

## SCIENCE INFORMATION

A summary of relevant scientific information available related to the proposal is provided below. The 2011 Science Advisory Report and the 2012 Science Response Report in English are attached for reference.

DFO recognizes the importance of Inuit Qaujimajatuqangit (IQ) as a component of fisheries management and relies upon IQ and scientific knowledge for effective fisheries decision-making. Northern shrimp is not a species traditionally harvested by Inuit; however, Inuit have participated in the offshore northern shrimp fishery since the late 1970s and as resource users have valuable Traditional Ecological Knowledge (TEK). DFO routinely consults resource users, and obtains their views and traditional knowledge on a wide range of management issues, including stock assessment studies, management measures, and the development of management plans.

There are several historical research projects that were conducted in the Hudson Strait and Ungava Bay areas from the late 1970s to mid 1980s. Qikiqtaaluk Corporation, Makikvik and the Labrador Inuit Association were involved in these research projects in association with DFO either jointly or individually. However these surveys were conducted with entirely different gear, boats, and survey design than the surveys conducted relevant to this proposal. As such, the historical data cannot be incorporated in the current assessment time series for shrimp in this proposal.

**1. Monitoring Update for Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in the Western and Eastern Assessment Zones (SFA 2 and 3)  
(Science Response Report 2012/001)**

### **Eastern Assessment Zone – *P. borealis***

#### **Fishery**

The 6 February 2012 Canadian Atlantic Quota Report (CAQR) showed a catch (directed and by-catch) in the EAZ of 7,999 t, 86% of the TAC and the largest catch in the time series (Fig. 2). Since the 2011/12 fishery runs until 31 March 2012, all catch records may not be complete. However, ice conditions should have curtailed fishing effort in the EAZ earlier in the year. Therefore it is likely that most of the catch for the season has been included. While the majority of catch taken in the EAZ comes from SFA 2 southeast of Resolution Island and east of the Nunavut and Nunavik land claims borders, the large increase in 2011/12 came in SFA2 east of 63°W.

#### **Biomass**

The fishable biomass and female spawning stock biomass (SSB) indices have not changed significantly over the period 2008–2011 with respective means of about 69,900 t and 39,500 t (Fig. 3).

#### **Exploitation**

The exploitation rate index varied without trend over the period 2008/09 to 2011/12 averaging 9% (Fig. 4) as did the potential exploitation rate index averaging 13% over the period. Most of the fishery was concentrated southeast of Resolution Island, however, there has been increased fishing in SFA 2EX in the past two years.

#### **Current Outlook**

Based on the Integrated Fisheries Management Plan (IFMP) (DFO 2007b) Precautionary Approach (PA) framework, the SSB for the EAZ was in the Healthy Zone with a slight probability of being in the Cautious Zone (Fig. 5).

### **Eastern Assessment Zone (EAZ) – *P. montagui***

#### **Fishery**

The majority of *P. montagui* catch is taken as by-catch in the directed fishery for *P. borealis* in SFA 2CM south of 63°N. There are quotas for directed *P. montagui* fisheries within the Nunavut Settlement Area (NSA) but generally have not been taken. The catch is taken between 63°W and 64°30'W with small amounts just over the eastern boundary of SFA 3 with no catch west of Resolution Island. The catch declined steadily from about 4,000 t in 1999 to about 600 t by 2009/10 where it has remained to date (Fig. 6). The catch in 2011/12 was about 680 t.

#### **Biomass**

The 2011 fishable biomass index was about 7,700 t, approximately the same as the 2010 level, but SSB index continued to decline to 3,100 t in 2011 (Fig. 7).

#### **Exploitation**

The exploitation rate index varied without trend since 2007/08 averaging 6% but was about 9% for 2011/12 (Fig. 8). The potential exploitation rate index has a mean of 62%, but with the first two years below and the last two above the mean. The potential exploitation rate for 2011/12 was 84%.

#### **Current Outlook**

The SSB in the EAZ entered the Cautious Zone in 2010 and in the lower half of the zone in 2011 with a small probability of being in the Critical Zone (Fig. 9).

### **Western Assessment Zone (WAZ) – *P. borealis***

#### **Fishery**

Until 2010/11, the WAZ had not been fished since the 1980s. The 2007 and 2009 research surveys renewed interest in fishing the area. A single trawler fished the zone in the 2010/11 and 2011/12 directing for *P. montagui*. All *P. borealis* caught in the WAZ are deducted from the 400 t *P. borealis* by-catch quota which can be fished in SFA 3 east of 66°W and SFA 2 inside the NSA. Observer records show that there was 56.9 t of *P. borealis* caught in 2010/11. No *P. borealis* catch was reported for 2011/12.

#### **Biomass**

The fishable biomass and SSB indices have not changed significantly in the three surveys conducted (Fig. 10). The mean fishable biomass index over the three surveys was about 16,600 t, while the mean SSB index was about 4,500 t. In 2011, the fishable biomass index was 19,700 t and the SSB index was 6,400 t.

#### **Exploitation**

*P. borealis* catch has only been reported from the 2010/11 fishery. Since there was no survey in 2010, the exploitation rate was based on the average of the fishable biomass from the 2009 and 2011 surveys. The exploitation rate for 2010/11 was less than 1%. If the entire by-catch quota was taken in the WAZ it would result in an exploitation rate between 2% and 3% (Fig. 11).

### **Western Assessment Zone (WAZ) – *P. montagui***

#### **Fishery**

Until 2010/11, the WAZ had not been fished since the 1980s. Renewed interest in the area after the 2007 and 2009 research surveys has resulted in catches of 310 t in 2010/11 and 836 t in 2011/12. The 2011 catch represents about 84% of the total *P. montagui* quota (1,000 t) which can be fished in the area.

#### **Biomass**

The fishable biomass and SSB indices have not changed significantly in the three surveys conducted (Fig. 12). The mean fishable biomass index for the three surveys was about 57,400 t, while the mean SSB index was about 23,300 t. In 2011, the fishable biomass index was 71,500 t and the SSB index was 32,500 t.

#### **Exploitation**

With 84% of the quota caught in 2011/12, the resulting exploitation rate was only 1% (Fig. 13).

Potential exploitation was also low given the current quota of 1,000 t.

## Conclusions

### **Eastern Assessment Zone (EAZ)**

#### ***P. borealis***

- The *P. borealis* resource is currently in the Healthy Zone well above the Upper Stock Reference.
- The mean exploitation and potential exploitation rates were 9% and 14% respectively.

#### ***P. montagui***

- The *P. montagui* female spawning stock biomass continues to decline and now in the lower half of the Cautious Zone with a small probability of being in the Critical Zone.
- While the mean reported exploitation rate (6%) is relatively low, the mean potential (62%) exploitation rate remains very high.

### **Western Assessment Zone (WAZ)**

#### ***P. borealis***

- In 2011, the *P. borealis* fishable biomass index was 19,700 t and female spawning stock biomass index was 6,400 t similar to previous surveys.
- The potential exploitation rate was between 2-3%.

#### ***P. montagui***

- In 2011, the *P. montagui* fishable biomass index was 71,500 t and female spawning stock biomass index was 32,500 t similar to previous surveys.
- The potential exploitation rate was 2%.

## **2. Assessment of Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in Western and Eastern assessment zones (SFA 2 and 3) (Science Advisory Report 2011/010)**

### **Summary**

- The thermal regime has been warming over the past five years. Effects of a warm regime on shrimp distribution and behaviour are unknown. However any effect may be greater on *Pandalus montagui* than *P. borealis* because of its preference for cooler waters.
- Two new assessment zones for the assessment of the *Pandalus* resources in the Arctic were adopted. As no new information was available for the Western Assessment Zone, no new advice was formulated. The advice from the 2010 assessment corresponding to this zone was carried forward.
- *Pandalus borealis* and *Pandalus montagui* were assessed in the new Eastern Assessment Zone.
- Since the 2010 assessment, one Northern Shrimp Research Foundation (NSRF)-DFO survey of SFA 2 Exploratory (EX) and Resolution Island Survey Area (RISA) provided the fishery-independent data for this assessment.
- Survey biomass, fishery data and fishery exploitation rate indices are used to assess the resources.

### **Eastern Assessment Zone (EAZ)– *P. borealis***

- The catch varied without trend at about 6,000 t since 1996.
- CPUE shows a strong upward trend in the time series but is believed to reflect changes in fishing patterns not resource status.

- Survey data are available for the period of 2006–2010, however the first two years are not considered to be comparable with the rest of series.
- Fishable biomass and female spawning stock biomass indices have not changed significantly over the period 2008–2010. The fishable biomass index was about 42,500 t from 2008–2010 and the female spawning stock biomass index was about 24,000 t from 2008–2010.
- Recruitment is uncertain.
- The observed exploitation rate index has varied without trend since 2007/08 around a mean of 9%.
- Under the Integrated Fisheries Management Plan Precautionary Approach Framework, the female spawning stock biomass has been in the Healthy Zone for the past four years but only the last three years are considered informative. The exploitation rate over this period has averaged 9% which is below the base target exploitation rate of 15% for the Healthy Zone.

#### **Eastern Assessment Zone (EAZ) – *P. montagui***

- The catch declined steadily from about 4,000 t in 1999 to about 500 t in 2009/10. This is thought to be a consequence of changes in fishing patterns, market conditions and alternative fishing opportunities after 1999.
- Survey data are available for the period of 2006–2010 however the first two years are not considered to be comparable with the rest of series.
- Fishable biomass and female spawning stock biomass indices decreased in 2010. This may be caused by a distributional shift away from warmer water. The fishable biomass index was about 15,000 t in 2008–2009 and 7,400 t in 2010. The female spawning stock biomass index was 11,000 t in 2008 and 5,800 t in 2010.
- Recruitment is uncertain.
- The observed exploitation rate index has varied without trend since 2007/08 around a mean of 5%.
- The potential exploitation rate index based on total TAC has varied without trend since 2007/08 around a mean of 56%.
- Female spawning stock biomass has declined into the Cautious Zone of the Integrated Fisheries Management Plan Precautionary Approach Framework and is slightly below the Upper Stock Reference.

#### **Western Assessment Zone<sup>1</sup> (WAZ) – *P. borealis***

- Resource status is based on two survey years, 2007 and 2009 using the Cosmos trawl.
- Fishable biomass index for the two years was 14,600 t (2007) and 15,500 t (2009).
- Female spawning stock biomass index was 3,200 t (2007) and 3,800 t (2009).
- Recruitment is uncertain.
- Prospects are uncertain due to limited data.

#### **Western Assessment Zone<sup>1</sup> (WAZ) – *P. montagui***

- Resource status is based on two survey years, 2007 and 2009 using the Cosmos trawl.
- Fishable biomass index was 48,400 t (2007) and 46,700 t (2009).
- Female spawning stock biomass index was 16,700 t (2007) and 18,000 t (2009).
- Recruitment is uncertain.
- Prospects are uncertain due to limited data.

<sup>1</sup>The Western Assessment Zone was not assessed at the February 2011 zonal assessment process (ZAP) because there were no new survey data. Advice from the 2010 ZAP for the area corresponding to the new Western Assessment Zone was carried forward.