

Status of Northwest Atlantic Redfish in Units 1, 2, 3 and in NAFO Division 3-0

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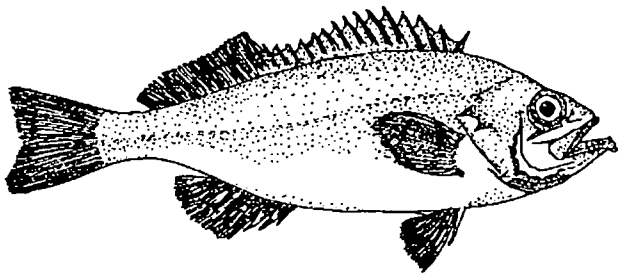
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REDFISH OVERVIEW

Redfish, also known as ocean perch or rosefish, belongs to a group of fish that are commercially exploited in both the Atlantic and Pacific Oceans. They occur on both sides of the Atlantic Ocean in cool waters (3° to 8° C) along the slopes of fishing banks and deep channels in depths of 100-700 m. In the west Atlantic, redfish range from Baffin Island in the north to waters off New Jersey in the south.

Three species of redfish are present in the northwest Atlantic (*Sebastes mentella*, *S. fasciatus* and *S. marinus*). These three species are similar and are nearly impossible to distinguish by their appearance. They are not separated in the fishery, and they are managed together. Except for the area of the Flemish Cap, *S. marinus* is relatively uncommon, but there is a geographic cline for *S. mentella* and *S. fasciatus*, *S. mentella* being the only species in the far north (Davis Strait) and *S. fasciatus* being the only species in the south (Gulf of Maine). In the intermediate areas, a mixture of the two is found, with *S. mentella* generally distributed deeper than *S. fasciatus*. The exception to this general trend is the Gulf of St. Lawrence where *S. mentella* dominates.

Redfish are slow growing and long lived. Specimens have been aged to at least 80 years. *S. fasciatus* is slower growing than *S. mentella*. Growth is usually faster in southern areas than in

northern areas, and females grow faster than males. On average, redfish take approximately 8 to 10 years to reach commercial size (25 cm or 10 inches).

Unlike many other fish species, fertilization in redfish is internal and females bear live young. Mating occurs in the fall and females carry the developing young until the spring when they are released from April to June. In all areas examined, *Sebastes mentella* release their young a month earlier than *S. fasciatus*.

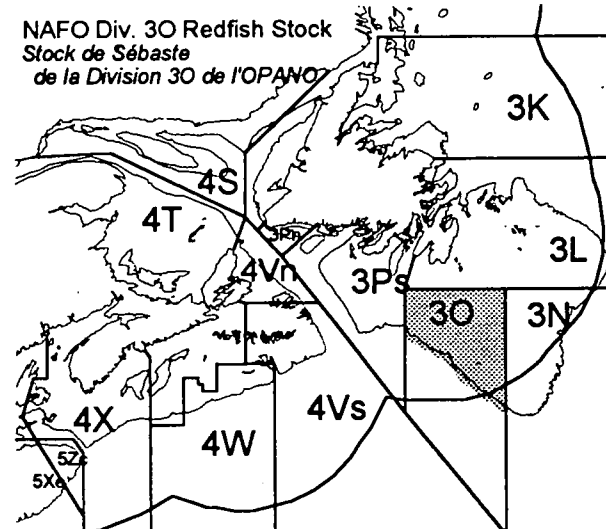
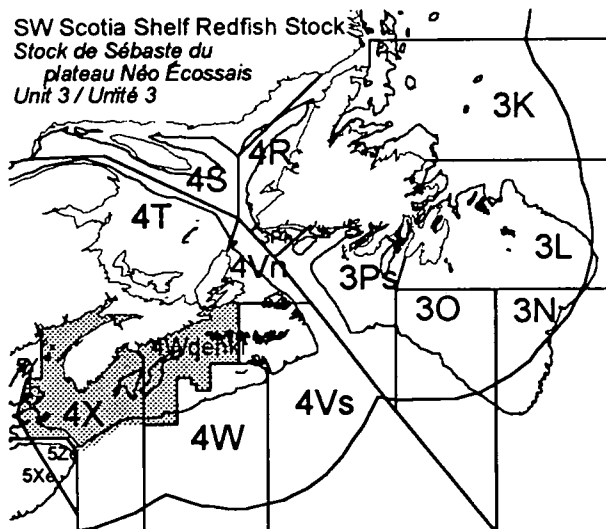
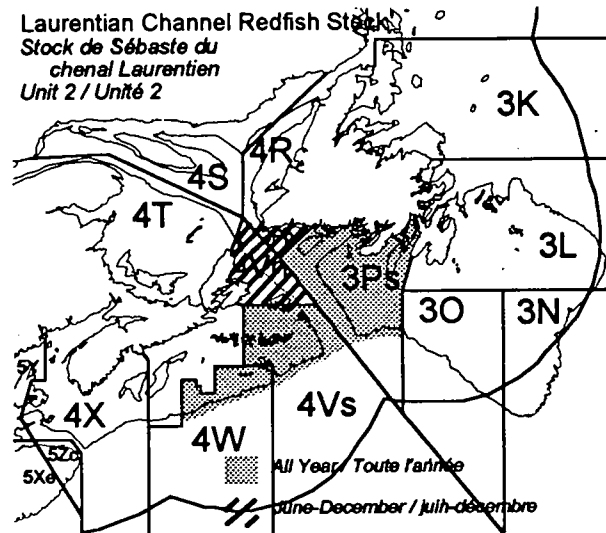
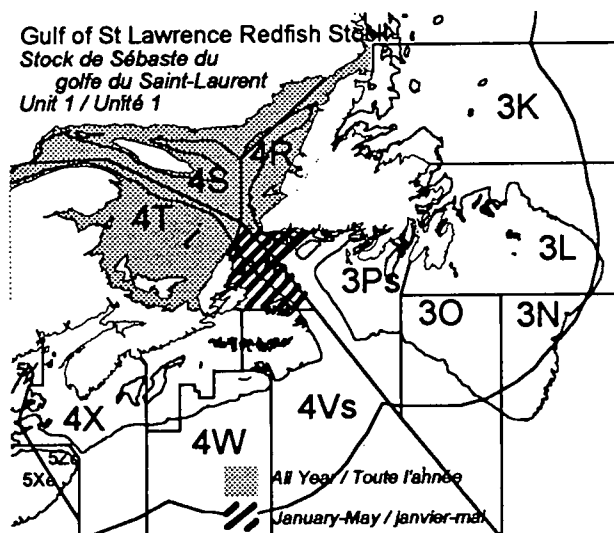
Recruitment success in redfish is extremely variable, and significant year-classes have been observed only at 5 to 12 year intervals.

In addition to being found near the bottom, redfish are often distributed well up in the water column. Fisheries take place using both bottom and mid-water trawls.

At present, there are eight (8) redfish management areas in the Northwest Atlantic: Subarea 2 + Division 3K, Divisions 3LN, Division 3O, Division 3M (Flemish Cap), Unit 1 (Gulf of St. Lawrence), Unit 2 (Laurentian Channel), Unit 3 (Scotian Shelf) and Gulf of Maine (Subarea 5). Except for the Flemish Cap and the Gulf of Maine, Canada has prosecuted redfish fisheries in these different management areas to varying degrees since the late 1940s. The most commonly fished areas have been Subarea 2 + Division 3K, as well as Units 1, 2 and 3.

Assessment and management strategies employed for redfish stocks have been the same as those applied to other groundfish. Reference levels were based on $F_{0.1}$ (12% exploitation rate) and F_{MAX} (24%) or MSY (maximum sustainable yield) and 2/3 the effort at MSY .

Although, it is well recognized that for the sustainability of fish stocks, female fish should be allowed to spawn at least once before being harvested, this has not been part of redfish management strategies to date. Based on



previously published information (Ni and Sandeman 1984), the average length at which 50 % of female redfish in divisions 3O, 3P, 4R, 4S, 4T, 4V, 4W and 4X are mature is about 27 cm (10.5 inches), ranging from 24.4 cm (9.6 inches) in 4W to 29.6 cm (11.7 inches) in 3P. Length frequency data from the 1994 commercial fisheries suggest that in Unit 3, about one half of the catch was less than 27 cm, and in Unit 2 about one third were below this length. For Division 3O, the picture is less clear, but it is likely that much of the catch was below 27 cm.

Because of its biology, the pattern of recruitment, and the presence of 2 or 3 species currently indistinguishable on a routine basis, management strategies and tools developed for other groundfish are not easy to apply and may not be appropriate for redfish. There is a need to develop new approaches, specific to redfish, to better understand and manage these stocks.

In recent years, with the decline of other groundfish, more sectors of industry have shown a renewed interest in redfish. This was particularly so in the Gulf of St. Lawrence (Unit 1), off Newfoundland's south coast (Unit 2) and

in the Scotian Shelf area (Unit 3). Although Division 30 has been traditionally avoided because of small fish, interest in fishing this area increased as well.

Industry has expressed a great deal of concern about the status of these redfish resources. Questions of stock structure, recruitment, assessment, and management approaches have been identified by stakeholders as the major issues. This has led to the establishment of a joint DFO/Industry Multidisciplinary Research Programme on redfishes in these areas.

What follows includes information specific to four redfish stocks (Units 1, 2, 3, and Division 30). It was prepared at a meeting of a zonal working group of redfish scientists held in Dartmouth during September 25-27. Redfish assessments were updated following the completion of the 1995 summer groundfish surveys on the Scotian Shelf (conducted by the Maritimes Region), in the Laurentian Channel (Newfoundland Region) and the Gulf of Saint Lawrence (Laurentian Region).

References

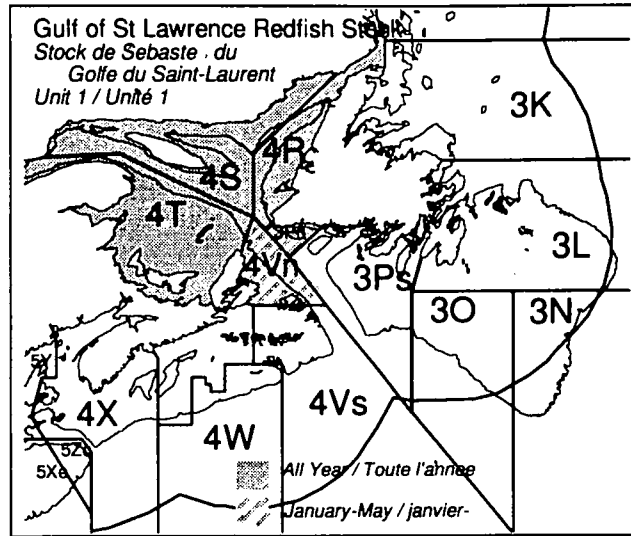
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UNIT 1 REDFISH

Background

Unit 1 represents a relatively new management unit. Redfish in the Gulf of St. Lawrence were previously managed as NAFO divisions 4RST only. In 1991, based on a detailed examination of available data, a recommendation was made to modify the management units to consider the winter migration of redfish to the Cabot Strait area. Thus 3Pn4Vn-Jan. to May, were included with 4RST to constitute the Unit 1 stock.

The new management units were put in place beginning in 1993. The quota for Unit 1 in that year was 60,000 t.



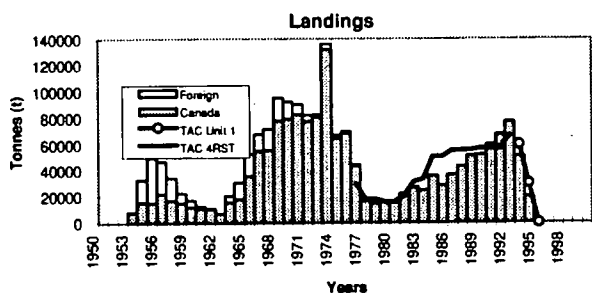
The Fishery

The redfish fishery in the Gulf of St. Lawrence has been characterized by two periods of high exploitation; the first one at the beginning of the 1970s and the second in the 1990s. These two periods are closely linked to the recruitment of strong year-classes. Following these peaks, landings dropped rapidly. For the most recent years, landings have decreased from 77,000 t in 1992 to about 19,500 t in 1994. The TAC for Unit 1 redfish was set at 60,000 t in 1993 and reduced to 30,000 t in 1994. Offshore vessels (> 100 feet) only caught 65 % of their allocation in 1994. The 1994 winter fishery in the Cabot Strait area was greatly reduced compared to the 1990-1993 period. The directed redfish fishery in Unit 1 was closed in 1995 due to low stock abundance.

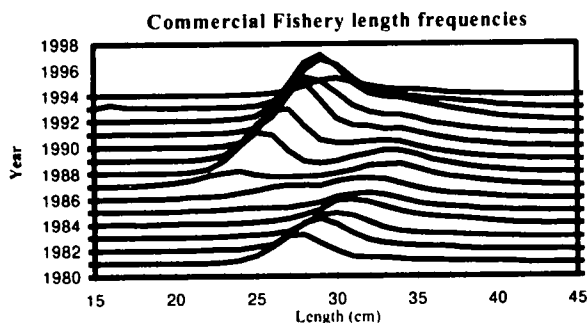
Landings (thousand tonnes)

Year	70-76 Avg.	77-90 Avg.	1991	1992 ¹	1993 ¹	1994 ¹	1995
TAC	-	-	-	-	60	30	0
Can.	79	32	68	77	51	19	
Others	3	0	0	0	0	0	
Totals	82	32	68	77	51	19	

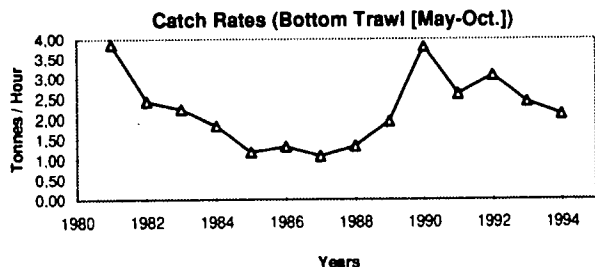
¹Provisional



Size composition from the commercial fishery for the 1981-1987 period showed that catches were mainly composed of fish born at the beginning of the 1970s (mainly 1970 year-class). Afterward, fish born at the beginning of the 1980s (mainly 1980 year-class) dominated the catches. Based on recent species identification from research surveys, *Sebastes mentella* dominated these year-classes. Modal length of redfish caught in 1994 was around 30 cm.



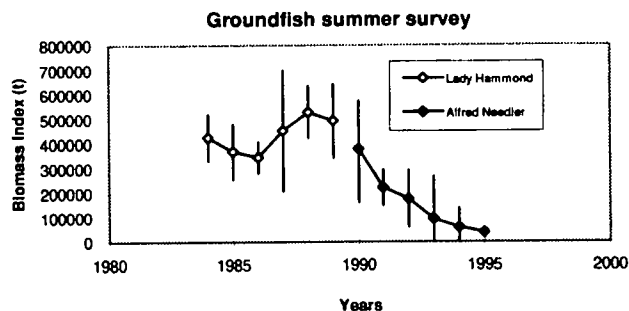
Catch per unit of effort (CPUE) of large trawlers (tonnage classes 4 and 5) using bottom trawls from May to October (the period when this gear was principally used) decreased by 45 % since 1990 when the best catch rates were observed for the 1990 to 1994 period.



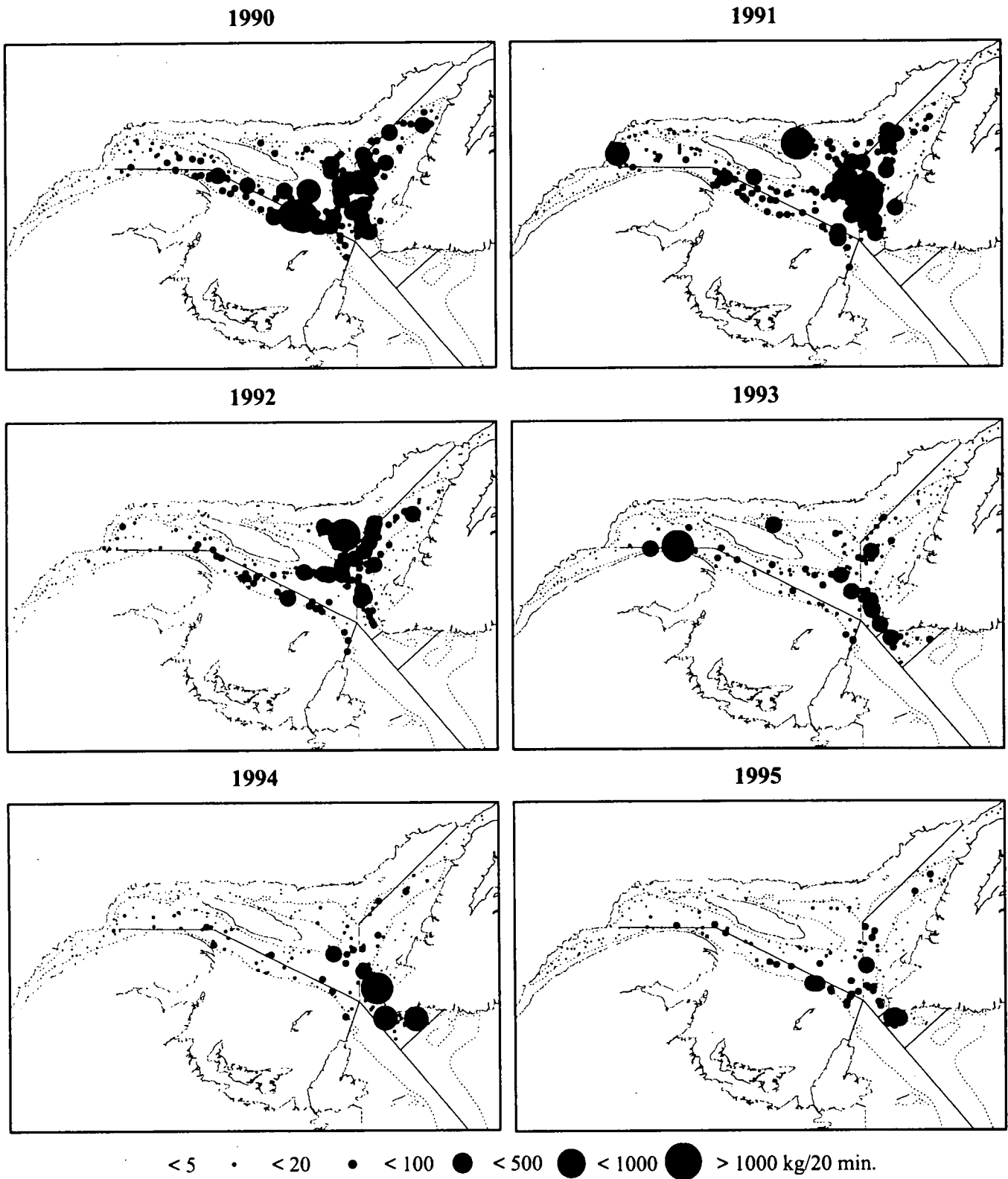
A spatial and temporal description of the CPUE showed that fishing activities were continuous within and outside the Gulf of St. Lawrence in the Cabot Strait area for the months of November and December (1990-1994 period). From these observations, it was concluded that redfish caught in 3Pn and 4Vn in these months belonged mainly to Unit 1. However, during the 1990-94 period some changes were observed in the timing of movements and the locations of the major concentrations of redfish. This needs further investigation.

Resource Status

Since 1984, stratified-random groundfish surveys have been conducted in 4RST in August-September. The biomass index from these surveys has continued to decline from 60,000 t in 1994 to 39,000 t in 1995 and only represents 10 % of the index level of 1990.

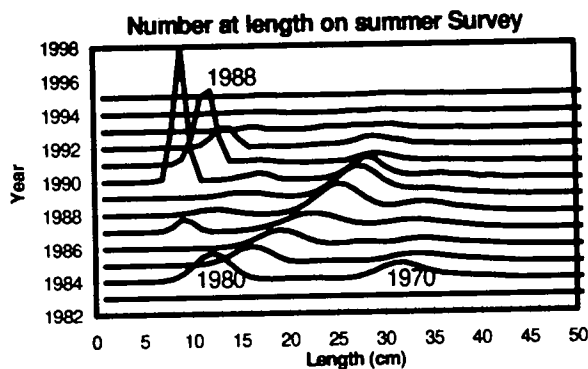


Although uncertain, the decline in the population may be coincident with a change in the distribution of redfish catches as the remaining concentrations of redfish were found in the Cabot Strait area. The 1994 and 1995 catch distributions are similar. The difference in the biomass estimate between these two years can be accounted for by a very large catch in southern 4R in 1994. The following figures give a better understanding of this decline in stock size and possible contraction in the distribution of the stock.



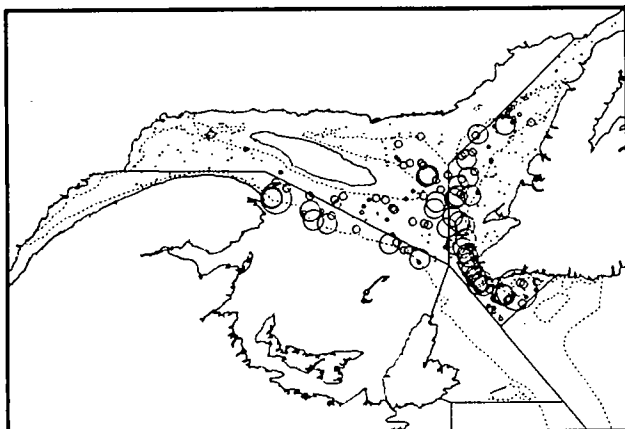
Note: Division 3Pn was surveyed for the first time in 1993

Size composition from the summer surveys for the period 1984 to 1995 indicates the presence of three important modes, each one being dominated by one year-class. The 1970 year-class supported the fishery in the 1980s while the 1980 year-class dominated the fishery catches in the late 1980s and at the beginning of the 1990s. The most recent mode represents the 1988 year-class which declined rapidly since 1992. By 1994, it had almost disappeared for reasons that remain unclear.



Three Sentinel fisheries targeting 4RS3Pn cod have been conducted by small otter trawlers since December 1994. The most extensive one was carried out in August 1995. Redfish biomass from this survey was estimated at 117,000 t. However, this value could not be directly compared with other biomass indices at this time. This new index will become meaningful as the surveys are repeated during the years to come.

August 1995 Sentinel Fishery survey



Industry perspectives

The decreasing abundance of Unit 1 redfish since 1993 was observed by most fleets involved in the redfish fishery. Also, certain sectors noted changes in the migration timing during 1993 and 1994. They observed that redfish moved outside the Gulf earlier (September) in comparison to previous years (late fall).

Outlook

Using research survey data, estimates of the exploitation rate were between 24 and 30 % for the 1970 and 1980 year-classes during the 1990-1994 period. This is well above the generally accepted $F_{0.1}$ reference level of 12 % for redfish. This high exploitation combined with the lack of recruitment to the fishery has resulted in the low current stock size.

With the closure of this fishery in 1995, stock abundance should decrease at a much lower rate. At this time there is no sign of any incoming recruitment.

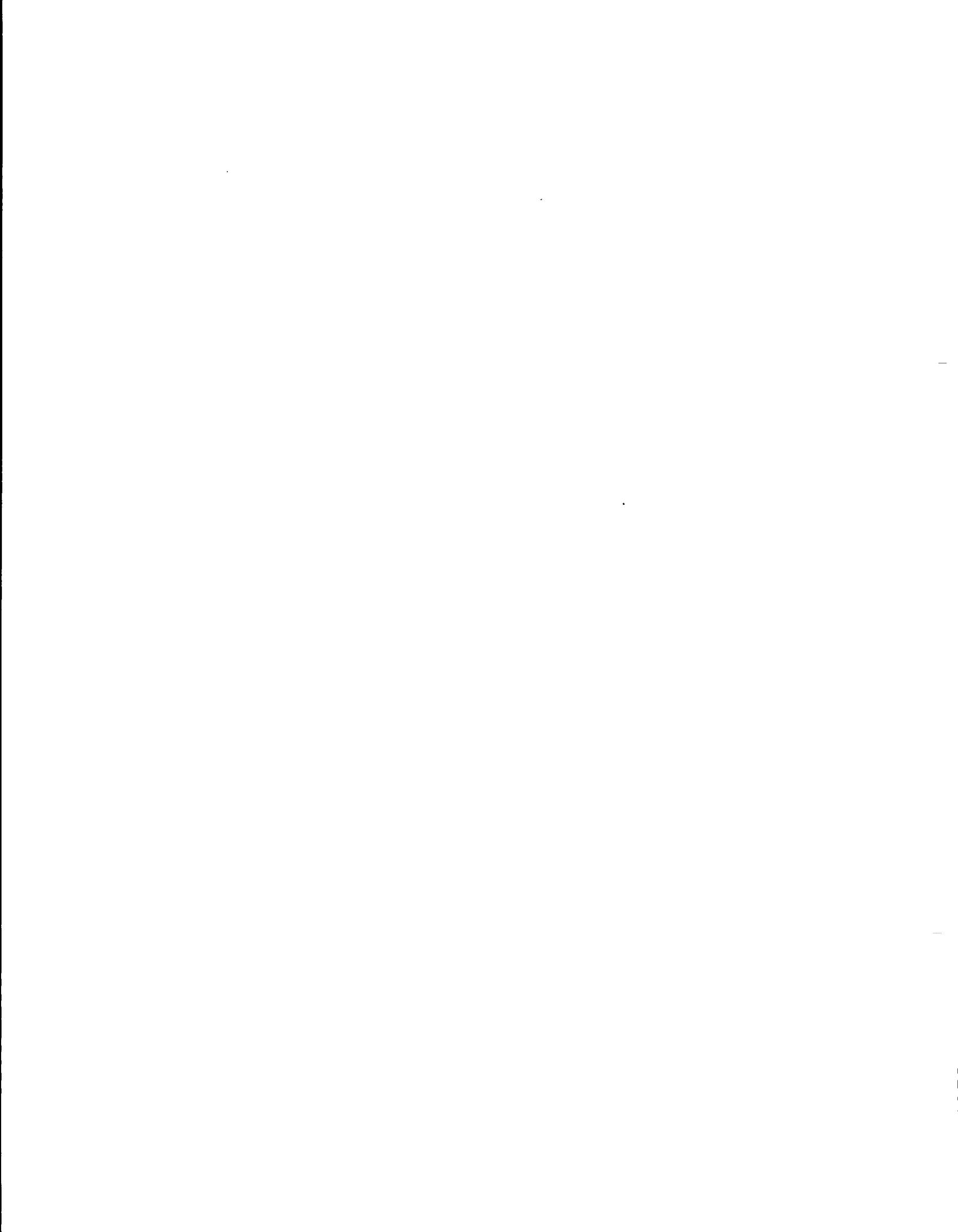
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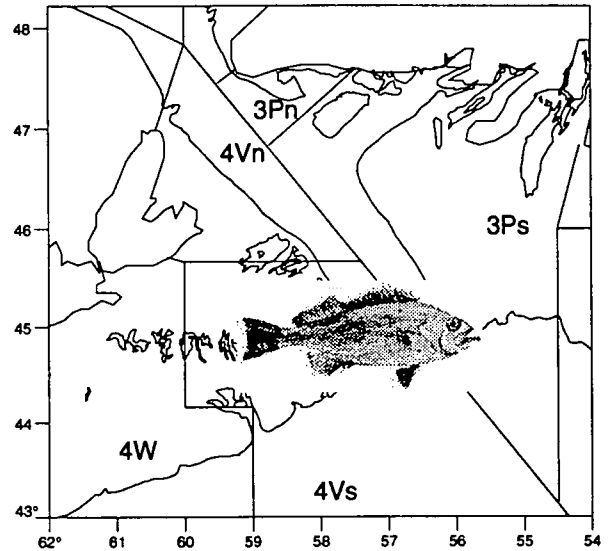


UNIT 2 REDFISH

Background

Unit 2 represents a relatively new management unit. Redfish in this area (NAFO 3Ps4Vs, 3Pn4Vn-June to Dec., 4W_{fd}) were previously managed separately as a 3P stock and part of a 4VWX stock. In 1991, based on a detailed examination of available data, a recommendation was made to realign the management units to better represent what was known about the resource in these areas.

The new management units were put in place beginning in 1993. The quota for Unit 2 in that year was 28,000 metric tons.



The Fishery

Annual catches have ranged between 8,100 metric tons (1984) to 58,000 metric tons (1971). From 1960 to 1968 landings were about 20,000 metric tons, increased to an average of 43,000 metric tons up to 1975 mainly due to increases by foreign fleets, then subsequently declined to the lowest on record in 1984 at 8,100 metric tons. Catches then steadily increased to 27,000 metric tons in 1993 approximating the TAC. The 1994 catch of 24,000 metric tons was again near the TAC. Up to September 20 1995, 10,100 metric tons of a 14,000 ton TAC had been taken.

Landings (thousand metric tons)

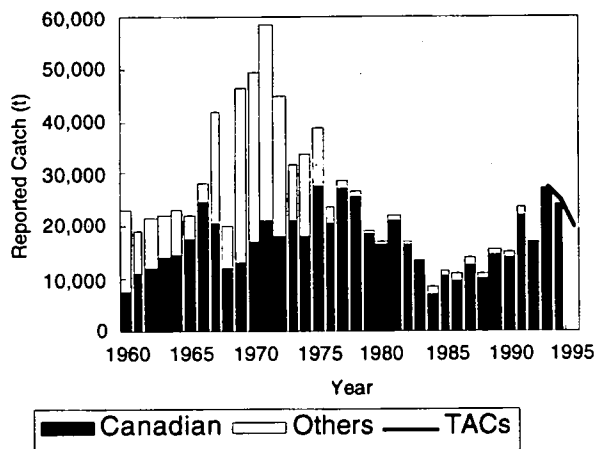
Year	70-76 Avg.	77-90 Avg.	1991	1992 ¹	1993 ¹	1994 ¹	1995
TAC	-	-	-	-	28	25	14
Can.	17	16	22	17	27	24	10 ²
Others	15	1	1	.2	0	0	0 ²
Totals	32	17	23	17	27	24	10 ²

¹ Provisional

² to September 20, 1995

Since declaration of the 200 mile limit in 1977, catches have been primarily by Canadian fleets. Maritimes vessels have generally accounted for the majority of landings from subdivisions 4Vs and 4Vn while Newfoundland vessels concentrated in subdivisions 3Ps and 3Pn.

The implementation of this new management unit in 1993 caused a change in the fishing pattern from that generally in place under the old 3P, 4RST and 4VWX units. There was a 10,000 metric ton increase from the 1993 catch of about 17,000 metric tons and this was almost totally accounted for by landings from 3Pn during October to December. Based on information presented to the Fisheries Oceanography Committee of DFO, Science in March, 1994 these catches were probably of Unit 1 redfish which moved into the area earlier in 1993. The situation changed in 1994 when only about 1,200 metric tons were taken in subdivisions 3Pn4Vn during this period.



Resource Status

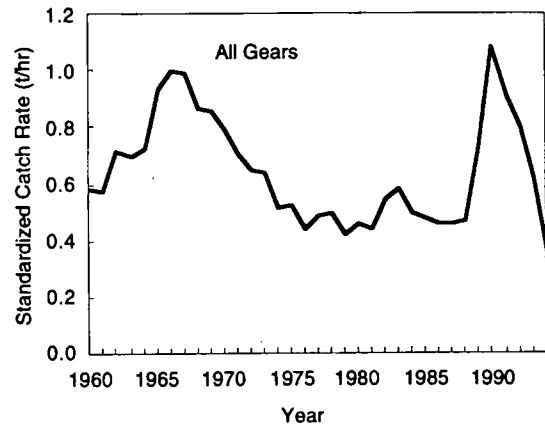
Indices of Stock Size

The standardized catch rate series based on hours fished shows a steady increase from 1960 to 1966 followed by a decrease to a low rate in 1979. The rate increased again until 1983 to about the same magnitude of the 1960 catch rate.

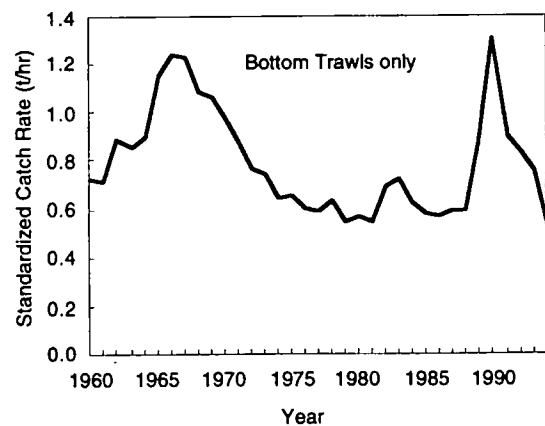
From 1983 to 1985, catch rates declined to about the level of 1979. Large increases occurred in 1989 and again in 1990 to the highest rate observed in the time series. Over the next four years catch rate declined sharply to the lowest rate on record in 1994.

The catch rates seem to track reasonably well with the movement of what were perceived to

be strong year-classes (1956-58 and early 1980s) through the fishery.

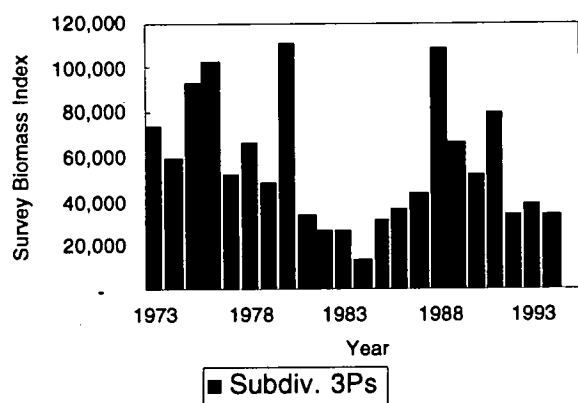


Successive large increases in catch rates in 1989 and 1990 can be partly attributed to the recruitment to the fishery of a relatively strong year-class of the early 1980s. It was also believed that technological changes in the fishery, specifically the introduction of the highly efficient midwater "turbo" trawl for all fleets, accounted for some of this increase. However, catch rates for bottom gears alone also show the large increases in 1989 and 1990 followed by declines to the lowest rate on record in 1994.



Stratified-random groundfish surveys have been conducted since 1973 in Subdivision 3Ps in the February to April period. It is important to note that these surveys do not cover the entire stock area so that apparent trends over time

may not be reflective of changes occurring throughout the entire management unit.



Size composition and numbers at age from the surveys are dominated by the **relatively strong year-class(es)** of the early 1980s that were first caught during the 1981 survey. These year-classes presently constitute the main component of the commercial fishery. There was also a much smaller pulse of recruitment found first during the 1988 survey (perhaps the 1984 or 1985 year-class), and a larger pulse observed in 1991 corresponding to the 1987 or 1988 year-class. The early 1980s year-class(es) comprised a much greater proportion of the research catch than those of either 1984-85 or 1987-88 suggesting that it is much stronger.

Stratified-random research surveys were conducted in subdivisions 3Ps, 3Pn, 4Vs, and 4Vn during the summers of 1994 and 1995. The **biomass index** (thousands of metric tons) from these surveys is as follows:

	3Ps	3Pn	4Vs	4Vn
1994	105	18	37	79
1995	84	15	74	36

It is not possible to directly compare these results for Subdivision 3Ps with those from the 3Ps survey series because a different net was used.

Although there are only two years of summer surveys, results from them are considered a better indicator of relative stock size because they cover most of Unit 2, and are conducted when the redfish in this area are considered to be well separated from Unit 1 fish.

The summer survey results suggest that stock size remained stable between 1994 and 1995 although the proportion of older commercial sized fish declined from 1994 to 1995.

Industry Perspectives

Some industry representatives have indicated that the 1995 fishing patterns in Unit 2 changed because of seasonal closures in April-May and November-December. They report that fishing has been good in subdivisions 3Ps and 4Vs and south Banquereau so far in 1995, and catch rates and fish sizes were comparable to 1994. Nonetheless, they haven't seen anything to help them decide whether the resource is up or down. Trawler captains have seen more "small" redfish (<23 cm (9 inches)) near the corner of Banquereau Bank than had been seen during the previous five years.

Other industry representatives reported good and consistent trips from July-September with fish sizes being comparable to those in 1994. They found it difficult to relate their 1995 experiences to previous years as the areas fished in 1995 have not been fished consistently for the past 15 years.

One fleet reported about the same catch rate as in 1994 even though more bottom trawling was conducted than midwater trawling compared to previous years. Therefore, they could not interpret what this may mean in terms of any possible change in the resource.

Industry representatives suggested that a cautious approach should be followed in the management of this resource.

Outlook

Fishing patterns changed in response to the implementation of this new management unit in 1993, and will certainly continue to change in 1995 due to seasonal closures related to spawning and migrations.

Because of the limited database, it is not possible to provide an estimate of the absolute size of this stock. Therefore it is not possible to estimate actual fishing mortalities for the past.

However, application of selectivity curves (90 mm and 130 mm mesh) to the catch-at-length from the 1995 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 14,000 metric tons in 1995 would generate an exploitation rate of between 13% and 24%. **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.**

Overall, this stock is probably lower than it has been in recent years. Catch rates have declined steadily since 1990. Current catches are composed primarily of the early 1980s year-class(es) which have been fished for about six years now. Based on these observations, the fishery will not improve in the immediate future because the abundance of fish sizes currently harvested (mainly >25 cm (10 inches)) will continue to decline until another pulse of recruitment reaches this size.

The next anticipated pulse of recruitment (1988 year-class) will probably not enter the fishery before 1997 or 1998. However, their contribution is likely to be less than that of the year-class(es) of the early 1980s.

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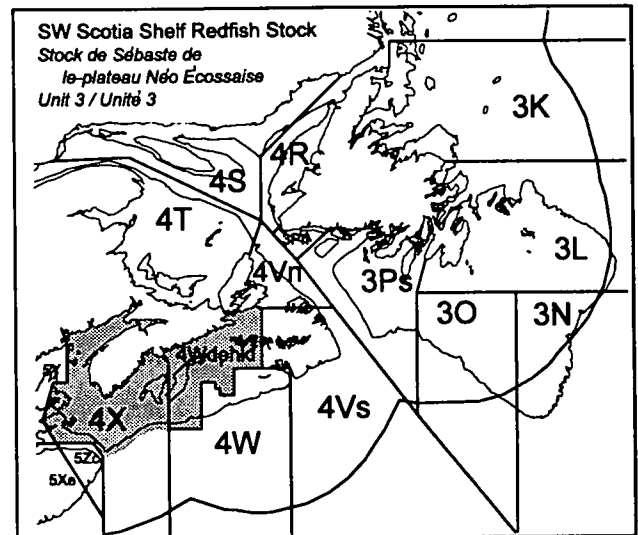
UNIT 3 REDFISH

Background

The Unit 3 management area for redfish was first implemented in the 1993 Groundfish Management Plan with a quota of 10,000 t. Redfish in this area were previously managed as part of a larger 4VWX management area.

Redfish in Unit 3 are caught in the basins and at the edge of the Scotian Shelf by otter trawlers using 90 mm mesh. Current regulations limit the by-catch of other species to 10% of the redfish catch.

In 1995, the Scotia-Fundy summer groundfish survey, which is the primary source of population and size composition data for this stock was extended to 400 fathom in order to cover redfish habitat at the shelf edge previously not surveyed.



The Fishery

Landings (thousands of tonnes)

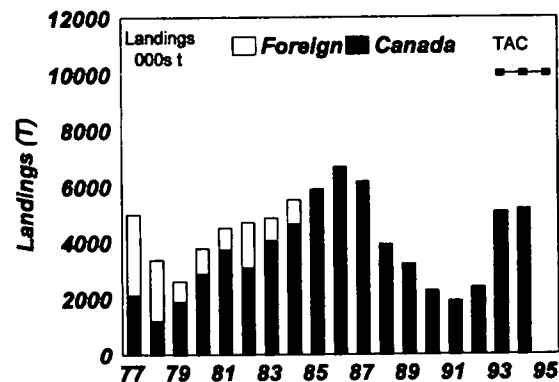
Year	70-79 Avg.	80-89 Avg.	1990	1991	1992 ²	1993 ²	1994 ²	1995
TAC						10.0	10.0	10.0
Canada	4.1	4.4	2.2	1.9	2.1	5.1	5.2	4.3 ³
Foreign	5.7 ¹	0.5	+	0.1	0.1	0.1	+	
TOTAL	9.7	4.9	2.3	2.0	2.2	5.2	5.2	

¹ 1970-79 foreign landings excludes up to 4,420 t/year on average not assignable to statistical unit area.

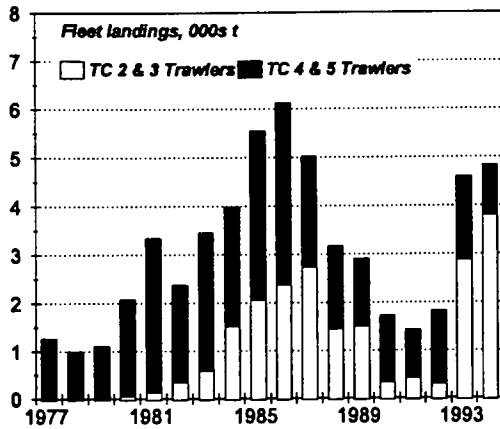
² Provisional.

³ Provisional, to September 20th, 1995.

Redfish landings from Unit 3 gradually increased from the late 1970s, peaking at almost 7,000 t in 1986, followed by a decline to about 2,000 t in 1991. Provisional catches for 1994 were about 5,200 t, approximately equal to 1993, and a 100% increase from 1992, but substantially below the 10,000 t TAC. The 1995 catch up to September 20th, was 4,300 t.

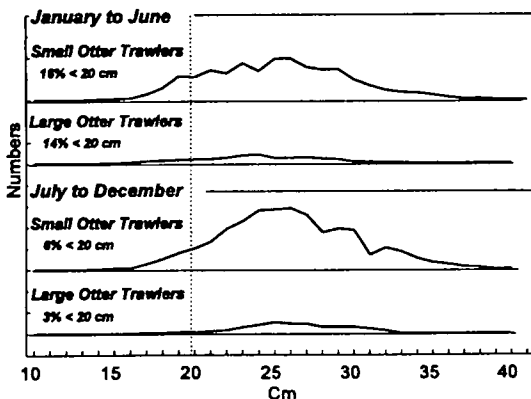


In 1994, small otter trawlers (less than 65ft), fishing primarily in the basins, took most of the reported catch. This is the highest catch taken by these vessels since they entered the fishery in the early 1980s. The small otter trawl fishery reached their allocation on 31 August, 1994. Large otter trawlers (greater than 65 feet) fishing in the basins and at the edge of the shelf, caught less than one third of their allocation because they could not find redfish on their traditional fishing grounds.



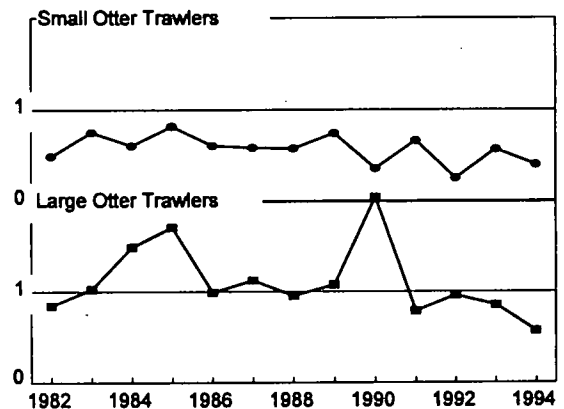
There were many reports early in 1994, that 'small' redfish were being landed from an area north and east of Browns Bank for use as lobster bait. On industry's request, the fishery in this area was closed to small otter trawlers until it was demonstrated through test fishing that 'small' redfish could be avoided.

Although no firm criteria were established to define 'small' redfish for management purposes, DFO Science used a less than 20 cm cutoff to examine the issue. In the first half of 1994, the occurrence of redfish less than 20 cm in port samples from this area ranged as high as 28% by number, while in the second half of the year, after the lobster season had closed, the occurrence did not exceed 9%. The total landings from Unit 3 as a whole were estimated to contain 7% of fish less than 20 cm by number in 1994.

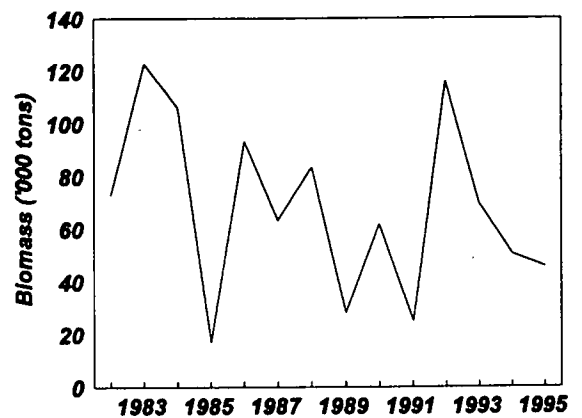


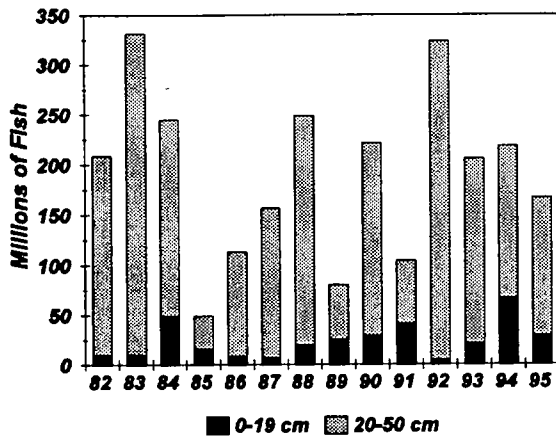
Resource Status

The small otter trawler catch rates exhibited little variation in the period 1982 to 1994 and no clear trend over time. Catch rates for large otter trawlers showed some inter-annual variation, but there was little overall trend over time, although the 91 to 94 catch rates were below the long term average.

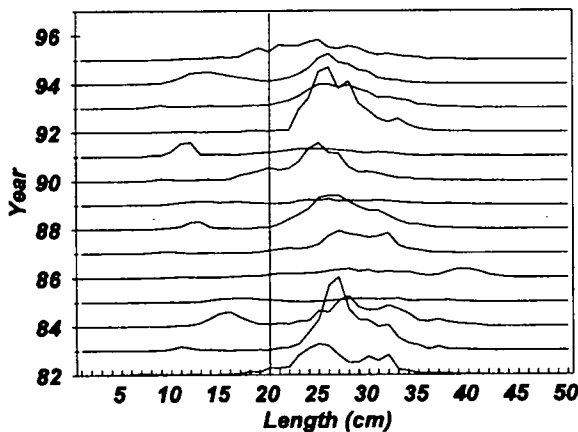


Survey estimates of population size are highly variable between years and show no obvious trend over time.





The size compositions of survey catches have been variable between years, possibly as a result of the surveys not covering all areas of distribution.



This is further supported by preliminary results from fishing sets in the newly extended survey area which indicate the presence of a high proportion of fish in the 35 cm and larger size range. These are not evident in standard surveys.

Industry Perspective

Industry's consideration that 'small' redfish should not be captured continues into 1995. However they have encountered significant problems with the bycatch of other groundfish species when attempting to capture only larger redfish.

Outlook

The ratio of catches to recent survey biomass estimates which indicate a maximum harvest rate of about 8% are likely conservative, given that the survey does not include the entire management unit.

The increase in catches in 1993 and 1994, compared to 1992, resulted from an increase in fishing effort particularly by the small otter trawlers. It appears that fishing in 1994 was directed towards 'small' fish because of their accessibility and the existence of a ready market. Catches of 'small' fish could be avoided when required.

Based on the lack of any apparent trend in the catch rates of the small trawlers or the RV surveys, it would appear that catches averaging about 5,000 t have not had a negative impact on this resource. At this point in time, it is not possible to evaluate potential impacts of catches at the level of current 10,000 t TAC.

For More Information

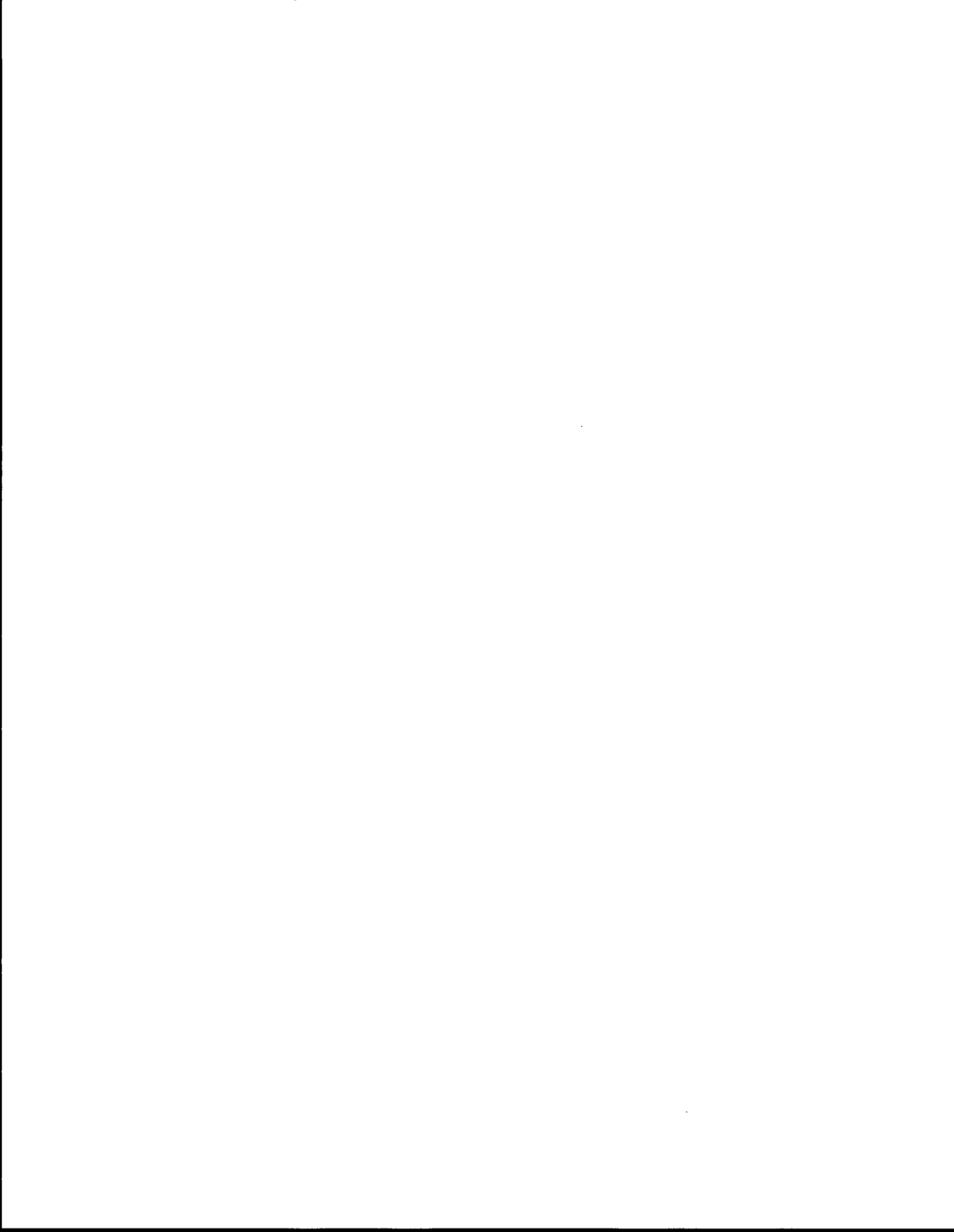
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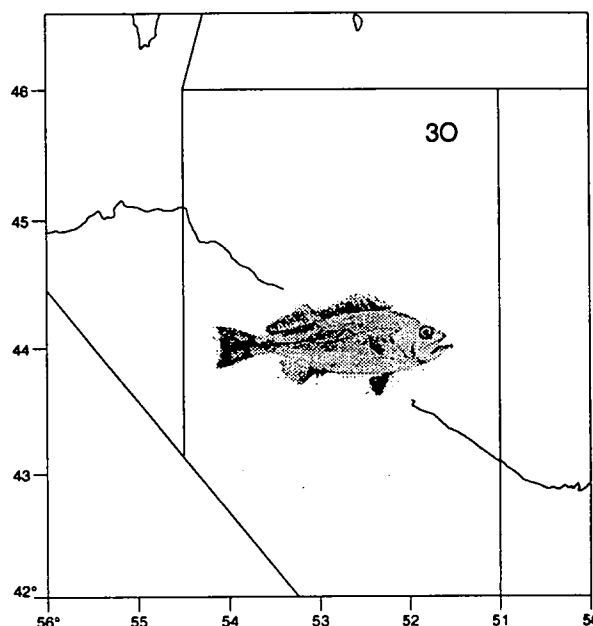


DIVISION 30 REDFISH

Background

Traditionally, Canadian industry has not had a great deal of interest in redfish in this area because of the relatively small sizes of fish found in the areas with trawlable bottom. Recently, because of declines in other groundfish resources, and most recently because of developing markets for small redfish for lobster bait, there has been some increased interest in fishing in this area.

The first quota was put in place for Division 30 redfish in 1974 at 16,000 metric tons.



The Fishery

Since 1959, nominal catches have been in the range of 5,000 to 35,000 metric tons. Up to 1986 catches averaged 13,000 metric tons, increased to 27,000 metric tons in 1987 with a further increase to 35,000 metric tons in 1988. Catches declined to 13,000 in 1989, and were about this amount annually through to 1993. The 1994 catch of about 5,100 metric tons represents an 11,000 metric ton reduction from 1993. The TAC was reduced from 14,000 metric tons in 1993 to 10,000 metric tons for 1994 and 1995.

Landings (thousand metric tons)

Year	70-76 Avg.	77-90 Avg.	1991	1992 ¹	1993 ¹	1994 ¹	1995
TAC	-	-	14	14	14	10	10
Can.	1	1	+	1	.7	2	.1 ²
Others	13	14	8	14	15	3	.7 ²
Totals	14	15	8	15	16	5	.8 ²

¹ Provisional

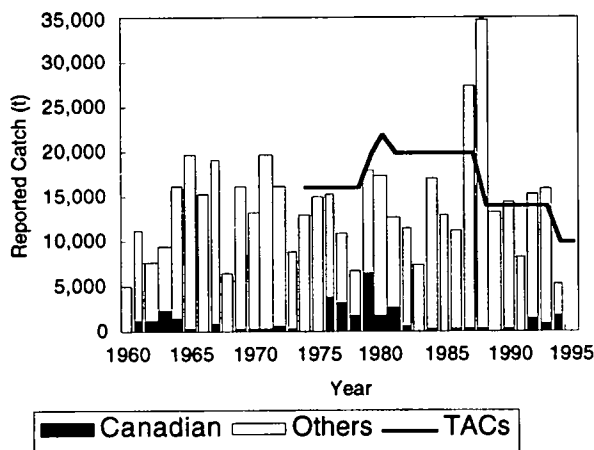
² To September 20, 1995

Russia predominated in this fishery up until 1993 and generally took its share (about 50%) of the total non-Canadian allocation, which accounted for about 2/3 of the TAC. Russia had

a very limited fishery in 1994 and Cuba did not participate at all. Portugal, which began fishing in the area in 1992 took 2,900 metric tons in 1994, a reduction of 2,000 metric tons from their 1993 catch. Canada, which landed less than 200 metric tons from 1983-1991, took 1,600 metric tons in 1994.

The fishery has occurred primarily in the second and third quarters of the year since 1983. The predominant means of capture from the mid-1970s to the early 1980s was the bottom otter trawl, but since 1984 there has been an increase in the use of midwater trawls.

For 1995, the reported Canadian catch to September 20 is only about 120 metric tons. The non-Canadian catch as reported to NAFO up to the middle of September is only 673 metric tons with about 66% of this reported by Russia.



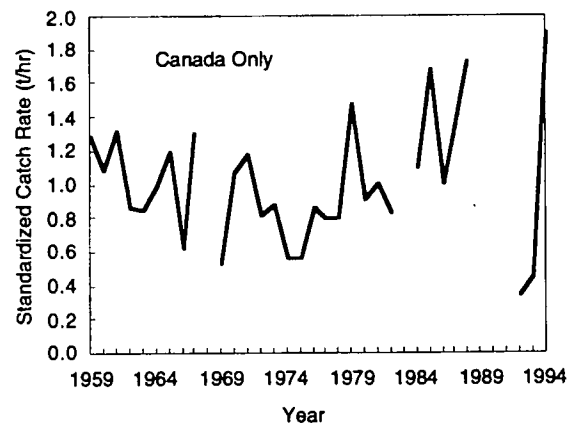
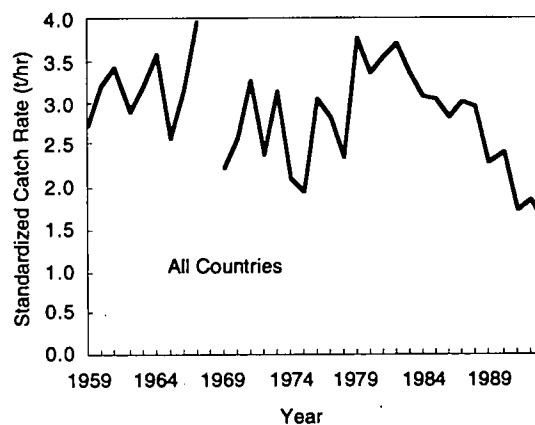
Resource Status

Indices of Stock Size

The standardized catch rate index based on effort in hours fished shows much inter-annual variability from 1959 to 1978. In 1979 there was a substantial increase in the catch rates, but since then there has been a continuous declining trend through 1993.

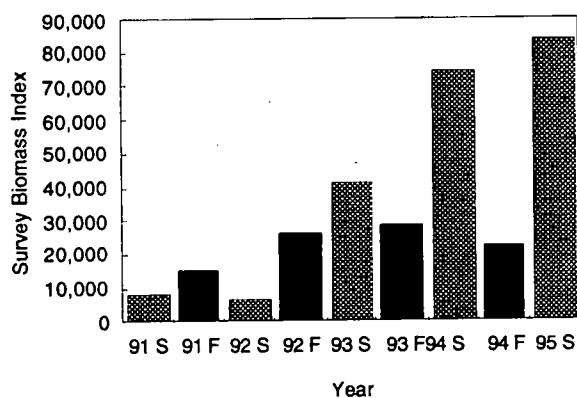
A preliminary analysis using Canadian data only (fishing inside the 200 mile limit) suggests a

different trend over the period since the mid-1970s compared to the non-Canadian fleets which operate only outside the 200 mile limit. Canada has not accounted for a major proportion of the reported catches from Division 30, and has only fished within the 200 mile limit. Because of this, the trend in overall catch rates is probably more indicative of a decline in the proportion of the stock outside the 200 mile limit where most of the effort is concentrated. Further investigations of these data are necessary.



Stratified random groundfish surveys have been conducted in the spring and fall in Division 30 since 1991, with coverage to depths down to 730 m. In addition, a summer survey was conducted in 1993. The spring survey biomass index increased steadily from about 7,000 metric tons in 1992 to 84,000 metric tons in

1995. The 1993 summer survey index, at 52,000 metric tons, was similar to the level estimated from the 1993 spring survey (42,000 metric tons). The fall survey biomass index has ranged between 16,000 metric tons and 28,000 metric tons from 1991 to 1994, although the 1992 fall survey only covered depths down to 370 m (200 fathoms). These results are difficult to interpret. Stratum by stratum estimates indicate that the increases during the spring surveys occurred over a great deal of the area, although the biomass estimates in strata outside 200 miles were low compared to those inside. The differences between the spring and fall surveys may be related to changes in availability within the Division at different times of the year.



A relatively low proportion of the estimates have been accounted for by fish greater than 25 cm (10 inches) in the surveys since 1991. By comparison, length frequencies from sampling of the 1994 fishery generally reveal a high proportion of fish greater than 25 cm (10 inches). This suggests that there is a component of the population in the area which may be undersampled during the surveys.

Estimates of **commercial catch-at-age** are available for 1987 to 1990. A catch curve analysis of these data (ages 9 to 25) indicates an average exploitation rate of about 14% during 1975 to 1990 when the average catch was about

15,000 metric tons. This is only slightly above the $F_{0.1}$ reference level (12%) for redfish.

Stock Affiliations

With the loss of the 1988 year-class from Unit 1, questions have been raised about the possibility of the recent increases in Division 30 being the result of movement of this year-class from Unit 1 to this area. Available evidence does not support this hypothesis, and recent increases in Division 30 may be partially associated with declines in Division 3N although this requires further investigation.

Preliminary analyses also suggest that growth rates and size of maturity, while similar in divisions 3N and 3O, are different from those further west.

Outlook

It is not possible to estimate the current size of this stock. It is not possible to determine **current fishing mortality**, or the possible fishing mortality generated by catching the TAC of 10,000 metric tons in 1995. There are indications that fishing mortality was somewhat above $F_{0.1}$ during the 15 years prior to the 1990s when catches averaged about 15,000 t.

Recently, more small redfish appear to be available in Division 30 based on research vessel surveys conducted during the 1990s. However, it is unclear whether redfish in this area are resident or migrants from another area. Based on the research vessel data, the stock appears to be mostly comprised of young immature fish, although significant amounts of larger fish have been found during research surveys in the past in the deeper, hard-to-fish areas of the Division.

The length at which half the females are sexually mature (L_{50}) is about 29 cm (11 inches). Given that generally the shallower the depth fished the smaller the size composition, caution is warranted because a greater proportion of **immature females** may be captured if fishing

is concentrated in shallower water (less than 375 m (205 fathoms)).

For More Information

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