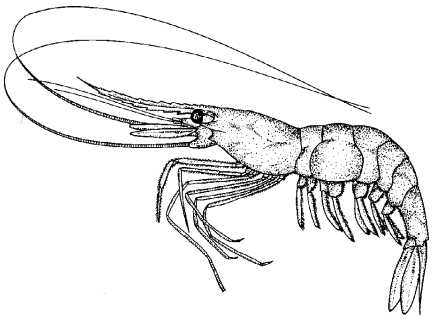
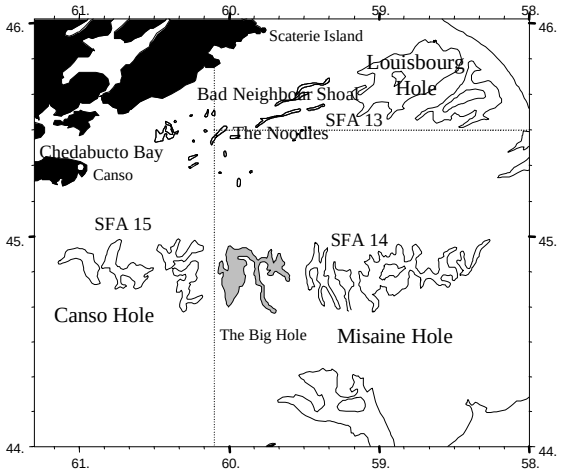
Fisheries and Oceans / Pêches et Océans

Maritimes Region

DFO Science

Stock Status Report C3-15(1999)





Northern Shrimp on the Eastern Scotian Shelf

Background

The northern or pink shrimp, Pandalus borealis, is the only shrimp species of commercial importance in the Maritimes Region. Shrimp are crustaceans, and have a hard outer shell which they must periodically shed (molt) in order to grow. The females produce eggs once a year in the late summer- fall and carry them, attached to their abdomen, through the winter until the spring, when they hatch. The newly hatched shrimp spend 3 to 4 months as pelagic larvae, feeding near the surface. At the end of this period they move to the bottom and take up the life style of the adults. On the Scotian Shelf, the northern shrimp first matures as a male, at 3 years of age, and at age 4 it changes sex, to spend another 1 to 2 years as a female.

Shrimp concentrate in deep holes on the eastern Scotian Shelf, but nearshore concentrations along coastlines closest to the offshore populations have recently been discovered. They prefer temperatures of 2 to 6 ºC, and a soft, muddy bottom with a high organic content.

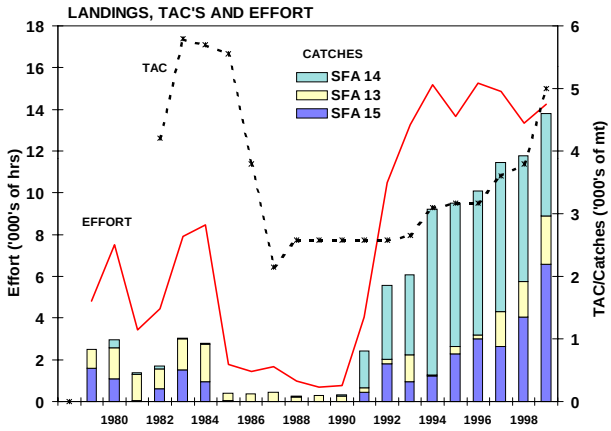
The shrimp fishery on the Scotian Shelf concentrates during summer in Shrimp Fishing Areas (SFAs) 13-15, also called the Louisbourg, Misaine and Canso holes, respectively. The shrimp are fished with otter trawls having a 40 mm mesh size throughout. The main management tools are limits on the number of licenses and size of vessels used, minimum mesh size, use of a Nordmøre separator grate, and a Total Allowable Catch (TAC). The fleet is divided into two sectors, a midshore sector consisting of vessels 65-100' LOA based in New Brunswick on the Gulf of St. Lawrence side, and an inshore sector consisting of vessels <65' LOA based on the Atlantic coast of Nova Scotia. An experimental trap fishery, currently consisting of 10 active licenses, has recently developed in Chedabucto Bay. Three vessels are currently engaged in an experimental trap fishery in Mahone Bay on the South Shore.

Summary

- The fishery continues to catch the TAC and stay within the 65 count (numbers per pound).
- The amount of catch taken from the inshore off Bad Neighbour Shoal increased from 20% of the total catch in 1998 to 40% in 1999.
- Biomass and CPUEs continued to increase in 1999.
- The DFO-industry survey shows that the 1995 year class is strong while the 1996 year class is very weak.
- There has been a change in the catch composition reflecting the strong 1995 and weak 1996 year classes.
- Exploitation was estimated to be 12.5%.
- The TAC for 2000 can remain at the 1999 level or be increased to take advantage of the strong 1995 year class but any increase should be kept at <10% to conserve the weak 1996 year class which will constitute a significant part of the catch.
- A decrease in the TAC may be required in 2001 to conserve the spawning stock.

The Fishery

The introduction of the Nordmøre grate in 1991 reduced by-catches of groundfish to negligible levels and allowed the shrimp fishery to expand to its full potential. In 1996, the inshore (23 vessels <65' LOA) component of the trawler fleet moved from individual quotas (IQs) to individual transferable quotas (ITQs), while the midshore (6 vessels 65-100' LOA) moved from a competitive fishery to IQs. In 1998, all vessels were under ITQs. Temporary licenses were introduced in 1998 as part of a co-management agreement to take advantage of increasing stock sizes and TACs while facilitating effort reduction in the event of the rapid downturn often seen in shrimp fisheries. This fishery continues to take most (75%) of the TAC early in the season during May and June and has taken the TAC every year since individual SFA quotas were combined into the single TAC in 1994.



Landings (mt)

Year	1993	1994	1995	1996	1997	1998	1999
TAC trawl	2650	3100	3170	3170	3600	3800	4500
Catch	2044	3074	3148	3171	3574	3800	4500
TAC trap	-	-	500	500	500	500	500
Catch	-	-	27	187	222	131	100
Catch Total	2044	3074	3175	3358	3796	3931	[1]4600

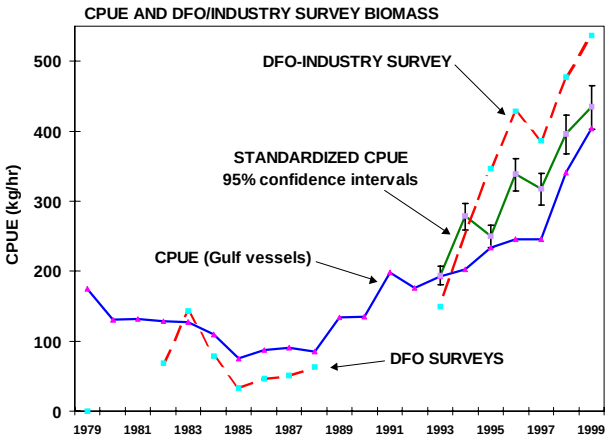
[1]1999 catches are projected.

Most of the effort and catch prior to 1999 has been in the Misaine Hole (SFA 14), while fishing in peripheral areas has varied.

In 1998 the Scotia-Fundy trawl fleet fished inshore in SFA 15 for the first time, taking 20% of the TAC near the Bad Neighbour Shoal. This increased to 40% of the catch in 1999. Initially, fishing in this area appeared to be a matter of convenience (the area is closest to markets) but in 1999 it became apparent that fishers were also targeting the concentration of females in this area to compensate for difficulties in "making the count" (65 shrimp per pound) offshore due to the abundance of males from the 1995 year class.

Resource Status

Assessments are based on two commercial catch rate (CPUE) indices (Gulf vessels only 1978-99, and all vessels 1993-99) obtained from trawler logbooks; samples from commercial trawl and trap catches (since 1995); a DFO shrimp survey (1982-88); a DFO-industry shrimp survey (since 1995); an experimental recruitment survey initiated in 1999; and logs from the experimental trap fishery.



The standardized **CPUE** index (all vessels) and the unstandardized CPUE series from Gulf based vessels continue to show an increasing trend, 1999 being the highest for both series.

The 1999 **DFO-industry survey** produced the highest biomass estimate to date, with increases recorded in SFAs 13 and 15 (offshore) , and stable biomass in SFAs 14 and 15 (inshore).

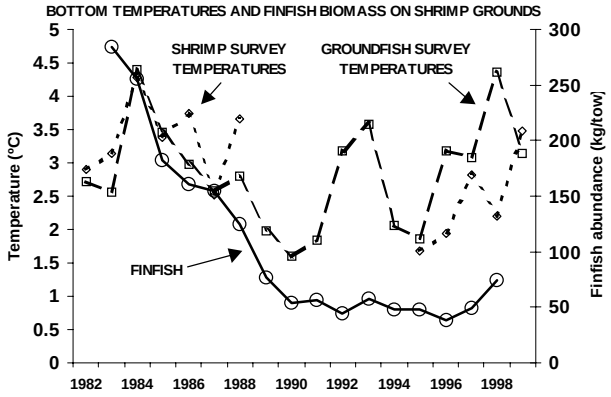
Port sampling in 1999 shows changes in the **catch composition,** including fewer shrimp taken below 20mm and a larger proportion of males compared to females than in previous years. This change can be attributed to the weak 1996 and strong 1995 year classes.

Population estimates at length and age from the DFO-industry survey indicate that the 1995 year class, which was just above average in the 1998 survey, is the largest of the series in the 1999 survey. The 1996 year class is the weakest in both the 1998 and 1999 DFO-industry survey and in an experimental recruitment survey conducted in February 1999. The spawning stock biomass remains high.

Size-specific **exploitation** based on minimum population estimates at length from surveys and commercial catch at length indicates that most females were exploited at <20% and most males <10% in 1999. Overall exploitation based on catch weight and the survey biomass was estimated to be 12.5%.

Ecosystem considerations: Feeding studies have shown that shrimp are important prey for many groundfish species. Significant negative correlations between shrimp and cod, redfish, plaice, and turbot abundance have been demonstrated from the Gulf of Maine to the Newfoundland Shelf. With many groundfish stocks at low levels on the eastern Scotian Shelf, predation mortality by fish is probably below the long-term average.

On the Scotian Shelf, northern shrimp are near their southern limit of distribution and population increases may be associated with colder water temperatures there during the early 1990's. Warmer temperatures were observed in 1997 and 1999 but there is no clear warming trend as yet.



Outlook

The TAC for 2000 can be maintained at the 1999 level or increased to take advantage of the strong 1995 year class which will then be fully recruited as females. However, it should not be increased more than 10% to conserve the male portion of the stock (1996 year class).

The continued high spawning stock biomass and low exploitation rate make it unlikely that the weak 1996 year class is due to fishing, however no causative environmental signals have been identified. The strong 1995 year class should sustain the fishery through 2000. However males constitute a significant part of the catch. The weak 1996 year class, which will have recruited as males in 2000, could result in a decrease in catch rates.

Management action beyond 2000 depends partly on the strength of the 1997 year class which cannot be determined at this time. The fishery will likely experience decreased catch rates of females from the weak 1996 year class in 2001 and a decrease in TAC may be indicated once the 2000 survey establishes the size of this year class. A recruitment survey which determines year class strength 2-3 years in advance is under development to allow longer term forecasting and planning.

The trap fishery in SFA 15 did not catch its TAC in 1999. This was due to a limited rate of immigration of female shrimp into Chedabucto Bay from surrounding areas rather than to undercapacity or low stock size. The experimental fishery in Mahone Bay caught about 16mt in 1999 and was probably limited by similar factors.

For more Information

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Koeller, P. (in press). Relative importance of environmental and ecological factors to the management of the northern shrimp (Pandalus borealis) fishery on the Scotian Shelf. J. Northwest Atl. Fish.

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