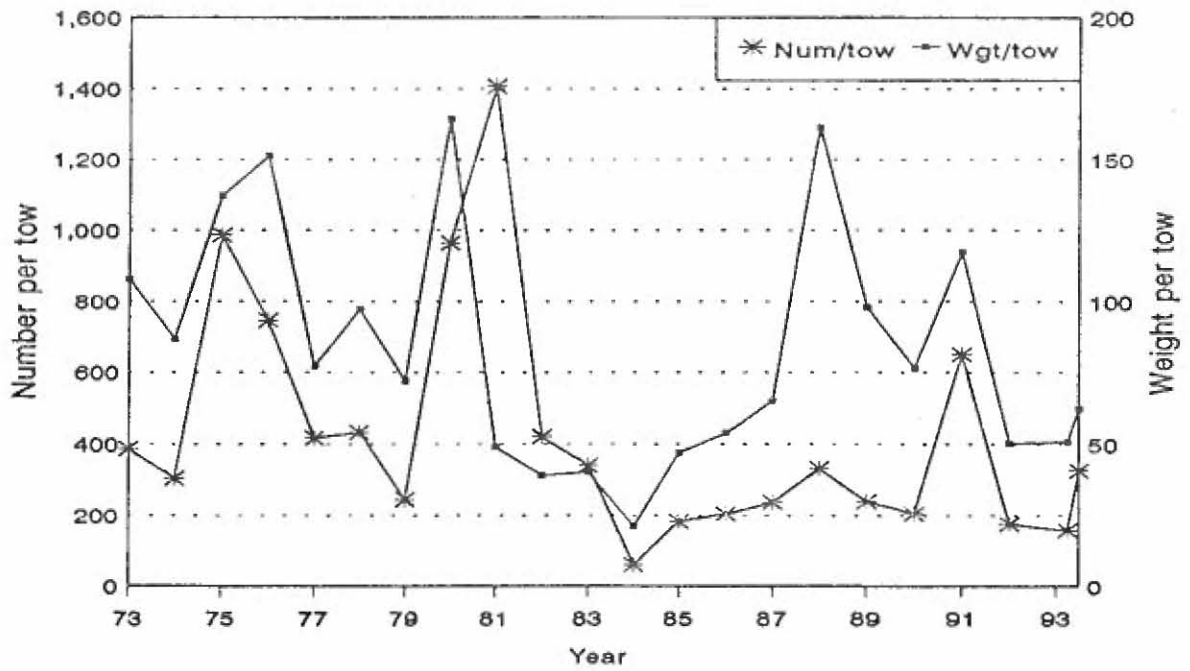


Fig. 9. RV mean numbers and weights per standard tow for redfish in Subdiv 3Ps. from 1973 to 1993

Fig 10. Unit 3 Redfish Annual Catch '80 to '93

Taken from CAFSAC ResDoc 92/65, NAFO Stata Bulls for 1980-1991 and Zonal Landings Database for 1992-1993

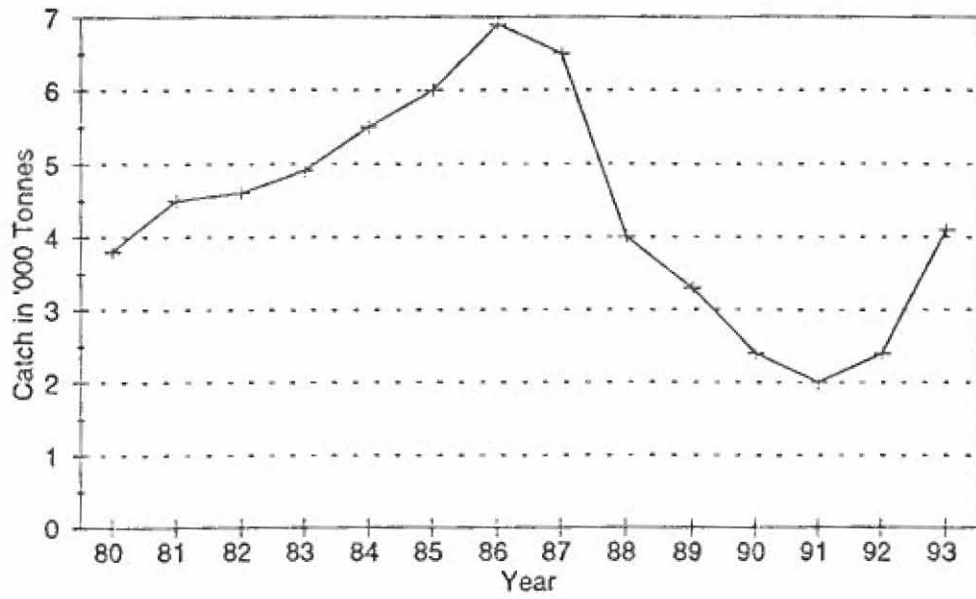
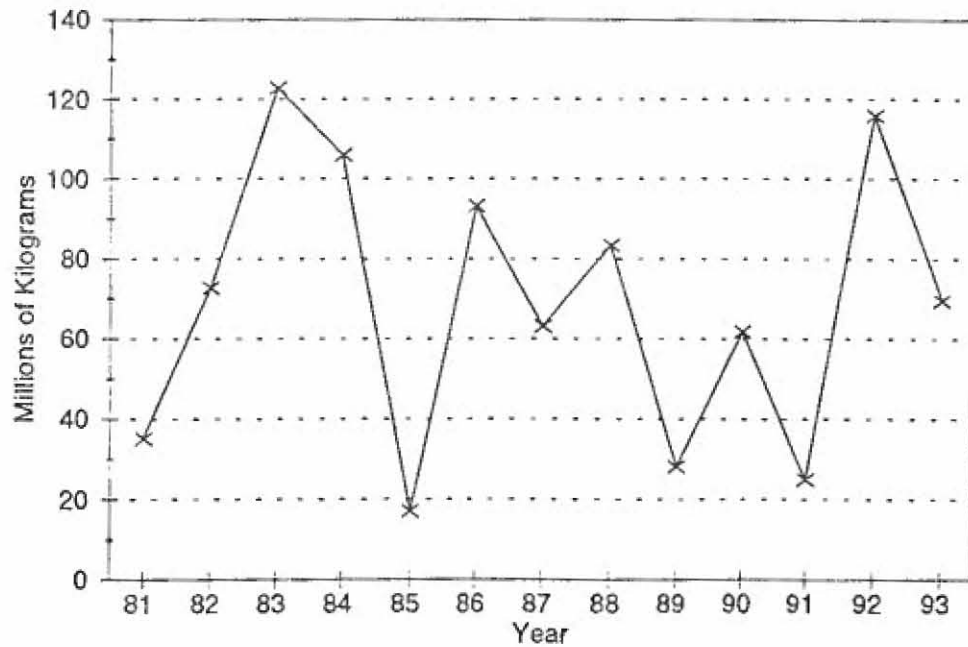


Fig 11. Unit 3 Redfish Biomass '81-'93

S.F. Summer Surveys Strata 456 458/495



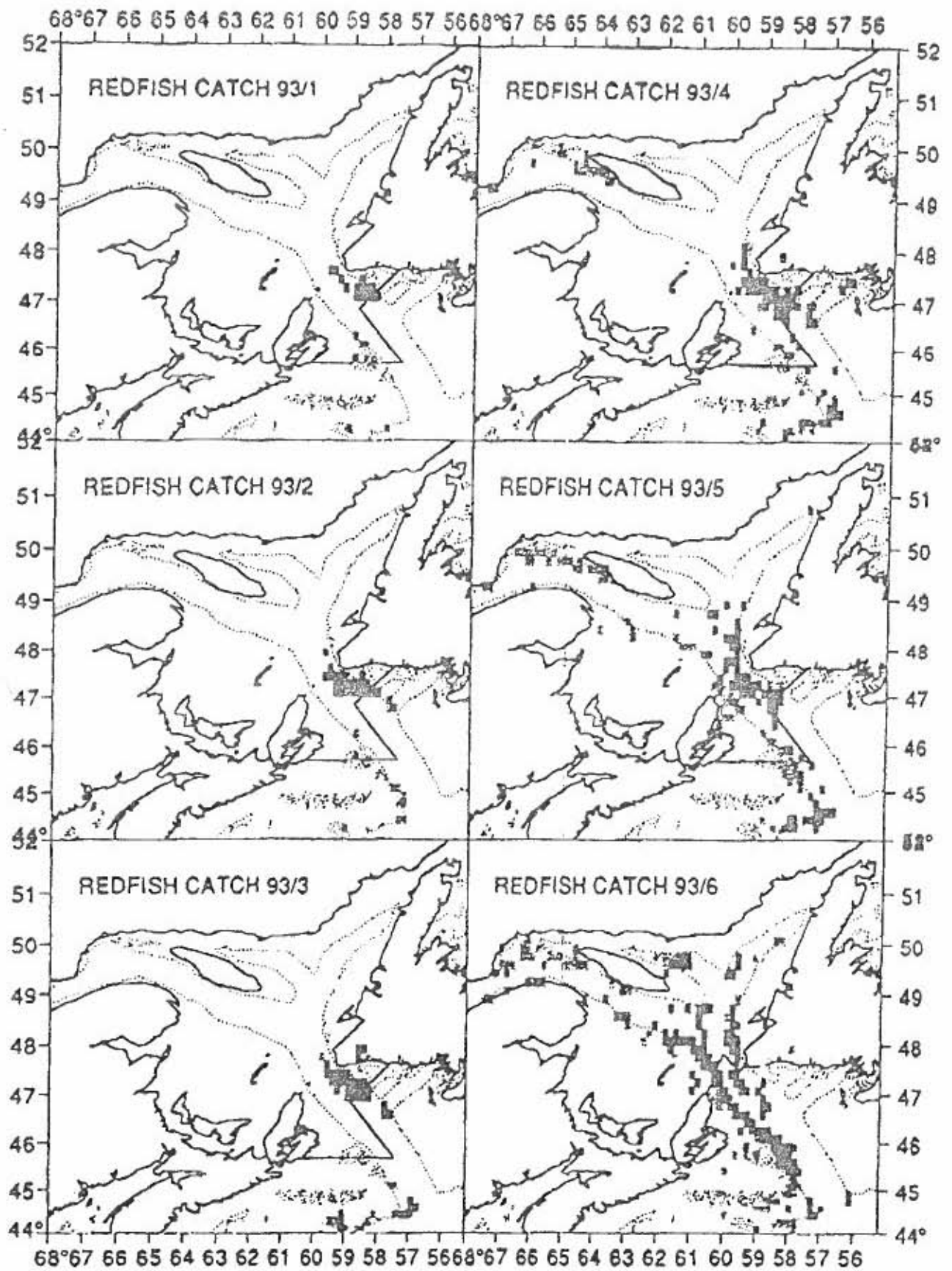


Fig 12: REDFISH catches 1991-93. Shading intervals are 0.2, 2, 20, and 100 t.

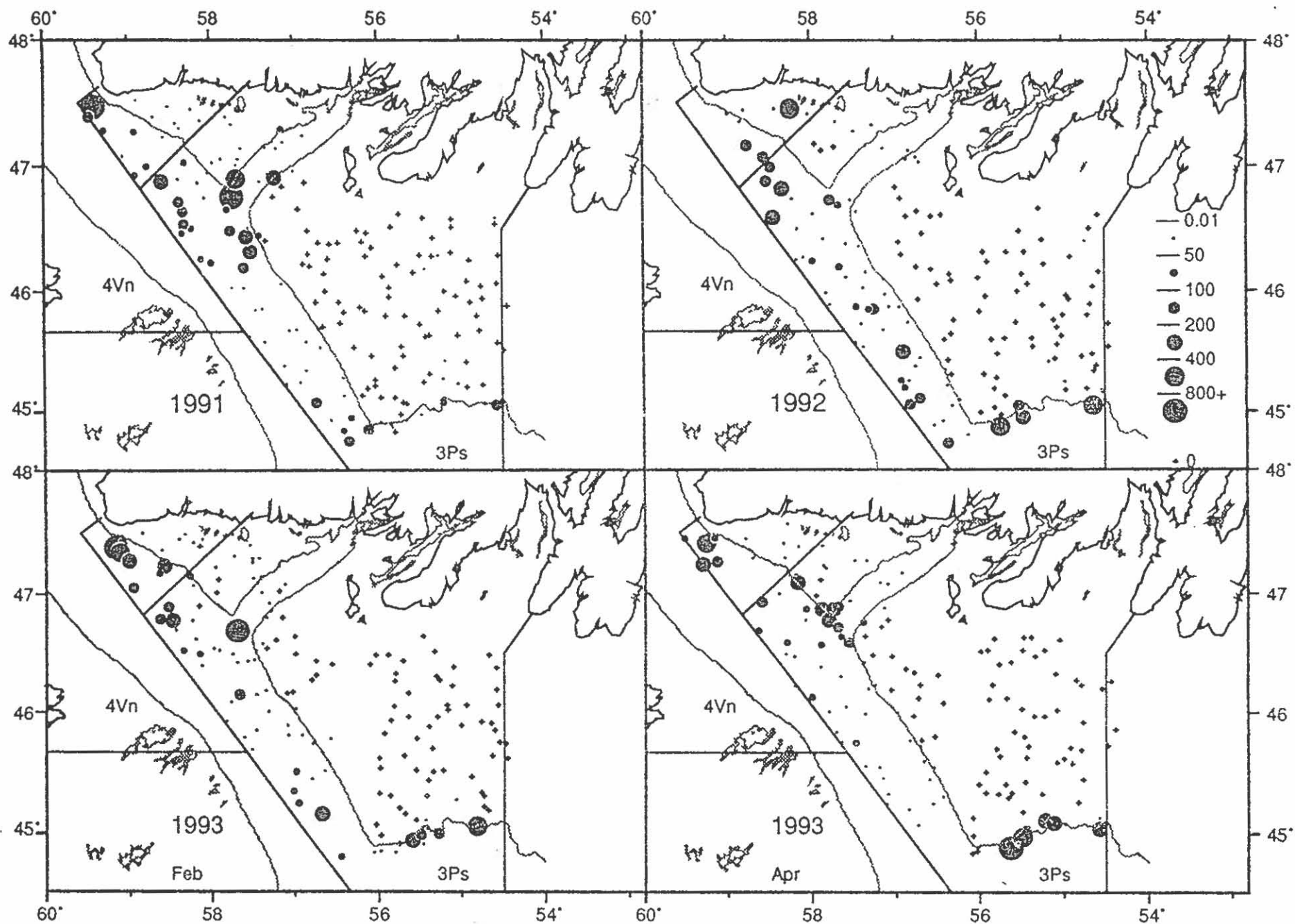


Fig. 13. Distribution of Redfish catches (Kg./standard tow) from 1991-1993 Canadian spring surveys to Div. 3P showing 250m depth contour.