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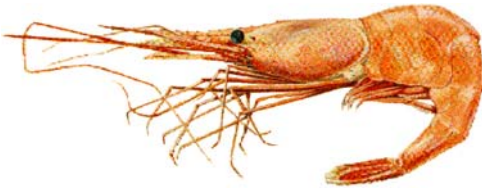
Newfoundland and Labrador Region **Stock Status Report 2004/022**



Northern Shrimp (*Pandalus borealis*) Stock Status Update Div. 0B to 3K

Background

Northern or pink shrimp (Pandalus borealis) are found in the Northwest Atlantic from Davis Strait to the Gulf of Maine, usually in areas where the ocean floor is soft and muddy and where temperatures near the bottom range from about 1 to 6^{0}C. These conditions occur throughout the Newfoundland and Labrador offshore area within a depth range of roughly 150 - 600 m, thus providing a vast area of suitable habitat. The species is the primary cold-water shrimp resource in the north Atlantic.

These shrimp are protandrous hermaphrodites. They first mature as males, mate as males for one to several years and then change sex to spend the rest of their lives as mature females. They are known to live for more than 8 years in some areas. Some northern populations exhibit slower rates of growth and maturation but greater longevity results in larger maximum size.

During the daytime, northern shrimp rest and feed on or near the ocean floor. At night, substantial numbers migrate vertically into the water column, feeding on zooplankton. They are important prey for many species such as Atlantic cod, Greenland halibut, skates, wolffish, snow crab and harp seals.

The 2003 TAC remained at the 2002 level in shrimp fishing area (SFA) 2 (Div. 0B), while increases were granted in SFA's 4 (Div. 2G), 5 (Hopedale + Cartwright Channels) and 6 (Hawke Channel + Div. 3K) (Fig. 1). Furthermore, in 2003 the fishing season was changed from a calendar year to a management year (Apr. 1, 2003 – Mar. 31, 2004). An interim quota of 20,229 t was set for Jan 1 – Mar. 31, 2004.

A formal assessment of the 2003 resource was not conducted; therefore, this report provides an update of resource status.

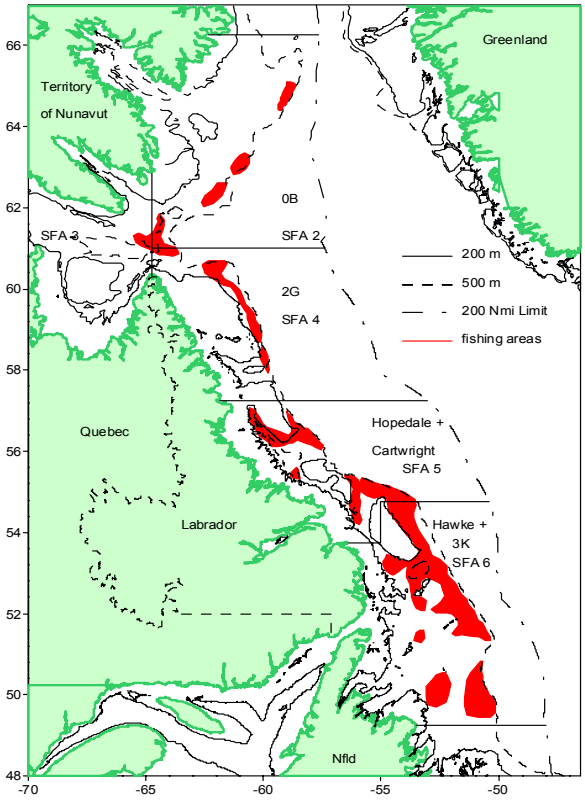


Figure. 1: Map of northern shrimp fishing areas (SFA's).

Summary

- Resource status was updated based on trends in fishery catch per unit effort (CPUE) and fishing pattern. Also a fall multispecies research vessel (RV) bottom trawl survey series (1995 – 2003) provided information on distribution, abundance and biomass indices, size and sex composition in the Div. 2J portion of SFA 5 and Hawke Channel + Div. 3K (SFA 6).
- In general, landings reached an all time high and resource status appears positive. However, uncertainties increase from south to north due to lack of fishery independent data.

SFA 6 (Hawke Channel + Div. 3K)

- Landings in 2003 totaled ~ 62,000 t, remaining near the all time high (TAC = 77,932 t).
- The 2003 large (>500 t) vessel CPUE remained above the long term average. The small vessel CPUE has remained stable since 1998. The resource continues to be distributed over a broad area.
- Biomass and abundance indices from research vessel surveys increased over the 1997 – 2001 period and have since remained high.
- The exploitation rate index has remained stable at a low level since 1998. Recent catches have had no observable impact on shrimp abundance and biomass.
- Current status remains positive.

SFA 5 (Hopedale and Cartwright Channels)

- Landings in 2003 totaled ~ 17,000 t, the all time high (TAC = 23,300 t).
- The CPUE has stabilized above the long term average since 1999.
- The 2003 research vessel bottom trawl survey was limited to the Div. 2J portion of SFA 5, where biomass and abundance indices have fluctuated without trend over the time series.
- Current status appears positive from the fishery data, but the lack of research survey data from Div. 2H creates uncertainty.

SFA 4 (Div. 2G)

- Landings in 2003 totaled ~ 10,000 t, the all time high (TAC = 10,320 t).
- Fishery CPUE has fluctuated around the long-term average since 1991.
- No research vessel surveys have been conducted in this area since 1999. Therefore, there is no exploitation rate index.
- Current status appears positive from the fishery data, but the lack of research survey data creates uncertainty.

SFA 2 (Div. 0B)

- Landings decreased from ~5800 t in 2001 to ~4400 t in 2003 (TAC = 8,750 t).
- Fishery CPUE has been stable above the long term average since 1998. However, it may not be reflective of stock status due to fishing constraints associated with the overlapping distributions of *Pandalus borealis* and *P. montagui*.
- Shrimp-related research surveys have not been conducted in this area since the late 1970's. Therefore, there is no exploitation rate index.
- Current status remains uncertain.

SFA 6 (Hawke Channel + Div. 3K)

Commercial Fishery

TACs were set at 11,050 t annually in the 1994 – 1996 Management Plan and increased to 23,100 t in 1997 as a first step toward increasing the exploitation of an abundant resource within the 1997 – 1999 Plan (Fig. 2). Most of the increase was reserved for development of the small vessel fleet. TACs more than doubled between 1997 and 1999, increased slightly to 2002 and further increased, by 23%, to 77,932 t in 2003.

TACs have been reached in most years, however, due to market constraints, small vessels have not taken their entire allocations since 2000.

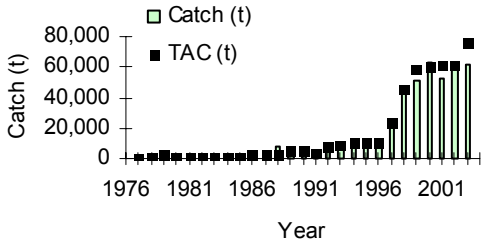


Figure 2: SFA 6 catch and TAC.

Resource Status

Large vessel catch rates increased throughout 1991 - 1997 and have since fluctuated above the long term average (Fig. 3). Small vessel CPUE has remained stable since 1998.

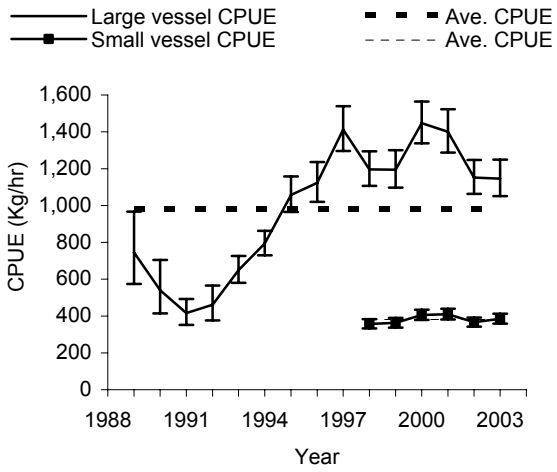


Figure 3: SFA 6 large and small vessel CPUE (bars indicate 95% confidence intervals around point estimates).

Research vessel survey biomass and abundance indices increased over the 1997 – 2001 period and have since remained high (Fig. 4).

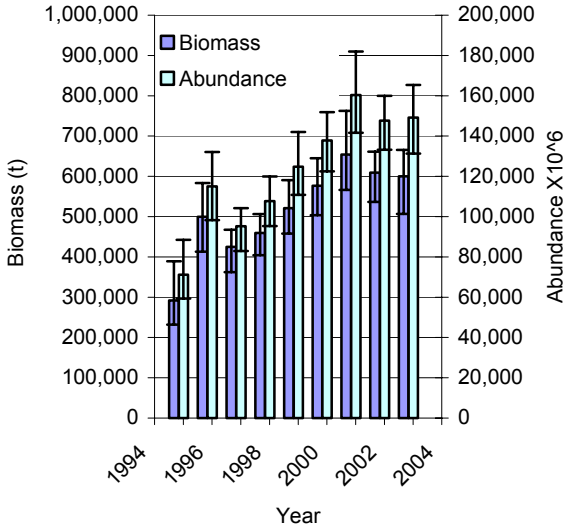


Figure 4: SFA 6 biomass and abundance indices.

The strong 1999 year class is expected to be mostly female during 2004. The presence of this year class and the high residual female biomass should maintain the female component over the next few years.

The **exploitation rate index** (ratio of commercial catch to lower 95% confidence interval of biomass index from the previous year's research vessel survey, expressed as a percent) has been less than 15% over the past several years. Since catchability of shrimp by the survey trawl is assumed to be <1, exploitation rates have actually been lower.

Sources of Uncertainty

The implications of finishing the 2002 and 2003 fall research surveys later than usual are unknown.

Outlook

The resource in this area remains healthy with high biomass and abundance of both sexes. Recruitment is expected to be maintained over the next two years.

Management Considerations

Removals at the current catch level will not likely increase the exploitation rate appreciably.

SFA 5 (Hopedale and Cartwright Channels)

Commercial Fishery

TACs doubled from 7650 t during 1994 - 1996 to 15,300 t over the 1997-2002 period (Fig. 5). TACs have been taken in most years. In 2003, the TAC increased 52% to 23,300 t of which only 17,000 t were taken. The 2003 TAC included a 2500 t allocation for northern shrimp science research.

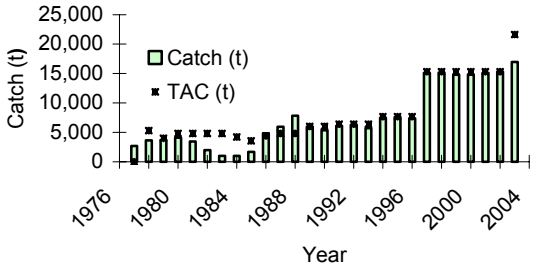


Figure 5: SFA 5 catch and TAC.

Resource Status

Commercial CPUE has been stable above the long term average since 1999 (Fig. 6).

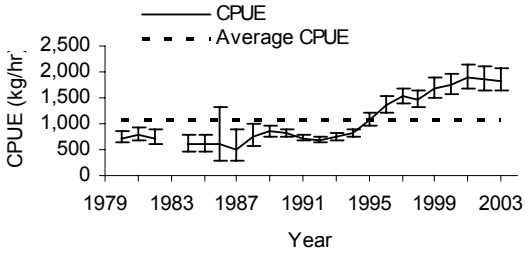


Figure 6: SFA 5 large vessel CPUE.

The 2003 research vessel bottom trawl survey was limited to the Div. 2J portion of SFA 5, where **biomass and abundance indices** have fluctuated without trend over the time series (Fig. 7).

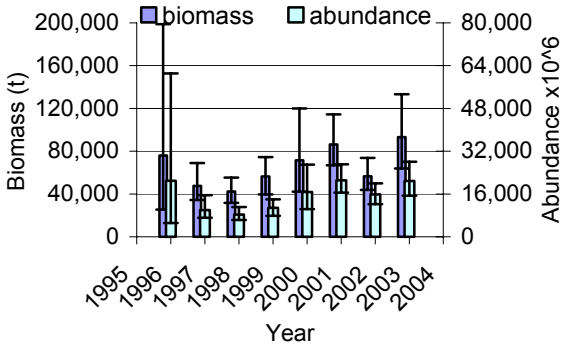


Figure 7: Biomass and abundance indices in the Div. 2J portion of SFA 5.

Since the catchability of small males in the survey is low, and SFA 5 has not been surveyed in its entirety since 2001, it is not

possible to make inferences about recruitment or to estimate an exploitation index for 2003.

Sources of Uncertainty

The lack of research survey coverage into Div. 2H creates uncertainty. The implications of conducting the 2001 - 2003 research surveys later than usual are unknown.

Outlook

Current status appears positive from fishery data.

Recruitment prospects are unknown.

Management Considerations

Assuming recent CPUEs reflect stability in the resource, maintaining the 2003 catch level will not likely increase the exploitation rate.

SFA 4 (NAFO Division 2G)

Commercial Fishery

TACs increased stepwise from 2580 t in 1989 to 5200 t in 1995 and 8320 t in 1998 (Fig 9). The 1998 TAC allocated 2184 t to the area south of 60°N to promote spatial expansion of the fishery. The 2003 TAC was increased to 10,320 t and included a 1125 t allocation for northern shrimp research. TACs have been taken in all years. Preliminary data indicate that landings were ~10,000 t in 2003.

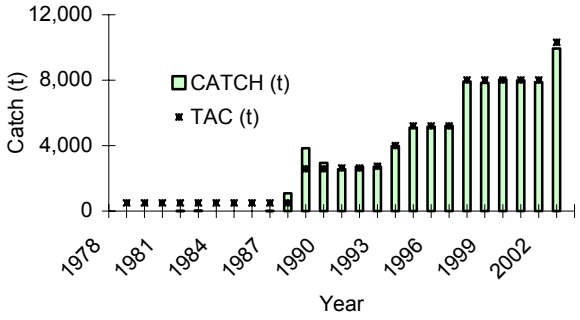


Figure 9: SFA 4 catch and TAC.

Resource Status

Commercial CPUE has fluctuated around the long term average since 1991 (Fig. 10).

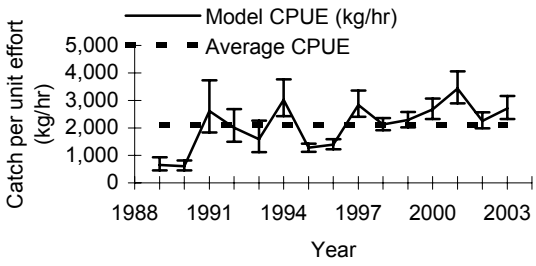


Figure 10: SFA 4 large vessel CPUE.

Sources of Uncertainty

Current status is uncertain because no research surveys have been conducted in SFA 4 since 1999, precluding estimation of stock size, exploitation and recruitment indices.

Outlook

Current status appears positive from the fishery data, but lack of a research survey creates uncertainty.

Recruitment prospects are unknown.

Management Considerations

Lacking research surveys, it was not possible to evaluate the impact of the 2003 fishery or contemplate future prospects.

SFA 2 (NAFO Division 0B)

Commercial Fishery

TACs were set at 3500 t annually for the period 1989 – 1996 then increased to 5250 t for 1997 and 1998 (Fig. 11). In 1999, an additional 3500 t allocation was provided for the area north of 63°N as an incentive for the large vessel fleet to return to grounds not fished extensively since 1995. However, only 105 t were taken from this area in 1999, and, the TAC reduced to the 1997- 1998 level in 2000.

In 2001, the TAC was increased to the 1999 level, and maintained to 2003, with 3500 t allocated to the area east of 63°W. TACs were not taken in most years. Preliminary data indicate that ~4,400 t were caught during 2003.

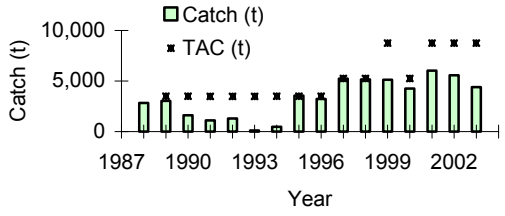


Figure 11: SFA 2 catch and TAC.

Recent catches have been estimated, in part, from the mixed *P. borealis/ montagui* fishery data for the area east of Resolution Island. Therefore, the accuracy is questionable. *Pandalus borealis* taken in SFA's 3 and 4, immediately adjacent to Resolution Island, were included in the catches reported for SFA 2.

Resource Status

Pandalus borealis concentrations in the northeast are elusive, as reflected by the low catch in recent years from the areas north of 63°N and east of 63°W. Concentrations immediately east of Resolution Island have persisted since 1995.

Commercial CPUE has been stable above the long-term average since 1998 (Fig. 12). However, this may not be reflective of stock status due to fishing constraints associated with the overlapping distributions of *Pandalus borealis* and *P. montagui*.

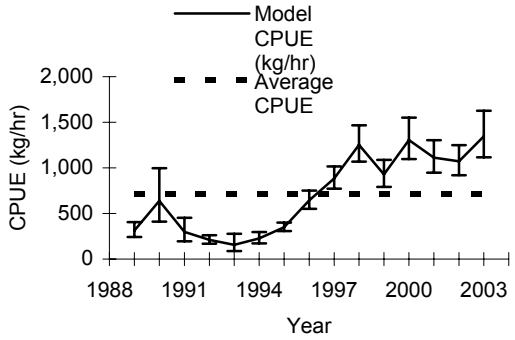


Figure 12: SFA 2 large vessel CPUE.

There have been no shrimp-related research surveys in SFA 2 since the late 1970's. Therefore it was not possible to calculate an exploitation rate index.

Sources of Uncertainty

The mixed fishery for *Pandalus borealis* and *P. montagui* confounds the assessment. The lack of knowledge on the distribution, abundance and biomass of both species will persist in the absence of a time series of research surveys. Neither exploitation rate nor recruitment indices could be estimated because there are no research surveys.

Outlook

Current status and prospects remain uncertain.

Management Considerations

In the absence of research survey data, it is not possible to evaluate the impact of the fishery nor future prospects.

Industry Perspective

Industry considers that the signals in SFA 7 continue to be positive. The availability of shrimp in SFA's 1 and 4 appears to be improving, though the shrimp size seems to be getting smaller. The resource in SFA 2 appears relatively stable. While abundance in SFA 5 continues to be strong, size is getting smaller, with observations of concern increasing nearer to the southern border with SFA 6.

There is increasing concern within industry about the status of the stock in SFA 6. The size of shrimp is getting even smaller than has been the case in recent years. Shrimp appear to be bearing eggs at a smaller size and appear thinner; possible indications to them of a resource under stress. There is an apparent absence of any large shrimp virtually throughout this entire management unit.

Colder water temperatures associated with the decline of groundfish and the increase of shrimp abundance through much of the 1990s, have generally been warming since about 1998. There are current reports of very warm water in SFA's 5 and 6. Offshore vessels are observing absences and/or reduced concentrations of shrimp in some traditional fishing areas in SFA 6; knowledge of shrimp abundance in the traditional shrimp areas of the Hawke Channel was preempted in 2004 as a result of the area being closed to the shrimp fishery. There is anxiety associated with DFO Science not being able to forecast or understand the dynamics that are at play. Conservative harvesting rates are being employed as a general management strategy, however, the general view is that unknown environmental factors will dictate the timing and rate of any future decline.

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DFO, 2003. Northern Shrimp (*Pandalus borealis*) – Div. 0B to 3K. DFO Science Stock Status Report 2003/36.

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