



AN ASSESSMENT OF THE SEA CUCUMBER (*CUCUMARIA FRONDOSA*) RESOURCE ON THE ST. PIERRE BANK IN NAFO SUBDIVISION 3PS



Sea cucumber (*Cucumaria frondosa*)

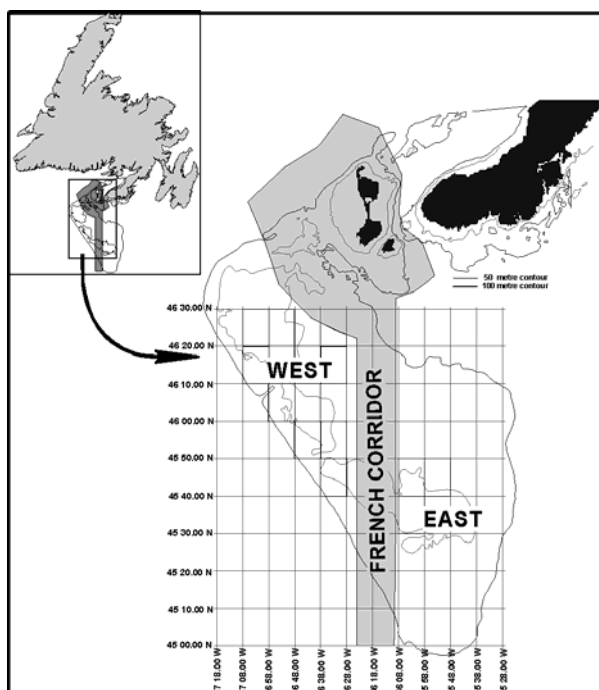


Figure 1: Map showing sea cucumber survey areas on the St. Pierre Bank.

Context :

The sea cucumber *Cucumaria frondosa* has been reported as being almost circumpolar in the northern hemisphere. Populations off Newfoundland and Labrador are normally found in waters down to 100 meters, usually on hard bottom with a cobble-shell-boulder substrate composition.

In 2003 a sea cucumber drag fishery, under the umbrella of the New Emerging Fisheries Policy, was established on the St. Pierre Bank with eight participants sharing a total allocation of 454 t. As part of the emerging fisheries policy, the same 8 harvesters entered into a five year Joint Project Agreement (JPA) with DFO to conduct resource assessment survey starting in 2004.

At the conclusion of the JPA, a science review was requested by Fisheries and Aquaculture Management to provide current information on the status of the sea cucumber resource in NAFO Subdivision 3Ps.

A meeting of the Regional Advisory Process was held April 6 – 7 and April 14 – 15, 2009 in St. John's, NL to assess the status of sea cucumber on St. Pierre Bank for the first time. Participants included DFO scientists and fisheries managers, and representatives from the Department of Fisheries and Aquaculture (DFA), industry and Memorial University. The next assessment for this stock is expected to be in 2011.

SUMMARY

- The fishery was initiated in 2003 with an allocation of 454 t. This allocation was increased in 2005 to 612 t and has remained unchanged. The catch averaged 460 t over the period 2003-06. In 2007, the catch was 190 t due to poor market conditions. The catch was 647 t in 2008.
- The fishery has been concentrated in the northwest portion of the resource distribution.
- As is common in emerging fisheries, commercial catch per unit effort (CPUE) has increased since the start of the fishery.
- In 2004, DFO negotiated a 5-year partnership with the Fish, Food and Allied Workers Union (FFAW) involving 8 harvesters to fund and undertake a pre-fishery sea cucumber resource survey in 3Ps on the St. Pierre Bank. It is recommended that this resource continue to be surveyed annually.
- The biomass index estimates from 2004 to 2008 (excluding 2005) averaged 88,000 t west of the French corridor and 212,000 t east of the corridor. The 2005 estimate is not considered reliable due to gear configuration problems.
- Sustainable exploitation rates are unknown; however, the annual exploitation rate has been very low at less than 1 %.
- There is limited information on the life history of sea cucumber on the St. Pierre Bank. Productivity and renewal rates are unknown. Basic metrics such as size-at-age cannot currently be obtained.
- Given the uncertainties with this species on the St. Pierre Bank there is no scientific basis for assessing the risk of any increase in harvest level.

BACKGROUND

Biology

Sea cucumbers are commonly distributed to depths of 100 m in waters off Newfoundland. They typically exhibit a 1:1 sex ratio and colonize bedrock, boulder, gravelly and sandy habitats. Sea cucumbers attach to the substrate using tube feet and are relatively sedentary. They are suspension feeders that filter food from the water column. Body wall thickness increases and water content decreases throughout the summer months.

There is limited information on the life history of sea cucumber on the St. Pierre Bank (So 2009). Most of the knowledge on this species in eastern Canada was obtained from studies in the St. Lawrence Estuary (Hamel and Mercier 2008). While some of this information may be relevant to the St. Pierre Bank, more in-situ observations are required. Spawning time, for example, occurs from late March to early May on the St. Pierre Bank, which is earlier than in the St. Lawrence Estuary. Size at sexual maturity on the St. Pierre Bank is ~ 9-11 cm (Grant et al. 2006). Growth rates, age-at-maturity, recruitment processes and natural mortality are unknown; thus

productivity and renewal rates are unknown. Due to the plastic shape and variable water content of the sea cucumber body, basic metrics such as size-at-age cannot reliably be obtained. Dry and immersed weights are the most accurate measures of sea cucumber size.

The purple sunstar (*Solaster endeca*) is the main predator of sea cucumber at all life stages. Injured sea cucumbers can attract, and are more vulnerable to scavengers and predators.

The Fishery

In the early 2000s, an initiative to explore the use of experimental towed gear on the St. Pierre Bank was undertaken by DFA. In 2002, the modified sea urchin drag from Maine was adopted as the standardized fishing gear to be used in the sea cucumber fishery in Newfoundland and Labrador.

In 2003, 8 harvesters were given an allocation of 454 t to do reconnaissance on the St. Pierre Bank in the hopes of finding commercial concentrations of sea cucumbers. In 2004, the same 8 harvesters entered into a five year Joint Project Agreement (JPA) with DFO to conduct a resource assessment survey starting in 2004. As a condition of license, all harvesters were required to actively participate in the fishery each year and submit detailed fishing logs. The fishery has normally taken place between June and September.

There are two main sea cucumber concentrations on the Canadian portion of the St. Pierre Bank, one on either side of the French Economic Zone.

ASSESSMENT

Commercial Fishery

Landings (Fig. 2): The fishery was initiated in 2003 with an allocation of 454 t. This allocation was increased in 2005 to 612 t and has since remained unchanged. The catch averaged 460 t over the period 2003-06. In 2007 it decreased to 190 t due to poor market conditions but increased to 647 t in 2008.

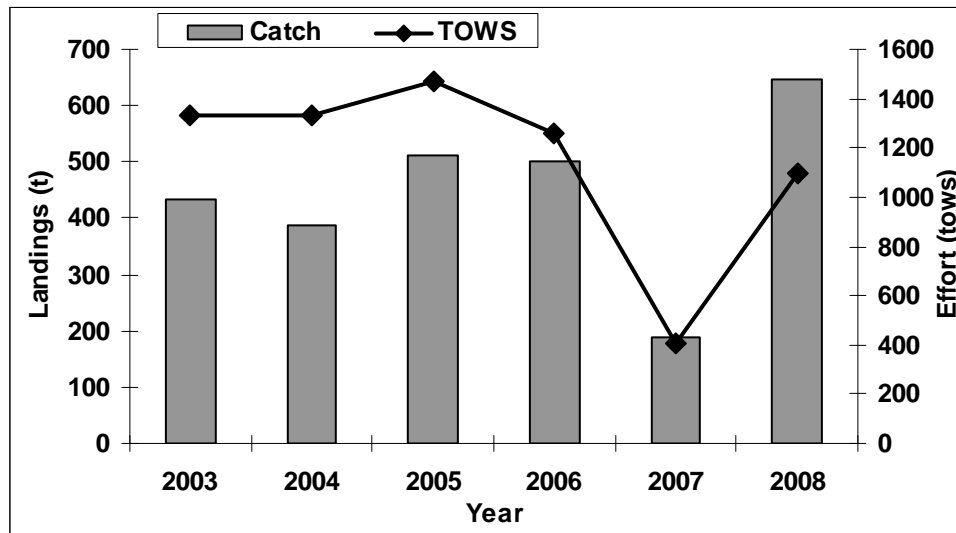


Figure 2: Sea cucumber catch (t) and effort from the St. Pierre Bank, 2003-08.

Allocations were divided equally among the eight participants. The allocation increase in 2005 was intended to compensate for the fraction of landed weight that was water and debris, estimated to be 30 % on average. Gross landings (including water & debris) are the weights recorded against allocation. **Effort** was relatively constant, averaging 1300 tows annually to 2006, declined in 2007 with only 400 tows and increased to 1100 tows in 2008. Sea cucumber discards ranged between 1 – 4 % annually and consisted of animals unsuitable for processing. The fishery has been concentrated in the northwest portion of the resource distribution. The removals from this area exceeded 90 % of the total landings each year.

As is common in emerging fisheries, commercial catch per unit of effort (CPUE) has increased since the start of the fishery (Fig. 3), as harvesters improve their knowledge of fishing area, etc. Tow speed ranged between 1.8 and 2.8 knots and had no affect on catch rates. Tow distances have also varied between 0.2 and 1 nautical mile with the overall mean being 0.5. **CPUE** has been standardized to a half-nautical mile tow.

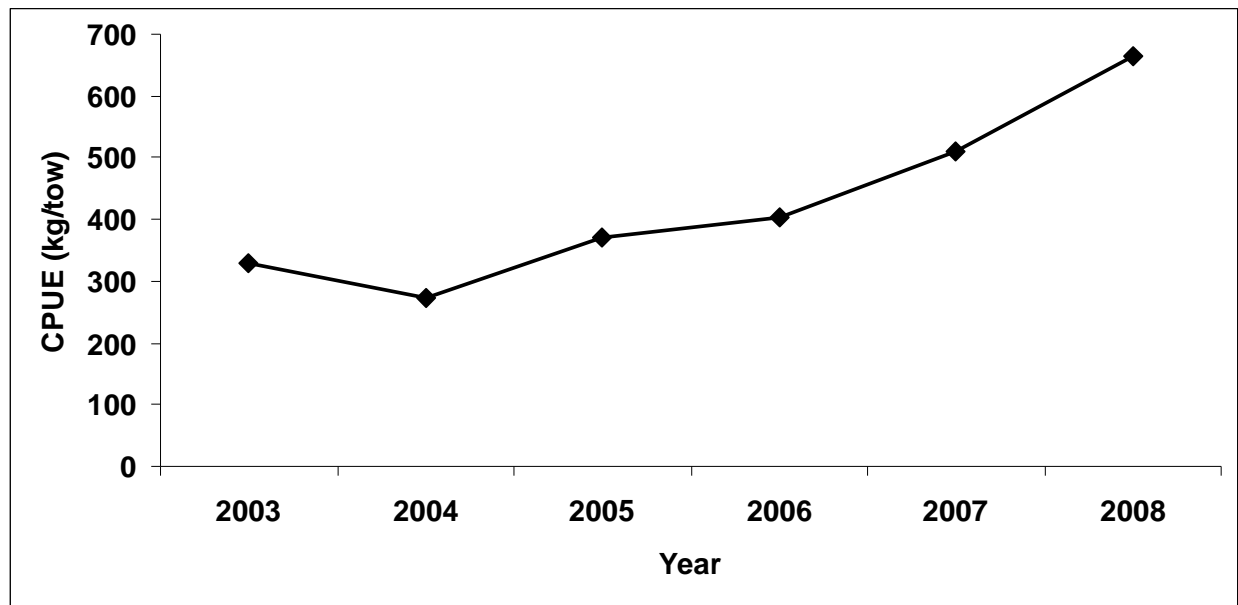


Figure 3: Trends in St. Pierre Bank commercial CPUE (kg/tow) 2003-08.

By-catch in this fishery has been 2 % or less by weight of the total catch each year, with the greatest contribution (70-80 %) coming from sea stars, sea urchins and sand dollars. The sea cucumber fishery takes place on or near aggregations of sea scallop, Iceland scallop and whelk which constitute 6-13 % of the total by-catch. The remainder of the by-catch consists of various crab and groundfish species.

Biomass

In 2004, DFO negotiated a 5-year partnership with the FFAW, involving 8 harvesters to fund and undertake an annual pre-fishery sea cucumber resource survey in Subdiv. 3Ps on the St. Pierre Bank. The main objectives of the survey were to delineate the sea cucumber distribution and obtain an estimate of biomass.

In 2004, the area of interest was divided into 32 blocks of 10' x 10' (latitude x longitude), and further subdivided into 1' x 1' survey units. Annually, ten units are randomly sampled from each block using a standardized tow length of 0.5 nautical miles. In 2006, the number of blocks was reduced to 23 because of the frequency of zero catches in 9 blocks in the northeast portion of the survey area.

Because survey drag efficiency is unknown but believed to be less than 1, the biomass estimate obtained from the annual survey is considered a minimal biomass index. The index is calculated from fresh wet weight of sea cucumber at time of capture with no adjustments for drainage or water absorption.

Two centres of sea cucumber distribution occur on the St. Pierre Bank, one on the northwestern and a second on the southeastern region of the bank. The biomass index estimates from 2004 to 2008 (excluding 2005) averaged 88,000 t west of the French corridor and 212,000 t east of the corridor (Fig 4). The 2005 estimate is not considered reliable due to gear configuration problems.

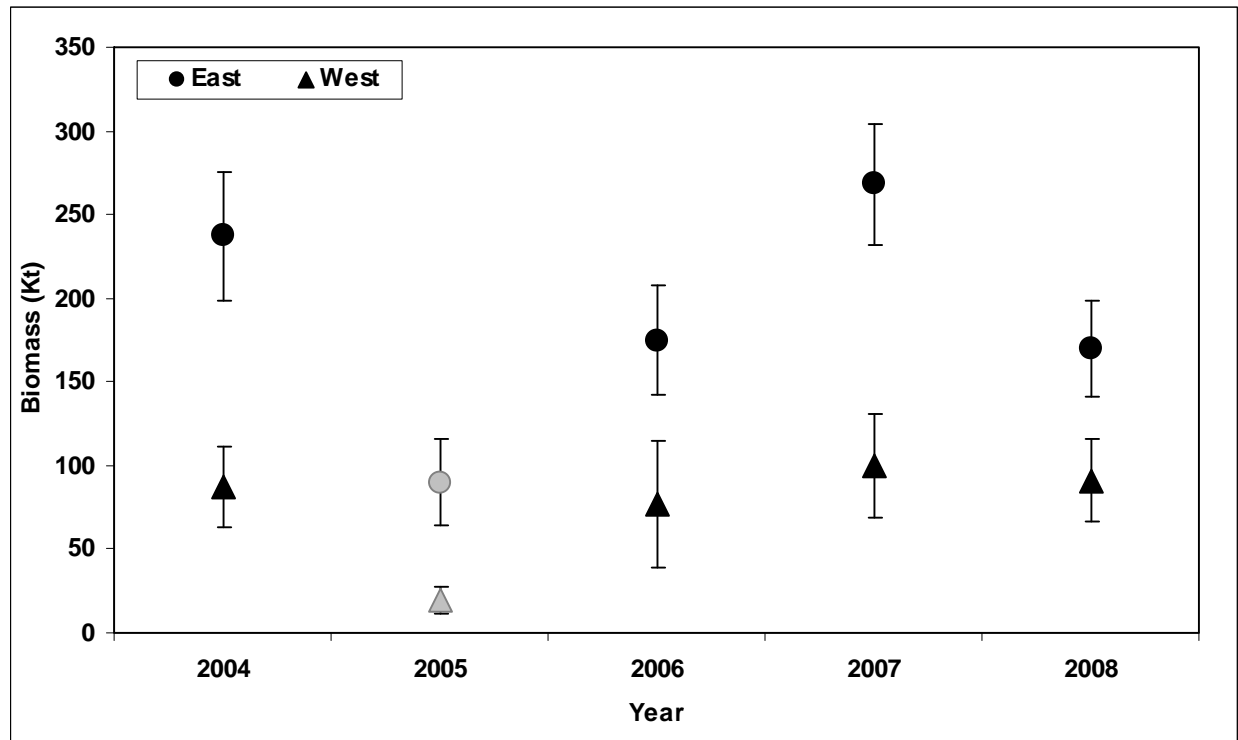


Figure 4: Annual biomass index estimates of sea cucumber, east and west of the French corridor on the St. Pierre Bank (bars indicate 95% CI).

Mortality

The natural **mortality** rate is unknown. The annual exploitation rate (Catch/Biomass index) has been very low at less than 1 %.

Sources of Uncertainty

Population structure and sustainable exploitation rates are unknown.

Basic morphometrics such as weight, length and age are difficult to obtain for this species.

Growth rates are inconsistent, whereas age-at-maturity and recruitment processes and natural mortality are unknown.

Biomass estimates are considered an index because there is no reliable estimate of sea cucumber catchability, but it is believed to be less than 1. The inter-annual variability in the survey (coefficient of variation (CV)) is 20 %. Assuming the population was constant over the last five years, the CV reflects inaccuracy in the survey. At low levels of removals, effects of exploitation will therefore be difficult to detect.

Survival of discards returned to the water has not been evaluated.

The consequences of the harvesting method and removals on ecosystem structure and function are unknown.

ADDITIONAL STAKEHOLDER PERSPECTIVES

It is recommended that this resource continue to be surveyed annually.

FFAW

For the last number of years a group of eight 3Ps harvesters have worked with support from and in collaboration with DFA and DFO to develop the sea cucumber fishery on St. Pierre Bank and move it through the New Emerging Fisheries Policy.

While sea cucumbers have a number of difficult-to-define life history characteristics, biological data on the species has been collected for the last five years through annual resource surveys. This work has provided information on abundance and distribution (Stansbury and Hynick 2009) and several biological traits (Grant et al. 2006; So 2009).

Department of Fisheries and Aquaculture (DFA)

The DFA has participated in the development of the sea cucumber fishery during the past 5 years with industry and DFO to determine if there is a resource of sea cucumbers that can be exploited sustainably, through a commercial fishery, on the St. Pierre Bank. The development of the fishery has now completed Stage 1 (Feasibility) and Stage 2 (Exploratory) of the DFO's *New Emerging Fisheries Policy*. The scientific data that was collected during Stage 2 has been analysed and presented during the sea cucumber RAP meeting, and used in the preparation of this Science Advisory Report (SAR).

The sustainability of the fishery, if developed commercially, is paramount. Therefore, DFO must continue with annual resource surveys on which to base their management decisions and plans. The harvesters should continue with data collection (under the direction of DFO) and DFO will be responsible for the analysis of this data, which will then be used for managing this fishery, in consultation with the harvesting industry and the DFA.

CONCLUSIONS AND ADVICE

Given the uncertainties with this species on the St. Pierre Bank there is no scientific basis for assessing the risk of any increase in harvest level. Sustainable exploitation rates are unknown.

Therefore the fishery should be developed cautiously. It is recommended that fishing be limited to the western region, maintaining the eastern region as a reserve until the effects of fishing can be evaluated. The exploitation rate is currently very low and it is likely that it could be increased without causing serious or irreversible harm.

MANAGEMENT CONSIDERATIONS

In other regions of Canada experimental exploitation rates for another species of presumably faster-growing sea cucumber in warmer water have been tested (Hand et al. 2008). It was found that exploitation rates higher than 10 % were unsustainable. One portion of the BC dive fishery has been operating at 4 % exploitation since 1997 and has not yet shown any

detrimental effects. As a basis for monitoring the effects of a fishery on the sea cucumber resource in the St. Pierre bank region, no more than 4 % exploitation in the western area would be advised, as potential risks are unknown (outlined above). This would represent an overall exploitation rate of about 1.2 % on the entire resource and would result in a harvest level of about 3500 t.

It is recommended that this resource continue to be surveyed annually. It should continue to be a pre-fishery-season survey. There should be better standardization of the survey and a new survey design to provide better estimates of biomass.

The fishing season should begin in summer to avoid the March-May spawning period and the catch of post-spawning sea cucumbers in poor condition. A minimum legal size should be greater than 10 cm contracted length, the approximate length at 100 % maturity. A protocol to monitor the temporal and spatial patterns in removals is required. Given their overlapping distributions and similar fishing methods, by-catch issues could arise with Sea scallop (*Placopecten magellanicus*) and Iceland scallop (*Chlamys islandica*). Mobile gear fisheries often conflict with fixed gear fisheries. Although overlap in the whelk and sea cucumber fishing areas is currently minimal, further expansion of one or both fisheries would increase the chances of conflict.

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