NEWFOUNDLAND REGION GROUNDFISH OVERVIEW

Background

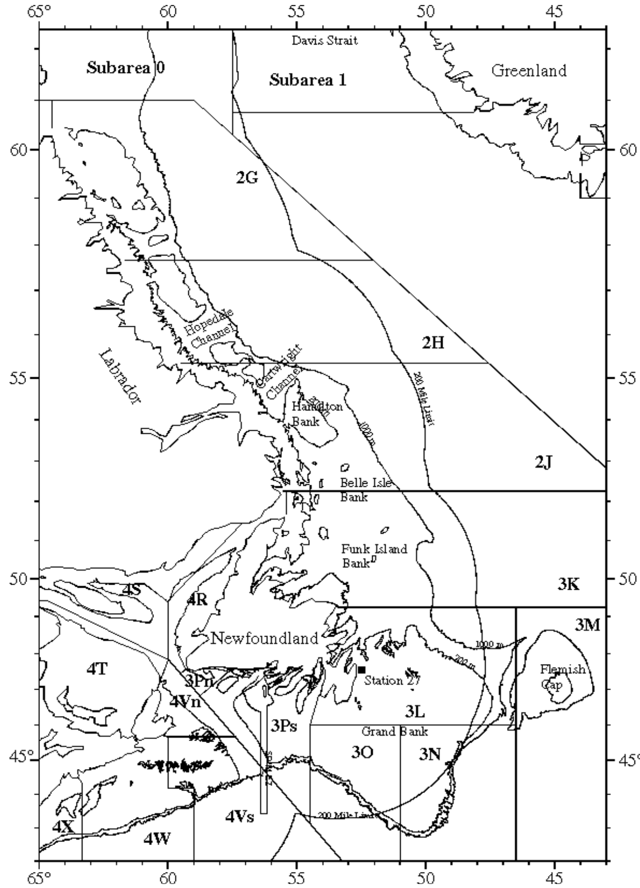
In Newfoundland, Science, Oceans and Environment Branch of the Department of Fisheries and Oceans is responsible, either directly or indirectly, for advising on the status of numerous groundfish stocks located from Davis Strait in the north to the south coast of Newfoundland in the south.

In this area, there are 5 cod stocks (2GH, 2J3KL, 3M, 3NO and 3Ps), 5 redfish stocks (SA2+3K, 3LN, 3M, 3O and Unit 2), 4 American plaice stocks (SA2+3K, 3LNO, 3M and 3Ps), 3 witch flounder stocks (2J3KL, 3NO and 3Ps), 2 Greenland halibut management areas (SA0+1 and SA2+3KLMNO), 2 haddock stocks (3LNO and 3Ps), 1 yellowtail flounder stock (3LNO), 1 pollock stock (3Ps), 2 roundnose grenadier stocks (SA0+1 and SA2+3), thorny skate, white hake and monkfish in 3LNO as well as a portion of the 3NOPs4VWX Atlantic halibut stock. In addition, there are coastal fisheries for lumpfish, and winter flounder.

Scientific information on the above stocks is provided either through the DFO Science, Oceans and Environment Branch regional review process and the FRCC, or the Scientific Council of NAFO. Quotas are set by the NAFO Fisheries Commission for 3NO and 3M cod, 3LN and 3M redfish, 3LNO and 3M American plaice, 3LNO yellowtail flounder, 3NO witch flounder, 2+3 grenadier and SA2+3KLMNO Greenland halibut. The NAFO Scientific Council also reviews the Canadian assessment of 2J3KL cod and 2J3KL witch flounder on an annual basis. Greenland halibut, and roundnose grenadier in SA0+1 are managed bilaterally by Denmark, on behalf of Greenland, and Canada. Quotas for the other stocks are set by the Minister of the Department of Fisheries and Oceans based on recommendations of the FRCC.

The Newfoundland Region Stock Status Reports contain information pertaining only to those stocks for which the FRCC directly provides catch recommendations to the Minister. Information on the stocks evaluated and managed by NAFO is contained in separate documentation; the reports of the NAFO Scientific Council.

Detailed technical information on each of the stock assessments can be found in the research documents listed with each stock report. Technical information for the NAFO stocks is available through the NAFO SCR Document series. ***This overview includes updates for stocks not formally assessed in 2000.***



The Groundfish Fisheries

Cod traditionally dominated groundfish catches in Newfoundland waters, but with the decline of this resource in the late 1980's and early 1990's, other species have become a more significant proportion of the catch. As well, reductions in catches of a number of different species and stocks have occurred since 1994 as a result of reduced fishing effort in the NAFO Regulatory Area (NRA). In 1995 and 1996, groundfish catches were dominated by Greenland halibut and redfish. In 1997 and 1998, gadoids, particularly 3Ps cod, once again became an increasingly greater proportion of the overall groundfish catch.

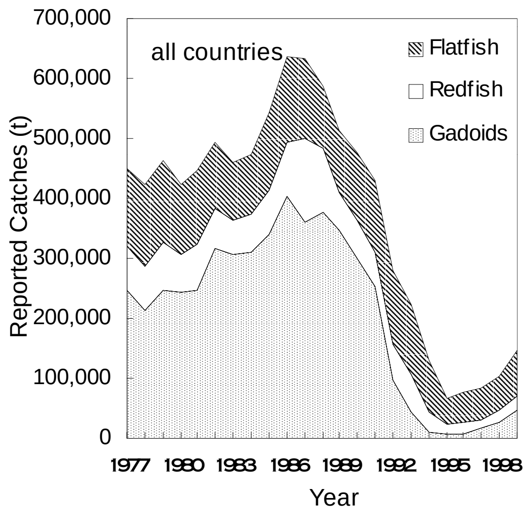


Figure 1- Groundfish catches for all stocks managed by the Newfoundland Region, 1997-1999

In 1994-1996, the only directed 'traditional' species fisheries were for Greenland halibut in SA0+1 and SA2+3KLMNO; cod in 3M; redfish in 3LN, 3M, 3O and Unit 2; and witch flounder in 3Ps. In 1997, following a three-year moratorium, the fishery for cod in 3Ps was re-opened with a 10,000 t TAC. The TAC was raised to 20,000 t in 1998, and 30,000 t for 1999, but was reduced to 20,000 t for the April 2000 to March 2001 fishing season. Nineteen ninety-eight also marked the re-opening of a fishery for yellowtail flounder in divisions 3LNO (4000 t TAC). This fishery continued in 1999 and 2000. Limited fisheries have also been conducted for cod in the inshore of 2J3KL; an index fishery with a 4000 t TAC in 1998, a commercial fishery with a 9000 t TAC in 1999, and an index fishery with a 7000 t TAC in 2000.

Canadian fisheries for 'non-traditional' species such as lumpfish, monkfish, white hake, winter (blackback) flounder and skates continued in 2000.

The fishery for yellowtail flounder in Div. 3LNO has increased from 4000 tons when it reopened in 1998 to 10,000 tons in 2000. Catches of Greenland halibut in Subarea 2+3 have also increased since 1998. Moratoria on the 3 stocks of American plaice (Div 3LNO, SA 2+ Div. 3K, Subdiv. 3Ps) continued in 1999 and 2000. The fishery for witch flounder in Subdiv. 3Ps was stable around 500 t in 1998-99, but moratoria existed in 2000 for this species in Div. 3NO and Div. 2J3KL. Fisheries for redfish continue in Unit 2, Div. 3M, and Div. 3O, but are under moratorium in SA 2 + Div. 3K and also in Div. 3LN

Background to Groundfish Reviews

This overview provides an update on the status of **2GH cod, 3LNO** and **3Ps haddock**, **3Ps pollock**, **SA2+3K redfish**, **3Ps American plaice, 3Ps witch flounder, thorny skate, white hake**, **winter (blackback) flounder, lumpfish,** and **wolfish (catfish),** the latter taken as bycatch only. These stocks were not formally assessed in 2000 but their status has been updated by the responsible assessment scientists.

Cod in Division 2J3KL (SSR A2-01) was assessed during a regional assessment meeting in spring 2000 and c**od in Subdivision 3Ps** (SSR A2-02) was assessed regionally in fall 2000. **American plaice in SA 2 + Div. 3K (**SSR A2-11**)** was assessed regionally in the fall of 2000.

Unit 2 redfish and Div. 3O redfish were reviewed in detail during a zonal meeting in November 2000. Stock Status Reports for these stocks are available.

Information on the status of stocks assessed by NAFO, as well as the 2000 advice of Scientific Council, is available in the **report of the June 2000 meeting (NAFO SCS Doc. 00/24)**.

Offshore Research Surveys

As elaborated in past Overview documents (Anon., 1996; Anon., 1997 Anon., 1998; Anon., 1999), the Newfoundland Region changed in 1995 to using the Campelen 1800 shrimp trawl with 'rock-hopper' foot gear for its research surveys. This gear provides better information on young fish as well as other species such as crab and shrimp.

Different fishing gears catch different sizes and quantities of fish species. Therefore, before being able to relate catches from surveys using the new survey trawl to those made in the past using the previous survey trawl (Engel), it was necessary to conduct **comparative fishing experiments**. These experiments were described in some detail in the 1996 Overview (Anon. 1996). Conversion factors are available for the 'traditional' species, such as cod, redfish, and most flatfish. Data conversion has been completed for most stocks/species, but it is not possible to develop conversion factors for 'non-traditional' species at this time.

Groundfish Resource Status

Most **'traditional' groundfish resources** in the waters around Newfoundland continue to be at, or very near historical low levels. For many of the **Canadian managed stocks** with TAC's still in place, more conserative TACs were imposed for 2000. The 3Ps cod fishery was reduced to 20,000 metric tonnes for the April 2000 to March 2001 fishing season. An index cod fishery in the inshore of 2J3KL with 7000 t TAC in 2000, was reduced from a commercial fishery with a previous TAC of 9000 t in 1999. The TAC for thorny skate (3LNO) has remained unchanged through the period 1997-1999. American plaice stocks remain under moratorium at relatively low levels of abundance. Redfish in Unit 2 and Division 3O have remained relatively stable.

For the **NAFO-managed groundfish stocks**, directed fisheries were permitted for yellowtail flounder in 3LNO. The yellowtail flounder stock in Division 3LNO has continued to increase following a moratorium in 1995-97. For cod in 3M, the TAC's declined during the late 1990s and the area was closed to fishing in 1999 and 2000. Cod in 3NO has remained closed to directed fishing since 1995. Fisheries for Greenland halibut in SA0+1 and SA2+3KLMNO continued through the 1990's without interruption. Greenland halibut abundance has increased due to improved recruitment of several year classes and TAC's have increased in 2000 and 2001.

Divisions 2GH Cod

As for most cod stocks in the Northwest Atlantic, 2GH cod experienced a large increase in catch by non-Canadian fleets from the mid 1960's to early 1970's peaking at 94,000 t in 1966. Non-Canadian catch was the largest component until 1986.

Canadian catches averaged only 480 t annually from 1960 to 1990 with a maximum catch of 3200 t in 1982.

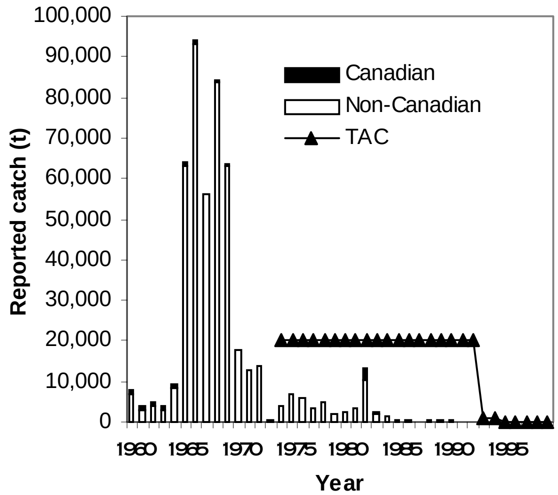


Figure 2 – Reported catch and TAC for Divisions 2GH cod, 1960-1999.

No directed fishing has been permitted on this stock since 1996 and there has been no reported catch since 1991.

Since 1996, Canada has carried out a multi-species survey of Divisions 2GH to 1500 meters. This survey has had varying coverage because of lost time. From 2000 onwards, 2G has been discontinued and 2H is to be surveyed in alternate years. Incomplete survey coverage prevents any updating of the status of this stock but the biomass is thought to remain at a very low level.

Divisions 3LNO Haddock

Management advice has specified no directed fishing and limited by-catch since 1993 for this stock. The closure on directed fishing remains in place for 2000. Reported **catch** in 1999 was 68 t, most of which was taken in 3O. To date reported catch for 2000 is 33 t most of which was taken as by-catch in the inshore of 3L (St. Mary's Bay). The recurrence of haddock in the inshore may be the result of warming trends in recent years.

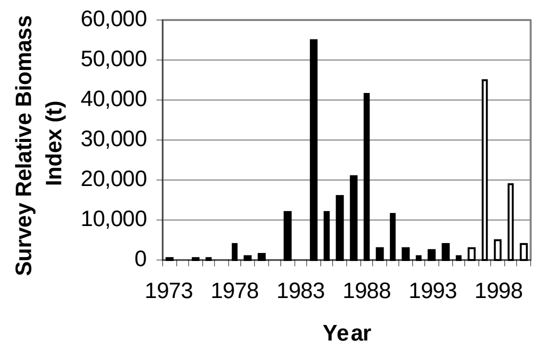


Figure 3 – Spring research survey biomass index for Divisions 3LNO Haddock, 1973-2000. Dark bars represent years done with Engels gear, white bars with Campelen.

Surveys conducted by Canada indicate the 1998 year-class is abundant as it has been seen in large numbers in all surveys since 1998. While evidence suggests the 1998 year-class maybe strong, the significance of this pulse of recruitment is not yet known. If the current moratorium on cod and plaice continues and mesh size and by-catch regulations in the yellow tail fishery are adhered to, fishing pressure on the 1998 year-class should be low.

Subdivision 3Ps Haddock

Catches of haddock in NAFO Subdivision 3Ps since 1960 have been mainly in the 1000 to 2000 t range, increasing to 7500 t in 1985 then falling below 1000 t after 1990. The preliminary estimate of catch in 2000 is 47 t. The increase in the mid-1980s was a result of a relatively strong 1981 year-class and increased effort by France. A moratorium on cod established by Canada from 1993 through 1996 and small bycatch quotas resulted in decreased catch for that period. In 1997 the cod fishery reopened with annual cod quotas of 10,000, 20,000, and 30,000 t in 1997, 1998, and 1999 respectively. These quotas resulted in by-catches of 69, 223 and 110 t respectively. The current cod quota of 20,000 t runs from April 1st, 2000 to March 31st . To date this quota has yielded a by-catch of 47 t.

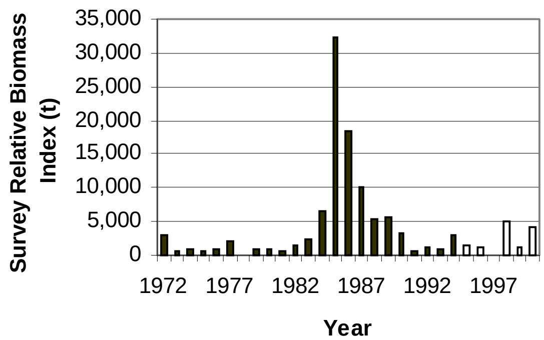


Figure 4 – Spring research survey biomass index for Subdivision 3Ps Haddock, 1972-2000. Dark bars represent years done with Engels gear, white bars with Campelen.

Research vessel surveys have been conducted by Canada since 1972. The trawl indices of haddock from these surveys were low from 1972 to 1982, peaked in 1985 due to the presence of the relatively strong 1981 year-class, but then declined again to low levels. In 1998, the survey found more haddock than in previous years and the 1999 and 2000 surveys caught significant numbers of young haddock. This would appear to be the 1998 year-class, which was also observed in significant numbers in the adjacent 3LNO haddock stock. There have been no reported problems with bycatch of small haddock in the cod fishery but this should be monitored in future.

Subdivision 3Ps Pollock

Catches of Pollock in Subdivision 3Ps are generally low, having been less than 1000 t annually from 1967-1982. Catches gradually increased however, peaking at 7500 t in 1986, but have since declined to pre-1980 levels. Catch in 1999 was 750 t and catch to date in 2000 is 806 t.

Due to the pelagic nature of the species research vessel (bottom trawl) surveys may not give a reliable index of abundance or biomass. However, surveys have been conducted by Canada in NAFO Subdivision 3Ps since 1972. The biomass index was low in the 1970s (<1000 t). It gradually increased to 7900 t in 1987 and has since declined to pre-1980 levels. Survey biomass increased in 1999 to 5700 t and declined in 2000 to 474 t. Overall, it appears that biomass is relatively low compared to the 1980's.

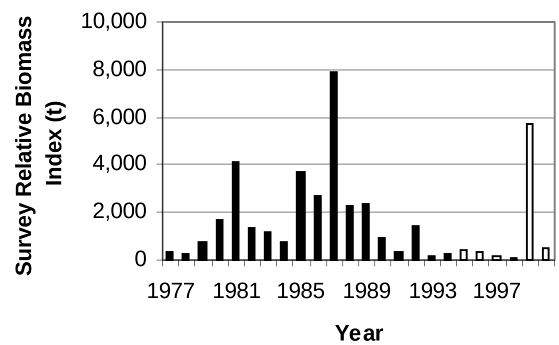


Figure 5 – Spring research survey biomass index for Subdivision 3Ps Pollock, 1977-2000. Dark bars represent years done with Engels gear, white bars with Campelen.

Pollock in Newfoundland waters are thought to be at the northern extension of their range in the Northwest Atlantic. Cold waters throughout the area in late 1980's and early 1990's have probably been restrictive to their distribution. Observed water temperatures in 3Ps in 1999 and 2000 have warmed to levels significantly above long-term means. Historically, warm periods have coincided with higher abundance of pollock in the area. However it is not known whether this increased abundance is due to immigration from adjacent stocks or increased recruitment from local spawning.

Subarea 2 + Division 3K Redfish

There has not been constant directed effort on this stock since 1990 when 2400 t were landed. **Landings** declined to 280 t in 1991 and have been 15 t or less in each year from 1992 through 1999. Estimates of discarded redfish, taken as by-catch in shrimp fisheries, declined from 386 t in 1992 to 110 t in 1994. Estimates from the 1995-97 shrimp fisheries have not been compiled to date. The estimate for 1998 indicates that about 180 t of redfish were discarded which represents a rate of about 0.25% of the total shrimp catch. Preliminary data for 1999 suggest that a similar tonnage of redfish discarded.

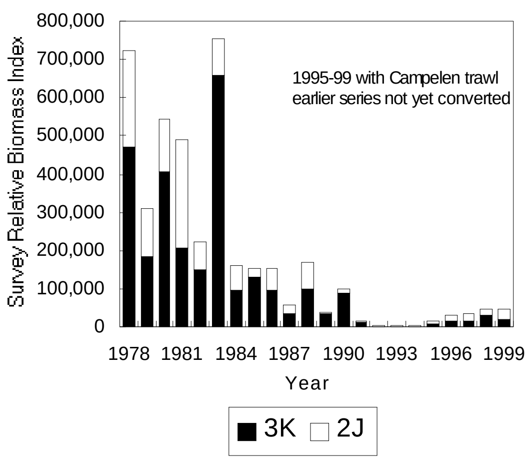


Figure 6 – Fall research survey biomass index for Subarea 2 + Division 3K redfish 1978-1999.

Results from **research vessel surveys** in Div. 2J and 3K suggest the resource was at an historically low level in 1994. The 1995-99 survey estimates cannot at this time be compared directly with the historical series because data conversion is not yet complete. Although the introduction of the Campelen trawl in 1995 has resulted in a higher catchability for fish sizes less than 35cm (14 inches), the survey biomass estimates for 1995-99 are still very low; between 5 and 15% of the 300,000 t 1978-90 Engel trawl average.

This **stock remains at a low level**. Recruitment has been very poor since the year classes of the early 1970's. Most of the abundance in the 1999 survey is composed of fish less than 23 cm (9 inches). Included in this are three pulses of recruitment at 9cm (3.5 inches), 14cm (6 inches) and 19cm 8 inches) that correspond to the 1997, 1995 and 1992 year-classes respectively. Further monitoring is required to determine the relative strength of these pulses. **Aside from this, there are no indications that the status of the stock will change in a positive way in the foreseeable future.**

Subdivision 3Ps American Plaice

This stock has been under moratorium since September 1993. Catches in recent years remain well below the historic average, but have increased from 90 t in 1995 to about 420 t in 1998 and 550 t in 1999. In 1998, more than 50% of the catch occurred as by-catch in the 3Ps cod fishery.

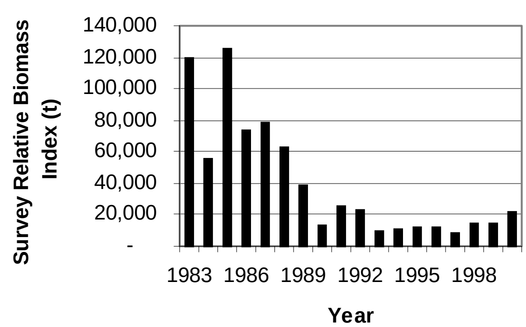


Figure 7 – Research Survey biomass index for Subdivision 3Ps American plaice, 1983-2000. All data 1983-1995 are in Campelen equivalents. Data from 1996-2000 are Campelen data.

Research vessel surveys indicate that this stock has remained at a low level since 1992. Biomass in 1999 was around 16% of the 1983-87 average. The 2000 survey showed an increase in both abundance and biomass, but the estimates are still well below those of the 1983-87 period.

In the short to medium term there is little prospect of significant rebuilding of this stock.

Subdivision 3Ps Witch flounder

This fishery has remained open with a TAC of 650 t in each year from 1998 to 2000. Catches in 1998 and 1999 were in the range of 470-500 t.

Research vessel surveys indicate that this stock has remained relatively stable in recent years. The mean biomass index estimate during 1992-99 was about two-thirds of the mean estimate during 1983-92. The estimates of abundance and biomass from the 2000 survey were similar to the average values of recent years.

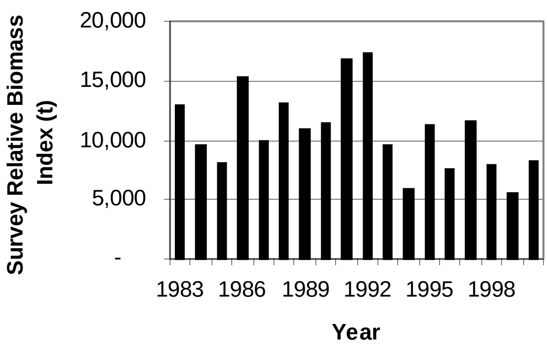


Figure 8 – Research survey biomass index for Subdivision 3Ps witch flounder, 1983-2000. All data 1983-1995 are in Campelen equivalents. Data from 1996-2000 are Campelen data.

There is no indication of an increase in recruitment and the stock appears to be relatively stable under the present level of exploitation.

Thorny Skate in Divisions 3L, 3N, 3O and Subdivision 3Ps

The Canadian skate fishery is regulated through quota control but the non-Canadian fishery outside 200 miles is unregulated. The NAFO Scientific Council expressed concerns about this unregulated fishery and for the first time, in 2000, the status of thorny skate was assessed at NAFO.

Until 1985, reported catches averaged less than 3000 t. Catches of skate increased dramatically in the early 1990's as a result of increased no-Canadian effort outside of the 200 mile limit. Canadian catches increased in the mid- 1990's. From 1992 to 1999, catches were on average half (close to 10,000 t) compared to the period 1985-1991.

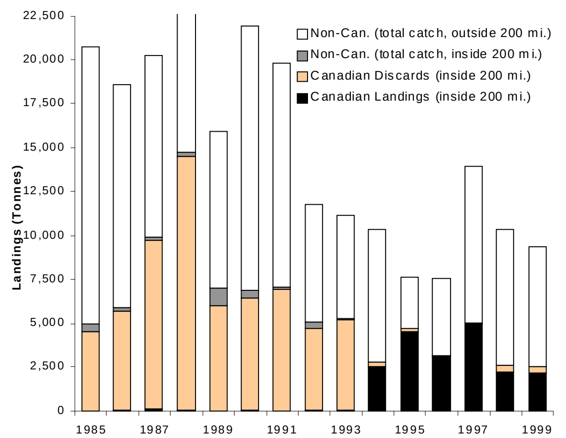


Figure 9 – Catches of thorny skate, 1985-1999.

Following a decline starting on the 1970's, biomass of thorny skate in Newfoundland reached its lowest historical level in the early 1990's. The decline was greater to the north. Average size of skates also declined until the early 1990's. However, in the years since 1995 when Campelen gear has been used to survey, the spring biomass index has been on a general upward trend The index is 30% higher in 2000 than in 1996. A longer time series is required to confirm if the trend over the past 5 years reflects an actual increase in biomass. Average size of skates has also increased steadily since 1995 due to an increase in the number of mature individuals in the population.

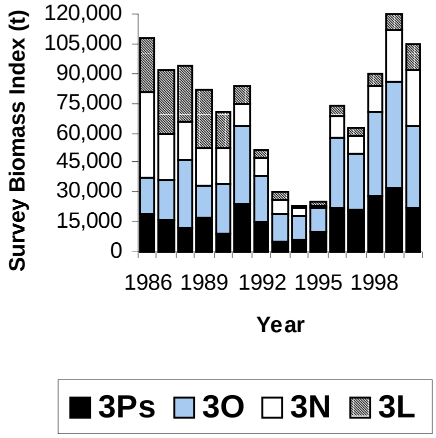


Figure 10 – Spring research survey biomass index for thorny skate, 1986-2000. Campelen gear was used for 1996-2000, Engel for previous years (not converted).

Analyses of spring and fall surveys and fishery data suggested that skate perform an annual migration toward the shelf edge in winter returning onto the shelf in mid-summer. These movements out of the research survey area affect spring estimates of biomass such that spring estimates are 36% lower than those from the fall surveys (1996-2000).

There is a lack of information on stock and age structure, growth rates and age at maturity of skate in the waters around Newfoundland. Also, what proportion of the decline of this resource in the late 1970's-early 1990's is attributable to changes in fishing mortality vs. environmental influences is unclear. **An increase in the biomass index over the past five years suggests that the period of decline starting in the 1970's has come to an end.**

White Hake in Divisions 3L, 3N, 3O and Subdivision 3Ps

The fishery for white hake on the Grand Banks is **not regulated by quota**. At present, closures due to high bycatch are the only limit on directed effort for hake. If this constraint was removed, catches could increase, possibly to the detriment of the stock.

Landings occur both as bycatch and from a directed fishery. Reported catches in recent years occur mainly in 3Ps and 3O although significant amounts were reported from 3N in the late 1980's. Catches declined during the last two decades to less than 1000 t annually since 1994. The catch in 1999 was only 920 t (2000 values are preliminary). Significant non-Canadian catches have not been reported to NAFO since 1991.

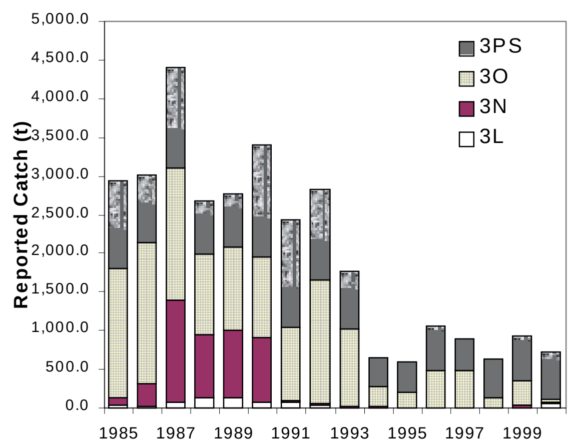


Figure 11 – Catches of white hake, 1985-2000.

Starting in the 1970's, **biomass** of white hake in 3LNOPs gradually declined to its lowest historical level in the early 1990's and has fluctuated at low levels since. White hake maintained the same geographical range along the south-western slope of the Grand Banks and Laurentian Channel where bottom temperatures are warm, in years of both low and high abundance.

What proportion of the decline of this stock is attributable to changes in fishing mortality vs. environmental influences is unclear. However, in 1999, the spring biomass index was three times the previous year with a further 28% increase in 2000 compared to 1999, primarily due to an increasing 3O index. This suggests a substantial increase in biomass for this stock since the low period of the early 1990's. A longer time series of Campelen data is required to confirm this trend. Average size of hakes declined dramatically during the 1980's and has remained low since.

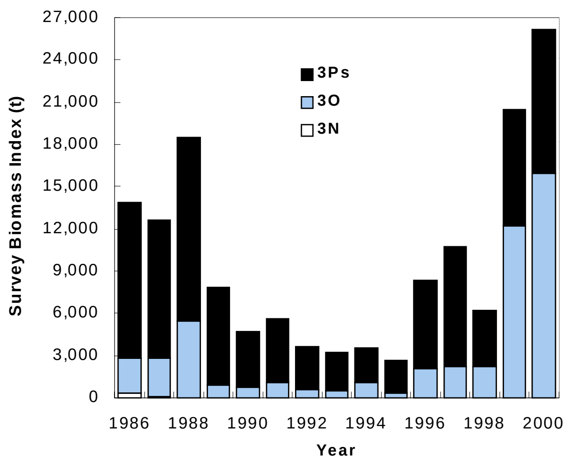


Figure 12 – Spring research survey biomass index for white hake 1986-1999. Campelen gear was used for 1996-2000, Engel for previous years (not converted).

The pelagic juvenile survey, conducted annually since 1992, found a large increase in young of the year white hake in 1996. Subsequently, an increase in proportion of 25 cm mode fish was noted in 1997, the best sign of small fish in recent years. Increases in estimates of abundance in 1999 and 2000 are even more dramatic than corresponding increases in biomass since the population consists mainly of juveniles. Abundance is more than 16 times higher in 2000 compared to 1997. This may largely be due to a large 1996 year class.

Information on stock and age structure of the population, growth rates and age at maturity of white hake in the waters around Newfoundland is lacking. However, a distribution restricted to the southwest slope of the Grand Bank and into the Laurentian Channel suggests that it comprises a single population with possible links to adjacent concentrations on the Scotian Shelf. **Indications of recruitment in 1996 and a dramatic increase in the abundance index in 1999-2000 may be positive signs. Further monitoring is required.**

Catfish (Wolffish) in Divisions 2J, 3K, 3L, 3N, 3O and Subdivision 3Ps

Catfish species are reported in the landing statistics as a single entity, catfish but comprises 3 species; striped (Atlantic), spotted and northern (broadhead), the first two of commercial value. Northern or broadhead catfish is not of commercial value and is discarded. There is no directed fishery for any of the species. **Rather, they had been taken in substantial numbers as by-catch in other fisheries in the past.** During the 1980's, catches including amounts discarded at sea exceeded 1000 t in most years then declined after 1991 when many groundfish fisheries were closed.

Reported Canadian landings were only 23 t in 1996, increasing to 157 t in 1997 and 155 t in 1998 and 315 t in 1999. Preliminary estimates for 2000 are 369 t. Recent increases are due mainly to bycatch from the cod fishery in 3Ps.

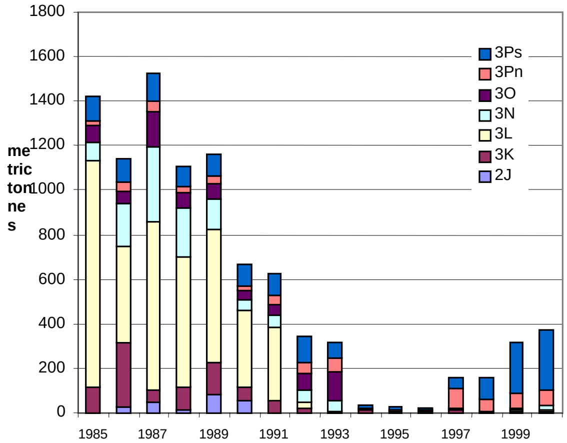


Figure 13 – Catches of wolffish, 1985-2000

For **striped catfish**, the **survey biomass index** also remains at a relatively low level, although the overall decline has not been as great as occurred with spotted or broadhead wolffish.

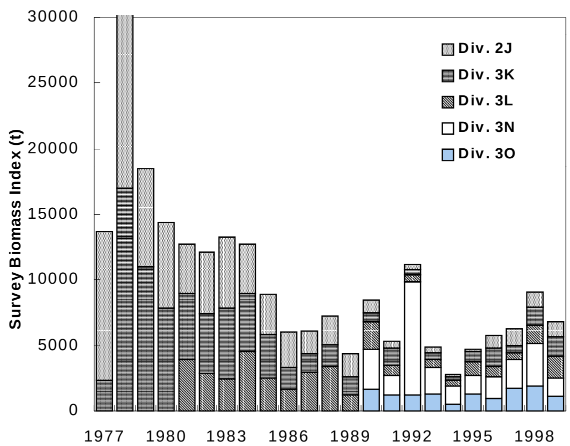


Figure 14 - Fall survey biomass index for striped catfish 1977-1999. Campelen gear was used for 1996-2000, Engel for previous years (not converted).

For **spotted catfish**, the **research survey biomass index** has fluctuated at a low level since the early 1990's, well below the values observed in the early 1980's.

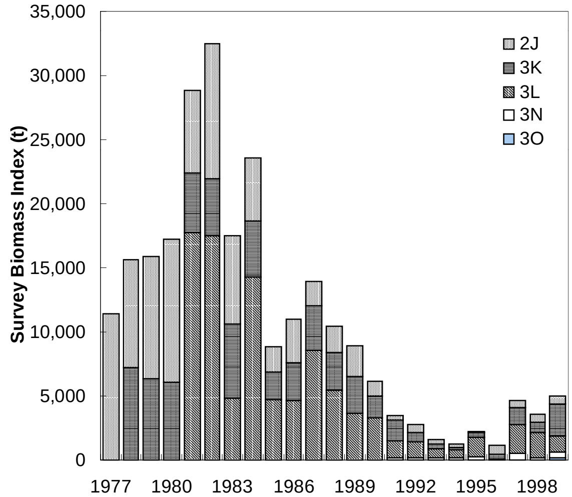


Figure 15 – Fall survey biomass index for spotted wolfish, 1977-1999. Campelen gear was used for 1996-2000, Engel for previous years (not converted).

Biomass index of spotted and striped catfish remain at low levels. However, the index for striped catfish has increased over the past five years to 1998 perhaps suggesting some moderate recovery. Exploitation on both of these species has been low in the 1990's.

Winter (Blackback) Flounder in Divisions 3K, 3L and 3Ps

This species has been taken in a directed species and as bycatch for many years. Catches increased in 1994 and 1995 to 1564 and 1054 t respectively, but declined again in 1996-1998 to 589, 498, and 504 t respectively. Landings increased to 809 t in 1999 similar to levels observed in the late 1980's and early 1990's. It is unknown whether trends in reported represent changes in the resource or changes in fishing effort. The increase in 1999 (mainly due to increased landings in 3L) is likely linked to the re-opened cod fishery in that area since blackback flounder are commonly taken in nets set for cod.

Blackback flounder is rarely observed in research vessel catches as it is generally restricted to less than 60 m water depth. **Lack of data make it impossible to determine trends in biomass or examine other biological characteristics.** The distribution of reported landings suggest that it is widespread near shore around the coast of Newfoundland.

Lumpfish in Divisions 3K, 3L and 3P

Lumpfish roe **landings** from divisions 3K, 3L and 3P were approximately 500 t from 1977 to 1984. They reached a high of 3000 t in 1987 then declined to an average of 2000 t from 1988 to 1994. There was a decline to 1000 t in 1995 and 1996. The landings increased to 2000 t in 1997 and fell to 1100 t in 1998. In 1999 total reported landings were 2200 t with 1600 t taken in 3P.

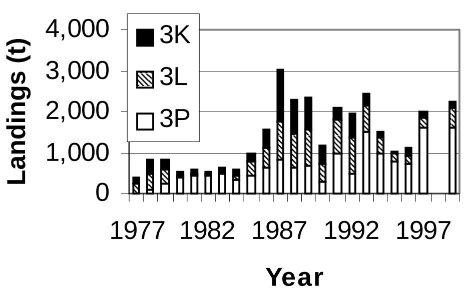


Figure 16 – Lumpfish roe landings for NAFO Divisions 3K, 3L, and 3Ps, 1977-1999.

The lumpfish fishery is exclusively on pre-spawning mature females and therefore the spawning stock is vulnerable to over-exploitation.

This fishery is regulated by **effort controls**. There have been reductions in numbers of nets allowed as well as duration of the fishery in recent years These reductions in effort over time were imposed as a result of indications of stock declines, particularly in divisions 3K and 3L.

Research vessel survey results are not useful in evaluating this resource due to the relative inshore distribution compared to survey coverage.

There are **no scientific investigations to determine the current status of this resource**.

The Environment

Annual mean air temperatures over most of the Northwest Atlantic were above normal during 1999. **Record highs were recorded at St. John's with temperatures 1.9°C above normal, a 126-year record and at Cartwright 1.9°C above normal, a 65-year record.** The peak extent of sea ice area on the Newfoundland and Southern Labrador Shelves during 1999 decreased over 1998 values and was about ½ the peak extent of the heavy ice years of the early 1990s. The number of icebergs reaching the Grand Banks in 1999 was only 22, well down from the 1384 observed in 1998. **In general, both the sea ice extent and duration were below normal during 1999.**

Ocean temperatures at Station 27, located off St. John's in the inshore branch of the Labrador Current, ranged from 0.3° to 0.8°C above normal for the winter months over most of the water column. By mid-summer **surface water temperatures increased to over 2°C above normal**. Water temperatures during the fall months over the upper 100-m of the water column were below normal by about 0.5°C. **Bottom temperatures throughout the year were also above normal by up to 0.5°C.** Surface salinities at Station 27 reached a maximum of 32.2 in mid-March and decreased to a minimum of 30.5 by late August, these values were below the long term mean by up to 0.5. Below 50-m depth, salinities generally ranged from 32.4 to 33.0. There was a slight positive anomaly during the winter months but generally salinities were fresher than normal throughout most of the year.

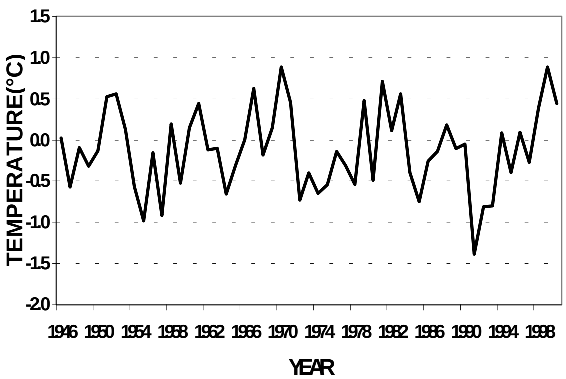


Figure 17 – Annual surface temperature difference from 1961-1990 mean, 1946-1999.

During the summer of 1999, the total amount of sub-zero ^{o}C water (**cold intermediate layer or CIL**) on the Newfoundland Shelf continued the below normal trend established in 1995. **The CIL area ranged from 25% below normal off eastern Newfoundland to near 50% below normal on the southern Labrador Shelf.**

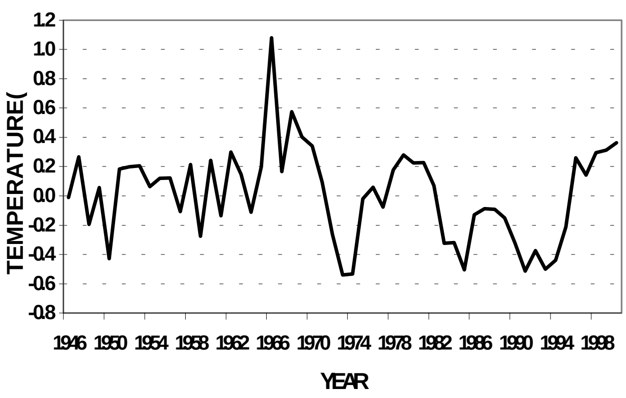


Figure 18 – Annual bottom temperature difference from 1961-1990 mean, 1946-1999.

Bottom temperatures during the spring of 1999 on the Grand Bank were above normal over northern areas by up to 1^{o}C and by 1^{o}-3^{o}C above normal over the central and southern areas. **During the spring and fall of 1999 the areal extent of sub-zero ^{o}C bottom water decreased to near 0% in the shallow areas of the banks.** In subdivisions 3Ps and 3Pn bottom temperatures were above average over Burgeo Bank and Burgeo Channel. Hermitage Channel temperatures were near normal while those over most of St. Pierre Bank were above normal by up to 2^{o}C. In general, bottom temperatures over most of the area were above normal continuing the trend established in 1998. The areal extent of sub-zero ^{o}C bottom water covering the banks in this region shows a dramatic increase since the mid-1980s, very low values in 1998 and a complete disappearance in 1999. The extent of bottom water with temperatures above 1^{o}C was about 50% of the total area of the banks during 1998 the first significant amount since 1984 and this increased to 70% in 1999. In general, temperature conditions in this region are highly variable but it appears that the cold trend on St. Pierre Bank has moderated during 1998 and 1999

In summary, the below normal trends in temperature and salinity, established in the late 1980s reached a peak in 1991. This cold trend continued into 1993 but started to moderate during 1994 and 1995. During 1996 temperature conditions were above normal over most regions, however, summer salinity values continue to be slightly below the long-term normal. During 1997 to 1999 ocean temperatures continued to warm and were above normal over most areas. A preliminarily analysis of oceanographic data for 2000 indicates a general decrease in temperatures towards normal values.

Outlook

For the groundfish stocks examined in this overview, there are few signs of stock recovery. Many of the species are relatively long lived and will require a number of years following the next good recruitment before these year-classes would begin to contribute to the spawning stock biomass.

The exceptions to the above are witch flounder in Subdivision 3Ps and thorny skate, which at current catch levels appear to be stable and increasing in stock size respectively. Strong 1998 year class recruitment for haddock is also encouraging; however, for this trend to continue bycatch levels for small haddock will need to be controlled in the future.

For More Information

Research Documents:

Anon. 2000. Oceanographic Conditions in the Newfoundland Region during 1999. DFO Science Stock Status Report G2-01.

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Reports:

Anon. 1996. Divisions 2GH cod. DFO Science Stock Status Report 96/44E.

Anon. 1996. Divisions 3LNO haddock. DFO Science Stock Status Report 96/46E.

Anon. 1996. Subarea 2+3K redfish. DFO Science Stock Status Report 96/47E.

Anon. 1999. American plaice in Subdivision 3Ps. DFO Science Stock Status Report A2-12.

Anon. 1996. Subdivision 3Ps haddock. DFO Science Stock Status Report 96/82E.

Anon. 1999. Subdivision 3Ps pollock. DFO Science Stock Status Report A2-07.

Anon. 1999. Witch Flounder in NAFO Subdivision 3Ps. DFO Science Stock Status Report A2-09.

Anon. 1998. Divisions 3L, 3N, 3O and 3Ps skates. DFO Science Stock Status Report A2-18.

Anon. 2000. Monkfish in Divisions 3L, 3N, 3O and 3Ps. DFO Science Stock Status Report A2-20.

Anon. 1998. White hake in Divisions 3L, 3N, 3O and 3Ps. DFO Science Stock Status Report A2-06.

Anon. 1996. Catfish (wolffish) in Divisions 2J, 3K, 3L, 3N, 3O and 3Ps. DFO Science Stock Status Report 96/91E.

Anon. 1997. Newfoundland Region Groundfish Overview. DFO Science Stock Status Report A2-19.

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Internet address: www.dfo-mpo.gc.ca/csas

ISSN: 1480-4913

La version française est disponible à l'adresse ci-dessus.

Correct citation for this publication

DFO, 2000. Newfoundland Region Groundfish Overview. DFO Science Stock Status Report A2-19 (2000).