



## Newfoundland and Labrador Region

## Stock Status Report 2003/023



### THORNY SKATE IN DIVISIONS 3L, 3N, 3O AND SUBDIVISION 3Ps

#### Background

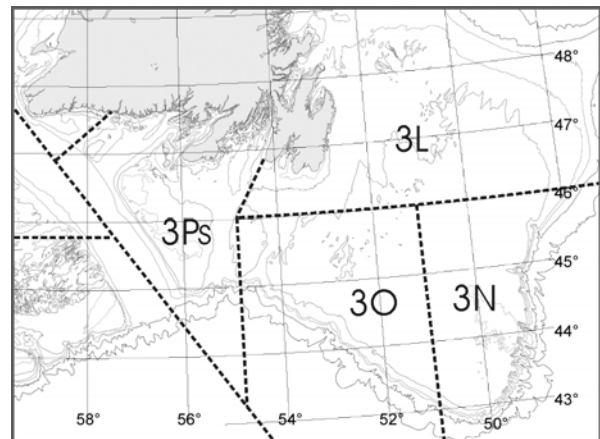
There are 10 species of skate in the waters around Newfoundland. Of these, thorny skate (*Amblyraja radiata*) is by far the most common, comprising greater than 90% of those caught during research surveys. On the Grand Banks, the centre of its distribution in Canadian waters, thorny skate is widely distributed in depths ranging from 18 meters (10 fathoms) to over 1500 meters (820 fathoms), in temperatures from  $-1.4^{\circ}$  to about  $6^{\circ}\text{C}$  and on both hard and soft bottoms. Recent studies indicate that thorny skate on the Grand Banks undergo an annual migration toward the shelf edge in the winter/spring returning onto the bank in midsummer and fall, probably to spawn.

It is not known how long thorny skate live in the waters around Newfoundland. The time between tagging and recapture of some individuals suggests that they can live at least 20 years. They deposit between 6 and 40 egg cases (also known as mermaids' or sailors' purses) per year that contain single embryos. Males mature at smaller sizes than females, and size at maturity increases from north to south. Limited data suggest that reproduction occurs during the summer/fall period when skates are concentrated on the Grand Banks. Thorny skate feed on a wide variety of items including invertebrates and fish. As well, significant amounts of offal have been found in the

stomachs of skate captured in the vicinity of commercial fisheries.

Until the mid-1990's, there was limited interest by the Canadian fleet in fishing for skate in the waters around Newfoundland. Previously, skate was usually discarded even though it constituted the most common non-commercial by-catch in offshore trawler catches. These by-catches were not reported in the Canadian catch statistics. Most of the reported catches before 1994 are attributable to non-Canadian fleets. With the decline of other groundfish resources, Canadian interest in skate increased and a quota was introduced in 1995 inside Canada's 200-mile limit. The quota was based on a 20% exploitation rate of the research survey biomass estimate for 1993. This rate was subsequently considered too high and was reduced to 10%. The current TAC is set at 3000 t. Catches outside 200 miles are currently unregulated.

Fishers are interested in the width of the skate wings, as the wings are the marketable products. Based on market conditions, the minimum acceptable size is about 46 cm (18 inches).



#### Summary

- The abundance of thorny skate increased from the early 1970's to the mid-1980's then declined to its lowest level in the mid-1990's. he

population has since been stable at this lower level.

- Thorny skate on the Grand Banks undergo a migration. They are concentrated along the outer bank between December and June and on the bank between July and November. The degree of offshore migration (proportion off the bank in the winter/spring) appears to have intensified during the period of decline of the population (mid-1980's to the early 1990's).
- Thorny skate have become increasingly concentrated in a smaller area (hyper-aggregation). The extent to which this is happening increased following the decline in biomass. Once densely concentrated on the northern Grand Bank, thorny skate are now absent from much of the area. About 90% of the biomass is now concentrated in 20% of the area (near the edge of the Southwest Grand Banks).
- The southwest edge of the Grand Bank is where the fishery occurs and commercial catch rates (inside and outside 200 miles) have increased as the fish have become increasingly more aggregated.
- Concurrent with the decline in biomass of thorny skate, a reduction in average weight was observed: 2 kg in the mid-1970's compared to 1.3 kg in the mid to late 1980's and 0.5 kg in the mid-1990's. Since 1994, average weight has increased to about 1.5 kg.
- Small skates (10-30 cm) have been largely absent from the northern Grand Banks (NAFO Div. 3L) since 1996. The largest occurrence of small skates is now found in NAFO Subdiv. 3Ps.
- Since the mid-1990's, 16.5% of the biomass has been outside of the 200-mile limit while 72% of the catch came from outside 200 miles.
- Reported commercial catch increased substantially in 2000 compared to the previous five years. The increase occurred outside of 200 miles.
- The Exploitation Index (commercial catch/spring survey biomass index) increased from about 5% in the mid-1980's to about 15% in 2000. This coincides with the period of decline.
- Causes for the decline are unclear. The area of greatest decline, on the Northern Grand Banks, is an area with little or no fishing. The period of decline was concurrent with that of the decline of many other demersal species.
- Information is lacking on most aspects of the population dynamics of thorny skate. Thus, it is not possible to undertake age based analyses or estimate the spawning stock biomass with any certainty.

## Species biology

Elasmobranch (skates and sharks) life history and population dynamics differ from most other marine fish. This group has a low reproductive potential due to slow growth rates, late sexual maturation, low fecundity (no more than 10s of progeny per female per year) and long reproductive cycles. They do not have the capacity to produce large year classes, resulting in low intrinsic rates of population increase. They are thought to have very low resilience to fishing mortality. Thus, they may be particularly susceptible to over-exploitation, and recovery from depletions, caused either by natural phenomena or human activities could take many years.

## The Fishery

Significant bycatches of skates have likely been taken since the start of offshore fishing in the late 1940's, initially by non-Canadian and later by Canadian fleets as well. In the mid-1980's, a non-regulated skate fishery was started by Spain outside Canada's 200-mile limit on the Tail of the Grand Bank.

Significant skate landings first appeared in the Canadian statistics in 1993 and 1994, as a result of experimental fishing. In 1995, a regulated directed skate fishery was established by Canada inside the 200-mile limit. A Total Allowable Catch (TAC) was set, gear and bycatch policies were implemented, and the existing licensing system was applied by Canada. The current TAC is 3000 t and Canadian landings over the past five years have averaged 2,760 t annually. These were taken by longline, gillnet and otter trawl.

The majority of catches are taken by non-Canadian fleets outside of 200 miles. Since the mid-1990's, 72% of the catch came from outside 200 miles while 83.5% of the spring survey biomass occurred inside 200 miles. In 2000, catches of all countries combined increased sharply to 19,812 t. All of the increases are attributable to fishing outside 200 miles. Preliminary catch figures for 2001 and 2002 are lower but still in the range of 10,000 t.

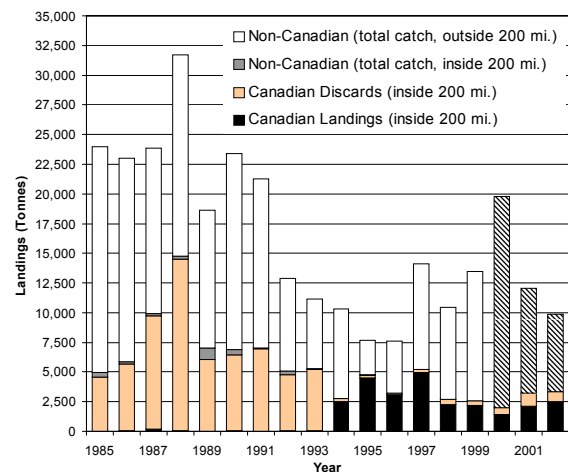


Figure 1. Catch of skate by all countries, 1985-2002. The data for 2000 to 2002 (striped portion of the bars) are preliminary.

## Industry perspective

A Canadian directed skate fishery is a relatively recent development. The value of the fishery compared to that of other groundfish, has remained low (about 45 cents per lb) over the life of the fishery and markets have been limited. The result is that the Canadian quota has not been taken. In contrast, the non-Canadian fishery outside of 200 miles has expanded in recent years.

### Resource Status

Research surveys indicate that thorny skate abundance on the Grand Banks increased from the early 1970's to the mid-1980's then declined to its lowest historical level in the mid-1990's.

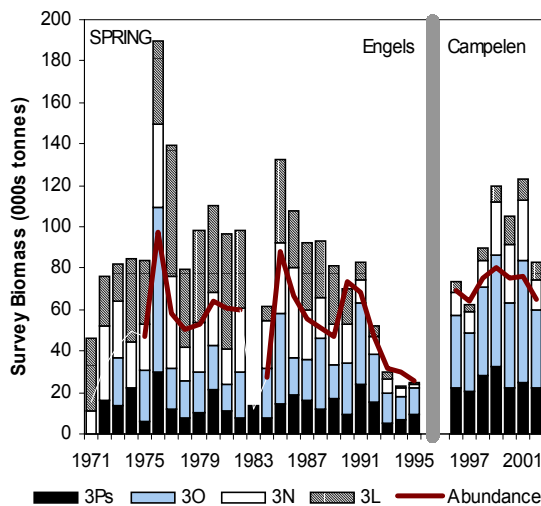


Figure 2. Spring survey biomass indices (vertical bars) and total abundance over all Divisions (solid line) for thorny skate in NAFO Divisions 3L, 3N, 3O, and Subdivision 3Ps, 1971-2002. Thick vertical line represents a change in survey gear from Engels to Campelen (Fall 1995).

Most of the decline occurred in the northern part of the area (Div. 3L) where fishing effort was largely absent. The biomass in Divs. 3NO and Subdiv. 3Ps remained relatively stable up to 1991 then also declined until 1994. The population has since been stable at this lower level. A change in gear from Engel to Campelen trawl in fall 1995 likely affected catchability of skate. Thus, the two periods are not comparable. The biomass has been stable since the mid-1990's.

An index of exploitation (commercial catch/spring survey biomass index) was used to examine relative changes. The index suggests that exploitation increased from about 5% in the mid-1980's to about

15% in 2000 (the period of stock decline).

Thorny skate have become increasingly concentrated in a smaller area (hyper-aggregation). The extent to which this is happening increased following the decline in biomass in the early 1990's. Once fairly evenly distributed over the entire Grand Bank, thorny skate are now absent from much of the northern area. About 90% of the biomass is now concentrated in 20% of the Bank (near the southwest edge).

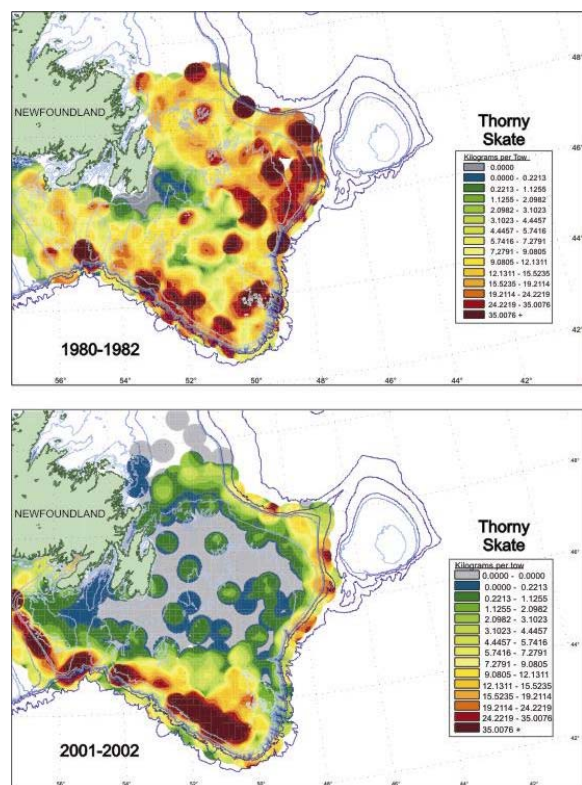


Figure 3. Distribution of thorny skate in 1980-1982 compared to 2001-2002 based on spring research surveys. Grey areas depict zero catches, red areas highest catches.

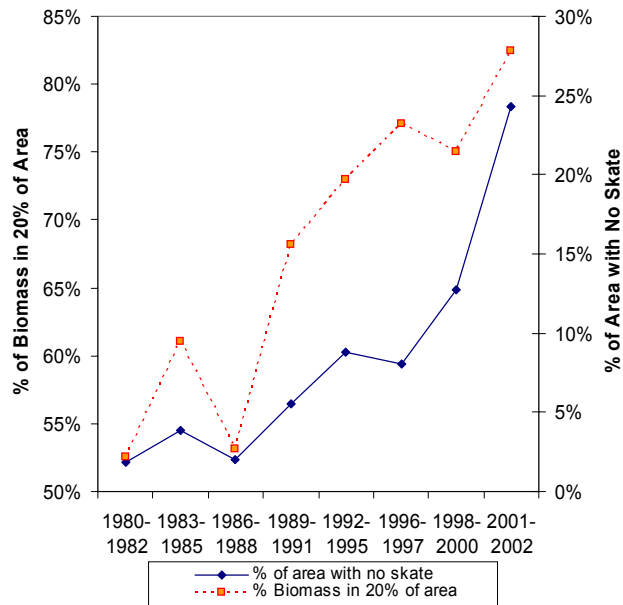


Figure 4. Percent of the stock area without thorny skate (solid line) and percent of biomass contained within 20% of the total stock area (dotted line).

### Sources of uncertainty

Our ability to assess the status of thorny skate is limited by a paucity of information on their life history and uncertainties with respect to the catch history. Information on such things as growth rates and age of maturity and details of the age structure of the population(s) is lacking. Thus, it is not possible to undertake age-based analyses or estimate the spawning stock biomass with any certainty.

Catches of skates outside 200 miles constitute the largest catch component and are unregulated. There are indications that catch information from outside 200 miles continues to be unreliable.

Given the available data, it is not possible to determine the current exploitation rate or what level is most appropriate for a sustainable fishery.

Thorny skate has undergone substantial changes in its distribution starting in the 1980's. It has become increasingly aggregated on the southern part of the Grand Bank and the rate of aggregation has accelerated in recent years following the decline. The result is a decreasing area of occupancy and increasing catch rates in the commercial fishery that occurs where the skate are aggregated. A very similar pattern was observed for northern cod just prior to its collapse. The result of the aggregation is that skate are increasingly more vulnerable to exploitation as they become more densely concentrated where fishing occurs. In addition, the degree of migration increased during the period of decline but has returned to previous levels since. Whether these spatial dynamics are an indication of a stock in stress is unknown.

As with numerous other species, the proportion of the decline that is attributable to changes in fishing mortality versus environmental influences remains uncertain. Whatever the cause, the stock has remained at its lowest level since the mid-1990's and has undergone distributional changes that may reflect stress.

### Outlook

Thorny skate underwent a decline in the late 1980's to early 1990's. Since then abundance has remained relatively constant at the lowest historic level. With the exception of the western extent of the skate distribution on the St. Pierre Bank (NAFO Subdiv. 3Ps), information on sizes of fish from research surveys indicates that recruitment has been low in all areas since 1996. Recruitment on the northern Grand Bank (NAFO Div. 3L) has been absent during this period.

Analysis of research data indicates that thorny skate declined earlier and at a greater rate in the north than in the southern part of its range. The decline starting in the early 1980's accelerated in the early 1990's. In recent years, the stock has reached its lowest level in all areas and the biomass shows no sign of recovery. The rate of the northern decline has also increased in recent years. As a result of the decrease in biomass, the index of exploitation has increased steadily since the 1980's.

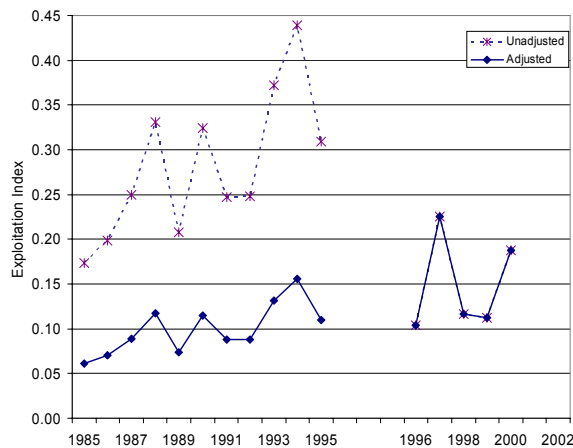


Figure 5. Exploitation Index (total estimated catch/spring survey biomass index). Solid line represents spring survey biomass converted to Campelen equivalent.

The available evidence indicates that at best the stock is stable at a low level of biomass. At worst, recent changes in distribution have reduced its range and made it more vulnerable to overfishing. Low recruitment over most of the stock area in the last seven years suggests that the stock may not be fully replenishing itself.

Considering the historical decline in biomass indices, the lack of comparable data on current stock status and the uncertainty about the ability of the

stock(s) to rebuild, an increase in harvest levels is not considered prudent.

### **Management Considerations**

The Canadian TAC for this stock is 3000 t. Low value and limited markets result in this TAC not being taken. However, the majority of the catch (90% of total catch in 2000, average of 67% since 1985) of this stock occurs outside of 200 miles where there are no quotas. In addition, catch reports from this area may not be reliable.

The index of exploitation in NAFO Div. 3N, which is fished exclusively by non-Canadian fleets outside of 200 miles, was on average 6.5 times higher than in areas fished by Canada inside 200 miles. Both Canadian fleets and non-Canadian fleets fish the same concentration, very likely the same stock of thorny skate. Thus, if significant reductions in the catches are to take place, the majority would have to occur in the unregulated fishery outside of 200 miles.

### **For More Information**

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## References

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