Intertek Moody Marine

Ref: 82531/GB/v5

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MSC Assessment Report for

Grand Bank Arctic Surfclam Fishery

Client: Clearwater Seafoods Limited Partnership

Version: 5 Public Certification Report

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1 SUMMARY

This report sets out the results of the assessment of the Clearwater Seafoods Limited Partnership (CSLP) Grand Bank Arctic surfclam (*Mactromeris polynyma*) fishery against the Marine Stewardship Council (MSC) Principles and Criteria for Sustainable Fishing. This version of the report is the Public Certification Report (PCR), such that changes have already been made as a result of peer reviews that were undertaken by appropriate, independent scientists, and following public consultation. A final 15 day consultation period of the Final Determination Report has also been undertaken, but no stakeholders have objected to the certification of the fishery; the fishery is therefore certified.

The assessment of the fishery was undertaken by Dr. Andy Brand, Dr. Rob Blyth-Skyrme and John Angel, who covered Principle 1 (target stock), Principle 2 (environment) and Principle 3 (management) components of the MSC Standard respectively. A site visit to Halifax, Nova Scotia, was undertaken in June 2011 to meet with scientists, fishery managers and stakeholders, as well as representatives of CSLP. During the two days that the team was convened, opportunities to meet with the team were provided for all stakeholders who expressed such a desire.

The CSLP Grand Bank fishery is conducted offshore, on the Grand Bank, off Newfoundland. CSLP holds three offshore clam licences, which authorize the company to employ up to four vessels in the fishery, as one of the licences entitles two vessels to fish. In total, only two vessels are currently engaged in the fishery, however. Two hydraulic dredges of approximately 3.8 m (12.5') width x 6 m (20') length each are used by each vessel to extract the Arctic surfclams from the sediment, and these are typically towed at 2 knots for 8 - 12 minutes before being returned to the surface so that the catch can be recovered. The most recent survey in 2010 estimated that the Grand Bank stock of Arctic surfclams amounted to 1,140,682 tonnes (t), while the total allowable catch (TAC) is 14,756 t per year.

Arctic surfclam is a long-lived bivalve; significant numbers on Grand Bank appear to reach 40 years of age, while the oldest aged so far from the bank was 73 years old. While the long life and slow growth of Arctic surfclams could be a concern if exploitation rates from the population were high, the total allowable catch (TAC) from Grand Bank is set at a precautionary level, well below the calculated level of maximum sustainable yield. The age of 50% maturity is also below the age of 50% selectivity, meaning that individual Arctic surfclams should be able to spawn approximately 10 times before growing to a size that would be selected by the fishery. The Grand Bank Arctic surfclam stock is at approximately the virgin biomass level.

Hydraulic dredges are known to have the potential to be damaging to bottom habitats and communities. However, the Grand Bank is very exposed to severe weather, and the seabed community of the shallow bank are subject to frequent natural perturbation resulting from wave-induced disturbance. A long-term hydraulic dredge-impact study was started on the nearby and similarly exposed Banquereau in 1998, with the aim of understanding and quantifying the effects of such dredging on bank habitats and communities. The results have shown that evidence of the dredge tracks had essentially disappeared within approximately 10 years, while the community, with the exception of the target bivalve species, was recovering after two years. The most recent results from resurveying the Banquereau experimental site in 2008 are still being analysed, but are expected to confirm that recovery in that area has continued to occur.

The Grand Bank fishery is managed through the Offshore Clams Integrated Fishery Management Plan (IFMP). The IFMP lays out management objectives, measures and responsibilities, as well as the specific strategy relating to enforcement of the fishery, and the research program that is undertaken between CSLP and the Department of Fisheries and Oceans (DFO). The establishment of an Offshore Clam Advisory Committee (OCAC) provides a route through which stakeholders may participate in and contribute to the management of the fishery.

The Grand Bank Arctic surfclam fishery achieved overall scores of 85.0 for Principle 1, 87.7 for

Principle 2, and 85.6 for Principle 3. As such, it is recommended that the fishery is certified according to the MSC standard as being sustainable.

Three conditions of certification were placed on the fishery, however, for Performance Indicators (PIs) 1.1.2, 1.2.2 and 3.1.2; these require the following outcomes to be achieved:

For PI 1.1.2

The client is required to demonstrate by the 2nd annual audit that:

- The management system includes a limit reference point that is appropriate for the stock and can be estimated.
- The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.

For PI 1.2.2

The client is required to demonstrate by the 2nd annual audit that:

- Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
- The selection of the harvest control rules takes into account the main uncertainties.

For PI 3.1.2

The client is required to demonstrate by the 2nd annual audit that the management system includes:

- Consultation processes that regularly seek and accept relevant information, including local knowledge.
- Consideration of the information obtained
- Opportunity for all interested and affected parties to be involved

Two non-binding recommendations were also made, concerning PI 3.1.2 and PI 3.2.1. These were that advance notice of the time and place of advisory committee meetings, and the minutes of such meetings, should be posted on the DFO website, and that the Integrated Fisheries Management Plan (IFMP) should be posted on the DFO website or in some other way made publicly available.

The fishery will be eligible for remote annual surveillance audits. The first surveillance announcement will indicate whether the first surveillance audit will be an on-site or an off-site surveillance audit.

2 INTRODUCTION

This report sets out the results of the assessment of the Clearwater Seafoods Limited Partnership (CSLP) Grand Bank Arctic surfclam (*Mactromeris polynyma*) fishery against the Marine Stewardship Council (MSC) Principles and Criteria for Sustainable Fishing.

2.1 The fishery proposed for certification

The MSC Guidelines to Certifiers specify that the unit of certification is "The fishery or fish stock (=biologically distinct unit) combined with the fishing method/gear and practice (=vessel(s) pursuing the fish of that stock) and management framework." The fishery proposed for certification is therefore defined as:

Species:	Arctic surfclam (*Mactromeris polynyma*)
Geographical Area:	Grand Bank, Newfoundland, Canada
Method of Capture:	Hydraulic clam dredge
Management System:	Department of Fisheries and Oceans (DFO) and the Offshore Clams Integrated Fishery Management Plan
Client Group:	Clearwater Seafoods Limited Partnership (CSLP)

In the course of the certification it is possible that further companies/vessels may join the client group. This would be in accordance with the MSC's stated desire to allow fair and equitable access to the certification.

2.2 Report Structure and Assessment Process

The aims of the assessment are to determine the degree of compliance of the fishery with the MSC Principles and Criteria for Sustainable Fishing, as set out in Section 8.

This report contains the following information:

- The background to the certified fishery and the context within which it operates in relation to the other areas where the target species is fished
- The qualifications and experience of the team undertaking the assessment
- The standard used (MSC Principles and Criteria)
- The stakeholder consultation carried out. Stakeholders include all those parties with an interest in the management of the fishery and include fishers, management bodies, scientists and environmental Non-Governmental Organisations (ENGO's)
- The methodology used to assess ('score') the fishery against the MSC Standard.
- A scoring table with the Scoring Indicators adopted by the assessment team and Scoring Guidelines which aid the assessment team in allocating scores to the fishery. The commentary in
- Any comments received from the peer reviewers and stakeholders, together with the assessment team's response.

This version of the assessment report is the Public Certification Report (PCR). It is noted that, to get to this stage, the report has been subject to critical review by two independent scientists at Peer Review, and by stakeholders at the Public Consultation; the comments received at Peer Review and during Public Consultation are appended to this report, with responses from the assessment team. Any changes made to the report as a result of any comments are also noted. Intertek Moody Marine's Governing Board (a body independent of the assessment team) has also reviewed the report at Final Determination, and the Governing Board made the final certification determination on behalf of Intertek Moody Marine Ltd.

It is also noted that no objections were received from stakeholders during the final public consultation period on the Final Determination, and so the fishery is certified.

2.3 Stakeholder meetings attended

Information used in the main assessment has been obtained from interviews and correspondence with stakeholders in this fishery, notably:

Table 1: Attendance at meetings conducted during the assessment site visit.

09/06/11	Rob Blyth-Skyrme Andy Brand John Angel Christine Penney Catherine Boyd Tony Jabbour (from 12:30) Jennifer Hewitt (from 12:45)	Intertek Moody Marine Ltd Intertek Moody Marine Ltd Intertek Moody Marine Ltd CSLP CSLP CSLP CSLP
09/06/11	Rob Blyth-Skyrme Andy Brand John Angel Susanna Fuller	Intertek Moody Marine Ltd Intertek Moody Marine Ltd Intertek Moody Marine Ltd Ecology Action Centre
10/06/11	Rob Blyth-Skyrme Andy Brand John Angel Christine Penney Catherine Boyd Wendy Williams Stefan Leslie Carl MacDonald Scott Coffen-Smout Dale Roddick Wade Barney Annette Rumbolt Kent Gilkinson (from 11:15)	Intertek Moody Marine Ltd Intertek Moody Marine Ltd Intertek Moody Marine Ltd CSLP CSLP DFO DFO DFO DFO DFO DFO – on telephone DFO – on telephone DFO – on telephone
10/06/11	Rob Blyth-Skyrme Andy Brand John Angel Daniela Diz	Intertek Moody Marine Ltd Intertek Moody Marine Ltd Intertek Moody Marine Ltd World Wildlife Fund

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3 GLOSSARY OF ACRONYMS AND ABBREVIATIONS USED IN THE REPORT

CHEA	Canadian Hokkigai Export Association
CPUE	Catch per unit effort
CSLP	Clearwater Seafoods Limited Partnership
DFO	Department of Fisheries and Oceans
EA	Enterprise Allocation
EAC	Ecology Action Centre
EBSA	Ecologically and biologically significant area
ESSIM	Eastern Scotian Shelf Integrated Management (Initiative/Project)
ETP	Endangered, threatened or protected (species)
IFMP	Integrated fisheries management plan
JPA	Joint project agreement
LOMA	Large ocean management area
LRP	Limit reference point
MCY	Maximum constant yield
MPA	Marine protected area
MSC	Marine Stewardship Council
MSY	Maximum sustainable yield
NAFO	Northwest Atlantic Fisheries Organization
OCAC	Offshore Clam Advisory Committee
OCMB	Offshore Clam Management Board
RAP	Regional advisory process
RDG	Regional Director General (DFO)
SSB	Spawning stock biomass
TAC	Total allowable catch
TRP	Target reference point
VME	Vulnerable marine ecosystem
WWF	World Wildlife Fund

4 BACKGROUND TO THE FISHERY

4.1 Introduction

This assessment report is of the Clearwater Seafoods Limited Partnership (CSLP) Grand Bank Arctic surfclam (*Mactromeris polynyma* Stimpson, 1860) fishery. The fishery is undertaken offshore, on the Grand Bank off Newfoundland, and is one of two principal areas targeted by the CSLP Arctic surfclam fleet, the other area being Banquereau (Figure 1). The CSLP Banquereau Arctic surfclam fishery is undergoing MSC assessment at the same time as the Grand Bank fishery as a separate unit of certification (UoC). A separate assessment report has been drafted for the Banqueareau UoC.

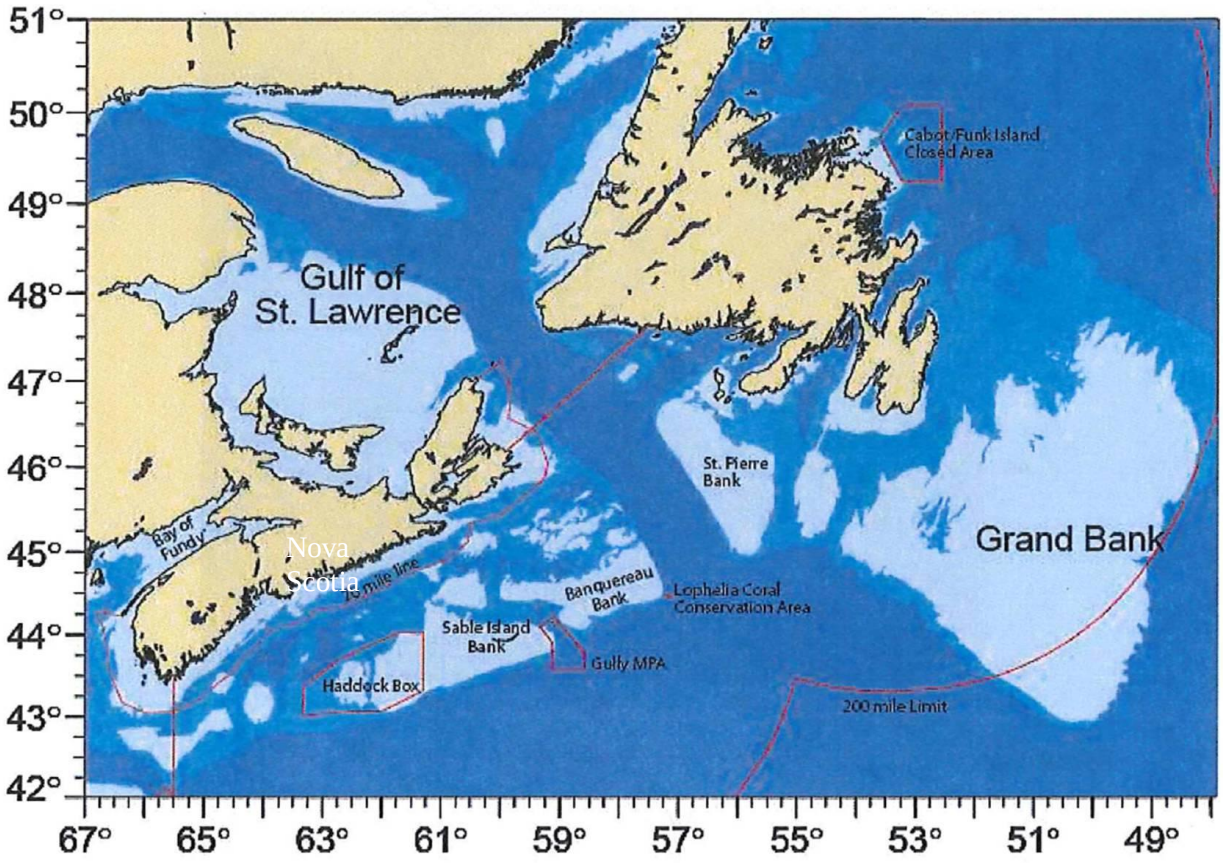


Figure 1: Offshore Banks of the Maritimes and Newfoundland Regions (DFO 2011c)

4.2 Biology of the Target Species

The Arctic surfclam, (*Mactromeris polynyma*), is a large, long-lived, bivalve found mainly in medium to coarse, well-sorted, sandy sediments. It is a strong, active burrower, capable of burrowing to approximately 20 cm into the sediment, or the depth to which the siphons extend. A distinguishing feature is that most specimens have a purple colour in the foot and mantle that turns red upon blanching, similar to lobster and shrimp. This makes it an attractive species for the sushi and sashimi market in Japan, and it has become the object of a substantial commercial fishery in Canada since the late 1980s (Roddick & Kenchington 1990).

Mactromeris polynyma is a circum-boreal species, inhabiting the Arctic, Atlantic and Pacific Oceans (Christian *et al.* 2010), in waters colder than 15°C. It is the largest clam in the northwestern Atlantic and occurs from Labrador to Rhode Island (Abbott 1974). In the Canadian part of its range, this species occurs in commercial quantities in the offshore areas of the Scotian Shelf and eastern Grand

Banks and in inshore areas off southwest Nova Scotia and in the Gulf of St. Lawrence (DFO 1989a; 1999; 2004a). In the Pacific they are found from the Juan de Fuca Strait to Point Barrow, Alaska, and also from Sakhalin Island, Russia. All Atlantic populations are subtidal down to 110 m depth but in Alaska there are some intertidal populations (DFO 2010). In the Bering Sea, the densest aggregations occurred at about 30m depth and at a salinity range of 29-32 ppt (Hughes & Bourne 1981), while on Banquereau Bank the highest densities in surveys were between approximately 50 and 65 m depth (Roddick *et al*. 2007). Data on stock densities and depth have not been presented for Grand Bank, but appear likely to be similar to Banquereau. Arctic surfclam appear to prefer habitats with high salinity (> 18 ppt) and lower water temperatures (Roddick & Smith, 1999).

Despite the commercial fishery, the biology and ecology of *M. polynyma* has not been very thoroughly studied, as reflected in the limited list of publications on the species. Some key aspects of the natural history and population biology of *M. polynyma* are unknown so they have often been inferred from the closely related Atlantic surfclam *Spisula solidissima*, for which there is a substantial literature (e.g. Chamberlin & Sterns 1963; Mann *et al.* 1990; Weinberg 1999).

Mactromeris polynyma is a slow-growing, long-lived species and significant numbers appear to reach more than 40 years of age. On Banquereau, the oldest Arctic surfclam aged was 61 years old and the largest observed was 157mm shell length, while on Grand Bank the oldest clam aged was 73 years old, and the largest observed was 142mm shell length. The Alaskan populations appear to have a shorter life-span, with a maximum age of about 25 years (DFO 2010). *M. polynyma* are patchily distributed, and commercially targeted populations may be widely separated from each other by hundreds of kilometers of ocean bottom in which the clams are relatively scarce. These populations also show significant variations in age structure including large variation in the relative abundance of age-classes 50 years old or more (Roddick & Smith, 1999). Such variability in age-structure is accompanied by significant genetic variation among age-classes in some *Spisula* species (David *et al.* 1997). However, studies of Arctic surfclam populations from various locations, examined in a study using microsatellite markers (Cassista & Hart 2005; 2007), found broad spatial homogeneity of allele frequencies among northwest Atlantic populations and significant spatial differentiation only on the largest geographic scale (between Atlantic and Pacific oceans).

Arctic surfclams are dioecious (they have separate sexes) and typically reach reproductive maturity at 5 to 8 years of age. They are broadcast spawners, with eggs and sperm released into the water column where fertilization and larval development occur. Like other similar large bivalves, fecundity is very high; C.V. Davis (pers. comm.) recalls spawns of 1-2M eggs per female under hatchery conditions. Spawning generally occurs during the late summer or fall, although some inshore populations may also exhibit spring spawning (DFO 1999; Christian *et al*. 2010). After a few weeks in the plankton the larvae metamorphose and settle on the seabed on inshore or offshore shallow sandy banks (Lambert & Goudreau 1997; Roddick & Smith 1999; DFO 2009e). Under laboratory conditions Arctic surfclam larvae hatched one day after spawning at 15ºC and four days after spawning at 8.5ºC (Davis & Shumway 1996). In the same study, metamorphosis to the post-larval stage occurred in 24 days at 15ºC and in 42 days at 10ºC.

There have been no studies of larval habitat selection but Davis & Shumway (1996) reported that the growth rate was greatest in silt/sand substrates. Arctic surfclams are filter feeders with a microalgal diet (e.g., diatoms and dinoflagellates), though they probably also utilise re-suspended organic detritus and bacteria from the bottom of the water column.

Many bivalve molluscs can be reliably aged from prominent concentric growth rings on the surface of the shell; these can be validated as annual rings (Beamish & MacFarlane 1983; Campana 2001). However, in long-lived, slow growing species this is rarely possible and it is necessary to utilize microscopic internal bands or annuli within the shell or the resilium (the hinge ligament) (Lutz & Rhodes 1980; Pentilla & Dery 1988; Kilada *et al*. 2009). In *Mactromeris polynyma*, age has been estimated by counting annuli in thin sections of the hinge area of the shell (Almeida & Sheehan 1997) and has been used to determine age frequency distributions through time to show variations in annual recruitment, temporal and spatial differences in growth rates, and to establish age at maturity (DFO 2010, Roddick *et al.* 2007). DFO undertakes training and testing of Arctic surfclam agers, with a

maximum permitted coefficient of variance of 5% being adopted before agers can routinely age Arctic surfclam; this is considered to be conservative (Roddick *et al.* 2011). For Arctic surfclams from Grand Bank, the size at 50% maturity was 39.9 mm shell length, well below the size of 50% retention of the dredge, and the age of maturity was 5.3 years old (DFO 2010).

Arctic surfclams have numerous predators. During the pelagic phase, the larvae are eaten by larger zooplankton and planktivorous fish. On the seabed, they are consumed by various predatory invertebrates and vertebrates. Rochette *et al.* (1995) and Himmelman & Hamel (1993) observed predation on the Arctic surfclam by the sea star *Leptasterias polaris* in the northern Gulf of St. Lawrence. In the same area the waved whelk (*Buccinum undatum*) attempted to scavenge meat from the Arctic surfclam, despite the presence of the sea star that also prey on whelks. Morissette & Himmelman (2000) indicated that other kleptoparasites, including sea stars (*Asterias rubens*), rock crab (*Cancer irroratus*) and lyre crab (*Hyas araneus*) fed on Arctic surfclam. Large groundfish, such as Atlantic cod (*Gadus morhua*) on Banquereau Bank, are also primary predators on *Mactromeris polynyma* (Roddick & Lemon 1992). Arctic surfclam has also been documented as a principal prey item for sea otters in Alaska (Green & Brueggeman 1991). There are also other faunal interactions with Arctic surfclams on the seabed. For example, in the northern Gulf of St. Lawrence, Iceland scallops (*Chlamys islandica*) were observed using empty *M. polynyma* shells as refuges (Arsenault & Himmelman 1998).

4.3 History of the Fishery

The CSLP Arctic surfclam fishery takes place in two areas in the northwest Atlantic – Banquereau Bank and Grand Bank (Figure 1). Although the presence of Arctic surfclams on the Grand Banks was reported as early as 1885 (Chamberlin and Sterns, 1963) and its distribution on parts of the Grand Bank was mapped in the 1960s (Nesis 1963), the start of the Canadian offshore clam fishery dates back to 1980 when DFO commenced a resource survey to determine the commercial potential of underutilised clam species in the Scotia-Fundy Region. These surveys took place from 1980 to 1983 and found commercial densities of Arctic surfclams on Banquereau Bank, for which there was commercial interest as a potential substitute for the highly valued Atlantic surfclam *Spisula solidissima*, which has a very limited distribution in Canadian waters (Rowell & Chaisson 1983; Chaisson & Rowell 1985). Commercial densities of Arctic surfclam were not found in other areas of the Scotian Shelf but these exploratory surveys were not comprehensive so the possibility of commercial quantities elsewhere could not be excluded.

Based on the survey results it was estimated that Banquereau Bank had a commercially exploitable biomass of Arctic surfclams of 561,000t and a maximum sustainable yield (MSY) of 16,821 t (Rowell & Amaratunga 1986). A three-month test fishery then took place with three companies participating, each company using a chartered US vessel equipped with a single hydraulic clam dredge, as a result of which the estimated MSY was raised to 24,000 t (Amaratunga & Rowell 1986).

In 1987 a three-year Offshore Clam Enterprise Allocation (EA) Program was developed with the industry. Total Allowable Catches (TAC's) and EA's were set for each of the three years of the program based on biological information provided by the surveys and the test fishery, and an economic break-even analysis on the required resource to make a vessel and processor viable. Three companies participated in the fishery. The TAC was set at 30,000 t for Banquereau Bank. One company, not having access to Banquereau Bank, tried experimental fishing on the Grand Bank (Northwest Atlantic Fisheries Organization (NAFO) area 3LNO). A review of the development of the fishery up to 1989 is available in Roddick & Kenchington (1990).

Arctic surfclams officially became a regulated species under the Atlantic Fishery regulations in February 1989 (DFO 2011c). In that year the fishery expanded to Grand Bank (NAFO area 3LNO) with the issuing of two exploratory licenses and two exploratory permits; these were issued to the three original participants plus a fourth, Newfoundland based, company. For the Grand Bank a preliminary resource assessment estimated the exploitable biomass at 504,000 t and the fishery operated with a precautionary TAC of 20,000 t.

In 1990 the Offshore Clam Enterprise Allocation Program was extended for the five-year period, 1990-1994. However, one company stopped fishing in the spring of 1991 due to financial problems, and went out of business in 1992. The offshore clam allocations were then revised from January 1, 1992, giving the remaining three offshore clam companies equal access and allocations on all banks. While the TACs for each fishing area remained unchanged (Banquereau Bank 30,000t; Grand Bank 20,000 t) it was decided that any future changes in the TAC would also be split equally between the licence holders. Since early 1993 there have been 2 or 3 factory processing vessels fishing year round and the EA program has continued through each management plan until the present day.

The 1995-1997 Offshore Clam Fishery Multi-Year Harvesting Plan stressed the need for improved scientific data to ensure sustainable harvesting and several information gaps were cited for both Banquereau and Grand Bank, including the lack of reliable estimates of standing stock biomass, growth rates, recruitment and natural mortality. With industry looking to long-term investments in the offshore clam fishery they required regular, up-to-date, estimates of the clam stocks so they entered into a Joint Partnership Agreement (JPA) with DFO to jointly fund the scientific studies. This program undertook to survey the various clam species and offshore banks involved in the fishery on a rotating basis. Under this program, Banquereau Bank was surveyed in 1996-97 (Roddick & Smith 1999), which resulted in a reduction of the TAC for Banquereau from 30,000 t to 24,000 t in 2004, but the results of the Grand Bank part of this survey were never completed due to the demise of the scientist in charge (DFO 2010). No change was made the Grand Bank TAC at that time. Subsequent surveys under this program were conducted on Banquereau in 2004, followed by Grand Bank in 2006-2009 and Banquereau again in 2010 (DFO 2012). In addition, the industry also undertook to fund an economic study of the fishery (Gardner Pinfold Consulting Economists Ltd. 1998), and a dockside-monitoring program (DFO 2011c).

The 1998-2002 Offshore Clams Integrated Fishery Management Plan (IFMP) incorporated similar management measures to the previous plan and stressed the need to determine a sustainable yield and scientifically based TAC. It also identified factors to be evaluated when considering applications for new licences, such as the total TAC exceeding historic levels, uncertainty surrounding recruitment, sustainability of the fishery and market conditions (DFO 2006). The 1998-2002 Plan was extended by the 2005-2009 IFMP on a five-year rolling or "evergreen" basis. Thus, at the end of each year of the agreement, a subsequent year was added to the Offshore Clams IFMP, thereby ensuring that a five-year plan was always in place. This "evergreen" process was subject to either the Minister of Fisheries and Oceans or the licence holders providing formal notification, within 15 days before the end of each calendar year of the Plan, of their intention whether or not to agree an annual renewal of the Plan. The 2005-2009 IFMP was recently updated in May 2011 with a new IFMP, which remains in effect until replaced (DFO 2011c). This new Offshore Clams IFMP is to be reviewed and amended as required at the end of each year.

When the Arctic surfclam fishery started, participation was initially based mainly on expectations of a strong US market. However, this failed to materialize, due mainly to the distinctive coloration of the Arctic surfclam clam meat that deterred US buyers, so from 1987 onwards the clam fishing companies focused their efforts on penetrating the Japanese market. This was initially slow to respond and by the end of 1989 the economic situation of the fishery had deteriorated (DFO 2011c). In response, Canadian exporters formed the Canadian Hokkigai Export Association (CHEA) to expand the marketing of hokkigai (Arctic surfclams) in Japan. Together with the Canadian and provincial governments, CHEA implemented a major marketing campaign at supermarkets and stores throughout Japan to introduce consumers to Canadian hokkigai. This lead to a gradual increase in Japanese market demand, with over 4,000 t of Canadian Arctic surf clam exported to Japan by 1995. However, reliance on a single market would have left the industry potentially vulnerable so the industry continued efforts to diversify and expand markets throughout China, Southeast Asia and elsewhere (DFO 2011c). By 2006, exports of Arctic surfclams by market were: Japan 41%, North America 20%, China 29%, and other 10% (DFO, 2011c). However, despite these marketing efforts, the fishery has generally been constrained by market demand (Table 2).

Table 2: Annual Arctic surfclam landings (t) for Banquereau Bank, Grand Bank and the Scotian Shelf fisheries, 1987 – 2010 (modified from Roddick *et al*. 2011).

Year	Grand Bank (3LNO)	Banquereau	Scotian Shelf	Total
1987	0	717	1	718
1988	0	1,824	0	1,824
1989	402	7,666	0	8,068
1990	8,027	4,765	0	12,792
1991	6,753	746	0	7,500
1992	11,154	0	0	11,154
1993	18,905	60	0	18,965
1994	15,881	4,590	0	20,471
1995	14,108	10,427	0	24,535
1996	6,458	18,745	0	25,203
1997	7,614	19,025	0	26,639
1998	963	24,695	0	25,658
1999	1,487	24,413	0	25,900
2000	3,775	19,989	0	23,764
2001	8,389	11,443	0	19,832
2002	6,901	12,492	10	19,403
2003	10,265	16,883	0	27,148
2004	6,731	16,686	0	23,417
2005	3,732	14,689	0	18,422
2006	4,927	14,859	0	19,786
2007	211	17,337	0	17,548
2008	0	19,336	0	19,336
2009	127	24,565	0	24,692
2010	0	22,845	0	22,845
Annual Mean	5,700	12,867	0	18,568

4.4 Fleet and Gear Description

4.4.1 Vessels

The Canadian Arctic surfclam fishery initially charted US hydraulic dredging boats, with shucking and processing taking place at shore-based plants. However, by 1988, the fleet was required to use Canadian-registered vessels so the fishing companies bought three converted oil rig supply ships, 53-61 m length, equipped with two stern mounted hydraulic dredges (Roddick & Kenchington 1990). Since 1992, the fishery has used large freezer processor vessels. Although the number of vessels in the fishery has fluctuated over time and up to four vessels may fish, only two factory freezer-processors currently prosecute the fishery, the *Ocean Concord* and the *Arctic Endurance*. These vessels meet the requirements of Schedule 111 of the Fish Inspection Regulations and operate under a certified Quality Management Program (DFO 2011c). The replacement value of a vessel is estimated at $45 million, which includes $4.5 million for the onboard processing equipment (DFO 2011c). All crew must be Canadian citizens or have landed immigrant resident status in Canada (DFO 2011c). These vessels operate year round and can fish on both Banquereau and Grand Bank, and effort has switched between the two banks over time.

4.4.2 Gear

Arctic surfclam vessels tow two hydraulic dredges, each approximately 3.8 m wide x 6 m long x 1.2 m high, and weighing some 9 t (DFO 2006). The dimensions and specifications are shown in Table 3.

Table 3: Specifications of the Canadian hydraulic Arctic surfclam dredge (DFO 2010).

Characteristic	Value
Dredge width	3.8 m (12.5 feet)
Dredge height	1.2 m (4 feet)
Dredge length	6 m (20 feet)
Blade depth	18 cm (7 inches)
Dredge weight (in air)	9.5 tonnes
Tow speed	About 2 knots
Hose diameter	22.5 cm (10 inches)
Bar spacing	2.8 – 3.2 cm (1 1/8 – 1 ¼ inches)
Nozzles on the manifold	32

The dredge is a large rectangular steel box or cage, on skis that run the entire length of both sides (Figure 2). In operation, seawater is pumped through a large diameter water hose from the vessel to a manifold on the front of the dredge where a series of nozzles direct the water backward at a 45° angle into the seabed. The nozzles shoot high-powered water jets at about 125 - 190 p.s.i. into the sediment; this fluidizes the sand in advance of the dredge and exposes and lifts the underlying clams. A cutting blade spanning most of the width of the dredge then scoops the clams up into the cage at the rear of the dredge. As the dredge moves forward the clams pass over a series of spacing bars that retain commercial-sized clams and allow smaller clams to drop through. The first portion of the cage is left open to allow debris to drop out immediately. The size of this opening can be adjusted with the insertion or removal of additional steel plates. Clams are retained in the dredge until recovered at the surface and offloaded on the vessel. Dredges are typically towed in pairs with the centres of the dredges about 30 m (100 feet) apart. Two dredges are used whenever possible but during bad weather, or when dredge repairs are being carried out, a single dredge may be towed. A typical tow is of some 12 minutes duration at a speed of about 2 knots.

Hydraulic clam dredges are used only to fish for clam species and can be deployed effectively only on sandy seabeds. Ships captains target the medium to coarse sand bottoms where clams are found and take great care to stay away from rough bottoms to avoid damage to the gear and lost fishing time. The fleet uses RoxAnn & WASSP acoustical bottom imaging systems to identify suitable clam bottoms and thereby avoid disturbing the seabed in areas unlikely to contain commercial densities of clams. The RoxAnn & WASSP system is integrated with differential GPS and a Microplot system that provides a permanent record of where the vessel has fished. The captain views this information in order to continually refine the areas to be fished.

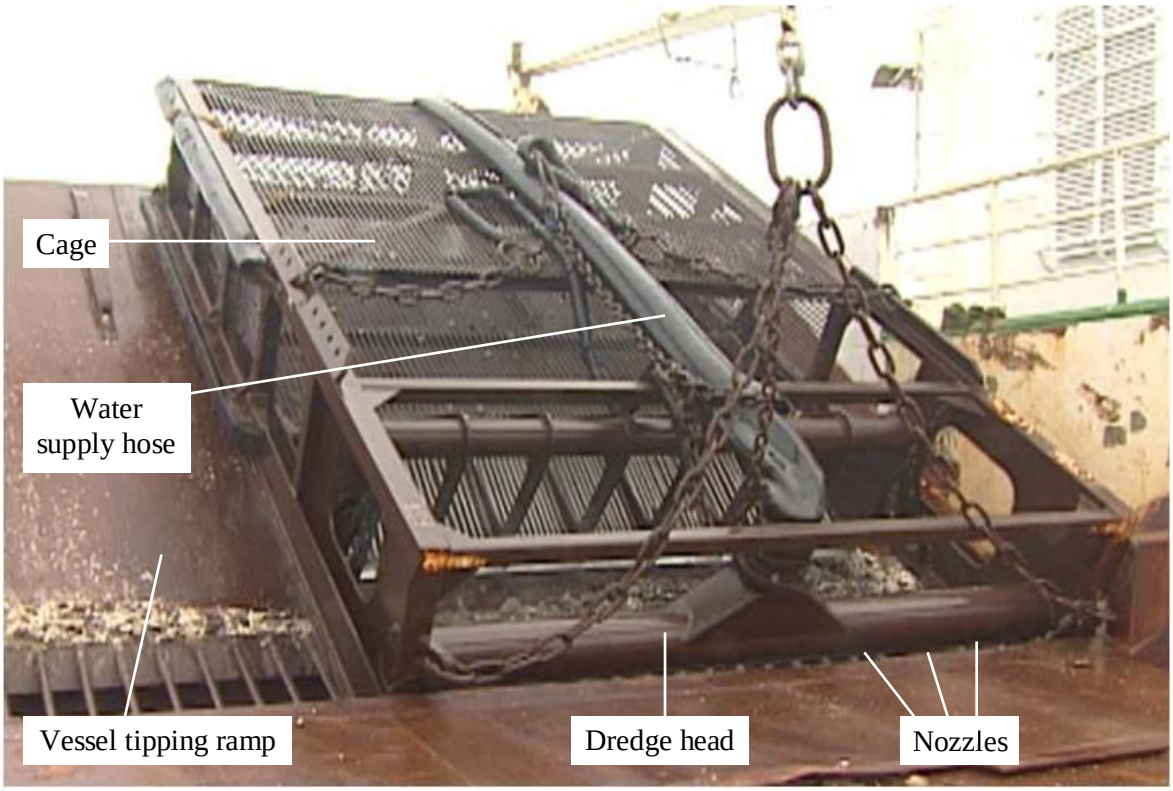


Figure 2: Arctic surfclam dredge sitting on a tipping ramp. Dredge head is 12.5 ' (3.8 m) wide.

5 STOCK ASSESSMENT

5.1 Management Unit

The Arctic surfclam *Mactromeris polynyma* is the subject of a hydraulic dredge fishery on Banquereau Bank, Grand Bank and occasionally at some other offshore banks on the Scotian Shelf (Figure 1). These fisheries are managed under the Offshore Clams Integrated Fishery Management Plan, Maritimes and Newfoundland Regions (DFO 2011c). This plan applies to both the Grand Bank and Banquereau fisheries and the same fishing vessels (currently two) are licenced to fish in both areas and to switch grounds whenever they require. The Arctic surfclam stocks on these two grounds are surveyed by collaborative industry/DFO surveys, and the resulting assessments form the basis for setting an individual TAC for each ground. Due to the time period between assessments the TAC's are set for a multi-year period, using the framework for these stocks developed during 2007 (DFO 2007d), and the TAC's generally remain in place until the next survey takes place.

While fishing and management processes for Grand Bank and Banquereau are integrated, and the populations on the two grounds are genetically homogeneous and belong to the same stock (Cassista & Hart 2007), the two banks are geographically well separated, ecological conditions and Arctic surfclam population parameters differ and separate TAC's are set, so they are best treated as separate management units.

The following MSC assessment is therefore directed specifically at the Grand Bank fishery but there is inevitably some scientific and management interaction with the more thoroughly studied Banquereau Arctic surfclam fishery that is being assessed at the same time as the Grand Bank fishery.

5.2 Assessments and stock status

5.2.1 Stock differentiation

One potentially important consideration for the management of this fishery is the extent of genetic variation within and among *M. polynyma* populations. The genetics of Arctic surfclam populations on Grand Bank and Banquereau were examined in a study using microsatellite markers (Cassista & Hart 2007). They found broad spatial homogeneity of allele frequencies among northwest Atlantic populations with no evidence of differentiation between harvested Arctic surfclam populations on either side of potential barriers to larval dispersal and gene flow such as offshore banks or the narrow straits that separate Gulf of St. Lawrence from Atlantic Ocean populations. Significant spatial differentiation occurred only on the largest geographic scale, between Atlantic and Pacific Ocean populations. All Arctic surfclams in the Canadian northwest Atlantic can therefore be considered to belong to a single stock. However, as Arctic surfclams are sedentary after settlement, geographically separated populations are demographically distinctive, with different age structures, growth rates, reproductive cycles and reproductive output (Cassista & Hart, 2007), as well as different fishing patterns, the fisheries on Grand Bank and Banquereau are best considered as separate management units. However, the genetic homogeneity indicates that there is some gene flow between these regional components of the stock through larval transport, which could contribute to episodic recruitment events.

5.2.2 Catch and landings

Three fishing vessels have operated for most years but the fleet currently consists of two factory freezer-processors fishing year round. These vessels have access to both Grand Bank and Banquereau grounds, and effort has switched between the banks through time (Table 2; Figure 3). The fishery started on Banquereau in 1987 and on Grand Bank in 1989. From 1990 - 1995 landings from Grand Bank were higher than those from Banquereau, often considerably so, but since 1996 they have been considerably lower. Grand Bank landings have been as high as 18,905 t but the TAC (1989 - 2010: 20,000 t; 2011: 14,756 t) has never been taken and for the last four years the catch has been below

300 t (Figure 4). The combined landings from the two fisheries have fluctuated somewhat from year to year but overall have remained fairly stable since 1993, at a level constrained mainly by market demand.

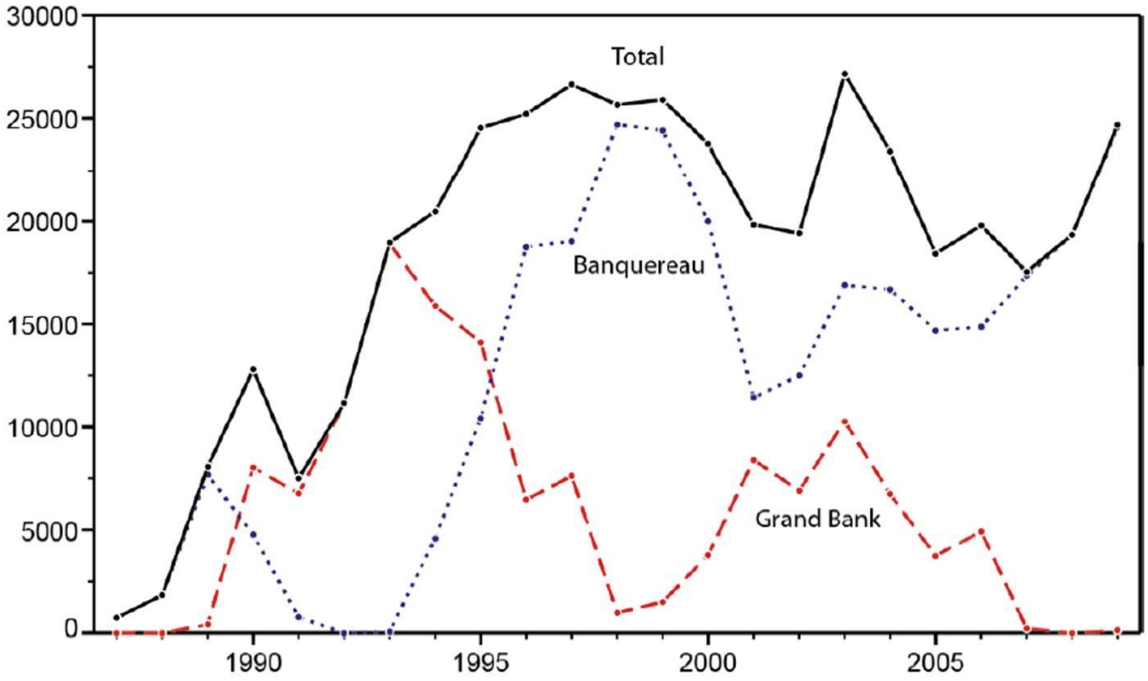


Figure 3: Arctic surfclam landings(t) for Banquereau and Grand Bank (DFO 2010).

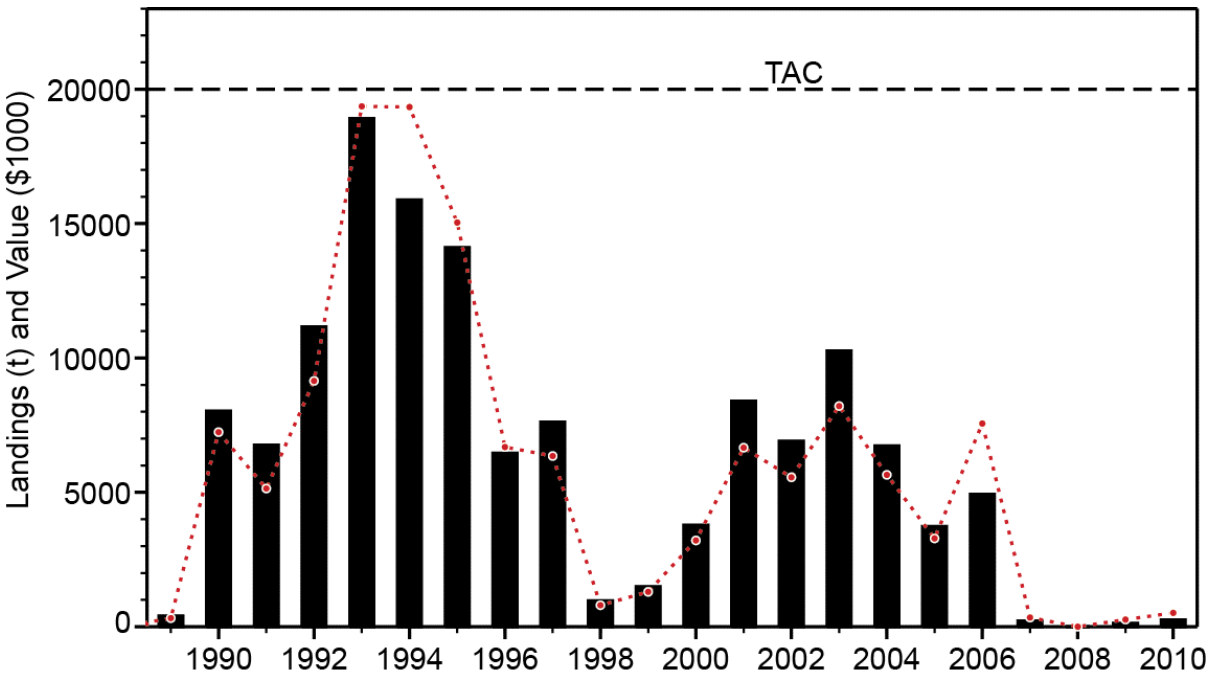


Figure 4:. Landings (bars) Total Allowable Catch (TAC) and landed value (dotted line) for the Grand Bank Arctic surfclam fishery on Grand Bank. Values are from the 2005-2009 Offshore Clam Management plan for 1987-1984, and from Newfoundland Statistics Branch for 2005-2010. Values are total landed value prorated to Grand Bank landings. 2010 landings and value are up to July 13, 2010 (Roddick *et al.* 2011).

5.2.3 Survey biomass and abundance trends

Arctic surfclams on Grand Bank were first surveyed by DFO in 1995 - 1997, but the data were never made publically available due to the demise of the scientist in charge (DFO 2010). The first full survey took place over 2006, 2008 and 2009, with different areas of the Bank surveyed each year. In addition to the problem of analyzing survey data split into three parts spread over four years, there were also changes in vessel, deck gear and dredges between surveys.

Stations were randomly assigned but with an assignment function that allowed a minimum of 1 km between tows. 722 survey tows were completed over the three years, which amounts to one station per 65.6 km^2. Some stations were repeated in 2008 and 2009 in order to compare catch rates between surveys but as these took place one to three years apart, gear differences are confounded with population changes (DFO 2010). In all, the area surveyed was calculated to be 49,473 km^2.

The vessel used for the 2006 survey was the *Cape Keltic*, a 43 m 360 GT side-dragger, equipped with a pump, towing frame and hydraulic clam dredge. The survey dredge was smaller than that used by the commercial boats, being 226 cm wide and 445 cm long, with a 177 cm cutting blade. The average bar spacing in the cage section was 23 mm on the top and sides, and 28 on the bottom. The back of the dredge was a chain bag and codend, and the dredge was set and landed from the side of the vessel. The depth of the cutting blade was set to 14.3 cm below the runners. Tow distance was measured and tow track recorded by the MaxSea navigation package, and the suitability of the seabed for the gear at each station was checked by the SeaScan bottom discrimination system (Seatronics Ltd., Scotland, UK).

For the 2008 and 2009 survey the vessel used was the *Tenacity I*, a 36 m. 353 GT stern-dragger. As the old dredge was wearing out, a new dredge was constructed, based on the 2006 dredge design used for the 2008 survey. There were problems landing the dredge over the stern during the 2008 survey, so a ramp and runner system similar to that used on some commercial vessels was installed for 2009. This made handling the dredge easier and safer, but the back of the dredge had to be changed from a chain bag and codend to a full cage. This reduced the capacity of the dredge, but retained smaller size clams than the chain bag or commercial dredges and was considered to retain less 'trash'. For all three surveys the standard tow was of 3 minutes duration at each station. A sensor system that provided more accurate data on the actual distance towed was tested during 2006 and 2008, and was functional for the 2009 survey. The data for 2009 were then used to adjust the towing distances for the 2006 and 2008 surveys.

A contour map of the Arctic surfclam biomass for the 2006-09 survey of Grand Bank is shown in Figure 5. There are relatively few, scattered, areas of high density. Only 30% of the total biomass is in areas with a density of 120 g/m^2 or more (Table 4) and more than half of the total biomass (51%) is in areas with a density of less than 75 g/m^2. This is good for the clam population, as it means that a large part of the population is unlikely to be fished, but it also means that the fishery will be concentrated on the higher density areas. This is of potential concern for long-lived, sedentary, species such as the Arctic surfclam will take a long time to recover once an area is fished down (DFO 2010). Survey densities on Grand Bank were lower than on Banquereau (Roddick *et al.* 2007).

Two methods were used to calculate the biomass in the survey area: simple statistics were used for the tows inside the 90 m depth contour, while the ACON Data Visualization package software (Black 1991) also used the deeper stations and calculated biomass by contouring (interpolating) using areal expansion with inverse distance weighting to create estimates of biomass between the point biomass data collected during the survey. Catches were standardized to a tow area of 500 m^2. Dredge efficiency could not be quantified so it was assumed to be 100%. This is prudent, given the present uncertainty about the efficiency of the survey dredge (DFO2010a) but means that the biomass is underestimated. Work is in progress to estimate the efficiency of the survey dredge.

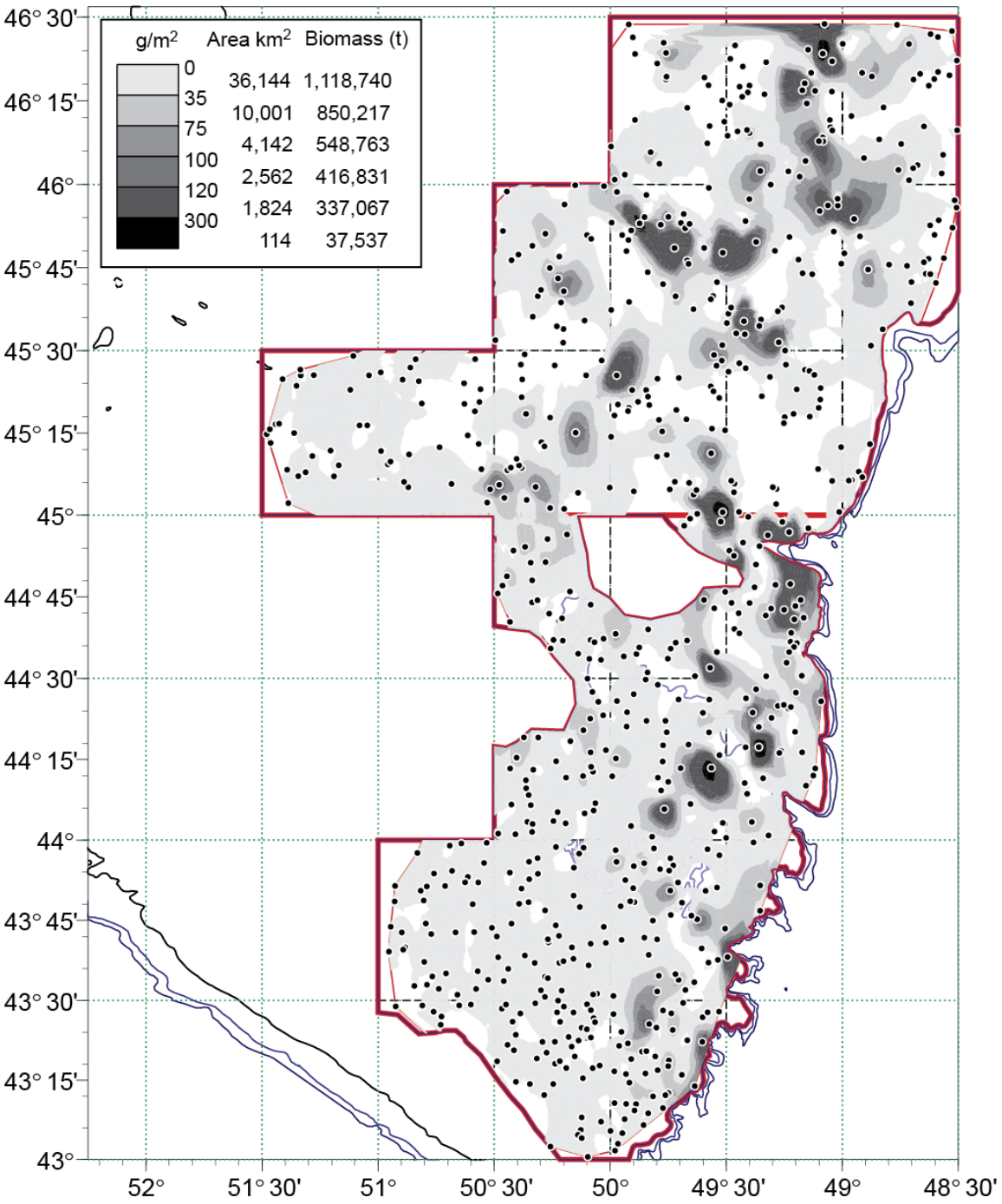


Figure 5: Contour map of the Arctic surfclam catch for the 2006-2009 Grand Bank survey (Roddick *et al.* 2011).

Table 4: Percent of total survey area and biomass within density contours for Grand Bank Arctic surfclam survey (DFO 2010a).

Density g/m^2	% Area	% Biomass
>0	73	100
35+	20	76
75+	8	49
100+	5	37
120+	4	30
300+	0.2	3

The research vessel biomass estimate (B_{RV}) for the 2006-2009 Grand Bank survey is shown in Table 5, together with the estimate from the 2004 Banquereau survey for comparison. The estimate for Grand Bank of 1,140,682 ± 35,933 t is 78% of that estimated for Banquereau, but this is for a survey area 4.8 times as large. A large part of the survey biomass for Grand Bank comes from a large area with a low density of clams.

Table 5: Research vessel biomass estimates (B_{RV}) estimates for the Arctic surfclam surveys on Grand Bank and Banquereau (DFO 2010a).

Survey	Year	Biomass (t)	Area (km^2)
Grand Bank	2006-2009	1,140,682	49,473
Banquereau	2004	1,462,097	10,265

The survey densities can be compared with the commercial densities of the areas that are being fished. The commercial catch per unit effort (CPUE) for Grand Bank and Banquereau is shown in Figure 6, with CPUE calculated on a per vessel-trip basis, for trips approximately one month long. CPUE has risen recently on Banquereau as a large recruitment pulse has entered the fishery (DFO 2007a), although the rise could also be due to increased knowledge and experience of the fishermen in catching surfclams using the new bottom profiling technology to accurately target surfclam concentrations (DFO 2007d). Taking the 1993 to 2006 period to avoid the recent increase, the average CPUE for Banquereau was 0.111 kg/m^2 fished (S.D. = 0.041, n = 222), while the average for Grand Bank (1993-2010) was lower at 0.096 kg/m^2 (S.D. 0.040, n = 172).

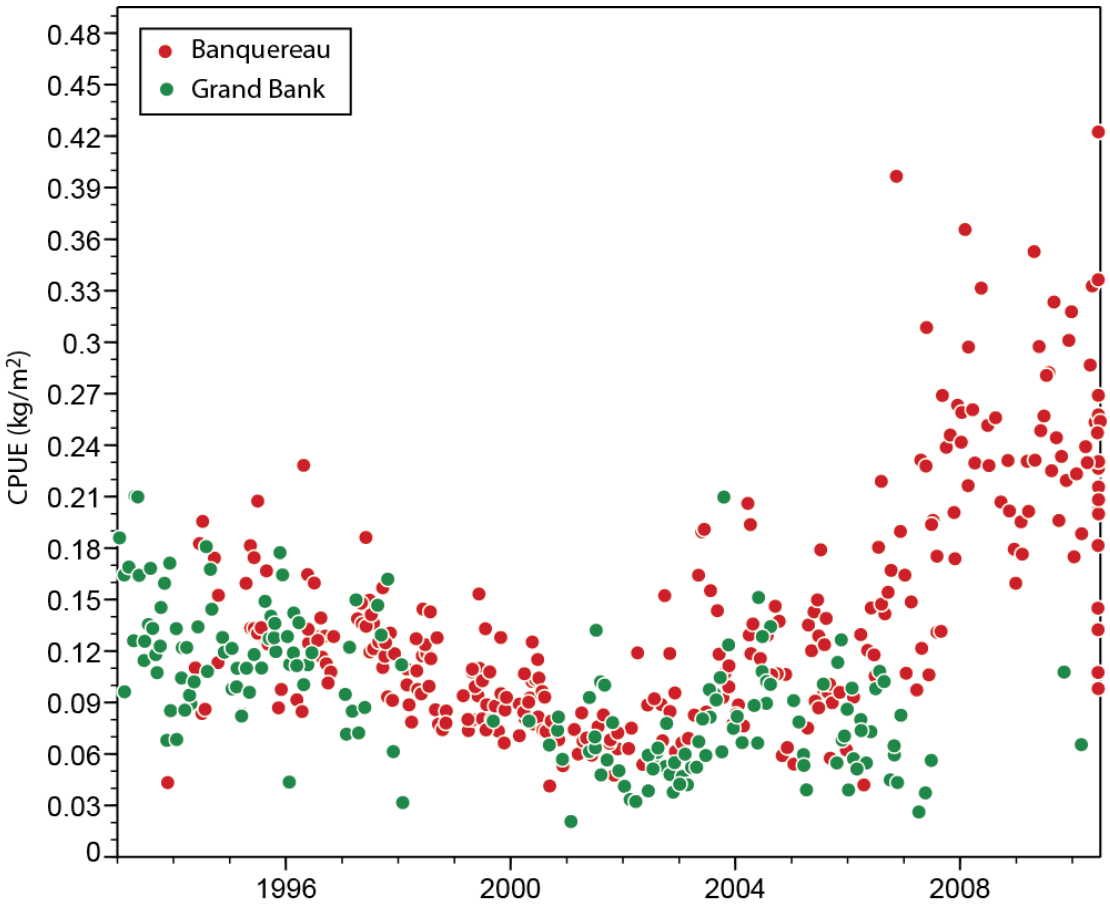


Figure 6: CPUE (kg/m^2 dredged) for the Arctic surfclam fishery on Grand Bank and Banquereau. CPUE is calculated on a trip basis (DFO 2007a).

The biomass distribution from the 2006-09 Grand Bank survey with the top three contour levels set to span the range of densities that have been commercially fished (0.075, 0.100, and 0.120 kg/m^2) is shown in Figure 7, with the biomass and area within these contour levels shown in the table in the upper left of the figure. Just over half the biomass (51%) is in areas with a density less than 0.075 kg/m^2. If the fishery needs higher densities for economic operation there is only 37% of the total biomass in areas with a density of at least 0.10 kg/m^2, which is about the average commercial density taken on Banquereau, and 30% in areas with a density of 0.12 or more. However, at 0.10 kg/m^2 the fishery on Grand Bank would be targeting the high density patches that make up only 8% of the total survey area. If these high-density areas are fished down to a level that is no longer profitable the fishery will take a long time to recover (DFO 2010).

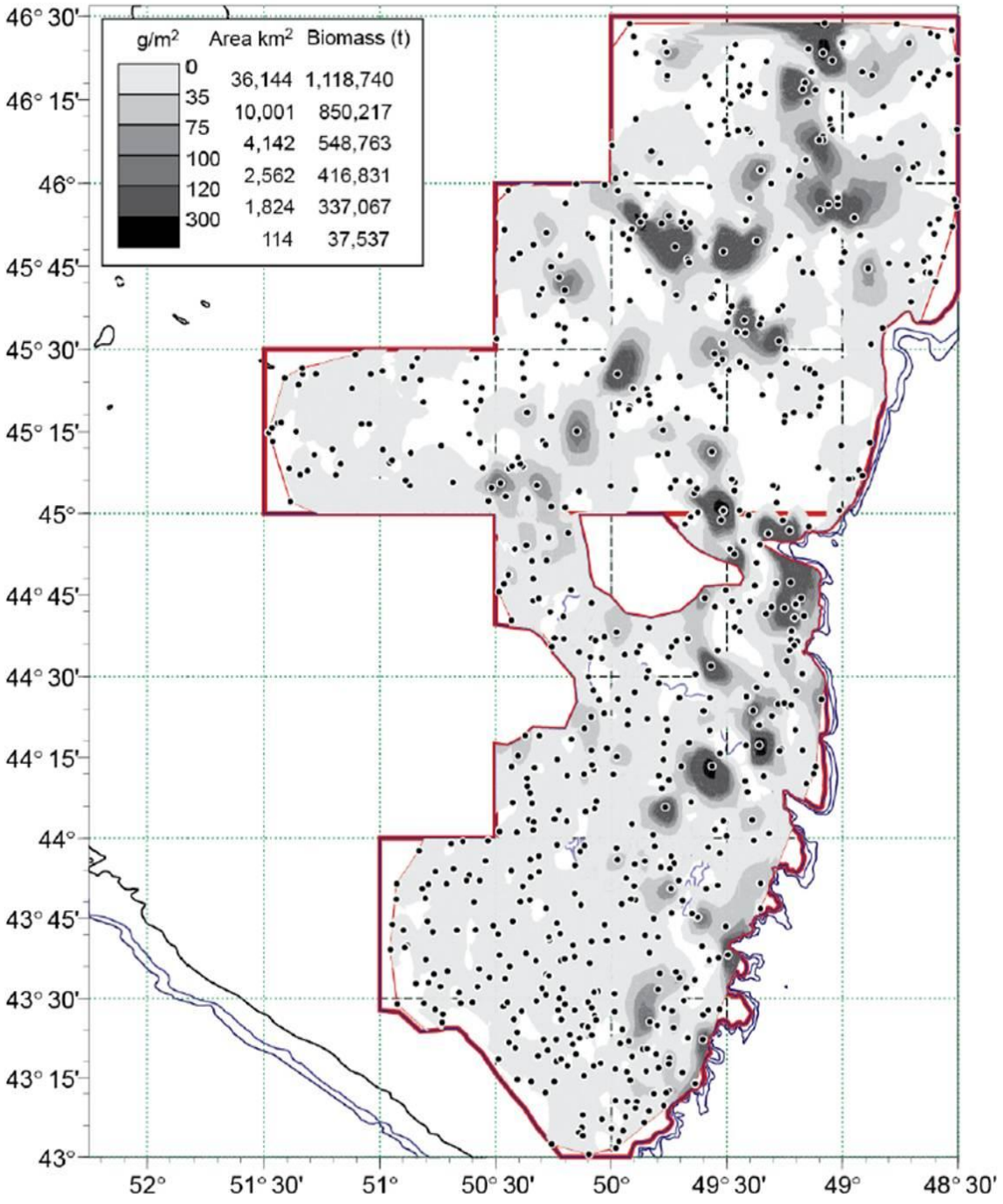


Figure 7: Biomass contours of the 2006-9 Grand Bank survey catch with the three highest levels set to span the range of densities being commercially fished (Roddick *et al.* 2011).

5.2.4 Size distribution

The length frequency distribution of the catch was determined for >23,000 clams, based on measured samples of approximately 100 clams taken from each tow of the survey (Figure 8). Most of the catch came within the size range of 35 – 120 mm shell length, with a median size of about 80 mm. In the previous survey on Banquereau Bank (DFO 2007a), and the 2006 and 2008 surveys on Grand Bank (Roddick *et al*. 2011) there was an obvious problem of measurement bias with greater numbers of clams being recorded at lengths with the last digit of 0 or 5 when using a manual measuring board. This bias was eliminated for the 2009 Grand Bank survey by using an electronic measuring board, but as the effect was present for the 2006 and 2008 data, lengths were aggregated to 5 mm increments in order to remove this effect (Roddick *et al*. 2011).

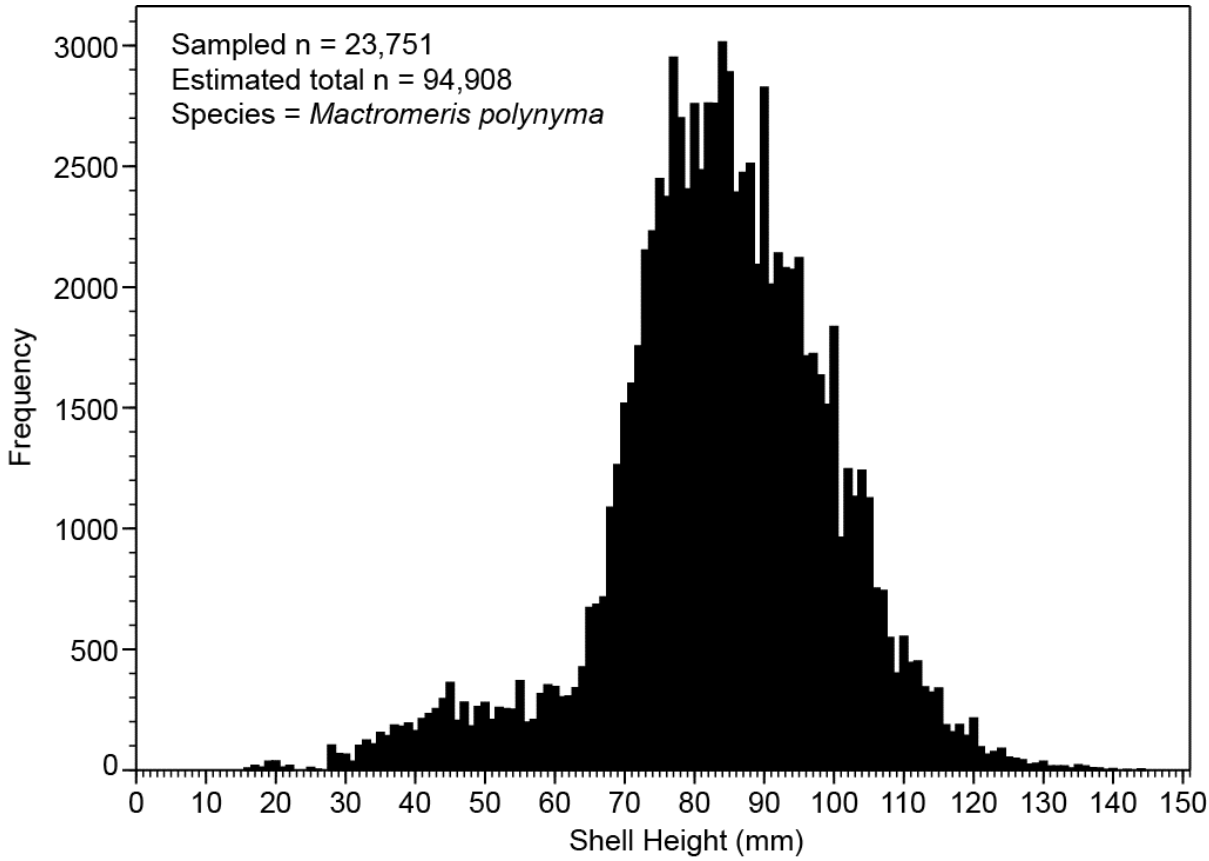


Figure 8: Size frequency distribution for Arctic surfclams caught during the 2006-2009 survey on Grand Bank (Roddick *et al*. 2011).

Smaller samples of whole clams taken on the survey were returned frozen to the DFO laboratory for analysis of length-weight relationships, spawning cycles, age structures and size and age at maturity. On-board sampling procedures were designed to ensure that these samples covered the full size range of the clams captured in the dredges (DFO 2011d) and they were later sub-sampled to provide a length-stratified sample for ageing studies.

The procedures for estimating the survey age frequency distribution are illustrated in Figure 9, which shows the histograms of the length-stratified sample and the survey size frequency distribution, together with the fitted von Bertalanffy growth curve. These data were then used to construct an age-length key to convert the length frequency distribution to the resulting age frequency histogram for the aged sample and to estimate the survey age frequency distribution (Roddick *et al.* 2011). The survey age frequency distribution provides information on year-class strength and indicates fluctuations in recruitment through time. Recruitment occurs every year, with no missing year-classes, but with evidence of stronger year-classes every few years.

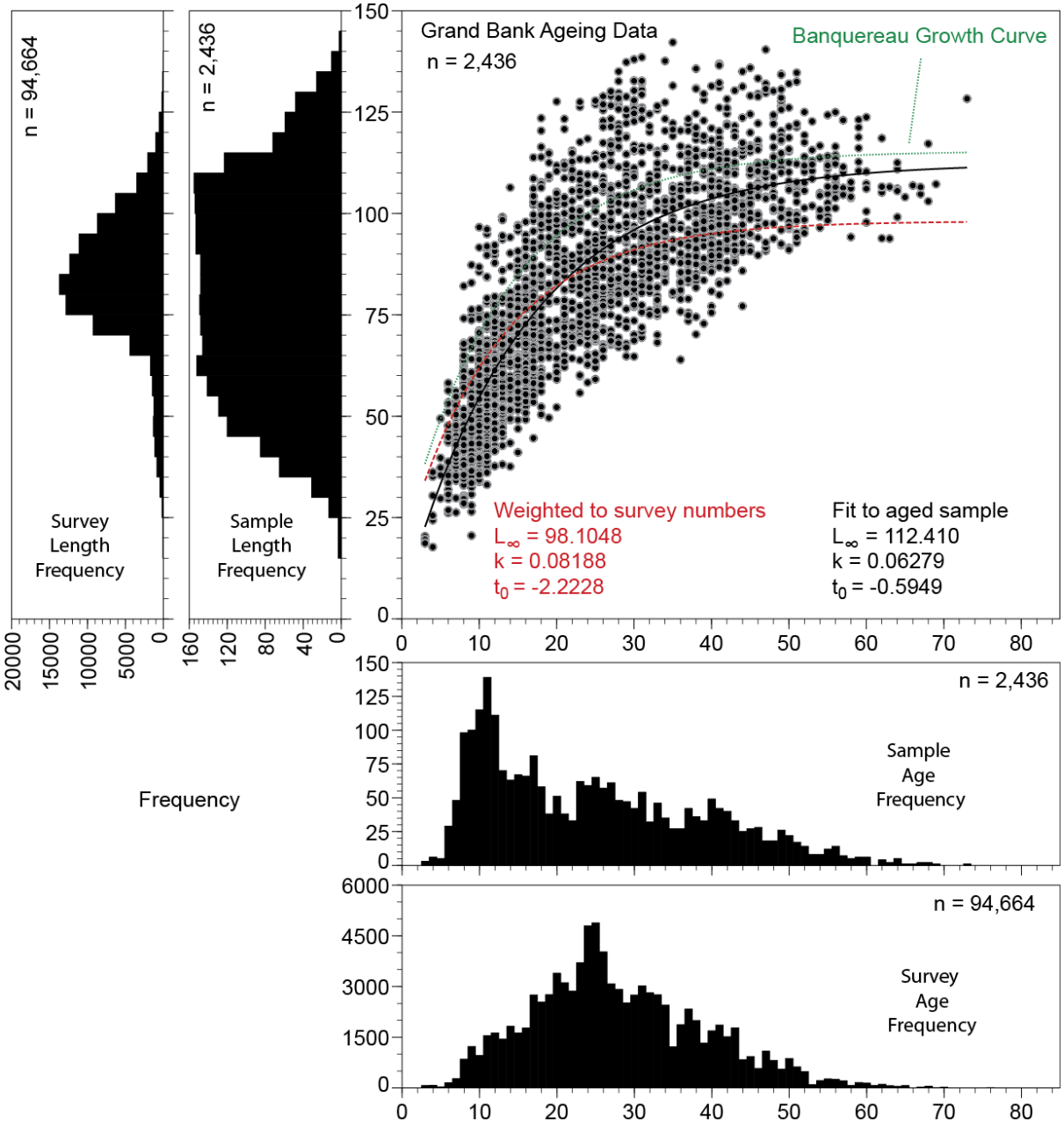


Figure 9: Survey and sample length frequency, ageing results and sample and estimated survey age frequency results from the aging of a random sample of 2,436 clams from the 2006-2009 Grand Bank Arctic Surfclams survey (Roddick *et al*. 2011).

5.2.5 Assessment models

Fishery dependent information like catch per unit effort (CPUE) is not used for assessment in this fishery as catch rates are not well correlated to stock abundance due to the spatial distribution of the stock, spatial changes in effort through time and the low spatial resolution of the available effort data (Jonsen, 2007). Instead, research vessel survey data is considered to provide the best basis for recommending harvest levels. The confidence limits around the biomass estimates are narrow (Roddick *et al.* 2007, Roddick *et al.* 2011), and sources of uncertainty are addressed in the Regional Assessment Process (RAP) (DFO 2007a, DFO 2010) and taken into consideration when deciding management advice.

Based on life history and selectivity parameter estimates the age of maximum biomass per recruit

occurs below the age of 50% selectivity (22.9 years) so growth overfishing is unlikely to occur. The age of 50% maturity (5.3 years) is also well below the age of 50% selectivity, indicating that surfclams on Grand Bank mature at a younger and smaller size than on Banquereau (DFO 2010). Grand Bank surfclams are, therefore, able to spawn over a period of 17 years before recruiting to the fishery, compared with 10 years for Banquereau. Although there have been no studies of the relative fecundity of young compared with older surfclams, this should help ensure that recruitment overfishing does not occur. There is, therefore, a high degree of certainty that neither recruitment nor growth overfishing is occurring in this fishery.

With no time series of CPUE or biomass for this fishery, yield estimates have been based on empirical equations relating biomass, growth and mortality to production. Various commonly used harvesting levels were evaluated, notably the constant yield levels, Maximum Sustainable Yield (MSY), 2/3MSY, and Maximum Constant Yield[1](MCY) and the constant fishing mortality level $F_{0.1}$. A constant fishing mortality approach to setting TAC levels was found to be preferable to a constant yield approach (DFO, 2007) and it was recommended that the harvest rate should be applied to the survey biomass, $B_{RV,}$ and not to the virgin biomass, B_0. The constant fishing mortality is preferred as it allows adjustment of catch every time a survey is conducted and is a more responsive strategy to changes in the population.

The Offshore Clam Framework Assessment meeting (DFO 2007a; DFO 2007d) agreed that the fishing mortality, F, should be a function of the natural mortality, M. A range of fishing mortalities (F) and the resulting TAC's were considered at the Framework Assessment meeting and a conservative TAC set at around F~MCY was finally recommended for the Banquereau fishery (DFO 2007c). This is based on a strategy of setting a yield that is low enough to be sustainable at all probable biomass levels. The same F target was later accepted for the Grand Bank fishery (DFO 2011e). Thus, the TAC for Grand Bank is based on harvesting a percentage (the exploitation rate) of the estimated harvestable biomass (i.e. the biomass > 75 g/m^2), which is intended to optimize yield and not expose the resource to risk of over-exploitation. The fishing mortality (F) target at Maximum Constant Yield is estimated to be one-third of natural mortality (M). F_{MCY} is applied to the harvestable biomass, such that the TAC is set at 2.64% of the harvestable biomass (DFO 2011c). The risk of detrimental effects to the stock were expected to increase to unacceptable levels as the TAC approached F = 0.5M, unless survey frequency increased (DFO 2007c).

By applying F_{MCY} to the harvestable biomass, the TAC for Grand Bank was revised down to 14,756 t in 2011, following detailed scientific advice from the 2010 Grand Bank assessment (DFO 2011c).

5.2.6 Biological reference points

Although there is no analytical assessment for this fishery and explicit biological reference points cannot be calculated, there is sufficient information and analysis available to determine that implicit reference points are used in the management of the fishery and that these comply with the Marine Stewardship Council's Policy Advisory 12 (MSC 2010b) on implicit reference points, which states "target reference points should be such that the stock is maintained at a level consistent with B_{MSY} or above, or some measure or surrogate with similar intent or outcome." The 2007 Framework Assessment of Banquereau concluded that a fishing strategy that resulted in an F ~ MCY (F of 0.33M) was appropriate for the offshore Arctic surf clam fishery based on the long-lived and slow growing nature of the species (DFO 2007a). As M = 0.08, this strategy is inherently conservative and

[1] Maximum Constant Yield (MCY) is defined as "the maximum constant catch that is estimated to be sustainable, with an acceptable level of risk, at all future levels of biomass" (Caddy & Mahon, 1995; Ministry of Fisheries, 2007). MCY is conceptionally similar to MSY but considers random fluctuations in production, rather than assuming deterministic dynamics following a Schaefer surplus production model (Sissenwine 1978). MCY is clearly explained in relation to MSY and other biological reference points in Mace (1994) and Caddy and Mahon (1995), while methods for calculating are detailed in Francis (1992). MCY is not a new concept but with the well-known pitfalls of MSY as a safe target reference point (e.g. Larkin, 1977; Sissenwine, 1978) many fisheries in New Zealand (Annala, 1993) and elsewhere opt for MCY as a more conservative option (Deroba & Bence, 2008).

precautionary and strives to maintain the biomass at the level of B_{MCY}, a higher level than that of the MSC default target of $0.4B_0$.

While B_{MCY} is an implicit target reference point, there is no limit reference point (LRP) or threshold that would trigger management action if the stock is becoming overfished. MSC guidance indicates that in the absence of explicit limit reference points, an appropriately conservative assumption is that LRP for stocks with average productivity is ½ B_{MSY} or 20% of B_0 (MSC 2010a). However, the Grand Bank Arctic surfclam clam stocks are very large and exploitation rates have been small, so the stock is far above such a suggested LRP. Applying estimated mortality, recruitment and growth rates to the survey population structure, suggests that production exceeds the level of removals by the fishery (Roddick *et al.* 2007). In some 23 years of fishing, the stocks have not been heavily impacted by the fishery and are probably still near the virgin biomass level. Serial depletion of grounds could become an issue but there is no indication of it at present. With the current restriction on fishing effort (only two boats fishing), any decline in biomass will be slow to occur and would be detected through the survey programme, and action taken, long before it affected reproductive output. Therefore, while a limit reference point would be desirable, it is not currently a priority for this fishery. In any case, the operational costs of exploiting the offshore Arctic surfclam stocks are such that fishing would be limited for economic reasons long before there is an appreciable risk that recruitment is impaired (Roddick *et al.* 2011).

5.2.7 Fishing mortality

Estimates of fishing mortality (F) have been made for the Grand Bank fishery based on the relationship:

Fishing mortality (F) = Total mortality (Z) – Natural mortality (M)

Total mortality (Z) was estimated using two methods of Chapman & Robson (1960), a catch curve method and another that uses the mean age of animals above the recruitment age (Roddick *et al.* 2011). The catch curve method was applied separately to the estimated age frequency distributions for the three years of the survey (Figure 10), which gave estimates of Z of 0.063, 0.087 and 0.148 respectively and an average weighted by number of tows of Z = 0.11. The second Chapman and Robson method gave estimates of Z = 0.079, 0.091 and 0.097 for 2006, 2008 and 2009 respectively, with a weighted average of Z = 0.091. These various estimates therefore put Z on Grand Bank within the range of 0.06 to 0.11. No separate estimate of natural mortality (M) has been made for Grand Bank but the value of M = 0.08 estimated for Banquereau (Amaratunga & Rowell 1986), has been accepted for the Grand Bank fishery (Roddick *et al.* 2011). This gives very low estimates of fishing mortality from F = 0 to F = 0.03. The 20,000 t TAC that was applied until 2010 produced an estimated F of 0.016 (Roddick *et al.* 2011). The new, lower TAC of 14,756 t would result in a lower, even more precautionary level of estimated F. However, for the last 10 years the fishery has landed an average of only 6,515 t per year, which gives an F of 0.006. These figures suggest that the low values estimated for F are reasonable, confirming that Grand Bank has only been subjected to a low level of exploitation.

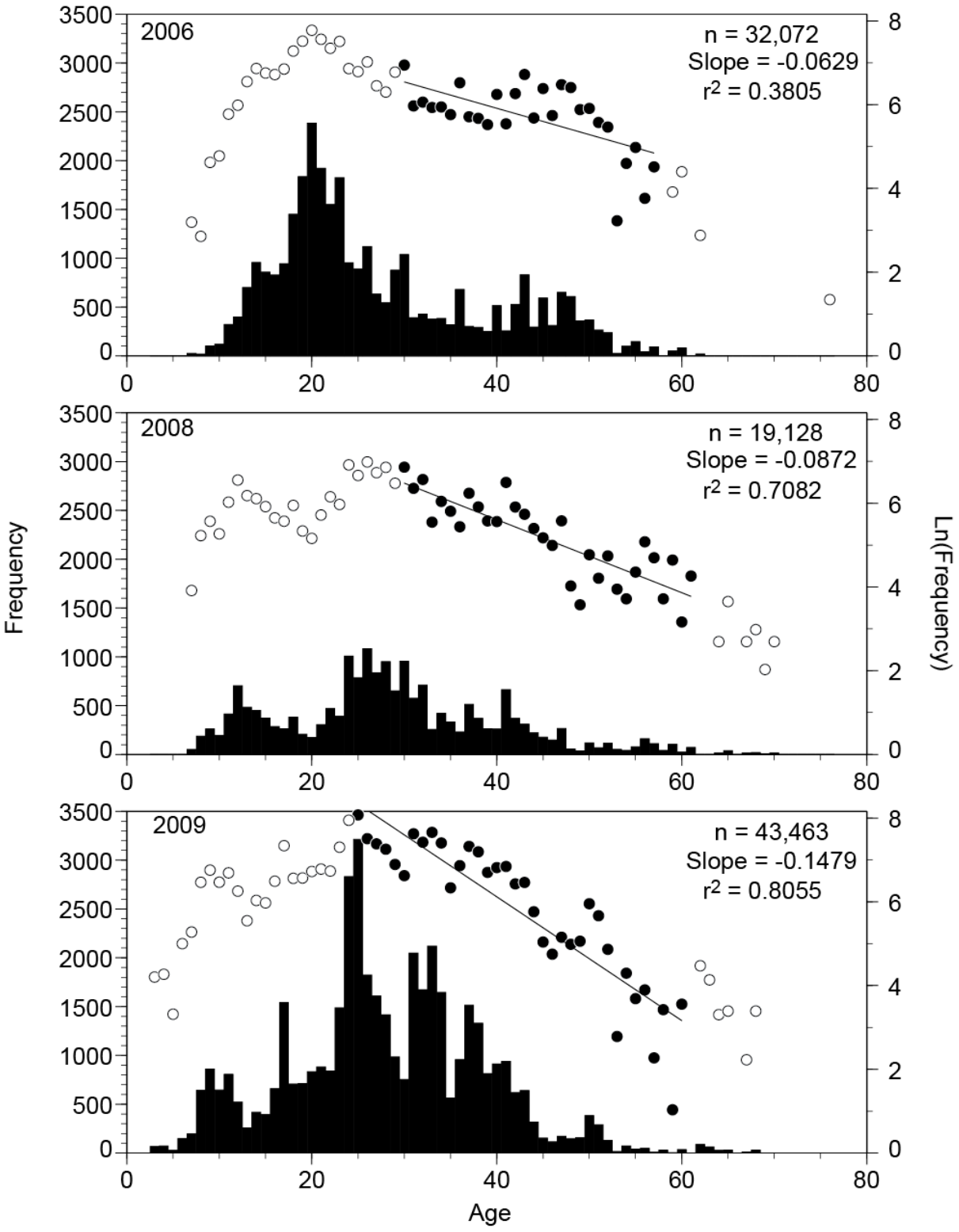


Figure 10: Catch curve estimates of mortality for Grand Bank Arctic surfclam surveys in 2006, 2008 and 2009. The average estimate weighted by survey number of tows is -0.1066 (Roddick *et al.* 2011).

5.2.8 Recruitment

Recruitment of surfclams on Grand Bank appears to have been fairly consistent, with no missed years, but with some evidence of stronger year-classes every few years (Figure 11). However, the age distribution in Figure 9 is for the population over the whole area of the survey and it is likely that considerably greater variation in recruitment between years would occur at smaller spatial scales.

An approximate estimate of recruitment has been obtained by taking the distribution of numbers at age and calculating the numbers at recruitment age using the estimated mortality rate:

$$N_{RA} = \frac{N_A}{e^{-Z(A-RA)}}$$

where N_{RA} are the number at recruitment age *RA*, N_A are the numbers at age *A*, and *Z* is the total mortality rate (Roddick *et al*. 2011). This assumes constant mortality, but produces an estimate of recruitment for the time period corresponding to the age of recruitment at the maximum age observed in the age frequency distributions (Figure 9). Converting the numbers at age shown for the catch curves in Figure 10 back to a common age for all three surveys (age 25), gives the age 25 recruitment patterns shown in Figure 11. Since the survey was done in three different years, separate age-length keys were used to produce the numbers at age for each year. This means that for any one age-length key there were approximately 50 clams aged per 5 mm increment. With the large range of ages represented, this is not a large aged sample for this type of analysis. It does, however, provide the best information available on past recruitment patterns. The recruitment patterns differed for the three surveys, indicating differences in recruitment by area over the bank. This is not unlikely for most bivalves recruit in "patches" of good settlement but it could be a product of the relatively low numbers of clams aged (2,436 in total). Recruitment also appears to have varied greatly through time within each area, although it is likely that larger aged samples would smooth out some of the variation in the distributions (Roddick *et al.* 2011). Taking the average number of recruits at age 25 from each survey and weighting it by the number of tows for each survey, gives an overall average of 1,591 clams age 25 per year actually caught in the survey tows. Expanded to the total area of the survey gives an estimate of average recruitment to Grand Bank of 208,726,000 clams at age 25 per year. This is a large number of recruits, but with the survey area so large it amounts to an average of just one recruit per 227m^2 over the whole survey area (Roddick *et al.* 2011). The history of the fishery is still too short and population levels have been too stable to estimate feedback effects such as the occurrence of a stock-recruit relationship. However, as a high fecundity, broadcast spawner, with external fertilization, a close stock-recruitment relationship is unlikely to occur, except at very low stock densities when there are just too few spawners to produce a good recruitment.

In most bivalve fisheries, understanding recruitment processes is one of the most important, and challenging, aspects of understanding and modeling the dynamics of a fishery. For the Grand Bank surfclam fishery it is a major source of uncertainty, with many questions yet to be answered. For example, are there any spatial or temporal patterns of settlement or recruitment over the bank? Do density-dependent mechanisms operate and at what spatial scale? For a long-lived, slow-growing, sessile bivalve like *Mactromeris polynyma* these are particularly important questions, for it is necessary for managers to know how long it will take for heavily fished areas to repopulate before they can be fished again.

5.2.9 Natural Mortality

Natural mortality (M) is one of the most difficult parameters to estimate in fishery research and, as a result, it has often been calculated from empirical relationships with other parameters, such as the well-known constant relationship between M and the growth constant *k* (Charnov 1993). For the Arctic surfclam, however, M was calculated from the simple relationship $Z = 3/T_{max}$, where T_{max} is the lifespan, which was taken as the cut off for the upper 5% of the recruited age distribution (Amaratunga & Rowell 1986). As the estimated lifespan for Banquereau surfclam was 40 years, 3/40 gave an estimate of Z = 0.075 and, since there was no fishery at the time, Z was considered to be equal to the natural mortality rate (M). This value has subsequently been accepted as the appropriate M to use in assessment of stocks on both Banquereau and Grand Bank, where the life span is similar and various analyses have suggested that it is reasonable (Roddick *et al*. 2007, Roddick *et al* 2011). Natural mortality (M) estimates for Alaskan populations, however, have been much higher at M = 0.13 - 0.25, which is to be expected given the shorter lifespan (Hughes & Bourne 1981).

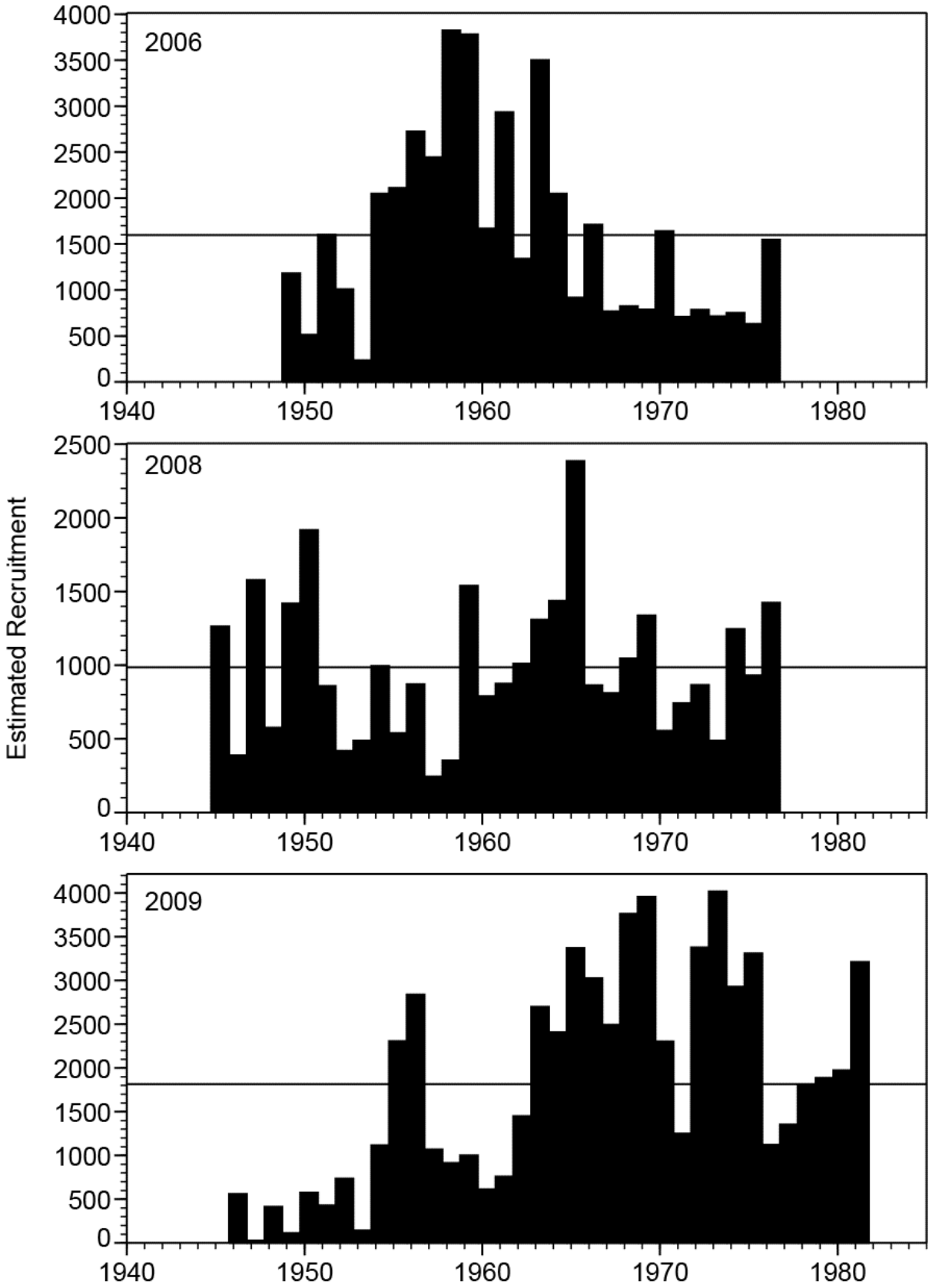


Figure 11: Population recruitment patterns estimated by applying the estimated (constant) mortality rate to the estimated age structure for the 2006, 2008 and 2009 portions of the Grand Bank Arctic surfclam survey (Roddick *et al*. 2011).

5.2.10 Incidental mortality

In a study of the incidental mortality of small clams that pass through the dredge, it was estimated that 15% of the clams passing through the dredge suffered lethal damage (DFO 2007a). Yield per recruit analysis with and without a 15% incidental mortality (Figure 12) indicated that incidental mortality greatly reduced both the yield at high fishing mortality rates and F_{MAX}. Spawning stock biomass (SSB) remained relatively high at fishing mortalities around the $F_{0.1}$ level. When incidental mortality was included in the model, the $F_{0.1}$ estimate was within the upper range of fishing mortalities recommended by the framework (DFO 2007a). This study was carried out on Banquereau but, with the same boats and dredges fishing, the conclusions would be equally applicable to Grand Bank. However, while the important effect incidental mortality has been recognized, it has not been explicitly incorporated into the process of setting the TAC.

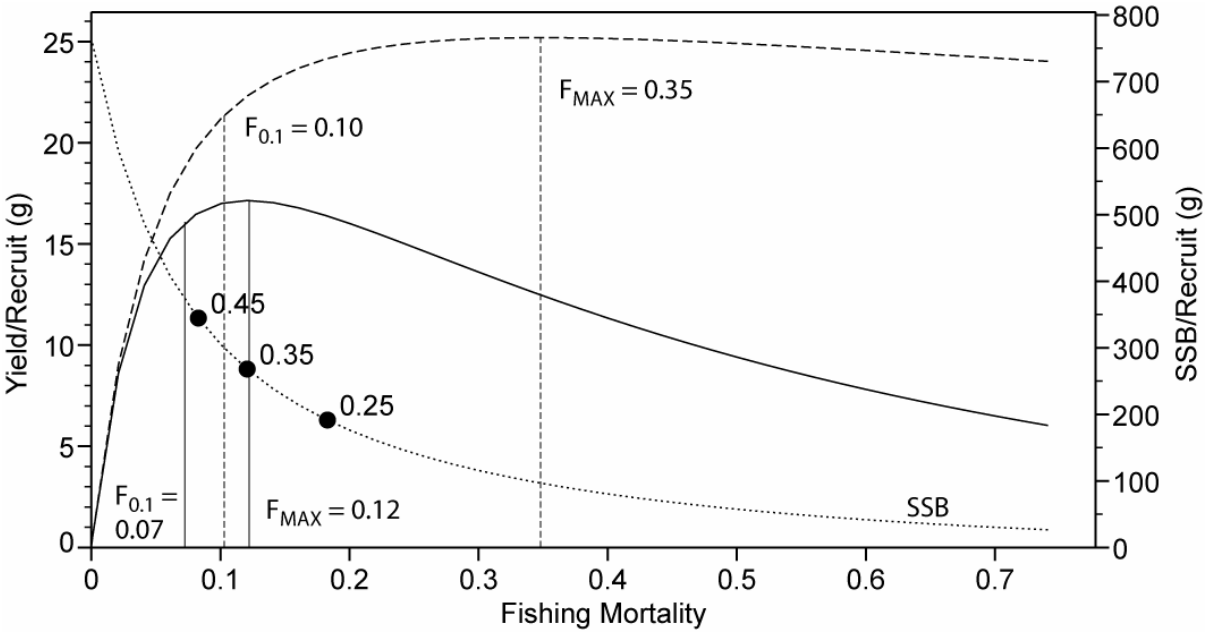


Figure 12: Yield and spawning stock biomass (SSB) per recruit for Banquereau Arctic surfclams. The top yield per recruit curve (dashed) is with no incidental mortality. The lower curve (solid line) is with a 15% mortality of small clams that pass through the dredge. Spawning stock biomass (dotted line) (adapted from DFO 2007a).

5.2.11 Stock status

The current status of the Arctic surfclam stock on Grand Bank is good. The major research vessel survey carried out over 2006, 2008 and 2009, with different areas of the bank surveyed each year, provided an estimate of the biomass of 1,140,682 ± 35,933 t of Arctic surfclams. These surveys are considered to provide good estimates of fishable biomass due to the high selectivity and efficiency of the gear and the sessile nature of the Arctic surfclam, which means that confidence limits around the biomass estimates are narrow (Roddick *et al* 2011). Moreover, they are likely to underestimate biomass since they conservatively assume a dredge efficiency of 100%. The area of the Grand Bank surveyed was enormous (49,473 km^2) but currently 51% of the biomass is found at densities < 75 g/m^2, and only 37% of the biomass is in areas with a density of at least 100 g/m^2. However, at 100 g/m^2 the fishery would be targeting high-density patches that make up only 8% of the total survey area (some 3,958 km^2). This is still a large area but if these high-density areas are fished down to a level that is no longer profitable the fishery will take a long time to recover (Roddick *et al.* 2011). However, with only two vessels currently fishing both the Banquereau and Grand Bank grounds, fishing effort and exploitation rates on each ground are very low. Since the Grand Bank surfclam fishery began in 1989, it has been calculated that 1,132 km^2 (uncorrected for overlap of tows) have been swept by the gear, with most of that in the period 1990-1998 (DFO 2010). This represents only

2% of the area surveyed. During the last five years (2005-2009) fishing effort on Grand Bank has been low and the average annual swept area has been only about 26 km^2; there is no evidence of serial depletion of grounds. The Arctic surfclam population has clearly not been heavily impacted by the fishery, and is probably still near the virgin biomass level. Concerns over the effects of the fishery on the stocks and the bycatch would undoubtedly increase if the footprint of the fishery increased.

The age at 50% selectivity in this fishery is 22.9 years, well above the 5.3 years age at 50% maturity, so individuals should have over 17 years of spawning before entering the fishery. The age at 50% selectivity is also near the age at maximum biomass per recruit. Hence, neither recruitment nor growth overfishing is a problem with the present gear selectivity pattern. Recruitment on Grand Bank is fairly consistent over the entire bank, with no missed year-classes, but there is evidence of stronger pulses of recruitment every few years, particularly at smaller spatial scales.

The 2007 Offshore Clam Framework Assessment recommended that the surfclam fisheries should be managed by a constant F approach, with a fishing mortality (F) target at Maximum Constant Yield (MCY) estimated to be one-third of natural mortality (DFO 2007a, DFO 2007c, Roddick *et al*. 2011). This results in a permitted annual harvest of 2.64% of the biomass at densities greater than 75 g/m^2. With 49% of the total biomass of 1.14 million tonnes currently found in densities > 75 g/m^2, this gives a TAC of 14,756 t, which is a reduction on the previous precautionary level of 20,000 t. However, the full quota has never taken and the fishery is, in any case, currently limited by market demand. This is a conservative approach but caution was advised as TACs and catch rates would be expected to decline as landings increase and exceed natural production. In addition, since current plans are for the stock to be surveyed only every 4 or 5 years, the allowable catch must be set low enough that the stock will not be overfished in the event of a period of poor recruitment or other declines in biomass between assessment updates. If surveys were more frequent a less conservative level of F could be set (DFO 2007d).

5.3 Management advice

The management objectives and methods for the Grand Bank offshore surfclam fishery can be found in the Offshore Clams Integrated Fishery Management Plan (IFMP), Maritimes and Newfoundland regions (DFO 2011c).

The long-term objectives set out in the IFMP are to:

- Increase certainty that harvesting occurs at an optimum sustainable level to ensure the long-term viability of the resource,
- Enhance industry's level of participation in the management of this resource to benefit Canadians,
- Maintain the long-term viability of the industry, and
- Assess, evaluate and minimize any adverse environmental effects of the fishing methods on the habitat.

With regard to conservation and sustainability the primary objective of the plan is stated to be "to ensure that a biologically and economically sustainable clam fishery continues through the auspices of scientifically-based management plans involving collaborative enforcement, monitoring and regulatory measures. A further objective includes the continued cooperation between the licence holders and the Department in establishing ongoing management measures that will "minimize impacts of harvesting on the habitat".

The main management tools for the fishery set out in the IFMP are limited entry licences, a TAC divided into EA's (enterprise allocations), 100% dockside monitoring, and mandatory logbooks and VMS (vessel monitoring system).

When the fishery started in 1989, a precautionary TAC of 20,000 t was set and this has remained in

place until it was revised down to 14,756 t in 2011, following analysis of the 2006-9 biomass survey data. The fishery now also has the same target fishing mortality recommended by the Offshore Clam Framework Assessment (DFO 2007a) for Banquereau that aims to maintain the biomass at the level of B_{MCY}, a higher level than that of the MSC default target of $0.4B_0$. This is an inherently precautionary strategy of setting a yield that is low enough to be sustainable at all probable biomass levels.

While B_{MCY} is an implicit target reference point, there is no limit reference point (LRP) or threshold that would trigger management action if the stocks become overfished, and no explicit description of how management would respond if the stocks were to sharply decline. However, with only one company exploiting the fishery, with only two licenced vessels fishing very large areas of seabed, good stocks of surfclams and regular recruitment, this is not a fishery under pressure. Exploitation rates are very low, annual production exceeds removals by the fishery and stocks have remained at or around the virgin biomass levels for some 23 years. Thus, while a LRP would be desirable for this fishery, should effort be allowed to increase or stocks decline suddenly, it is not currently a priority as there are no plans to increase exploitation.

The scientific advisors for this fishery are well aware that for a long-lived, slow-growing, late recruiting sessile species, managed under a constant fishing mortality approach, it is necessary to set a very precautionary target fishing mortality level (DFO 2007a, DFO 2010). The surfclam vessels fishing Grand Bank operate by regularly changing fishing areas, moving to new grounds when catches decline. Although it is not considered that overfishing is occurring at this time, the pattern of constantly moving to new grounds, while using highly efficient gear, means that sequential overfishing is a potential danger. This would not show up in trends of CPUE until the vessels started running out of grounds but it would be detected in the biomass surveys. However, these surveys take place infrequently, which is an additional reason for maintaining very conservative levels of target fishing mortality and TAC.

In the continuous, if periodic, scientific monitoring of this fishery, the concern with environmental effects, close involvement of the industry in both the surveys and the management, and wide level of consultation and participation in the RAP process, the fishery management is making notable efforts to meet its objectives stated in the IFMP. Provided fishing effort remains low, the low frequency biomass surveys and relatively simple system for assessing and managing these stocks should be adequate to ensure the long-term viability of this fishery.

It is noted that, at the time of writing this report, the latest (2011) version of the IFMP is not available on the DFO website. Although the IFMP is available upon request, it would be helpful if it was also made available on-line.

6 FISHERY MANAGEMENT FRAMEWORK

6.1 Fishing rights, licensing etc

Fishing of marine species in Canada falls under the jurisdiction of the federal Minister of Fisheries and Oceans (DFO) pursuant to the *Fisheries Act 1985*. The *Fishery (General) Regulations, 1993*, made under the authority of the Act provide a framework for the issue of leases and licences to fish.

In addition to the legislative framework, there are a number of policy directives, the major one of which is the 'Policy Framework for the Management of Fisheries on Canada's Atlantic Coast' (DFO 2004). It contains four objectives:

1. Conservation and sustainable use: Conservation of marine resources and habitat, and rebuilding of resources and restoration of habitat where necessary, will remain the highest priority for the management of all fisheries.
2. Self-reliance: Self-reliant fisheries and continued collaboration with the provinces and Nunavut, communities, aboriginal groups, industry and others will contribute to the well-being of coastal communities.
3. A stable and transparent access and allocation approach: The access and allocation of fisheries resources will be more stable and predictable, and decisions will be made and conflicts resolved through a more fair, transparent and rules-based processes.
4. Shared stewardship: Participants will be effectively involved in fisheries management decision-making processes at appropriate levels; they will contribute specialized knowledge and experience, and share in accountability for outcomes.

Other policy directives include the "Sustainable Fisheries Framework" that focuses on the incorporation of the precautionary and ecosystem approaches to fishery management (DFO 2009c); the "Policy to Manage the Impacts of Fishing on Sensitive Benthic Areas" dealing with the mitigation of the impacts of fishing on sensitive benthic areas (DFO 2009d); the Emerging Species Policy that sets out the requirements and procedures for new fisheries (DFO 2008b), and the Aboriginal Fisheries Strategy (DFO 1992).

Clearwater Seafoods Limited Partnership (CSLP) is the sole participant in this fishery. Three licences – one to CSLP (Nova Scotia) that authorizes two vessels to fish, one to CSLP (Newfoundland) and one to Arctic Surf Co Inc. (Newfoundland), a wholly owned subsidiary of CSLP - are included in the Unit of Certification. In total, four vessels are authorized to fish in the fishery, but only two purpose-built factory-freezer clam vessels are currently employed in the fishery, operating year round. All product is landed in Argentia, Newfoundland, for further processing at Grand Bank, Newfoundland.

6.2 Fishing locations

There are two major fishing areas for Arctic surfclam covered within the offshore clam fishing licence – Banquereau off the coast of Nova Scotia and the Grand Bank off the island of Newfoundland and Labrador (Figure 1); this assessment is of the Grand Bank fishery.

6.3 Administrative Arrangements and Boundaries

Under the *Fisheries Act, 1985*, the Minister of DFO has the ultimate responsibility for the fishery and his/her authority is delegated to officials through the organizational structure of the department. The unit of certification (Grand Bank) falls within the Newfoundland and Labrador Region of DFO. The management of both the Banquereau and Grand Bank fishing areas is conducted by the Resource Management Branch of DFO in Halifax, Nova Scotia. Within the Canadian management system, Integrated Fishery Management Plans (IFMP) are developed that outline the fisheries objectives and management measures by stock and area. The Offshore Clams IFMP is a comprehensive document that was updated in May 2011 (DFO 2011c). The harvest is controlled through the establishment of annual Total Allowable Catches (TAC) in each area. The fishery is managed through an Enterprise

Allocation Program whereby each of the four licences receives an equal allocation in both fishing areas.

The Offshore Clam Advisory Committee (OCAC) (see section 6.7 below) is the main consultative and management body for the fishery. It is composed of major stakeholders in the fishery. The chair of the committee is a DFO official and is rotated between the Maritimes and Newfoundland and Labrador regions. Meetings are held in Nova Scotia or Newfoundland and Labrador. The final decision-making authority for the fishery is the Regional Director General (RGD) of the Maritimes Region of DFO.

6.4 Legislation and Regulation

The legislative authority for the management of seacoast and inland fisheries in Canada falls under the exclusive jurisdiction of the Parliament of Canada. There are several pieces of legislation that apply to fishing, the major one being the *Fisheries Act, 1985*. That *Act* grants wide discretionary authority to the Minister of Fisheries and Oceans and provides for the enactment of regulations respecting the management of the fishery. *The Atlantic Fishery Regulations, 1985* and the *Fishery (General) Regulations* are the main regulatory instruments governing the fishery. These and other legislative instruments are outlined in Table 6 below.

Table 6: Principle acts and policy documents

Principal Acts and Policy Documents	Description
The Fisheries Act, 1985	Provides absolute discretion to the Minister for the management of fisheries and for the establishment of fishing licences, regulations, reporting requirements, powers of fishery officers, protection of fish habitat and pollution prevention.
The Atlantic Fishery Regulations, 1985	Prescribes conditions for the operation of the fishery including seasons, closures, management and conservation measures, etc. Variation Orders are used to alter conditions and to shorten or lengthen the fishing season as appropriate.
The Fishery (General) Regulations 1993	Provides for the issue of licences and the authority to specify conditions in a fishing licence, e.g. allocations, vessel monitoring systems, hail-in/hail-out requirement, observer coverage, dockside monitoring, etc.
The Coastal Fisheries Protection Act, 1985	Prescribes conditions under which foreign vessels are permitted to fish in Canadian waters.
The Species at Risk Act 2002	Authorizes actions aimed at managing species of special concern, preventing the extirpation or extinction of endangered marine species, or promoting their recovery.
The Oceans Act 1996	Prescribes the Canadian oceans management strategy, including sustainable development, the precautionary approach, and the implementation of integrated management of marine activities.
The Fish Inspection Act 1985	Governs fish processing operations on shore and aboard vessels in Canadian waters.

The regulations noted above create the legal framework for the management, licensing and registration of participants of fisheries in Canada and more specifically for harvesters participating in the offshore clam fishery. They also provide a ticketing and court sanction system with fines ranging from low to as high as hundreds of thousands of dollars and even jail time in extreme cases. The court also has the discretion to forfeit catch and equipment upon conviction.

6.5 Harvest controls

Annual catch limits (TAC) based on formal scientific assessments are the major harvest control measure used for the offshore clam fishery. The TAC in each of the areas is based on harvesting a percentage of an estimate of the harvestable biomass and is intended to optimize yield and not expose the resource to risk of over-exploitation. TACs of 24,000mt for Banquereau and 20,000 for Grand Bank remained unchanged for the period 1998-2010. In 2011, the Grand Bank TAC was revised to 14,756 following detailed scientific advice from the 2010 fishery assessment. The TAC for each area is divided among the four licences in equal portions called Enterprise Allocations.

6.6 Monitoring, Control and Surveillance

The DFO is the responsible enforcement agency for fishing in Canadian waters. It has a staff of land-based and seagoing Fishery Officers and a complete system of monitoring, control and surveillance (MCS) for the offshore clam fishery, including:

- At-sea surveillance by patrol vessels and fixed-wing aircraft
- Limited on-board observer coverage with protocols to monitor catch, species, etc.
- 100% dockside monitoring of landings
- Submission of vessel fishing log books
- Catch and Effort database to track catch against allocations
- Electronic vessel monitoring systems (VMS) on each vessel
- A ticketing system for minor offences and a court-based process for serious offences which can result in fines up to $500,000, jail terms and forfeiture of catch and gear
- Detailed conditions of licence for each participant in the fishery

DFO advises that the offshore clam fishery has not had any serious compliance issues and there is no evidence of systematic non-compliance (DFO pers. comm.).

6.7 Consultation and Dispute Resolution

The major consultative mechanism in the fishery is the Offshore Clam Advisory Committee (OCAC), the Terms of Reference of which are outlined in Appendix II of the IFMP (DFO 2011c). The committee is composed of representatives of licence holders, other fishermen and fishermen's associations/unions, processors, First Nations representatives (standing invitation), the Federation of Newfoundland Indians, and provincial government representatives from Newfoundland and Labrador, and Nova Scotia and other stakeholders. Meetings are open to the public, while fishery managers, scientists and enforcement staff from DFO attend the committee and provide advice and assistance.

The purpose of the committee is to provide input and advice to the DFO on the conservation, protection and management of the offshore clam resource. The committee also serves as an open public consultation forum on all issues affecting the offshore clam fishery on Canada's Atlantic coast. Information including scientific and management advice is presented at committee meetings and recommendations on harvest levels and management measures are forwarded to the regulator for final decisions on management plans.

A second committee called the Offshore Clam Management Board (OCMB) is charged with the responsibility of overseeing and directing the implementation of the management plan. This committee is composed of two representatives each of the two licence holding companies (both wholly owned by the client, CSLP) and four representatives of DFO, two each from science and management. The OCMB is co-chaired by an industry member and DFO staff person. The Board meets annually or as required. Most disputes are resolved using the representational framework in the OCAC/OCMB forum. Regional managers of DFO have a particular role to play in brokering solutions on policy related issues, with most unresolved disputes being referred to the RDG or the minister for decision.

7 ECOSYSTEM CHARACTERISTICS

7.1 Ecosystem characteristics

Grand Bank is an offshore bank located off the eastern coast of Newfoundland, making up the largest part of the Grand Banks that also include Burgeo Bank, St. Pierre Bank, Green Bank and Whale Bank. Grand Bank is centred approximately 240 km to the south-south-east of St. John's, Newfoundland, or 950 km roughly due east of Halifax, Nova Scotia. In total, the Grand Banks comprise an area of approximately 279,720 km^2 (Parks Canada 2006), of which the Arctic surfclam habitat on Grand Bank makes up approximately 49,473 km^2 (DFO 2010). The Nose and the Tail of the Bank lie outside the 200 nautical mile Canadian territorial limit. The Southeastern Shoal is an area of shallow water less than 50 m deep at the extreme eastern edge of the bank, but it is otherwise relatively flat-topped, with an average water depth of around 80 m. The limits of the bank are defined by the shelf break to the south and east. Whale Deep then lies to the west of Grand Bank, while the bank gently shelves into deeper water to the north. Newfoundland lies to the north west of the Grand Bank (Figure 13).

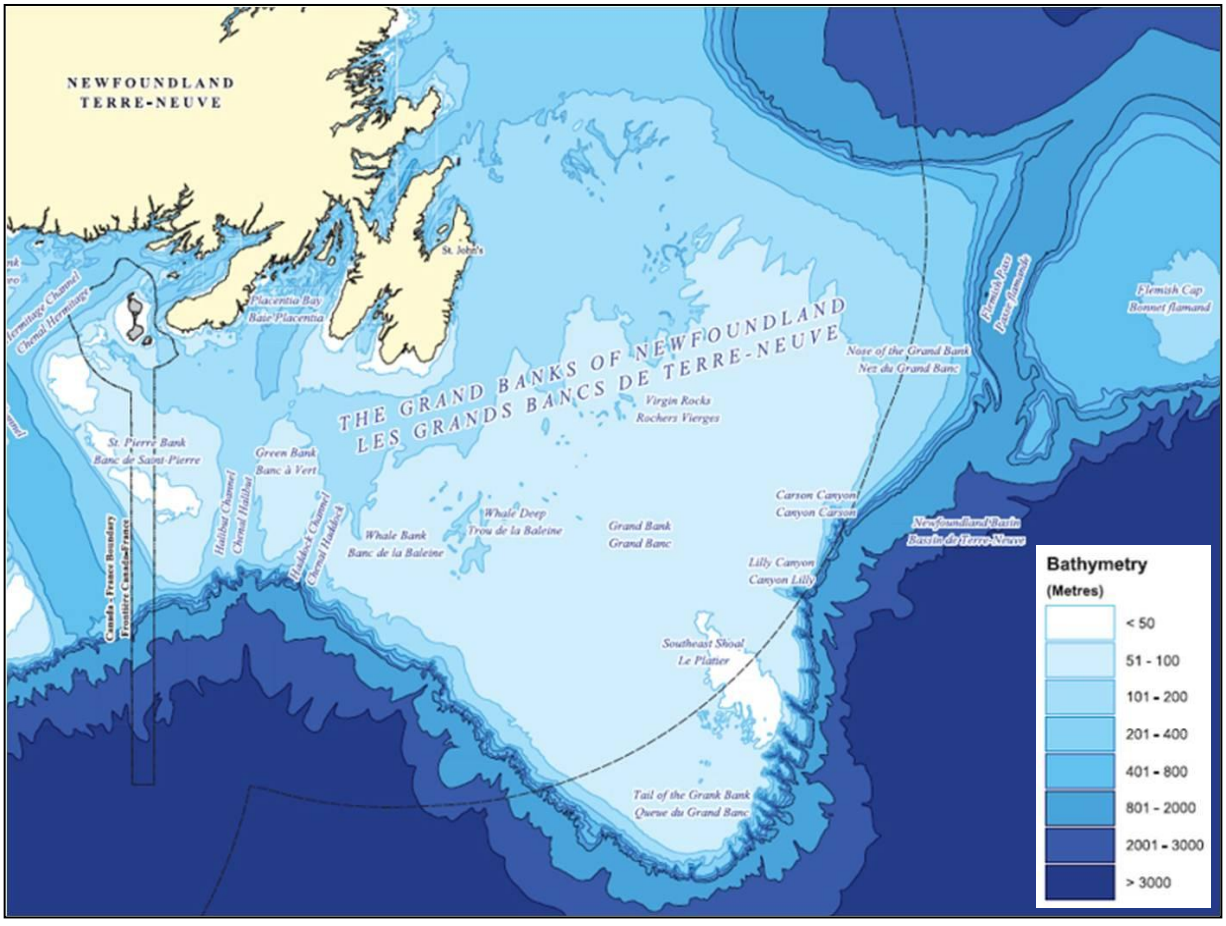


Figure 13: Map of the Grand Banks (DFO 2010c).

The seabed of the Grand Bank is essentially made up of sediments draped over topography created during a rift phase of seafloor spreading (Mason *et al.*, 1984). The shallow seabed of the Grand Bank is a high-energy environment, with frequent winter storms and accompanying large seas. Estimated wave heights from the Scotian Shelf (Kostylev 2004), suggest that the maximum significant wave height over much of the nearby Grand Bank is likely to equal or exceed 12 m. These data also suggest that the bottom habitats of Grand Bank are impacted by major storms; benthic disturbance effects from fully developed wind waves of 14 m height can extend to a water depth of approximately 100 m (Kostylev 2004).

Some modelling work has been conducted on the likelihood of seabed sediments in the Grand Bank area being mobilised by wind, wave and current stressors (Figure 14- E. King, Geological Survey of Canada, pers. comm.). This analysis was based on past wind, wave and currents over a three year period, the stress this has on the seabed, and the potential effect on the sediment grain size at any location, based on a 0.1 degree resolution. Although it should be noted that the model is still being assessed to determine its predictive success (E. King, Geological Survey of Canada, pers. comm.), it supports the suggestion that the fishery occurs in areas of the Grand Bank that are subject to relatively frequent natural perturbation (shaded blue-green). Figure 15 shows the extent of fishing activity on the Grand Bank from 1988 to 2010.

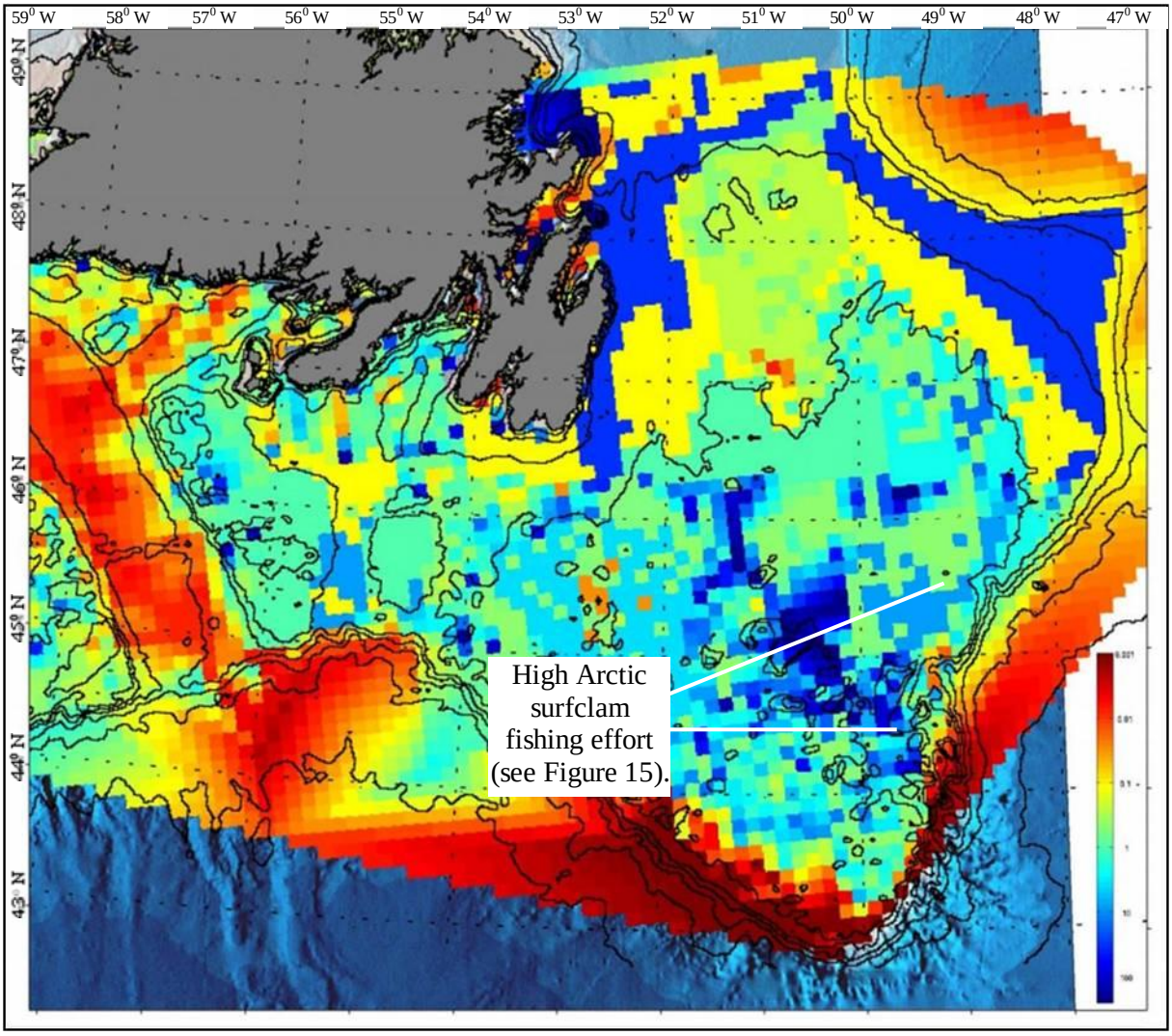


Figure 14: Predicted likelihood (% probability) of seabed stress sufficient to mobilise sediments in the area of the Grand Bank (from Geological Survey of Canada, E, King, pers.comm).

Natural disturbance is also caused by icebergs, with an annual average of more than 540, ranging in size from small growlers to large icebergs of greater than 1Mt, making it into the Grand Banks area from 1997 – 2006 (McClintock *et al.* 2007). Some of these icebergs are large enough to contact the seabed, and plough marks of greater than 3 km length, and up to 80 m wide and 10 m deep have been observed (Barrie *et al.* 1992). The Geological Survey of Canada maintains a database of more than 5,000 ice scour features in the Grand Banks area.

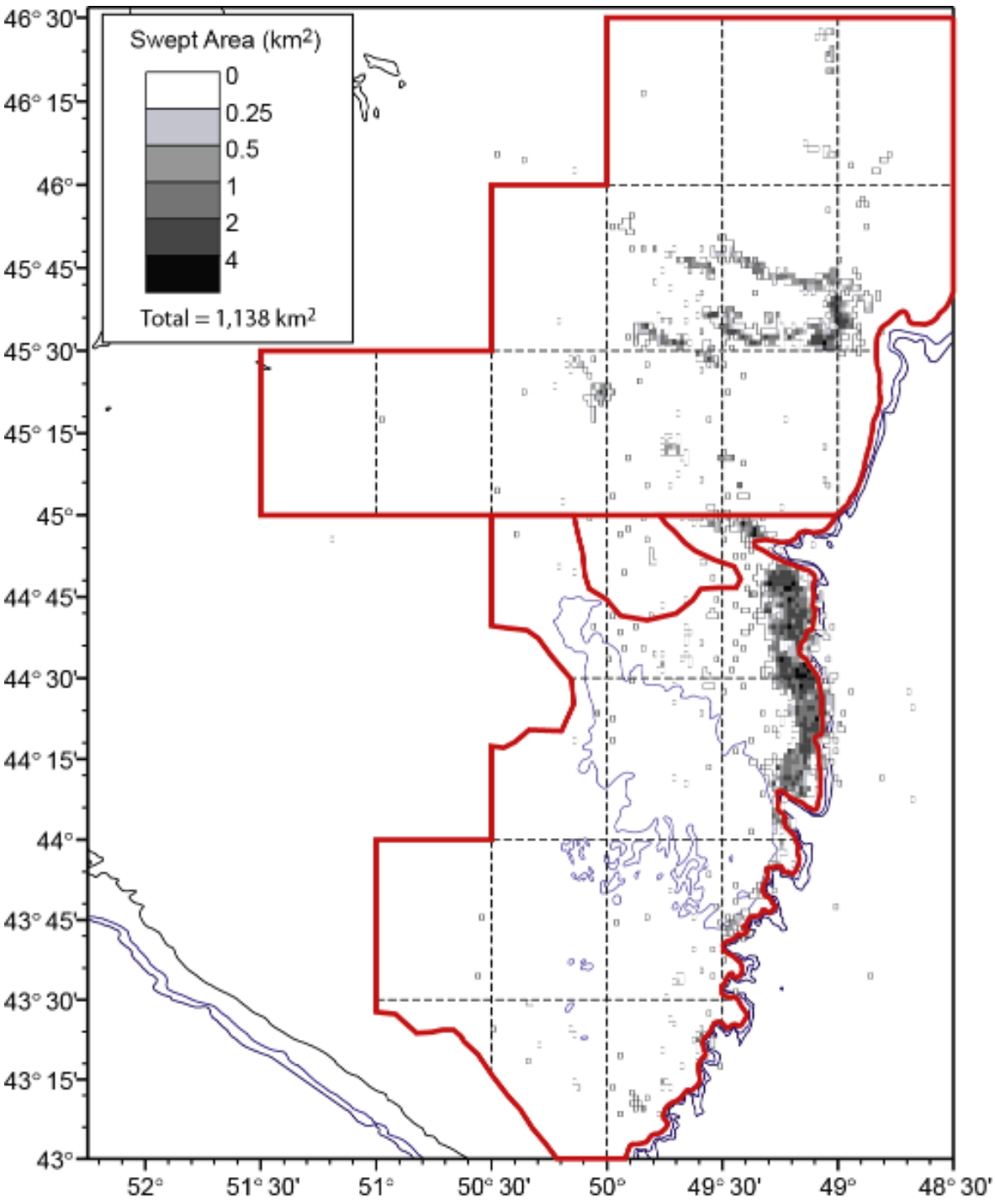


Figure 15: Spatial distribution of area swept in the Grand Bank Arctic surfclam fishery from 1988 to July 2010 from log data. Total km^2 dredged is aggregated by one minute squares (not corrected for overlap of dredge tracks or logbook errors) (DFO 2010).

7.2 By-catch and discarding

Bycatch of species other than Arctic surfclam in the Grand Bank fishery may be divided into commercially valuable species that are retained, and other species that are discarded. In the former group, ocean quahog (*Arctica islandica*) are listed as a permitted species under CSLP's offshore clam licence and may therefore be retained with Arctic surfclams. Greenland cockle (*Serripes groenlandicus*), northern propellerclam (*Cyrtodaria siliqua*) and whelk (*Buccinum* sp.) may also be retained as co-occurring molluscan shellfish species (DFO 2011a).

Arctic surfclams made up 24.65% of the total catch in onboard sampling from the Grand Bank fishery between 2002 and 2009, while Greenland cockle and northern propellerclam made up 21.14% and 18.32% respectively. As such, these are considered to be main retained species as defined by the MSC as comprising more than 5% of the catch of the targeted species. The ocean quahog catch was small at just 0.27% of the total, similar to that of whelk at 0.24% (Table 7).

Greenland cockle has a circum-polar distribution in the northern hemisphere, and northern propellerclam is also widely distributed in the North Atlantic from Cape Cod to Norway. It is understood that formal assessments of either species have not been conducted in Canadian waters. Greenland cockle are, though, estimated to mature at a minimum shell length and age of 28 mm and 2.8 years for males, and 37 mm and 3.7 years for females (Kilada *et al*. 2007) while northern propellerclam are estimated to mature at 4.7 years of age or 28.6 mm shell length (Kilada *et al*. 2009). As such, individuals of both species mature well below the size at which they are likely to be selected for in the Arctic surfclam fishery, as the dredges employ a bar spacing of 28 mm, and the selectivity is related to shell height, the smallest shell dimension, rather than shell length. Furthermore, there is no directed fishery for either species on Grand Bank, and significant quantities are unlikely to be taken as bycatch in other fisheries on the bank due to their infaunal lifestyle. These data, as well as the very large proportion of the bank over which fishing for Arctic surfclam is not undertaken (Figure 16) suggest that neither species is at risk of serious harm from the Arctic surfclam fishery.

It is understood that the ocean quahog stock on Grand Bank has not been formally assessed, although the data indicate that the areas of the Grand Bank that are targeted for Arctic surfclam are not optimal for ocean quahog (Roddick *et al.* 2011); instead, the tail of the Bank holds a greater proportion (Figure 16). Also, there is a large ocean quahog stock on the nearby Sable Bank (DFO 2007c). Essentially, ocean quahog is a widely distributed species, and the Grand Bank fishery is very unlikely to pose a threat to this species. Whelk is also widely distributed in the North Atlantic, but is reported to occur in greatest densities at a depth of 15 - 30 m (DFO 2009a), which is shallower than the depth at which the Arctic surfclam fishery occurs. Although a small fishery occurs off the south coast of Newfoundland, on the St. Pierre Bank, no fishery occurs for this species on the Grand Bank (DFO 2009b). Again, the Arctic surfclam fishery is very unlikely to pose a threat to this species.

Table 7: Catch composition from on-board sampling of unsorted catch from commercial clam vessels from 2002 to 2009 on Grand Bank (DFO 2010).

Common Name	Scientific Name	Weight (kg)	%	Cumm %
Arctic surfclam	*Mactromeris polynyma*	410.06	24.65	24.65
Greenland cockle	*Serripes groenlandicus*	351.63	21.14	45.80
Sand dollars	*Echinarachnius parma*	315.61	18.98	64.77
Northern propellerclam	*Cyrtodaria siliqua*	304.71	18.32	83.09
Shell	Shell	200.17	12.04	95.13
Rock	Rock	50.05	3.01	98.14
Cancer crabs	*Cancer sp.*	8.90	0.53	98.67
Starfish	*Asterias sp.*	5.72	0.34	99.02
Ocean quahog	*Arctica islandica*	4.54	0.27	99.29
Whelk	*Buccinum sp.*	4.07	0.24	99.53
Unidentified	Unidentified	1.85	0.11	99.65
Whelk	*Colus sp.*	1.56	0.09	99.74
Wrinkle whelk	*Neptunea lyrata decemcostata*	1.45	0.09	99.83
Sand Lance (ns)	*Ammodytes sp.*	1.42	0.09	99.91
Sea urchin	*Strongylocentrotus droebachiensis*	1.27	0.08	99.99
Hermit crab	*Pagurus sp.*	0.19	0.01	100

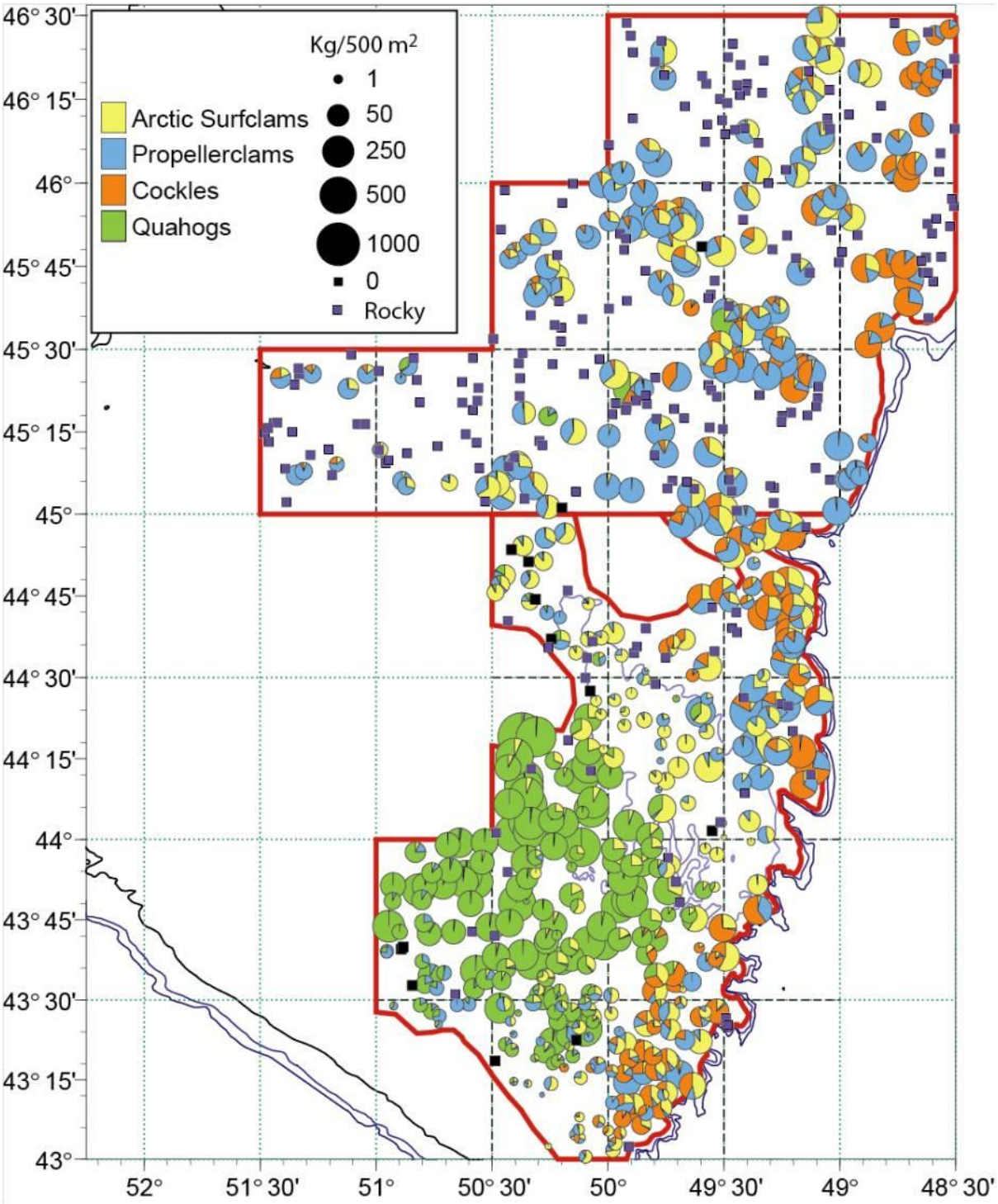


Figure 16: Distribution of the major clam species from the 2006-2009 Grand Bank Arctic Surfclam survey on Grand Bank (Roddick *et al*. 2011).

Of the discarded bycatch species, only the sand dollar, *Echinarachnius parma*, at almost 19% of the catch, is considered to be a main bycatch species (Table 7). Although comparatively large amounts may be taken in the fishery, *E. parma* is very widespread, with a circum-polar distribution in the northern hemisphere (Mooi & Telford 1982). In addition, a large proportion of the Grand Bank is not targeted by the Arctic surfclam fishery, and there is no indication that the *E. parma* population on Grand Bank has been impacted significantly over time by the fishery (DFO, pers. comm). Other species, mainly from the echinoderm and crustacean families may be caught and discarded in relatively small amounts, but, again, there is no indication that any of these species are unusual or at risk as a result of the fishery. This result is corroborated by fishery-independent survey data from the

Grand Bank (Table 8). Any differences between these data and the commercial catch data may be due to the survey dredge design (which for the 2009 survey retained a markedly greater proportion of small animals than commercial dredges- Roddick *et al.* 2011), or because the survey extended over a much larger area of the Grand Bank than the fishery itself.

In addition to the bar spacing of 28 mm, which will allow many small animals to pass through the dredge, part of the reason for the low bycatch of non-bivalve species other than *E. parma* in the Grand Bank fishery is likely to be that there is a 60 - 70 cm gap between the cutting bar carrying the hydraulic jets and the top of the dredge cage, such that fish or other mobile animals may escape the dredges rather than being retained (Figure 2). A similar gap is also present on the bottom side of the dredge, but it is understood that this is covered by a selector grid when fishing on clean ground to maximise the Arctic surfclam catch (CSLP, pers. comm.).

Although the levels of bycatch of discarded species in the Arctic surfclam fishery are generally low, unobserved mortality of these species will occur. For example, Gilkinson *et al.* (2005) reported observing large numbers of northern propellerclams on the sediment surface after experimental dredge tows, with varying levels of shell damage from minor to potentially lethal. Approximately 15% of the small Arctic surfclam that pass through the dredge are thought to suffer lethal damage (DFO 2007a). Individuals of other species that are found in the path of the dredge but that pass through the dredge bars will also suffer varying levels of damage; quantifying this impact, including any sub-lethal effects that result in a higher predation risk for impacted animals, is very difficult, however.

7.3 Endangered, threatened or protected (ETP) species

Species of relevance to this section include any that are protected under international law, as well as those listed under the Canadian Species At Risk Act (SARA 2009). The listing of a species by the COSEWIC (Committee on the Status of Endangered Wildlife in Canada) does not result in a species being considered under the Endangered Threatened and Protected (ETP) species performance indicators for MSC assessments. As such, winter skate (*Leucoraja* ocellata) or Atlantic cod (*Gadus morhua*) do not qualify currently as ETP species.

No ETP species were reported from sampled fishery catches on Grand Bank from 2002 - 2009 (DFO 2010). In any case, there are unlikely to be any large ETP species that would be impacted by the gear directly, as the dredges are narrow, have a very low mouth opening, and are towed at only 2 knots. The narrow dredge swathe and slow dredge speed means that most mobile animals should be able to avoid the gear. Also, the small mouth opening means that cetaceans, as well as other large ETP species such as leatherback turtle (*Dermochelys coriacea*), are highly unlikely to be impacted. Also, there are no Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listed bird species that are likely to co-occur with the Grand Bank Arctic surfclam fishery.

Northern wolffish (*Anarhichas denticulatus*), spotted wolffish (*Anarhichas minor*) and Atlantic wolffish (*Anarhichas lupus*) are classified as ETP species through their listing on schedule 1 of the SARA. Knowledge of the habitat associations of these three wolffish species is somewhat limited and is based on their occurrence in research trawls in areas of known water depth and temperature (Kulka *et al.* 2007). The distribution of *A. denticulatus* is centred on the Grand Banks and Labrador Shelf. It has been found on mud, sand, pebbles, small rock and hard bottoms at depths from 38 m to 1504 m (the deepest depth surveyed), but is most common between 500 m and 1000 m, although slightly shallower in the warmer months. The distribution of *A. minor* is similar to that of *A. denticulatus*, although this species is found at water depths from 56 m to 1,046 m, but most commonly between 200m and 750 m. *A. lupus* is a more southern species that is distributed predominantly on the southern Grand Banks and Scotian Shelf, as well as being the most common wolffish species in the Gulf of St. Lawrence. This species is found from the nearshore to depths of 918 m, but is most common between 150 m and 350 m on rocky bottoms (Kulka *et al.* 2007).

Table 8: Estimated catch composition from Grand Bank Arctic Surfclam survey tows where Arctic surfclam catch is greater than or equal to 100 g/m^2 (Roddick, *et al.* 2011).

Common name	Scientific name	Weight (kg)	%	Cumulative %
Arctic surfclam	*Mactromeris polynyma*	9,606.41	37.12	37.12
Sand dollars	*Echinarachnius parma*	6,889.62	26.62	63.73
Northern propellerclam	*Cyrtodaria siliqua*	4,687.40	18.11	81.85
Greenland cockle	*Serripes groenlandicus*	2,685.77	10.38	92.22
Common sea cucumber	*Cucumaria frondosa*	748.16	2.89	95.11
Ocean quahog	*Arctica islandica*	239.20	0.92	96.04
Arctic roughmya	*Panomya norvegica*	212.53	0.82	96.86
Atlantic lyre crab	*Hyas araneus*	126.29	0.49	97.35
Whelk - Buccinum spp.	*Buccinum* spp.	111.37	0.43	97.78
Crenate barnacle	*Balanus crenatus*	101.22	0.39	98.17
Sand tunicate	*Molgula arenata*	91.99	0.36	98.52
Sea urchin	*Strongylocentrotus droebachiensis*	50.97	0.20	98.72
Slender armed sea star	*Leptasterias tenera*	49.70	0.19	98.91
Sea mouse	*Aphrodita hastata*	26.63	0.10	99.01
Arctic lyre crab	*Hyas coarctatus*	22.13	0.09	99.10
Iceland scallop	*Chlamys islandica*	21.30	0.08	99.18
Truncate soft shell clam	*Mya truncata*	21.04	0.08	99.26
Sinuous whelk	*Buccinum plectrum*	18.12	0.07	99.33
Ventricose whelk	*Colus terraenovae*	17.70	0.07	99.40
Hermit crab	*Pagurus* spp.	16.07	0.06	99.46
Snow crab	*Chionoecetes opilio*	15.46	0.06	99.52
American sand lance	*Ammodytes americanus*	14.41	0.06	99.58
Common seastar	*Asterias rubens*	14.01	0.05	99.63
Winter flounder	*Pseudopleuronectes americanus*	11.71	0.05	99.68
Sea urchins	*Strongylocentrotus*	11.11	0.04	99.72
Whelk Colus sp.	*Colus* sp.	10.85	0.04	99.76
Waved whelk	*Buccinum undatum*	10.13	0.04	99.80
American plaice	*Hippoglossoides platessoides*	9.27	0.04	99.84
Thin whelk	*Buccinium totteni*	6.83	0.03	99.86
Bluish whelk	*Buccinium cyanneun*	6.23	0.02	99.89
Starfish	*Asterias* spp.	4.02	0.02	99.90
Yellowtail flounder	*Limanda ferruginea*	3.33	0.01	99.92
Disreputable whelk	*Neptunea despecta*	2.94	0.01	99.93
Discordant mussel	*Musculus discors*	1.81	0.01	99.94
Rough razor clam	*Siliqua squama*	1.73	0.01	99.94
Rough/Spiny sunstar	*Crossaster papposus*	1.59	0.01	99.95
Finger sponge	*Haliclona oculata*	1.38	0.01	99.95
Thecate hydroid	*Leptothecatae*	1.18	0	99.96
Catworm	*Nephtys bucera*	1.06	0	99.96
Sea anemone	Actiniaria	0.93	0	99.97
Iceland moonsnail	*Amauropsis islandica*	0.92	0	99.97
Sandbar worm	*Ophelia limacina*	0.89	0	99.97
Sea strawberry	*Gersemia rubiformis*	0.83	0	99.98
Plant	Plantae	0.56	0	99.98
Nephtyidae	Nephtyidae	0.55	0	99.98
Northern moonsnail	*Euspira heros*	0.48	0	99.98
Whelk	Buccinidae	0.35	0	99.98
Black mussel	*Musculus niger*	0.34	0	99.99
Sponge	Porifera	0.34	0	99.99
Flatfish - unid.	Pleuronectiformes	0.32	0	99.99
Sertularia hydrozoa	Sertularia	0.30	0	99.99
Bryozoan	Ectoprocta	0.26	0	99.99
Ladder whelk	*Buccinum scalariforme*	0.26	0	99.99
Grammaria hydrozoa	*Grammaria* spp.	0.25	0	99.99
Athecate hydroids	Anthoathecatae	0.25	0	99.99
Purple sunstar	*Solaster endeca*	0.24	0	99.99
Slender sea star	*Leptasterias* sp.	0.22	0	99.99
White burrowing cucumber	*Stereoderma* sp.	0.21	0	100
Dahlia anemone	*Urticina felina*	0.17	0	100
Featherduster worm	*Sabellidae* spp.	0.15	0	100
Threadworm	*Lumbrineris fragilis*	0.14	0	100
Blue mussel	*Mytilus edulis*	0.14	0	100
Snail - unid.	Gastropoda	0.12	0	100
Polychaete - unid.	Polychaeta	0.10	0	100
Wavy liocyma	*Liocyma fluctuosum*	0.09	0	100
Club shaped tunicate	*Pelonaia corrugata*	0.07	0	100

Arctic surfclam dredges can only be used effectively in well-sorted sand in relatively shallow water. The three wolffish species that occur in the Grand Bank area prefer water that is deeper than is prosecuted for Arctic surfclams, and appear to be more common on harder or mixed substrates; as such, the potential for wolffish to be taken in the fishery is low. This is supported by by-catch data (Table 7), and by scientific survey data from Banquereau (
Table 8), which show an absence of wolffish in the catches. It should be noted that the bycatch composition of the Banquereau commercial fishery is different to that of the Grand Bank fishery, and the scientific survey data are also likely to be different from those of a commercial fishery as the survey uses a dredge with a narrower bar spacing, and it extends into deeper areas of the bank, and into areas that are not optimal for Arctic surfclam, in comparison to the commercial fishery (DFO 2007a). Finally, the potential for damage to be caused to wolffish spawning sites by this fishery is very low due to the reported preference for wolffish to spawn in stony or rocky habitats (Kulka *et al.* 2007).

7.4 Habitat effects

Towed bottom fishing gears, including hydraulic dredges as used in the Grand Bank Arctic surfclam fishery, have the potential to cause significant and long-lasting impacts to benthic habitats and communities (Jennings & Kaiser 1998). In particular, chronic fishing disturbance can cause the removal of high-biomass, emergent seabed organisms that increase the topographic complexity of the seabed and have been shown to provide shelter for fish and other species (Kaiser *et al.*, 2002). However, the nature, scale and recovery time of these impacts vary widely depending on a combination of factors including the frequency of use, the previous history of towed bottom gear use at a site, the benthic habitat and community composition, and the level of natural perturbation that the area is subject to (DFO 2006a). In general, communities in areas with higher levels of natural perturbation are more resilient to towed gear use because of being adapted to regular disturbance (Hiddink *et al*. 2006).

Hydraulic dredges use high pressure water jets to fluidise the seabed in front of the dredge, allowing the cutting bar to progress through the sediment to a deeper depth than would otherwise be possible. Arctic surfclam dredges are designed to target surfclams to a sediment depth of at least 18 - 20 cm, at a speed of 2 knots. Because of this mode of operation, hydraulic dredges can only be used effectively in non-compacted soft sediments, and Arctic surfclams are found at water depths of less than 110 m. The commercially exploited Arctic surfclam beds on Grand Bank are found in depths of $\leq$ 70 m, where some natural perturbation from storms will occur due to the bank's highly exposed location. Natural perturbation will therefore be expected to limit the potential for hydraulic dredging impacts to have lasting, detrimental effects on the benthic habitat of Grand Bank.

In order to determine the impact of the Arctic surfclam fishery on offshore banks, a dredge impact study was started on nearby Banquereau in 1998, and repeat surveys have been undertaken to assess recovery. The experimental site was chosen to closely reflect fished areas, but was also selected slightly away from the main fishery on Banquereau in order to ensure that the results of the study would not be confounded by previous hydraulic dredging events. At 70 - 80 m, the study site was also at the maximum depth that Arctic surfclam are commercially exploited, and recovery would therefore be expected to be as slow or slower than anywhere in the fishery. In fact, visual evidence of the experimental dredge tracks had disappeared after one year (Gilkinson *et al.* 2005), while side-scan sonar was still barely able to detect dredge tracks after 10 years (DFO 2010). In contrast, 6 of 12 dredge tracks at a 40 m depth site on Sable Bank were reported to be undetectable after just one year (DFO 2010). A study of otter trawling on Grand Bank, undertaken in water of 120 - 146 m depth, determined that benthic habitats had recovered in a year or less (Gordon *et al.* 2002).

Only a proportion of the Grand Bank TAC has been taken in recent years. As such, while the swept area of the fishery from 1989 - 2009 has been limited to 1,138 km^2 ($\approx$ 54.2 km^2 or 0.11% of the area surveyed for Arctic surfclam per year), exploitation levels during that period have varied considerably in relation to the available TAC. A more realistic annual figure under full exploitation might, therefore, be closer to treble that figure; this still represents < 0.4% of the available Arctic surfclam habitat (DFO 2010 and Figure 15). These figures do not account for repeated dredging over the same

sites, which is likely to occur to a greater extent where stock density is highest (Figure 17). The fishery is unlikely ever to extend over large areas of Grand Bank, however, as the stock density over much of the bank is below the 75 g per m^2 threshold that is considered to be the minimum viable break-even density for the fishery (CSLP pers. comm.).

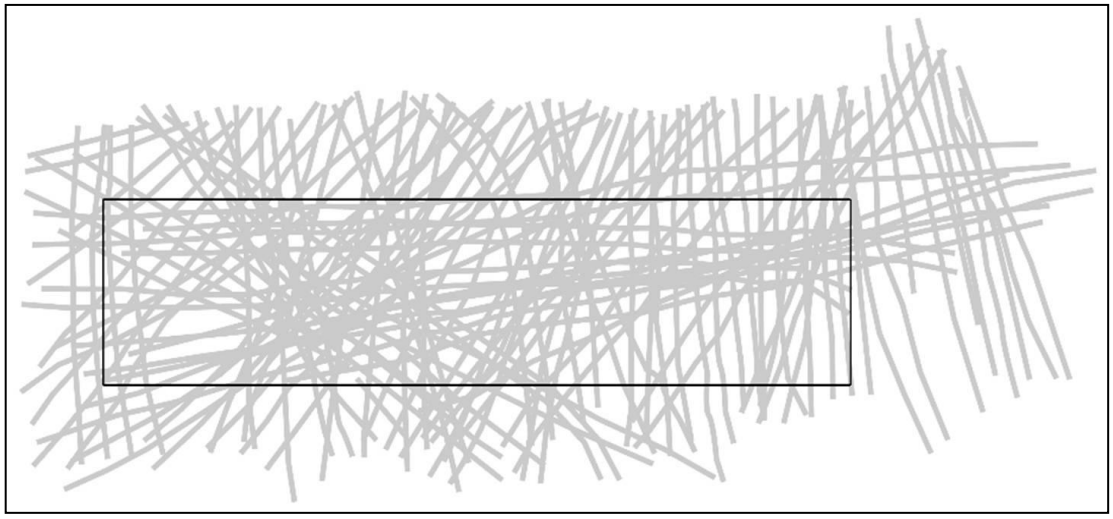


Figure 17: Sidescan of Arctic surfclam dredge tracks from CFV Concordia on Banquereau, 1996. Dredge tracks scaled to 12 feet, box used for area analysis is 500 m x 125 m, percentage of ground covered within box is 67.4% (adapted from Roddick & Smith 1999).

7.5 Ecosystem impacts

Canada's Oceans Act 1995 introduced the concept of integrated ocean management through large ocean management areas (LOMAs). The intention of the LOMA designation is to advance collaborative management so that ecosystem health and economic development issues can be addressed (DFO 2008c). LOMAs have been identified in Canadian waters in five areas that are characterised by important living and non-living marine resources, high biological diversity and productivity, and the existence of many stakeholders competing for ocean space and resources. The Grand Bank area is included within the Placentia Bay-Grand Banks Large Ocean Management Area (LOMA) (DFO 2007b). It is now one of three LOMAs in the Canadian Atlantic; the Gulf of St. Lawrence and the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative are the other two.

In common with the Gulf of St. Lawrence and the Eastern Scotian Shelf, the Grand Banks suffered a collapse of groundfish stocks in the late-1980s to early-1990s. This collapse followed intensive fisheries exploitation by both domestic and foreign fishing fleets, and resulted in a moratorium being placed on groundfish species in these areas in 1992 (Taggart *et al*. 1994). Fisheries landings of northern cod alone fell from a high of < 800,000 t in 1968, to less than 50,000 t in 1992 (DFO 2010b). Although very large catches, such as those of 1968, were clearly not sustainable, the fact that the moratorium on northern cod is still in place today is indicative of the unprecedented scale and duration of the collapse.

Prior to the groundfish collapse, the Grand Banks ecosystem was dominated by groundfish such as Atlantic cod (*Gadus morhua*), yellowtail flounder (*Limanda ferruginea*) and American plaice (*Hippoglossoides platessoides*), marine mammals, including harp seals (*Phoca groenlandica*), but few pelagic fish. Subsequently, while the abundance of groundfish fell dramatically, the abundance of invertebrate groups, including crabs and shrimp, increased markedly, and the harp seal population has also grown (Bundy 2001). Similar changes on the Eastern Scotian Shelf have been described as a 'regime shift' (Choi *et al*. 2005). Importantly, these ecosystem-level changes on Grand Bank were entrained well before the development of the Arctic surfclam fishery. Also, the changes were largely

mirrored elsewhere on the Canadian Atlantic shelf. As such, the Arctic surfclam fishery cannot be considered to have been the cause of, or even a contributing factor towards, the changes observed on the Grand Banks after 1990. As the standing stock of Arctic surfclam on Grand bank is estimated to exceed 1.1 million t, it also appears to be highly unlikely that the fishery is retarding the recovery of groundfish species or the ecosystem more generally through critically reducing the abundance of prey items. In fact, signs of a groundfish recovery on the Scotian Shelf have recently been reported, linked to a decline in the abundance of forage fish species after they outstripped the supply of their zooplankton prey (Frank *et al.* 2011). Although it is not apparent that a comparable groundfish recovery is occurring on Grand Bank, the improvement on the Scotian Shelf provides some additional reassurance that the Arctic surfclam fishery is not a contributory factor in the adverse health of groundfish stocks.

As part of the effort to develop integrated, ecosystem-based management of Canada's oceans, the DFO has been working with stakeholders to identify ecologically and biologically significant areas (EBSAs) within LOMAs. EBSAs may be identified for their structural properties, or because of the functions they serve in the ecosystem (Doherty & Horsman 2007). While EBSAs have no legal status and their use as tools for planning and management has yet to be clarified (Doherty & Horsman 2007), EBSAs have been identified in the Placentia Bay - Grand Bank LOMA, and conservation objectives have been outlined (DFO 2007b).

Table 9: Placentia Bay-Grand Banks EBSA conservation priority matrix of those EBSAs relevant to the Arctic surfclam fishery (adapted from DFO 2007b).

EBSA	EBSA Score	Depleted Species (rationale overlap)	Top 10 Trophic + Structural ESS (rationale overlap)	Add overlap	Total rank	PB-GB Rank
The Southeast Shoal and Tail of the Banks	25.5	Atlantic cod, American plaice, Capelin (3NO) Leatherback	Atlantic cod, Capelin (3NO), Seabirds, Benthos	8	33.5 (High)	1
Lilly Canyon-Carson Canyon	4.00	X	Corals, Harp seals	2	6 (Low)	9

Of the EBSAs identified, those of potential relevance to the Arctic surfclam fishery on Grand are the Southeast Shoal and Tail of the Bank, Lilly Canyon-Carson Canyon and Virgin 9 and

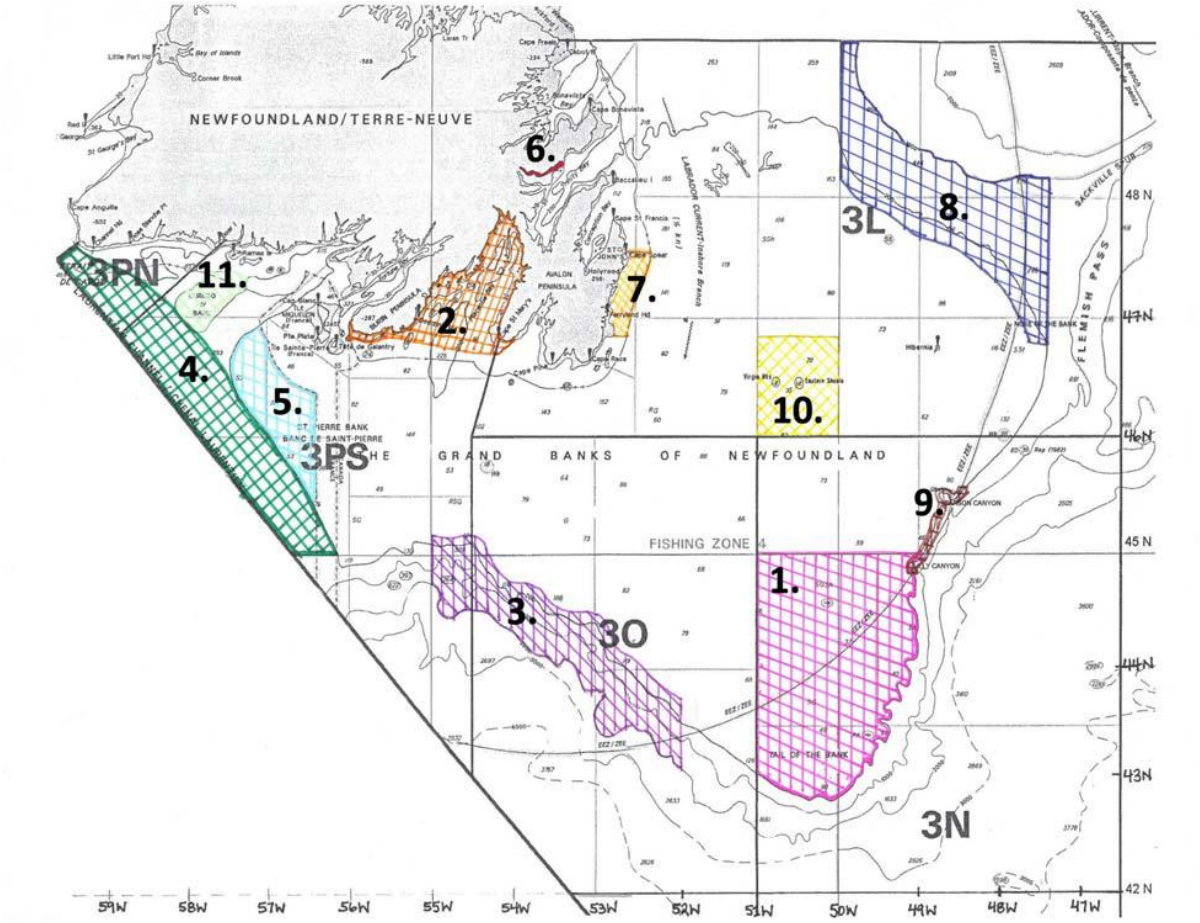
Figure 18). The Southeast Shoal and Tail of the Banks EBSA was ranked as being of highest conservation priority within the Placentia Bay – Grand Banks LOMA (DFO, 2007b). It was identified for having the highest overall benthic biomass on the Grand Banks, as well as for a unique offshore capelin spawning ground and yellowtail flounder nursery, and for relict populations of blue mussel (*Mytlius* sp.) and wedge clams (*Mesodesma arctatum*), none of which were recorded in bycatch sampling from the Grand Bank between 2002 and 2009 (Table 7). Tiny amounts of blue mussel were recorded in the 2006-2009 Arctic surfclam survey on Grand Bank (≈ 0.0006% of the total catch). The Arctic surfclam fishery was screened-out (i.e. it was not considered to be an impacting activity) in a DFO analysis of all activities potentially impacting spawning cod in this area (DFO 2009f).

The majority of the Arctic surfclam fishery on Grand Bank occurs within the Southeast Shoal and Tail of the Banks EBSA, including in areas outside the Canadian 200 nautical mile territorial limit (based on Figure 15). An important consideration is the level of natural perturbation that the seabed and benthic community in this area is subject to, which is considerable, as well as the likely area of ground covered annually by the fishery, which is small. Even accounting for the low exploitation levels in recent years in comparison to the available TAC, it is likely that the fishery would sweep less than 0.4% of the available Arctic surfclam habitat annually. Further, experimental dredging results

from Banquereau suggest that recovery of the habitat is expected to take in the order of 10 years (DFO 2010), while the benthic community, with the exception of the long-lived target and retained bivalve species, is likely to have largely have recovered within two years.

Lilly Canyon – Carson Canyon EBSA was ranked as being of low conservation importance, but was identified for concentrations of Iceland scallops, soft corals and for aggregations of cetaceans and seals. This site is located along the 200 m isobath, and is characterised by the presence of the canyons that shelve very steeply off into deep water. It is, though, very unlikely that the Arctic surfclam fishery would stray in to the EBSA, as the target stock is concentrated in water of < 70 m depth, and the dredges employed in the fishery are inefficient below 100 m depth (Roddick *et al.* 2007). The lack of Iceland scallops in the catch and survey data may support this assertion (Table 7 and Table 8). While sediment loading of the water may increase around an active dredging site, storms are noted as being common in the area (Rao *et al.* 2009), and it is therefore very unlikely that sediment from dredging would cause anything other than mild, temporary and local effects.

The Virgin Rocks EBSA is located on Grand Bank, and was identified for its geology, and as a cod, American plaice and yellowtail flounder spawning site (DFO, 2007b). However, this site was ranked as being of low conservation priority, and is located well away from the densest Arctic surfclam aggregations; the fishery has never approached the area (Figure 15). There is no reason to suspect that the stock distribution and exploitation patterns would change in the short to medium term at least, and it is therefore considered that the fishery poses no risk to the features of the Virgin Rocks EBSA.



1. The Southeast Shoal and Tail of the Banks
2. Placentia Bay Extension
3. The Southwest Shelf Edge and Slope
4. Laurentian Channel and Slope
5. St. Pierre Bank
6. Smith Sound
7. Eastern Avalon
8. Northeast Shelf and Slope
9. Lilly Canyon-Carson Canyon
10. Virgin Rocks
11. Burgeo Bank

Figure 18: EBSAs within the Placentia Bay-Grand Banks LOMA (DFO 2007b).

An important consideration for the Arctic surfclam assessment is that no areas of the Placentia Bay-Grand Bank LOMA were considered to be degraded (DFO, 2007b). However, this non-degraded assessment was reported to have been somewhat preliminary, and based on the assessment of agencies other than DFO. Related to this issue is that there was no clear guidance established during the LOMA process as to what the reference date was for protection, meaning that there is no guidance as to whether the present ecosystem should be protected or whether the aim should be to restore an ecosystem from a point in history. If an earlier target reference point was selected, some areas may be down-graded in future due to heavy exploration or exploitation (DFO, 2007b).

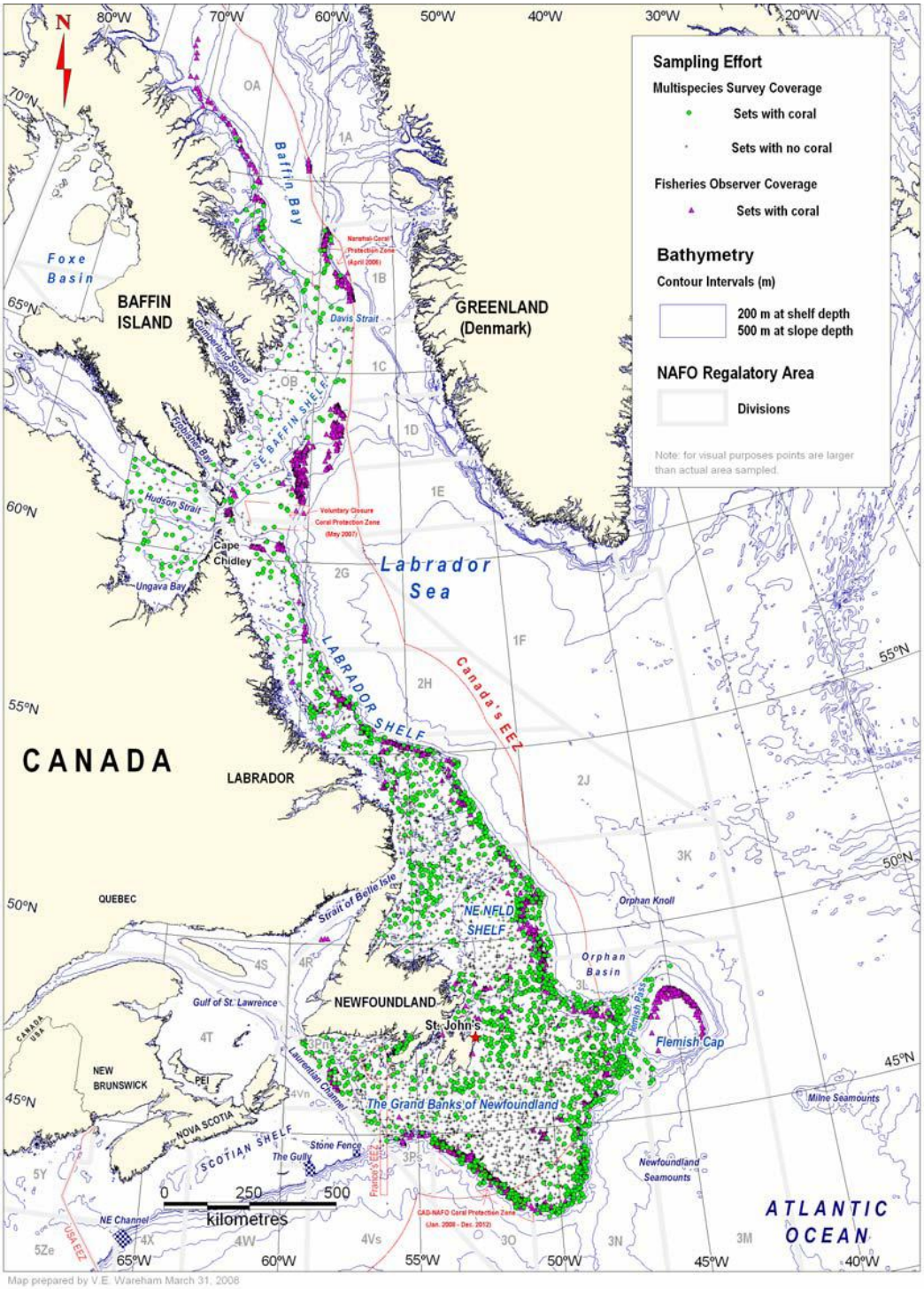


Figure 19: Distribution of deep-sea corals from a number of fisheries surveys and from observers aboard commercial fishing vessels (Wareham 2009).

Deep-sea corals are an important and vulnerable component of the Grand Bank ecosystem. There have been extensive efforts made recently to map and characterise the deep-sea coral found off eastern Canada (e.g. Wareham and Edinger, 2007; Wareham, 2009) and analyses of fisheries and survey data suggest that almost all the deep-sea corals in the Grand Bank region are found at depths well beyond those that are fished for Arctic surfclam (Figure 19). The exception is soft corals of the order Alcyonacea, which are found on the top of the Grand Bank in shallower water, but mainly on the northern half of the bank. Wareham (2009) considered that *Gersemia rubiformis* was the only species in the study that was consistently distributed on the continental shelf, with an average depth of < 174 m. Laboratory experiments suggest that these shallow water, soft coral species are somewhat resistant to regular perturbation (Henry *et al.* 2003). In any case, no *G. rubiformis* was reported in the commercial catch sampling data (Table 7), and this species represented just ≈ 0.003% of the total catch in the Grand Bank survey data (Table 8).

At depths of < 100 m, hydraulic dredging is an efficient method for catching infaunal bivalve species. The removal of large, bioturbating bivalves, together with other epifaunal and infaunal benthic species (see section 7.2), has the potential to affect community structure and biomass. Bivalve burrows provide habitat complexity in structurally limited seabeds, and dense aggregations of Arctic surfclam, northern propellerclam and other long-lived bivalves support the settlement of the benthic larvae of other species, as well as acting as important competitors of suspension and deposit feeders. Gilkinson *et al*. (2005) reported that the immediate effects of hydraulic dredging on Banquereau were to significantly reduce the total abundance of target and non-target species by an average of 46%, while community biomass also declined significantly; the effects of dredging were most pronounced within the dredge tracks. After one year, however, there was a pronounced increase in abundance of non-target species, including some species of polychaete worms and micro-crustaceans (mainly amphipods) that had reached numbers in excess of the pre-dredging condition. Community recovery was incomplete two years after the experimental dredging ceased, with some species, such as the opportunistic polychaete *Spiophanes bombyx*, continuing to increase in abundance; in contrast, the abundance of target bivalve species had not changed from the levels observed immediately post-dredging, a not unexpected result given the variable recruitment patterns, slow growth and very limited motility of those species.

The impact of hydraulic dredging on Grand Bank should be placed in the context of the extent of the fishery in comparison to the size of the bank. Although Gilkinson *et al.* (2005) found that recovery of the benthic community on Banquereau was still occurring two years after dredging, and a similar result would be expected on Grand Bank, the fishery is likely to cover a maximum of only approximately 0.4% of the Arctic surfclam habitat on the bank each year. Arctic surfclam vessels are also reported to return to productive locations after approximately 10 years (CSLP, pers. comm.), leaving a considerable amount of the bank in recovery or untouched in any year. Similarly, there will be areas of unfished ground left even within intensively fished areas that will help to promote recovery of the benthic community within nearby fished areas through emigration (Kaiser *et al.* 2002).

A separate issue investigated by the assessment team was an anecdotal report of large volumes of hydraulic fluid being lost from an Arctic surfclam vessel or vessels. Such losses would certainly be a matter of concern regarding the wider environmental impact of the fishery on the Grand Bank ecosystem. However, upon review, DFO could find no observer reports or other evidence of hydraulic fluid being lost by vessels in the fishery, and DFO fishery enforcement specialists considered that such losses would in any case be highly unlikely. As such, losses of hydraulic fluid were not considered further in this assessment. It should be noted that while the fishery employs 'hydraulic' dredges, the term refers to the use of high pressure water jets to dig into the seabed, rather than because hydraulic fluid runs to the dredges when they are working on the seabed.

8 OTHER FISHERIES AFFECTING TARGET STOCK

Arctic surfclam is a sessile, infaunal species, and there is likely to be only relatively localised movement of post-settled individuals, possibly as a result of storm disturbance on the seabed. It is also thought that there is only very limited genetic mixing between the Grand Bank and Scotian Shelf Arctic surfclam populations, probably mainly in a north-south direction, through larval dispersal in the Labrador Current (DFO, pers. comm.). The Arctic surfclam stock on the Grand Bank can therefore be considered to be isolated from other stocks.

CSLP is licenced to use up to four vessels in the Grand Bank Arctic surfclam fishery; no other entities are licenced to operate in the offshore fishery in the area. Although it is theoretically possible that Arctic surfclams could be taken by other vessels using gears other than hydraulic dredges (for example, by vessels using groundfish trawls), such catches would be accidental and the quantities taken would inevitably be extremely small as other gears are not designed to penetrate the sediment to a depth that would result in Arctic surfclams being caught. As such, there is very little potential for Arctic surfclams from Grand Bank, other than those caught by the CSLP fleet, to enter the commercial market.

There are no aboriginal or recreational fisheries for Arctic surfclam on Grand Bank (DFO 2011c).

9 STANDARD USED

The MSC Principles and Criteria for Sustainable Fisheries form the standard against which the fishery is assessed and are organised in terms of three principles. Principle 1 addresses the need to maintain the target stock at a sustainable level; Principle 2 addresses the need to maintain the ecosystem in which the target stock exists, and Principle 3 addresses the need for an effective fishery management system to fulfil Principles 1 and 2 and ensure compliance with national and international regulations. The Principles and their supporting Criteria are presented below.

9.1 Principle 1

A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery. [2]:

The intent of this principle is to ensure that the productive capacities of resources are maintained at high levels and are not sacrificed in favour of short term interests. Thus, exploited populations would be maintained at high levels of abundance designed to retain their productivity, provide margins of safety for error and uncertainty, and restore and retain their capacities for yields over the long term.

Criteria:

1. The fishery shall be conducted at catch levels that continually maintain the high productivity of the target population(s) and associated ecological community relative to its potential productivity.
2. Where the exploited populations are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level consistent with the precautionary approach and the ability of the populations to produce long-term potential yields within a specified time frame.
3. Fishing is conducted in a manner that does not alter the age or genetic structure or sex composition to a degree that impairs reproductive capacity.

9.2 Principle 2

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

The intent of this principle is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

Criteria:

1. The fishery is conducted in a way that maintains natural functional relationships among species and should not lead to trophic cascades or ecosystem state changes.

2. The fishery is conducted in a manner that does not threaten biological diversity at the genetic, species or population levels and avoids or minimises mortality of, or injuries to endangered, threatened or protected species.

3. Where exploited populations are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level within specified time frames, consistent with the precautionary approach and considering the ability of the population to produce long-term potential yields.

[2] The sequence in which the Principles and Criteria appear does not represent a ranking of their significance, but is rather intended to provide a logical guide to certifiers when assessing a fishery. The criteria by which the MSC Principles will be implemented will be reviewed and revised as appropriate in light of relevant new information, technologies and additional consultations

9.3 Principle 3

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

The intent of this principle is to ensure that there is an institutional and operational framework for implementing Principles 1 and 2, appropriate to the size and scale of the fishery.

A. Management System Criteria:

1. The fishery shall not be conducted under a controversial unilateral exemption to an international agreement.

The management system shall:

2. Demonstrate clear long-term objectives consistent with MSC Principles and Criteria and contain a consultative process that is transparent and involves all interested and affected parties so as to consider all relevant information, including local knowledge. The impact of fishery management decisions on all those who depend on the fishery for their livelihoods, including, but not confined to subsistence, artisanal, and fishing-dependent communities shall be addressed as part of this process.

3. Be appropriate to the cultural context, scale and intensity of the fishery – reflecting specific objectives, incorporating operational criteria, containing procedures for implementation and a process for monitoring and evaluating performance and acting on findings.

4. Observe the legal and customary rights and long term interests of people dependent on fishing for food and livelihood, in a manner consistent with ecological sustainability.

5. Incorporates an appropriate mechanism for the resolution of disputes arising within the system[3].

6. Provide economic and social incentives that contribute to sustainable fishing and shall not operate with subsidies that contribute to unsustainable fishing.

7. Act in a timely and adaptive fashion on the basis of the best available information using a precautionary approach particularly when dealing with scientific uncertainty.

8. Incorporate a research plan – appropriate to the scale and intensity of the fishery – that addresses the information needs of management and provides for the dissemination of research results to all interested parties in a timely fashion.

9. Require that assessments of the biological status of the resource and impacts of the fishery have been and are periodically conducted.

10. Specify measures and strategies that demonstrably control the degree of exploitation of the resource, including, but not limited to:

    a) setting catch levels that will maintain the target population and ecological community's high productivity relative to its potential productivity, and account for the non-target species (or size, age, sex) captured and landed in association with, or as a consequence of, fishing for target species;

[3] Outstanding disputes of substantial magnitude involving a significant number of interests will normally disqualify a fishery from certification.

b) identifying appropriate fishing methods that minimise adverse impacts on habitat, especially in critical or sensitive zones such as spawning and nursery areas;
c) providing for the recovery and rebuilding of depleted fish populations to specified levels within specified time frames;
d) mechanisms in place to limit or close fisheries when designated catch limits are reached;
e) establishing no-take zones where appropriate.

11. Contains appropriate procedures for effective compliance, monitoring, control, surveillance and enforcement which ensure that established limits to exploitation are not exceeded and specifies corrective actions to be taken in the event that they are.

B. Operational Criteria

Fishing operation shall:

12. Make use of fishing gear and practices designed to avoid the capture of non-target species (and non-target size, age, and/or sex of the target species); minimise mortality of this catch where it cannot be avoided, and reduce discards of what cannot be released alive.

13. Implement appropriate fishing methods designed to minimise adverse impacts on habitat, especially in critical or sensitive zones such as spawning and nursery areas.

14. Not use destructive fishing practices such as fishing with poisons or explosives;

15. Minimise operational waste such as lost fishing gear, oil spills, on-board spoilage of catch etc.

16. Be conducted in compliance with the fishery management system and all legal and administrative requirements.

17. Assist and co-operate with management authorities in the collection of catch, discard, and other information of importance to effective management of the resources and the fishery.

10 BACKGROUND TO THE EVALUATION

10.1 Evaluation Team

Lead Assessor and Project Coordinator: Dr. Rob Blyth-Skyrme

Rob has worked in marine fisheries science, management and policy for 15 years. Prior to becoming a fisheries consultant he was a senior advisor to the UK Government on environmental and fisheries issues and the Deputy Chief Officer for the largest inshore fisheries management organization in England. Rob now runs a marine fisheries and environmental consultancy with offices in the UK and Hawaii and has undertaken all facets of MSC work as a lead assessor and expert team member.

Expert advisor: Dr. Andy Brand

Andy worked for 40 years on the academic staff of the Port Erin Marine Laboratory, Isle of Man, retiring in 2006 as Director of the Laboratory. During this time he developed large, well-funded, research programmes on the biology, ecology, and fisheries of bivalve molluscs and the environmental impact of scallop dredging. He has had extensive fishery management and environmental assessment consultancy experience, including contracts with government departments and industry. He has recent experience as an assessor and reviewer for MSC certifications of scallop, mussel and oyster fisheries in the Irish Sea, Faroes, Denmark, the USA and Canada.

Expert Advisor: John Angel

John worked with the federal Department of Justice before moving to the Department of Fisheries and Oceans as head of legal and regulatory affairs in 1983. His last position in government (1994) was as Regional Director of Fisheries Management for the Scotia-Fundy Region. After ten years as Executive Director of the Canadian Association of Prawn Producers, a trade association representing offshore northern shrimp interests in Eastern Canada, John retired from full time employment but continues to provide consulting services to the fishing industry of Atlantic Canada. He has extensive experience in the development of integrated resource management plans and fishing strategies as well as a background in Canadian fisheries law and is a past member of the Fisheries Resource Conservation Council (FRCC), an independent advisory body to the Minister of Fisheries and Oceans. He has been on several MSC assessment teams as the Principle 3 lead.

10.2 Previous certification evaluations

The fishery has not been previously assessed against the MSC standard.

10.3 Inspections of the Fishery

Inspection of the fishery focused on the practicalities of fishing operations, the mechanisms and effectiveness of management agencies and the scientific assessment of the fisheries. In order to gather information, a meeting was held with scientists and managers from the Department of Fisheries and Oceans, Canada. The key issues discussed are identified in Table 10, below.

Table 10: Key issues discussed at a meeting with the DFO

Name	Affiliation	Date	Key Issues
Wendy Williams Stefan Leslie Carl MacDonald Scott Coffen-Smout Dale Roddick Wade Barney	DFO DFO DFO DFO DFO DFO	10th June 2011	- Existence of implicit or explicit target and limit reference points - The methodological approach to setting the TAC - MCY compared with MSY - Stock survey frequency

Name	Affiliation	Date	Key Issues
Annette Rumbolt Kent Gilkinson (from 11:15)	DFO DFO		- Availability of information on spatfall and pre-recruit strength - Evidence concerning serial depletion of stock - Information on stock density dependent effects on spawning and/or growth - Dredge efficiency - Abundance and ecology of retained and discarded bycatch species - Habitat impacts and recovery - Habitat mapping - Ability of ENGOs to engage with the management process - IFMP drafting process - Internal and external review of the management performance

11 STAKEHOLDER CONSULTATION

11.1 Stakeholder Consultation

Information on the assessment of the Grand Bank Arctic surfclam fishery main assessment was made publicly available at the following stages of the assessment:

Date	Purpose	Media
22nd March 2011	Announcement of assessment	Direct E-mail/letter Notification on MSC website Advertisement in 'The Navigator' magazine.
12th April 2011	Notification of Assessment Team nominees	Direct E-mail Notification on MSC website
12th April 2011	Notification of intent to use MSC FAM Standard Assessment Tree	Direct E-mail Notification on MSC website
6th May 2011	Notification of assessment visit and call for meeting requests	Direct E-mail Notification on MSC website
9th - 11th June 2011	Assessment visit	Meetings
29th November 2011	Notification of Proposed Peer Reviewers	Direct E-mail Notification on MSC website
	Notification of Public Comment Draft Report	Direct E-mail Notification on MSC website
	Notification of Final Report	Direct E-mail Notification on MSC website

11.2 Stakeholder Issues

A total of four stakeholder groups were identified and consulted specifically by Intertek Moody Marine; these were the Sierra Club of Canada, the World Wildlife Fund (WWF), Canada, the Ecology Action Centre (EAC) and Sea Choice. Representatives of those organisations were contacted by e-

mail and invited to meet with the team during the site visit. Sea Choice did not respond to the e-mail, while Dr. Winsor of the Sierra Club of Canada sent a letter to the team, outlining their position (included in this report as Section 16.1), and the WWF and the EAC met with the team but also submitted written evidence (included in this report as Section 16.2 and Section 16.3, respectively). The key issues discussed during the meetings with the WWF and the EAC are listed in Table 11, below.

Table 11: Key issues discussed with stakeholders.

Name	Affiliation	Date	Key Issues
Susanna Fuller	Ecology Action Centre	9th June 2011	- Independence of fishery science related to the Arctic surfclam stock assessment - Availability of raw data from stock surveys - Stock survey frequency - Impact of hydraulic dredging on habitats and communities - Desirability of control areas within commercial fishing grounds closed to dredging - Impacts of prey removal on recovery of clam predators including groundfish - Possible reports of hydraulic fluid leaks from clam fishing vessels - Ability of ENGOs to engage with the management process
Daniela Diz	WWF	10th June 2011	- Impact of dredging on ETP species and their habitats - Existing MPAs and the Canadian MPA designation process - Hydraulic dredge impacts on EBSAs and VMEs - Ability of ENGOs to engage with the management process

12 OBSERVATIONS AND SCORING

12.1 Introduction to scoring methodology

The MSC Principles and Criteria set out the requirements of certified fishery. These Principles and Criteria have been developed into a standard (Fishery Assessment Methodology) assessment tree - Performance Indicators and Scoring Guideposts - by the MSC, which is used in this assessment.

The Performance Indicators (PIs) have been released on the MSC website. In order to make the assessment process as clear and transparent as possible, each PI has three associated Scoring Guideposts (SGs) which identify the level of performance necessary to achieve 100, 80 (a pass score), and 60 scores for each Performance Indicator; 100 represents a theoretically ideal level of performance and 60 a measurable shortfall.

For each Performance Indicators, the performance of the fishery is assessed as a 'score'. In order for the fishery to achieve certification, an overall weighted average score of 80 is necessary for each of the three Principles and no Indicator should score less than 60. As it is not considered possible to allocate precise scores, a scoring interval of five is used in evaluations. As this represents a relatively crude level of scoring, average scores for each Principle are rounded to the nearest whole number.

Weights and scores for the Fishery are presented in the scoring table (Appendix A).

13 LIMIT OF IDENTIFICATION OF LANDINGS FROM THE FISHERY

Traceability of product from the sea to the consumer is vital to ensure that the MSC standard is maintained. There are several aspects to traceability that the MSC require to be evaluated: traceability within the fishery; at-sea processing; at the point of landing; and subsequently the eligibility of product to enter the chain of custody. These requirements are assessed here.

13.1 Traceability within the fishery

Products from the Grand Bank Arctic surfclam fishery are 100% processed at-sea. The CSLP vessels engaged in the fishery deliver product only to the CSLP plant in Grand Bank, Newfoundland, after landing in Argentia. No transhipments are permitted in the fishery, and no other vessels are permitted to retain Arctic surfclams. No instances of these requirements being broken were reported to the assessment team by DFO. There is 100% observer coverage of landings. There are not thought to be any traceability issues that would prevent the demonstration of a secure supply chain for products from the fishery.

It may be noted that the Arctic surfclam vessels operating in this fishery are highly specialised for fishing with hydraulic dredges. As such, there is no possibility of the CSLP vessels using a fishing gear that has not been assessed as part of this Banquereau Arctic surfclam unit of certification (i.e. other than hydraulic dredges).

13.2 At-sea processing

The vessels engaged in the Grand Bank Arctic surfclam fishery are equipped with processing and freezing facilities.

The whole animal is blanched and then the tongues (feet) are separated from the mantle material. The tongues are frozen individually and packaged in 16 kg boxes, while the mantles are frozen as a by-product in 7 kg boxes.

13.3 Points of landing

Products are landed only at Argentia, Newfoundland, for further processing at Grand Bank, Newfoundland.

13.4 Eligibility to enter chains of custody

The scope of this certification ends at the point of landing. Downstream certification of the product would require appropriate chain-of-custody certification of shore-based storage and handling facilities.

13.5 Target Eligibility date

The Public Comment Draft Report for this fishery was published on April 26th, 2012. The earliest date that can be set for the target eligibility date is therefore October 26th, 2011 (CR 27.6.1.2). This is a logical date in that the client has confirmed that it would provide the most benefit to the fishery from certification.

As the eligibility date for products from the fishery would be before the certification date, Intertek Moody Marine must be confident that the vertical integration and traceability systems in the Clearwater Seafoods Limited Partnership operations allow them to track and clearly identify product landing dates and to separate MSC-eligible from all non-eligible product. Intertek Moody Marine is confident that this is the case.

14 ASSESSMENT RESULTS

The Performance of the Fishery in relation to MSC Principles 1, 2 and 3 is summarised below:

MSC Principle	Fishery Performance
Principle 1: Sustainability of Exploited Stock	Overall : 85.0
Principle 2: Maintenance of Ecosystem	Overall : 87.7
Principle 3: Effective Management System	Overall : 85.6

The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any Indicators. It is therefore confirmed that the Grand Bank Arctic surfclam fishery is certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

14.1 Conditions and action plan

As a standard requirement of the MSC certification methodology, the fishery shall be subject to (as a minimum) annual surveillance audits. These audits shall be publicised and reports made publicly available.

The fishery attained a score of below 80 against three Performance Indicators. The assessment team has therefore set three Conditions for Continued Certification that the client for certification is required to address. The Conditions are applied to improve performance to at least the 80 level within a period set by the certification body but no longer than the term of the certification.

The client has developed an 'Action Plan' for Meeting the Conditions for Continued Certification; the action plan has been approved by Intertek Moody Marine, and a letter of support has been provided by DFO (See).

The Conditions, associated timescales and relevant Scoring Issue are set out below.

Condition 1	
Reference Points	**1.1.2**
PI	Limit and target reference points are appropriate for the stock.
SG 60	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.
SG 80	Reference points are appropriate for the stock and can be estimated. The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity. The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome. For low trophic level species, the target reference point takes into account the ecological role of the stock.
SG 100	Reference points are appropriate for the stock and can be estimated.

	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues. The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
Score	**70**
Scoring Rationale	Although there are no analytically determined reference points for this fishery, the management strategy aims to maintain the biomass at the level of B_{MCY}, which is higher than the MSC default target of $0.4B_0$, and is thus an acceptable surrogate target reference point that meets both the third and fourth issues of SG 80. With biomass maintained at or around the virgin biomass level and a very low exploitation rate, no limit reference point has been defined or is implicit within the management strategy, so while the fishery has clearly remained above the MSC default value for an implicit limit reference point of ½ B_{MSY} or 20% of B_0, the lack of any stated threshold at which management action would be taken means that the fishery does not meet the first and second issues of SG 80. The score of 70 requires that a Condition is set.
Condition	The client is required to demonstrate by the 2nd annual audit that: • The management system includes a limit reference point that is appropriate for the stock and can be estimated. • The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity. Milestones in achieving this goal are: **Year 1 (First surveillance audit)** • Work with relevant scientists to undertake a review of potential limit reference points.
Client Action Plan	The Client, in conjunction with DFO will, by the 2nd annual audit, identify appropriate limit reference points for the stock that ensure that there is no appreciable risk of impairing reproductive capacity. Progress of this initiative will be presented at the first annual audit.

Condition 2	
Harvest control rules and tools	**1.2.2**
PI	There are well defined and effective harvest control rules in place.
SG 60	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached. There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.
SG 80	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.

	The selection of the harvest control rules takes into account the main uncertainties. Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules
SG 100	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached. The design of the harvest control rules take into account a wide range of uncertainties. Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score	**70**
Scoring Rationale	This fishery is managed on a very precautionary basis, with a low annual exploitation rate and a conservatively set TAC, the uptake of which is closely monitored, so that the stocks are still at, or around, the virgin biomass level after 25 years of fishing. However, there are no analytically determined reference points and there are no well-defined harvest control rules stating under what circumstances action would be triggered to ensure that the exploitation rate is reduced as limit reference points are approached. The fishery does not, therefore, meet the first and second issues of SG 80, although the tools in use (limited licences, conservative TAC) are appropriate and have been effective in maintaining a low exploitation rate so that the third issue of SG 80 is met. The score of 70 requires that a Condition is set.
Condition	The client is required to demonstrate by the 2nd annual audit that: • Well-defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached. • The selection of the harvest control rules takes into account the main uncertainties. Milestones in achieving this goal are: **Year 1 (First surveillance audit)** • Work with relevant scientists to undertake a review of potential harvest control rules.
Client Action Plan	The Client, in conjunction with DFO, will establish decision rules appropriate to manage the stock that are consistent with the harvest strategy and consider the main uncertainties. An update of this work will be provided at the first surveillance audit.

Condition 3	
Consultation, roles and responsibilities	**3.1.2**
PI	The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved

	in the management process are clear and understood by all relevant parties
SG 60	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system
SG 80	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained The consultation process provides opportunity for all interested and affected parties to be involved
SG 100	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.
Score	**65**
Scoring Rationale	Interested parties have been identified in the advisory process. The functions, structure, purpose and administration of the advisory committee are clearly outlined in the IFMP and well understood. The management system considers all information presented during the consultative process on key elements of the management of the stocks. While the advisory committee process is open to the public and does provide an opportunity for all attending parties to participate, there is no indication that potential interested parties are made aware of meetings. Similarly, minutes of meetings are circulated to committee members but no indication of wider distribution to parties that may be interested in the deliberations of the advisory committee. All the scoring issues of SG 60 are met, as is the first scoring issue of SG 80. However, as the OCAC has not met on a regular basis (including gaps of several years), it cannot be said that the process regularly seeks and accepts relevant information or that the process provides the opportunity for all interested and affected parties to be involved, as required by the last two of the three scoring issues of SG 80. Nor is there evidence that potential interested parties are made aware of advisory meetings being held or of the results of such meetings. A score of 65 is therefore awarded and a condition set.
Condition	The client is required to demonstrate by the 2nd annual audit that the management system includes: • Consultation processes that regularly seek and accept relevant information, including local knowledge. • Consideration of the information obtained.

	• Opportunity for all interested and affected parties to be involved. Milestones in achieving this goal are: **Year 1 (First surveillance audit)** • Provide evidence of seeking and accepting relevant information through established consultation processes. • Provide evidence of providing opportunity for interested and affected parties to be involved.
Client Action Plan	The Client, in conjunction with DFO will hold regular OCAC meetings so that relevant information can be obtained, considered, and where appropriate, incorporated into fisheries management. OCAC meetings will be open to the public so that interested and affected parties have an opportunity to be involved. Evidence of this will be provided via OCAC meeting minutes at the first and second year surveillance audits.

14.2 Non-binding recommendations

Two non-binding recommendations, specific to PI 3.1.2 and PI 3.2.1, were made:

Recommendation 1: PI 3.1.2

In order to promote opportunities for all interested and affected parties to be involved, advance notice of the time and place of advisory committee meetings, and the minutes of such meetings, should be posted on the DFO website.

Recommendation 2: PI 3.2.1

In order to ensure that the latest IFMP is available to stakeholders, it should be posted on the DFO website or in some other way made publicly available.

15 APPENDIX A - SCORING TABLE

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

Principle 1	A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

1.1	Management Outcomes:

1.1.1	**Stock Status**: The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is <u>likely</u> that the stock is above the point where recruitment would be impaired.	It is <u>highly likely</u> that the stock is above the point where recruitment would be impaired. The stock is at or fluctuating around its target reference point.	There is a <u>high</u> <u>degree of certainty</u> that the stock is above the point where recruitment would be impaired. There is a <u>high degree of certainty</u> that the stock has been fluctuating around its target reference point, or has been above its target reference point, <u>over recent years</u>.

Scoring Comments

For Grand Bank, the estimated age at 50% selectivity is 22.9 years, well above the 5.3 years for age at 50% maturity, which means that individuals should have over 17 years of spawning before they enter the fishery. Although there have been no studies of the relative fecundity of young compared with older surfclams, the fishery should be resistant to recruitment overfishing at moderate exploitation levels (Roddick *et al*. 2011). Recruitment on Grand Bank has been fairly consistent, with no missed year-classes, but with some evidence of stronger year-classes every few years and evidence of spatial variability from year to year. No stock-recruitment relationship has been demonstrable, but as a high fecundity, broadcast spawner, a close relationship between stock size and subsequent recruitment is unlikely to occur except at very low stock densities. Stock surveys of Arctic surfclam undertaken on Grand Bank in 2006-9 provided a biomass estimate of 1,140,682 ± 35,933 t in the survey area. No comparison with previous surveys is possible for Grand Bank because, although data were collected in 1995-1997, these were never formally presented for review (due to the demise of the scientist in charge). A rough estimate shows annual production to be higher than the removals by the fishery; this, and other, evidence suggests that the fishery over 23 years has not had a significant detrimental impact on the stock, which is estimated to be still near the virgin biomass level (Roddick *et al*. 2011, DFO 2010).

While fishing effort is ultimately limited by the TAC, this has never been taken and with only two or three boats fishing, fishing effort is very low, with exploitation rates of only 1 - 2% per year, and, in some years, considerably less. Since the Grand Bank surfclam fishery began in 1989, it has been calculated that 1,132 km^2 (uncorrected for overlap of tows) have been swept by the gear, with most of that in the period 1990-1998 (DFO 2010). This represents only 2% of the area surveyed. During the last five years (2005-2009) fishing effort on Grand Bank has been very low with an average annual swept area of only about 26 km^2, and there is no evidence of serial depletion of grounds. There is, therefore, a high degree of certainty that recruitment overfishing is not occurring. It is also estimated that the age of maximum biomass per recruit occurs close to the age of 50% selectivity, making the fishery resistant to growth overfishing (Roddick *et al*. 2011).

The Offshore Clam Framework Assessment meeting in 2007 (DFO 2007a; DFO 2007d) agreed that the fishing mortality (F) for the Banquereau fishery should be a function of the natural mortality (M) and recommended a conservative TAC set at around F~MCY (F of 0.33M) (DFO 2007c), based on a strategy of setting a yield that is low enough to

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

be sustainable at all probable biomass levels. The same F target was later accepted for the Grand Bank fishery (DFO 2011e). Thus, the TAC for Grand Bank is based on harvesting a percentage (the exploitation rate) of the estimated harvestable biomass (i.e. the biomass > 75 g/m^2), which is intended to optimize yield and not expose the resource to risk of over-exploitation. In 2011, the TAC for Grand Bank was revised down to 14,756 t from the original precautionary level of 20,000 t, following scientific advice from the 2010 Grand Bank assessment (DFO 2011c), which recommended a cautious strategy while implementing a constant fishing mortality approach with the current low frequency of surveys. Arctic surfclam is a long-lived and slow growing species, such that the stock would take many years to recover from a high exploitation rate that resulted in a significant stock decline. Based on the survey biomass estimate, the TAC of 20,000 t that was in operation up to and including 2010 would produce an estimated fishing mortality rate of F = 0.016 (Roddick *et al.* 2011). However, the fishery has never reached the TAC and for the last 10 years has landed an average of only 6,515 t, which gives an F of 0.006.

The management strategy of setting a conservative TAC at F~MCY (F of 0.33M) strives to maintain the biomass at the level of B_{MCY}, which is more conservative than the MSC recommendation of B_{MSY} (=0.4B0). B_{MCY} can therefore be considered to be an implicit target reference point, complying with the MSC Policy Advisory 12 (MSC 2010b) on implicit reference points, which states "target reference points should be such that the stock is maintained at a level consistent with B_{MSY} or above, or some measure or surrogate with similar intent or outcome."

With the stock size estimated to be still near the virgin biomass level (Roddick *et al.* 2011), and very limited annual fishery removals, the stock is clearly at or fluctuating around its target reference point.

Score: 100

The fishery complies with SG 60 and SG 80, and there is a high degree of certainty so the first issue of SG100 is met. Since there are convincing arguments that the stock is still at or near the virgin biomass levels, the second scoring issue of SG100 is also met.

Audit Trace References

DFO 2007a, DFO 2007c, DFO 2007d, Roddick *et al* 2007, Roddick *et al.* 2011, MSC 2010b.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
1.1.2	**Reference Points:** Limit and target reference points are appropriate for the stock.	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated. The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity. The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome. For low trophic level species, the target reference point takes into account the ecological role of the stock.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues. The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.

Scoring Comments

There are no analytically determined reference points for this fishery but the use of implicit reference points is clarified in MSC Policy Advisory 12 (MSC 2010b), which states: "*target reference points should be such that the stock is maintained at a level consistent with B_{MSY} or above, or some measure or surrogate with similar intent or outcome*." The 2007 Offshore clam Framework Assessment concluded that a fishing strategy that resulted in F ~ MCY (F of 0.33M) was appropriate for the offshore Arctic surf clam fishery based on the long-lived and slow growing nature of the species. As M = 0.08, this strategy is inherently conservative and precautionary and strives to maintain the biomass at the level of B_{MCY}, which is a higher level than the MSC default target of 0.4B0. By using this strategy, the management of the Offshore Arctic Surf Clam fishery is implicitly striving to maintain the stock at a B_{MCY}, which is more conservative than the MSC recommendation of B_{MSY}.

While there is no explicit limit reference point for this fishery, the need to implement one has recently been noted by the scientific advisors (Roddick *et al.* 2011). However, with the biomass at or around the virgin biomass level (DFO 2010, Roddick *et al.* 2011), and the current restriction on fishing effort through the application of a conservative TAC, any decline in biomass will be slow to occur and should be detected in surveys long before it affected reproductive output. Therefore, while a limit reference point would be desirable, it is not currently a priority for this fishery as the fishery is well above the MSC default value of ½ B_{MSY} or 20% of B0. In any case, the operational costs of exploiting the offshore Arctic surfclam stocks are such that fishing would be limited for economic reasons long before there is an appreciable risk that recruitment is impaired (Roddick *et al.* 2007).

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

The management strategy is therefore consistent with the MSC guidance regarding implicit reference points

Score: 70

Although there are no analytically determined reference points for this fishery, the management strategy aims to maintain the biomass at the level of B_{MCY}, which is higher than the MSC default target of $0.4B_0$, and is thus an acceptable surrogate target reference point that meets both the third scoring issues of SG 80. As Arctic surfclam is not a low trophic levels species, the fourth scoring issue of SG 80 does not apply. With biomass maintained at or around the virgin biomass level and a very low exploitation rate, no limit reference point has been defined or is implicit within the management strategy, so while the fishery has clearly remained above the MSC default value for an implicit limit reference point of ½ B_{MSY} or 20% of B_0, the lack of any stated threshold at which management action would be taken means that the fishery does not meet the first and second scoring issues of SG 80. The score of 70 requires that a Condition is set.

Audit Trace References

DFO 2007a; DFO 2011c, MSC 2010b, Roddick *et al.* 2007; Roddick *et al.* 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
1.1.3	**Stock Rebuilding:** Where the stock is depleted, there is evidence of stock rebuilding.	Where stocks are depleted rebuilding strategies which have a reasonable expectation of success are in place. Monitoring is in place to determine whether they are effective in rebuilding the stock within a specified timeframe.	Where stocks are depleted rebuilding strategies are in place. There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the shortest practicable timeframe.

Scoring Comments
The Grand Bank Arctic surfclam stocks are not depleted so this PI does not apply.
Score: N/A
N/A
Audit Trace References
N/A

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

1.2	Harvest Strategy (management)			
1.2.1	Harvest Strategy: There is a robust and precautionary harvest strategy in place	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points. The harvest strategy is likely to work based on prior experience or plausible argument. Monitoring is in place that is expected to determine whether the harvest strategy is working.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points. The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points. The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels. The harvest strategy is periodically reviewed and improved as necessary.

Scoring Comments

The Grand Bank Arctic surfclam fishery is managed under the Offshore Clams Integrated Fisheries Management Plan (DFO 2011c), that is revised on an annual rolling basis. Its primary objective is "to ensure that a biologically and economically sustainable offshore clam fishery continues through the auspices of scientifically-based management plans involving collaborative enforcement, monitoring, and regulatory measures." An additional stock-specific objective is "to increase certainty that harvesting occurs at an optimum sustainable level to ensure the long-term viability of the resource." The stock assessment for Grand Bank (Roddick *et al*. 2011), is comprehensive and precautionary as demonstrated by the following:

- Throughout the stock assessment, the dredge efficiency is assumed to be 1 (when experimental results suggest that efficiency is closer to 0.8),
- Gear-related mortality of non-retained target species is estimated,
- Gear selectivity is such that the age of 50% maturity (5.3 years) is below the age of 50% selectivity (22.9 years), indicating that the individual surfclams will be able to spawn about 17 times before recruiting to the fishery,
- Through 100% VMS, 100% DMP, fishing logbooks, and occasional at-sea observers, the catch is accurately recorded and F is reliably estimated.
- Effort is kept low by limited licences (only two vessels now fishing), exploitation rates are very low (1-2% of the research vessel total biomass per year), and the TAC has never been reached.
- Annual production probably exceeds removals by the fishery and the stock is still at, or around, the virgin biomass.

It has been observed that the areas of greatest effort are still the areas with the highest biomass even after 23 years of fishing, indicating that serial depletion, a concern with

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

fisheries for sedentary species, is not happening in this fishery. The harvest strategy of maintaining F ~ MCY implicitly indicates that the target biomass is B_{MCY}, so that the harvesting strategy is having the intended outcome of ensuring sustainable harvest levels and the long-term viability of the resource.

Score: 95

The fishery meets SG 60 and SG 80, as there is evidence that the harvest strategy is achieving its objectives of maintaining stocks at or around the target biomass of B_{MCY}. The strategy is designed to maintain the stock at or around the target biomass and is also responsive to the state of the stock, as indicated by the recent reduction in TAC following the 2011 stock assessment, therefore meeting the first of the SG 100 scoring issues. The third SG100 scoring issue is also met as there are periodic reviews and improvements made to the strategy. However, while there is evidence that it is achieving its objectives, including being clearly able to maintain stocks at target levels, the performance of the harvest strategy has not been fully evaluated so it does not meet the second scoring issue of SG 100. A score of 95 is therefore given.

Audit Trace References

DFO 2007a, DFO 2010, DFO 2011c, Roddick *et al* 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
1.2.2	**Harvest control rules and tools:** There are well defined and effective harvest control rules in place	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached. There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached. The selection of the harvest control rules takes into account the main uncertainties. Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules	The design of the harvest control rules take into account a wide range of uncertainties. Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.

Scoring Comments

The exploitation rate of the Arctic surfclam fishery on Grand Bank is controlled through limited licences to a low level (1-2% of the biomass per year) and an annual TAC, which is set at the precautionary level of $F_{MCY} = 0.026$ of the biomass of the stock that exist in densities > 75 g/m2. The TAC is set at a very precautionary level because of the long time interval between surveys (4-5 years), taking into account uncertainties with the estimation of biomass, recruitment and gear efficiency. F_{MCY} can be considered to be an implicit target reference point (TRP), which indicates that B_{MCY} is the target biomass. Catches are closely monitored, via 100% VMS, 100% DMP, fishing logbooks, and occasional at-sea observers, and together these ensure that exploitation will decrease to zero as the TAC is approached. MSC guidance indicates that in the absence of explicit limit reference points (LRP), an appropriately conservative assumption is that LRP is ½ of the target reference point (MSC 2010a). The fishery has been constantly well above this level, and it is generally understood between CSLP and DFO that the stock should be maintained at or close to the virgin biomass level. In addition, the market realities and operational costs of the offshore Arctic surf clam fishery are such that fishing would be limited by economic considerations long before the biology of the resource was at risk. As the stocks on Grand Bank do not appear to have deviated significantly from virgin biomass levels over 25 years fishing, it may be concluded that the current TAC has achieved the primary biological objective of the IFMP.

Score: 70

This fishery is managed on a very precautionary basis, with a low annual exploitation rate and a conservatively set TAC, the uptake of which is closely monitored, so that the stock is still at, or around, the virgin biomass level after 25 years of fishing. This has resulted from a generally understood harvest control rule between CSLP and DFO, so meeting the first and second scoring issues of SG 60. However, there are no analytically determined reference points and there are no well-defined harvest control rules stating under what circumstances action would be triggered to ensure that the exploitation rate is reduced as limit reference points are approached. The fishery does not, therefore, meet the first and second scoring issues of SG 80, although the tools in use (limited licences, conservative TAC) are appropriate and have been effective in maintaining a low exploitation rate, so that the third scoring issue of SG 80 is met. The score of 70 requires that a Condition is set.

Audit Trace References

DFO 2010a, DFO 2011c, MSC 2010b; Licence conditions, Roddick *et al.* 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
1.2.3	**Information / monitoring:** Relevant information is collected to support the harvest strategy	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy. Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy. Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule. There is good information on all other fishery removals from the stock.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available. All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.

Scoring Comments

Information on biomass, stock structure and productivity has been collected twice (1996/1997 and 2007-2009), although the results of only the latter survey have been published. Size and age structure and relevant biological information, including age at maturity is collected during surveys.

The fishery is limited to three licenses and up to four vessels only (though only two have fished in recent years), so fleet composition is very well understood. Other information, including fishing location and fishery removals is collected at high resolution, through excellent catch monitoring, via 100% VMS, 100% DMP, fishing logbooks, and occasional deployment of at-sea observers. No other fisheries remove Arctic surfclam from the relevant areas in significant quantities.

A very good range of information on stock structure, stock abundance, productivity, fleet composition and fisheries removals etc is available for this fishery. However, recruitment dynamics are not well understood and, given the importance of the estimate of natural mortality (M) in setting the target fishing mortality and TAC ($F \sim MCY = 0.33M$), it is a potential weakness that the fishery managers rely on the simple relationships $Z = 3/T_{max}$, where T_{max} is the lifespan, and $M = Z$ for an unfished stock (Amaratunga & Rowell 1986). This gives a value of M=0.08, originally calculated for the Banquereau stock, but it has subsequently been uncritically accepted as the default value for both the Banquereau and the Grand Bank stock, when it is likely that M varies both temporally and spatially. The uncertainties associated with the acceptance of this default value have not been evaluated. Similarly, although incidental mortality has been shown to reduce F_{max} and $F_{0.1}$ the implications of incorporating incidental mortality into the process of setting TACs has not been evaluated.

Score: 90

The fishery meets SG 60 and SG 80, and the first scoring issue of SG 100 since the information available is considered comprehensive in relation to the scale and intensity of the fishery. However, with only infrequent surveys it cannot be said that the information is available at a high frequency (although it is perhaps at a frequency suitable for the

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

stock) and the uncertainties associated with recruitment, incidental mortality and the accepted M value throw some doubts on the robustness of the assessment so the fishery fails to meet the second scoring issue of SG 100.

Audit Trace References

Amaratunga & Rowell 1986, DFO 2007a, DFO 2007d, DFO 2010, DFO 2011c, Roddick *et al*. 2007, Roddick *et al*. 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
1.2.4	**Assessment of stock status:** There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points. The assessment identifies major sources of uncertainty.	The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points. The assessment takes uncertainty into account. The assessment of stock status is subject to peer review.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery. The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way. The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored. The assessment has been internally and externally peer reviewed.

Scoring Comments

The Grand Bank Arctic surfclam grounds have been surveyed, using efficient gear and the sessile nature of the species means that confidence limits around the biomass estimates are narrow. This assessment of stock status is appropriate for management that is based on setting precautionary TACs that have maintained fishing mortality at a low level. The assessments are conservative because sampling gear is assumed to be fishing at 100% efficiency and the selection of an appropriate target F value and TAC is cautious because of the low frequency of the biomass surveys.

Age distribution and density is known, as are the age at maturity, maximum biomass per recruit, and size and age of selectivity by the gear. Incidental mortality has been determined at 15% but, while the effect of this has been recognised, it has not been specifically incorporated into the assessment. Other major sources of uncertainty have been identified and are taken into account. The assessment is appropriate for the stock and takes into account the major features relevant to the biology of the species and the nature of the fishery. The assessment is also appropriate for the generally understood harvest control rule, as is referred to under PI 1.2.2. The assessment is subject to extensive internal review during the RAP process, and there was also external peer review in the 2007 Framework process.

Score: 85

The fishery meets SG 60 and SG 80, and the first, scoring issue of SG 100 but the other scoring issues are not met. Thus, while some uncertainties are taken into account, these have not been considered in a probabilistic way. The assessment process has not been extensively tested and, although some alternative approaches have been tried, they cannot be said to have been rigorously explored and although there is a good level of internal peer review in the RAP process there is little external input. A score of 85 is therefore awarded.

Audit Trace References

DFO 2007a, DFO 2007d, DFO 2010, DFO 2011c, Roddick *et al.* 2011.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

Principle 2	Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends

2.1	Retained non-target species

2.1.1	***Status:*** The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.	Main retained species are <u>likely</u> to be within biologically based limits or if outside the limits there are <u>measures</u> in place that are <u>expected</u> to ensure that the fishery does not hinder recovery and rebuilding of the depleted species. If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.	Main retained species are <u>highly likely</u> to be within biologically based limits, or if outside the limits there is a <u>partial strategy</u> of <u>demonstrably effective</u> management measures in place such that the fishery does not hinder recovery and rebuilding.	There is a <u>high degree of certainty</u> that retained species are within biologically based limits. Target reference points are defined and retained species are at or fluctuating around their target reference points.

Scoring Comments

The catch of species other than Arctic surfclam that may be retained in the Grand Bank fishery is limited by licence conditions to Greenland cockle, northern propellerclam, ocean quahog and whelk. Sampling from the fishery from 2002 - 2009 showed that Greenland cockles made up 21.14% of the catch, northern propellerclam made up 18.32%, ocean quahog made up 0.27%, and whelk made up 0.24% (DFO 2010). As such, only Greenland cockle and northern propellerclam are considered to be 'main' retained species in the Grand Bank Arctic surfclam fishery.

Northern propellerclam is a long-lived, slow-growing species, and analysis of commercial catches from Grand Bank showed that the population is dominated by old animals up to more than 100 years of age. The species is widely distributed across the northern Atlantic from Cape Cod to Norway, and maturation occurs relatively early at 4.7 years of age or 28.6 mm shell length (Kilada *et al.* 2009). This size is likely to be well below the size of selection in the Arctic surfclam fishery, where the bar spacing in the hydraulic dredges is 28mm, because of the selectivity acting across the height of the animals rather than the shell length. There is no specific targeting of northern propellerclam on Grand Bank, and so it appears highly likely that the fishery has only a minimal impact on this species.

Greenland cockles have been studied relatively little, although they are known to have a circum-polar distribution in the northern hemisphere. It is estimated that this species matures at a minimum size and age of 28 mm and 2.8 years for males, and 37 mm and 3.7 years for females (Kilada *et al.* 2007). This is likely to be well below the size at which they would be selected by the commercial Arctic surfclam fishery, again because of the selectivity acting across the height of the animals rather than the shell length. While Greenland cockles have at times been targeted in the fishery (Roddick *et al.* 2011), there is no current fishery for Greenland cockle on Grand Bank or the wider Scotian Shelf, and so it appears highly likely that the fishery has only a minimal impact on this species.

Ocean quahog is mainly distributed away from the Arctic surfclams, and this species, together with whelk, is taken in small amounts in the Grand Bank fishery (DFO 2010), Ocean quahog and whelk are widely distributed in the North Atlantic, and the ocean quahog stock on nearby Sable Bank exceeds 1,300,000 t (DFO 2007a), while whelk is

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

reported to occur in greatest densities at a depth of 15 - 30 m (DFO 2009a), shallower than the depth at which the Arctic surfclam fishery occurs. The Grand Bank stock of neither species is subject to targeted fishing (ocean quahog: DFO 2007a, whelk: DFO 2009a), and there is no reason to suspect that the Grand Bank Arctic surfclam fishery poses a risk to the stocks of any retained species.

Score: 90

Although the quantities of Greenland cockle and northern propellerclam taken in the fishery are substantial in relation to the Arctic surfclam catch, other retained species are taken in very limited quantities. The widespread distribution and limited removals of these species by this and other fisheries allows for a high degree of certainty that retained species are within biologically-based limits, thereby meeting the first scoring issue of SG 100. However, target reference points are not defined, and so the fishery does not meet the second scoring issue of SG 100. The fishery therefore scores 90 for this performance indicator.

Audit Trace References

DFO 2007a, DFO 2009a, DFO 2010, Kilada *et al*. 2007, Kilada *et al*. 2009

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.1.2 ***Management strategy:*** There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is a partial strategy in place, if necessary that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved. There is some evidence that the partial strategy is being implemented successfully.	There is a strategy in place for managing retained species. The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work. There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its overall objective.

Scoring Comments

The bar spacing employed in the dredges ensures that northern propellerclam and Greenland cockle are unlikely to be selected for in the Grand Bank Arctic surfclam fishery until well after they have matured. Maturity data on ocean quahog suggest that some individuals may be below the age of first maturity when first selected (DFO 2007a), but the majority of the southern Grand Bank appears to represent marginal habitat for this species (e.g. Figure 16). Also, there is a 10% bycatch or 500 t maximum TAC for ocean quahog on the Grand Bank. Whelks are found in greatest abundance at a shallower depth than that at which the Arctic surfclam fishery occurs on Grand Bank (DFO 2009a). These features, including that only a small area of the bank (≈ 0.5% of the Arctic surfclam habitat) is likely to be fished each year, constitute a partial strategy to manage retained species bycatch at sustainable levels. Survey and comprehensive landed catch data are available.

Score: 80

The measures in place to manage the Arctic surfclam fishery constitute a partial strategy that is expected to maintain retained species at levels which are highly likely to be within biologically-based limits, so meeting the first scoring issue of SG 80. There is objective basis for confidence that the partial strategy will work, based on evidence from the landings and survey data that show the catches are being maintained at moderate levels, and because the age of maturity is well before the animals are likely to be selected for. These data also provide evidence that the partial strategy is being implemented successfully, so meeting the second and third scoring issues of SG 80. A lack of specific objectives pertaining to bycatch levels, and therefore the existence of a specific strategy for managing retained species, prevents the fishery from scoring higher for this performance indicator.

Audit Trace References

DFO 2007a, DFO 2009a

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.1.3	***Information / monitoring:*** Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species.	Qualitative information is available on the amount of main retained species taken by the fishery. Information is adequate to qualitatively assess outcome status with respect to biologically based limits. Information is adequate to support measures to manage main retained species.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery. Information is sufficient to estimate outcome status with respect to biologically based limits. Information is adequate to support a partial strategy to manage main retained species. Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations. Information is sufficient to quantitatively estimate outcome status with a high degree of certainty. Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective. Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.

Scoring Comments

The Grand Bank Arctic surfclam fishing vessels are monitored continuously with VMS, and dockside monitoring occurs at all landings (DFO 2011c). In combination with the absence of a quota for northern propellerclam, Greenland cockle, ocean quahog or whelk, this means that there is comprehensive reporting of all retained species catches (i.e. because there is no incentive for under-reporting bycatch levels). However, it is understood that the actual landings data are confidential due to the small number of vessels and single company prosecuting the fishery. Fishery dependent data are available, though, that provide information on bycatch species including retained molluscan shellfish (DFO 2010), while survey data are available for a much wider area of the Grand Bank (Roddick *et al.* 2011). No quantitative analysis has apparently been undertaken on the catch data in order to understand the impacts of the fishery on the retained species, but the information on size at maturity and age structure in the stocks, habitat preferences of the different species, as well as the swept area of the fishery, suggest strongly that the Grand Bank Arctic surfclam fishery does not pose a risk to stocks of retained species.

Score: 90

The comprehensive VMS and dockside monitoring of the fishery provide accurate and verifiable information on the catches of all retained species, while the broad age structure of the stocks, fishing activity distribution and absence of other fisheries targeting these species or taking large quantities as bycatch on the Grand Bank is adequate to understand the consequences for the status of all affected populations, so meeting the first scoring issue of SG 100. Information is also adequate to support a comprehensive strategy to manage these species, and to evaluate with a high degree of certainty if it was achieving its objective, so meeting the third scoring issue of SG 100. The information is sufficient to estimate outcome status with respect to biologically based limits, and to detect an increase in risk level, so meeting the second and fourth scoring issues of SG 80. Overall, the fishery scores 90 for this PI.

Audit Trace References

DFO 2007a, DFO 2010, DFO 2011c, Roddick *et al.* 2011.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

2.2	Discarded species (also known as “bycatch” or “discards”)			
2.2.1	***Status*** The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups.	Main bycatch species are <u>likely</u> to be within biologically based limits, or if outside such limits there are mitigation <u>measures</u> in place that are <u>expected</u> to ensure that the fishery does not hinder recovery and rebuilding. If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.	Main bycatch species are <u>highly likely</u> to be within biologically based limits or if outside such limits there is a <u>partial strategy</u> of <u>demonstrably effective</u> mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	There is a <u>high degree of certainty</u> that bycatch species are within biologically based limits.

Scoring Comments

Sampling from the 2002-2009 Grand Bank fishery showed that sand dollars, *Echinarachnius parma*, made up just under 19% of the catch. No other bycatch species made up more than 1% of the total (DFO 2010). A survey of the bank also recorded *E. parma* as being the only species that could be considered to be a 'main' bycatch species, but it comprised a higher percentage (26.62%) of the survey catch. The common sea cucumber, *Cucumaria frondosa*, also made up 2.89% of the survey catch when it was not recorded in the commercial catch sampling data (Roddick *et al.* 2011).The survey data are not necessarily representative of the commercial fishery, however, as the survey covers a wider area than is fished in the commercial fishery, including marginal habitats for Arctic surfclam, and employs a dredge with a narrower bar spacing that is likely to retain a higher proportion of the animals in the path of the dredge.

While observed catches make up part of the impact of the fishery on bycatch species, there will also be an unobserved fishing mortality of animals located in the path of the dredge that are either swept aside or pass through the dredge bars. This is certainly the case for northern propellerclam as a retained species (Gilkinson *et al*. 2005), but is also highly likely for fragile species such as *E. parma*. However, while the magnitude of post-dredging mortality is not known, Gilkinson *et al.* (2005) reported little or no change in abundance of *E. parma* immediately post experimental dredging on the Banquereau site. Movement of animals on the seabed is likely to account for this lack of a detectable change. Also, this echinoderm species is very widespread, with a circumpolar distribution in the northern hemisphere (Mooi & Telford 1982).

There is very likely to be some unobserved mortality of the other bycatch species recorded in the fishery data, although the greatest catch of any other species was for the *Cancer* spp. crabs, which made up just 0.53% of the total. The fish species taken in greatest quantity in both survey and commercial catches was sand lance, which accounted for 0.06% of the survey catch and 0.09% of the commercial catch. Although some unobserved mortality of fish species will occur, it is considered that these quantities will be negligible given the very limited quantities taken as bycatch. When considering that only ≈ 0.5% of the Arctic surfclam habitat on Grand Bank appears likely to be fished in any year, it is very unlikely that the fishery poses a risk to stocks of bycatch species.

Score: 80

The widespread distribution of *E. parma*, evidence of lack of detectable change in the population post-dredging at the Banquereau experimental site, and limited swept area of

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

the fishery mean that this single main bycatch species is highly likely to be within biologically-based limits, so meeting SG 80. However, lack of a specific assessment of bycatch species against biologically-based limits prevents the fishery from meeting the high degree of certainty required for SG 100.
Audit Trace References
DFO 2010, Gilkinson *et al.* 2005, Mooi & Telford 1982, Roddick *et al.* 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.2.2	***Management strategy:*** There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations.	There are <u>measures</u> in place, if necessary, which are expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery. The measures are considered <u>likely</u> to work, based on plausible argument (e.g general experience, theory or comparison with similar fisheries/species).	There is a <u>partial strategy</u> in place, if necessary, for managing bycatch that is expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery. There is <u>some objective basis for confidence</u> that the partial strategy will work, based on some information directly about the fishery and/or the species involved. There is <u>some evidence</u> that the partial strategy is being implemented successfully.	There is a <u>strategy</u> in place for managing and minimising bycatch. The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports <u>high confidence</u> that the strategy will work. There is some <u>evidence</u> that the strategy is achieving its objective. There is <u>clear evidence</u> that the strategy is being implemented successfully, and intended changes are occurring.

Scoring Comments

The only main bycatch species in the Grand Bank Arctic surfclam fishery is sand dollar, *E. parma* (DFO 2010). This species is very widely distributed (Mooi & Telford 1982), and is not a target species in any fishery. Additionally, although the levels of unobserved mortality of animals that pass through or are swept aside by the dredge may be significant but are unknown, little or no change in abundance of *E. parma* was reported immediately following experimental dredging on Banquereau (Gilkinson *et al.* 2005). There is no reason to suspect that results from a similar experiment on Grand Bank would be significantly different. In fact, the dredge design, with a space between the dredge head and the cage, will allow some animals in the path of the dredge to escape before being retained. Most importantly, though, only ≈ 0.4% of the bank is likely to be fished with dredges each year, ensuring the benthic community is minimally impacted.

The IFMP also contains this objective related to bycatch (DFO 2011c):

- Minimize incidental mortality of non-target species.

While this objective is listed, there are no specific actions associated with it. However, the IFMP notes that bycatch mortality of other species is minimal, and that the dredge impact study from Banquereau indicates that the benthic community impacted by the gear is resilient to the disturbance caused by the fishery.

Score: 95

The characteristics and location of the fishery, in combination with the community present on Grand Bank, ensure that bycatch is maintained at generally low levels; together with the on-going long-term dredge study on Banquereau and the formal objective of the IFMP, these features of the fishery comprise a strategy for managing and minimising

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

bycatch, so meeting the first scoring issue of SG 100. The strategy is based on information directly about the fishery and species involved, while testing from the Banquereau dredge impact study supports high confidence that the strategy will work and that it is achieving its objective, so meeting the second and third scoring issues of SG 100. While there is evidence that the strategy is being implemented successfully, it is not clear that changes are intended or are occurring, so meeting the third scoring issue of SG 80. Any unnecessary bycatch must be considered to be unwelcome, but there are generally very low levels of bycatch of most species, while *E. parma*, as the single bycatch species taken in large quantities, is abundant and widely distributed. A score of 95 is awarded for this performance indicator.

Audit Trace References

DFO 2010, DFO 2011c, Gilkinson *et al.* 2005, Mooi & Telford 1982.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.2.3	***Information / monitoring*** Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch.	Qualitative information is available on the amount of main bycatch species affected by the fishery. Information is adequate to broadly understand outcome status with respect to biologically based limits. Information is adequate to support measures to manage bycatch.	Qualitative information and some quantitative information are available on the amount of main bycatch species affected by the fishery. Information is sufficient to estimate outcome status with respect to biologically based limits. Information is adequate to support a partial strategy to manage main bycatch species. Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Accurate and verifiable information is available on the amount of all bycatch and the consequences for the status of affected populations. Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty. Information is adequate to support a comprehensive strategy to manage bycatch, and evaluate with a high degree of certainty whether a strategy is achieving its objective. Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.

Scoring Comments

Survey and fishery data provide quantitative information on the amount of bycatch taken in the Grand Bank Arctic surfclam fishery. The sand dollar, *E. parma*, is the only main bycatch species (DFO 2007a). No formal assessment has been undertaken to determine how or if the fishery impacts this species with respect to biologically-based limits, but information on its widespread distribution (Mooi & Telford 1982), the extent of the fishery, and lack of observed impact on numbers after experimental dredging (Gilkinson *et al.* 2005), is sufficient to determine that the fishery poses no risk to this species. The fishery is also considered to pose no risk to the other bycatch species, based on the very limited quantities taken and annually small spatial extent of the fishery.

Observers are only carried on an average of 1 trip out of 20 per year (CSLP, pers. comm.), but the landed catch and VMS data are comprehensive, providing information on the likely levels of bycatch in the fishery based on relative quantities of catch and area swept; this provides sufficient detail to determine any increase in risk to bycatch species.

Score: 80

Qualitative and some quantitative information is available on the amount of bycatch taken in the fishery, which is sufficient to estimate outcome status with respect to biologically based limits. The fishery therefore meets the first and second scoring issues of SG 80. Information is adequate to support a partial strategy to manage bycatch species, and sufficient data continue to be collected to detect any increase in risk to main bycatch species, so meeting the third and fourth scoring issues of SG 80. In order to score higher, accurate and verifiable information on the amount of all bycatch would need to be collected more frequently and in greater detail aboard the fishing vessels, and

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

the consequences for the status of affected populations, including with respect to biologically based limits, would need to be assessed.
Audit Trace References
DFO 2007a, Gilkinson *et al*. 2005, Mooi & Telford 1982.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

2.3	Endangered, Threatened and Protected (ETP) species			
2.3.1	***Status:*** The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.	Known effects of the fishery are <u>likely</u> to be within limits of national and international requirements for protection of ETP species. Known direct effects are <u>unlikely</u> to create <u>unacceptable impacts</u> to ETP species.	The effects of the fishery are known and are <u>highly likely</u> to be within limits of national and international requirements for protection of ETP species. Direct effects are <u>highly unlikely</u> to create <u>unacceptable impacts</u> to ETP species. Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a <u>high degree of certainty</u> that the effects of the fishery are within limits of national and international requirements for protection of ETP species. There is a <u>high degree of confidence</u> that there are <u>no significant detrimental effects (direct and indirect)</u> of the fishery on ETP species.

Scoring Comments

MSC guidance is that species on non-binding lists (e.g. the IUCN Red List) or requirements that are recognised at intergovernmental level (e.g. FAO International Plans of Action) but that are not included in national legislation or binding international agreements etc. shall be assessed under performance indicators covering retained or bycatch species (MSC 2010). As such, species that are listed by COSEWIC but are not SARA-listed are considered under PI 2.1.1 - PI 2.2.3, and it is only SARA-listed or internationally protected species that are considered to be ETP species under this assessment.

It is very unlikely that any ETP species of seabird, whale, dolphin or turtle will be impacted by the gear directly, and there is no suggestion that the fishery would cause indirect harm to habitats or feeding opportunities for these species; none of these species have been reported in survey or catch data. It is therefore only the SARA-listed northern, spotted and Atlantic wolffish as ETP species that are of potential relevance to the Arctic surfclam fishery. However, while Grand Bank is within the potential geographic range of these three wolffish, in all cases, survey and catch data indicate that no direct mortality occurs (DFO 2010, Roddick *et al.* 2011). Importantly, the distribution of the three wolffish species is focused in deeper water than is fished for Arctic surfclam, while the potential for the fishery to impact spawning sites is very low due to the reported preference for wolffish to spawn in stony or rocky habitats (Kulka *et al.* 2007).

Score: 100

There are no reports of ETP species being taken in the Grand Bank Arctic surfclam fishery, and there is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species (i.e. for wolfish, as specified by Kulka *et al*. 2007), and there is a high degree of confidence that there are no significant detrimental direct or indirect effects of the fishery on ETP species. All the scoring issues are therefore met and a score of 100 is awarded to the fishery.

Audit Trace References

DFO 2010, Kulka *et al.* 2007, Roddick *et al.* 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.3.2	***Management strategy*** The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.	There are measures in place that minimise mortality, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species. The measures are considered likely to work, based on plausible argument (eg general experience, theory or comparison with similar fisheries/species).	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, that is designed to be highly likely to achieve national and international requirements for the protection of ETP species. There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and/or the species involved. There is evidence that the strategy is being implemented successfully.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, that is designed to achieve above national and international requirements for the protection of ETP species. The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work. There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is evidence that the strategy is achieving its objective.

Scoring Comments

The hydraulic dredge gear employed in the Arctic surfclam fishery has a very low and narrow mouth opening, such that the potential for large ETP species, such as whales or turtles, to be impacted appears to be almost non-existent. There is no reason to suspect that ETP seabirds are impacted in any way by the fishery. Also, the gear can only be operated efficiently on well-sorted sandy sediments; in order to ensure the gear is only used on suitable sediments, the vessels are equipped with Roxanne seabed discrimination systems (CSLP, pers. comm.). As such, and because the Arctic surfclam fishery occurs in shallower waters than the main areas of wolffish abundance, while wolffish also prefer to spawn in rocky substrates (Kulka *et al.* 2007), the potential for the fishery to impact wolffish or their habitat is very limited. Survey and catch data support these assertions (DFO 2010, Roddick *et al*. 2011). These features of the fishery can be regarded as a strategy for managing the fishery's impact on ETP species.

The IFMP requires that the offshore clam fishery participants take all feasible measures to minimize the impact on listed species and their residences, and that the survival or recovery of listed species will not be jeopardized. The Species at Risk Act (2002) also requires that *A. denticulatus* or *A. minor* captured while fishing must be returned to the place from which they were taken, and where they are alive, in a manner that causes them the least harm.

Score: 80

Features of the fishery can be considered to be a strategy for managing its potential impact on ETP species that is designed to be highly likely to achieve national and international requirements, and so the fishery meets the first scoring issue of SG 80. There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and on the species involved, while data from the fishery provides evidence that the strategy is being implemented successfully, such that the fishery meets the second and third scoring issues of SG 80. It is not considered that the strategy is designed to achieve above national and international requirements, and no quantitative analysis has been undertaken, so preventing the fishery from meeting the first and second scoring issues of SG 100, while a greater level of observer coverage would be required in order to meet the final scoring issue of SG 100.

Audit Trace References

DFO 2010, DFO 2011c, Kulka *et al.* 2007, Roddick *et al.* 2011.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.3.3	***Information / monitoring*** Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.	Information is adequate to broadly understand the impact of the fishery on ETP species. Information is adequate to support measures to manage the impacts on ETP species Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and if so, to measure trends and support a full strategy to manage impacts. Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty. Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives. Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species

Scoring Comments

The CSLP vessels engaged in the Grand Bank Arctic surfclam fishery are monitored 100% of the time with VMS, logging each vessel's location and speed. Northern, spotted and Atlantic wolffish are the ETP species that appear to be at greatest risk from the fishery as their ranges overlap with the fishery (Kulka *et al.* 2007). However, information on habitat preferences suggest that all three wolffish prefer deeper water than is targeted by the fishery, and that they prefer rockier bottoms for spawning than is targeted. Also, the available survey and fishery catch data show an absence of wolffish in Arctic surfclam catches from Grand Bank (DFO 2010), and no wolffish were reported in surveys of fishery catches from the Grand Bank from 2004 - 2009 (Roddick *et al*. 2011). These data provide confidence that the fishery does not pose a direct or indirect threat to the protection or recovery of ETP species.

Score: 85

Information is sufficient to determine that the fishery is not a threat to the protection and recovery of ETP species, so meeting the first scoring issue of SG 80. Sufficient data are also available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species, while information on fishing location, habitat preference for the three wolffish species, gear type and substrate limitations of the gear, as well as catch and survey data, is adequate to support a comprehensive strategy to manage impacts (even if one is not in place), and to evaluate with a high degree of certainty whether the strategy was achieving its objectives, so meeting the second scoring issue of SG 100. Greater amounts of accurate and verifiable information from the commercial fishery, for example through an increased level of observer coverage, that also allowed the qualitative estimation outcome status with a high degree of certainty, would be required for the fishery to achieve a higher score.

Audit Trace References

DFO 2010, Kulka *et al*. 2007, Roddick *et al*. 2011.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

2.4	Habitat

2.4.1	***Status*** The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.

Scoring Comments

Hydraulic dredges can only be used effectively in well-sorted sandy sediments, and Arctic surfclams are found in relatively shallow depths of less than 110 m. Commercially exploited Arctic surfclam beds are found in depths of ≤ 70 m (CSLP, pers. comm.). An experimental dredge impact study was started on nearby Banquereau in 1998, and repeat surveys have been undertaken to assess recovery. The survey area is 70-80 m depth, such that habitat recovery might be expected to be as slow as is ever likely to occur on the commercial beds (i.e. deep areas are likely to recover slower than shallow areas as natural perturbation is lessened at deeper depths). Although dredging produces pronounced tracks through fluidising and digging through the sediment at depths of up to 20 cm, visual evidence of the tracks had disappeared in the experimental site after one year (Gilkinson *et al*. 2005). Preliminary results indicated that side-scan sonar was barely able to detect dredge tracks after 10 years (DFO pers. comm.). This contrasts with evidence from a site at 40 m depth on Sable Bank, where 6 of 12 dredge tracks were reported to be undetectable after just one year (DFO 2010). There is no reason to suspect that the habitats in which Arctic surfclams are targeted on Grand Bank would have a significantly slower recovery time, and a study of otter trawling impacts in 120 - 146 m water depth on Grand Bank determined that the physical structure of the habitat had recovered in a year or less (Gordon *et al*. 2002).

An important consideration is the MSC's interpretation of the words 'serious' and 'irreversible' in relation to harm. It is stated: "*Serious harm relates to gross change in habitat types or abundances, and disruption of the role of the habitats. Irreversibility relates to changes that are expected to take much longer to recover than the dynamics in unfished situations would imply (e.g. some sort of regime change is implied from which recovery may not automatically occur) ... The full extent of the habitats shall be considered in assessing the status of habitats and the impacts of fishing, and not just the part of the habitats that overlap with the fishery.*" (MSC 2010).

Although some habitat disturbance must occur on Grand Bank through the use of hydraulic dredges, the area covered by the tracks is small in comparison to the area of the bank. From 1989 to 2009 (21 years), approximately 1,138 square km of Grand Bank were swept by the fishery, representing ≈ 2.3% of the Arctic surfclam habitat. This includes periods when little of the available TAC was taken, however, so a more likely annual figure at full exploitation is probably closer to 0.4% of the surveyed Arctic surfclam habitat. However, in the Banquereau Arctic surfclam fishery, which has been more heavily prosecuted in recent years than the fishery on Grand Bank, vessels have returned to areas that were previously found to support high Arctic surfclam biomass after a fallow period of approximately 10 years, suggesting that some sites will be fished more frequently and intensively than others, thereby limiting the geographic range of impact (CSLP, pers. comm.). Further, the estimate of swept area fails to correct for any overlap of tows, and so represents the worst case scenario (DFO 2010).

Score: 100

No specific work has been undertaken to determine the impact of the Arctic surfclam fishery on the seabed habitat of Grand Bank. Data are available from otter trawling on Grand Bank, and from hydraulic dredging on Banquereau, however, and, together with the very limited swept area of the fishery, these provide evidence that the Grand Bank Arctic surfclam fishery is highly unlikely to reduce habitat structure and function to a point where there would be a serious or irreversible harm. As such, the fishery meets SG

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

100.
Audit Trace References
DFO 2010, Gordon *et al.* 2002, Gilkinson *et al.* 2005, MSC 2010.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.4.2	***Management Strategy*** There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance. The measures are considered likely to work, based on plausible argument (e.g general experience, theory or comparison with similar fisheries/habitats).	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above. There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved. There is some evidence that the partial strategy is being implemented successfully.	There is a strategy in place for managing the impact of the fishery on habitat types. The strategy is mainly based on information directly about the fishery and/or habitats involved, and testing supports high confidence that the strategy will work. There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its objective.

Scoring Comments

Hydraulic dredging can only be undertaken in sandy sediments, and the fishery takes place in relatively shallow water of less than 70 m depth that is subject to levels of natural perturbation. The fishing vessels utilise Roxanne ground discrimination gear to ensure the dredges are used in areas that are appropriate for Arctic surfclams (CSLP, pers. comm.). Comprehensive VMS data from the fishery are available that demonstrate the limited area over which the fishery has operated since 1989.

Experimental dredge impact work on nearby Banquereau has provided data showing recovery of the seabed habitat within about 10 years, although the depth of the experimental site suggests that this timescale is likely to be a worst case scenario, and recovery has been shown to be faster at shallower depths on Sable Bank (Gilkinson *et al.* 2005). It is important that the annual swept area of the fishery is restricted in part by the TAC; while the TAC is set at the current level, the area of Grand Bank that is fished is limited. While it may increase from the existing mean annual level of 0.1% of the area of surfclam habitat, a brief analysis suggests that it is unlikely to significantly exceed 0.4% of the surfclam habitat annually. Any significant increase to the TAC, and the potential for that to result in significantly increased impact on habitats, would be assessed through the regular surveillance audit process.

Score: 80

The various features of the fishery that limit the extent and duration of any effects, including the TAC, can be considered to constitute a partial strategy for managing the impact of the fishery on Grand Bank habitats, such that the fishery meets the first scoring issue of SG 80. The experimental work from nearby Banquereau and the comprehensive VMS data that is available from the Grand Bank also allows the fishery to meet the second scoring issue of SG80. Comprehensive VMS data provide the evidence required in order to meet the final scoring issue of SG 80. As such, the fishery scores 80 for this PI. The fishery would score higher if specific work was undertaken on Grand Bank.

Audit Trace References

DFO 2007a, Gilkinson *et al.* 2005, Kostylev 2004, Stanley *et al.* 1972)

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.4.3	***Information / monitoring*** Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.	There is a basic understanding of the types and distribution of main habitats in the area of the fishery. Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear	The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery. Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear. Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types. Changes in habitat distributions over time are measured. The physical impacts of the gear on the habitat types have been quantified fully.

Scoring Comments

Hydraulic dredges can only be used in well sorted, sandy sediments. Clearwater Seafood's vessels are equipped with Roxanne ground discrimination equipment and are able to target appropriate habitats (CSLP, pers. comm.). Habitats on the southern Grand Bank appear not to have been mapped in detail in a publicly available format, but work to predict the likelihood (% probability) of seabed stress sufficient to mobilise sediments suggests that the areas of the Grand Bank that are prosecuted for Arctic surfclams are highly likely to suffer high levels of natural perturbation (Geological Survey of Canada, pers. comm.). Comprehensive data on the distribution of the fishery is available through the 100% VMS coverage, and these show that the fishery has covered an average of only 0.11% of the Arctic surfclam habitat on Grand Bank each year (DFO 2010). Although this would almost certainly be exceeded if the fishery was fully exploited, the data suggest that, if that was the case, no more than 0.4% of the area surveyed for Arctic surfclam on the Grand Bank would be swept annually. An ongoing benthic impacts study on Banquereau has provided specific data to inform managers and participants in the fishery on the effects on, and recovery rates of, the types of habitats targeted for Arctic surfclams, showing that the dredge tracks had all but disappeared after approximately 10 years (Gilkinson *et al*. 2005).

Score: 80

The nature and distribution of main habitat types is known at a level that is relevant to the scale of the fishery, and the physical impacts of the gear on the habitat types in which the gear can be used have been identified. There is reliable information on the spatial extent of interactions and on the timing and location of the use of the dredge gear. Sufficient data also continue to be collected to detect any increase in risk to habitats. As such, the fishery meets all of the scoring issues for SG 80. The lack of good quality habitat data on the Grand Bank prevents the fishery from scoring higher.

Audit Trace References

DFO 2010, Gilkinson *et al.* 2005.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

2.5	Ecosystem			
2.5.1	***Status*** The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.	The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

Scoring Comments

Because of the nature of hydraulic dredging as a towed, bottom-fishing activity, the impact of the fishery is focused on the seabed. Sedimentation from the dredging operation is a potential source of impact to the pelagic environment, but this is unlikely to be a significant or long-lasting factor given the high probability of natural seabed perturbation across large areas of the Grand Bank. As such, it is considered that there are no known impacts on the pelagic environment. Although the Grand Bank was previously dominated by large demersal fish species (Taggart *et al.* 1994, Zwanenburg 2000), the timelines of the groundfish collapse and the commencement of the Arctic surfclam fishery indicate that the Arctic surfclam fishery cannot be implicated in the collapse, or in the failure of those species to recover. It may also be noted that the Arctic surfclam fishery was screened-out (i.e. it was not considered to be an impacting activity) in a DFO analysis of all activities potentially impacting spawning cod in this area (DFO 2009f). Furthermore, the very limited quantities of fish bycatch recorded from surveys and commercial catches on Grand Bank, and likely very limited quantities of unobserved mortality of fish species, constitute a negligible impact from the fishery.

Hydraulic dredges, as used in the Arctic surfclam fishery, have a relatively small footprint but dig deeply into sediments and therefore have the potential to effect change in benthic communities. However, the fishery is prosecuted at water depths shallower than 70 m on Grand Bank (CSLP pers. comm.), where natural disturbance will impact the seabed. As such, the benthic community is likely to be somewhat resistant to perturbation from fishing (Jennings & Kaiser 1998).

A dredge impact study was started on nearby Banquereau in 1998. Results showed that benthic species abundance and biomass immediately reduced by approximately 40% on average across the experimental plots. After two years, only four polychaete species still showed decreased abundance with the pre-dredging state, but a number of species had dramatically increased in abundance, including the tube dwelling polychaetes *Euchone papillosa* and *Spiophanes bombyx*, as well as the brittlestar *Ophiura sarsi*, although the latter species is likely to have been due to immigration rather than larval recruitment. Results until 2005 concluded that the disturbed community was still in the colonizing phase (Gilkinson *et al.* 2005), while the results from the repeat survey in 2008 are still being written-up (DFO, pers. comm.). After two years, the Arctic surfclam and other targeted bivalve species were still greatly reduced in abundance, having sustained reductions in biomass of up to 67%. Preliminary analysis suggested there were few juvenile clams found in the grab samples after ten years (DFO, pers. comm.). However, while a lack of recruitment at this timescale could be a concern, episodic and patchy recruitment is to be expected in Arctic surfclam (Roddick *et al.* 2007). Also, the fishery on Banquereau has returned to previously productive areas after 10 years to find that new recruitment to the fishery had occurred (CSLP, pers. comm.). Although data has not been collected on Grand Bank, it is anticipated that results would be similar on Grand Bank.

Clams including Arctic surfclam may be important bioturbators on Grand Bank, such that very high removal levels may be significant for community composition (Gilkinson *et al.* 2005). The Arctic surfclam fishery does not work an area to exhaustion, however, as the economics of the fishery require that the vessels move on before that point. In

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

addition, the gear cannot be worked with very high accuracy, and so unfished patches will be present even in ground that is intensively prosecuted (Roddick & Smith 1999).

It may be noted that the Southeast Shoal and Tail of the Banks EBSA was identified because of the presence of a number of fish species and for populations of wedge clams and blue mussel. However, the very limited bycatch of mobile fish species, limited fishery footprint and analysis of habitat impacts from Banquereau provide evidence that the fishery is highly unlikely that serious or irreversible harm would occur.

Score: 90

The results of experimental work undertaken on nearby Banquereau, together with the limited spatial extent and bycatch profile of the Grand Bank fishery, provide some evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be serious or irreversible harm. The assessment team considers that this goes some way towards meeting the SG 100 scoring issue, without quite fully meeting its intent. In accordance with the MSC Policy Advisory 18, V1 (MSC 2010c), the fishery is therefore scored 90.

Audit Trace References

DFO 2009f, Gilkinson *et al*. 2005, Jennings & Kaiser 1998, MSC 2010c, Roddick & Smith 1999, Roddick *et al*. 2007, Stanley *et al*. 2007, Taggart *et al*. 1994, Zwanenburg 2000.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.5.2	***Management strategy*** There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.	There are measures in place, if necessary, that take into account potential impacts of the fishery on key elements of the ecosystem. The measures are considered likely to work, based on plausible argument (eg, general experience, theory or comparison with similar fisheries/ ecosystems).	There is a partial strategy in place, if necessary, that takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance. The partial strategy is considered likely to work, based on plausible argument (eg, general experience, theory or comparison with similar fisheries/ ecosystems). There is some evidence that the measures comprising the partial strategy are being implemented successfully.	There is a strategy that consists of a plan, containing measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm. The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved. There is evidence that the measures are being implemented successfully.

Scoring Comments

Canada's Oceans Act (1997) requires consideration of the impacts of all human activities on the respective ecosystem, while the 2002 Oceans Strategy requires stakeholders and regulators to work together to decide how best to manage designated geographic areas of the ocean. The Placentia Bay - Grand Bank LOMA is the integrated management program covering Grand Bank that is intended to deliver those commitments. The IFMP contains various specific elements focused on ensuring the fishery poses no threat to ecosystem structure and function, including the overarching objectives for ecosystem-based management that are or will be developed through the Placentia Bay - Grand Bank LOMA process (DFO 2007b):

- Minimize incidental mortality of non-target species.
- The sustainability of human ocean resources, and
- The conservation of species and habitats, including those other ecosystem components that may not be utilized by humans.

The objectives laid out in the IFMP are functionally transformed into a partial strategy through a combination of the precautionary TAC for Arctic surfclam and work undertaken to determine the impact of the dredges on Arctic surfclam habitat and its associated community on nearby Banquereau, which effectively determined that no long term impacts from the fishery are likely (DFO 2011c). On this latter point, hydraulic dredges can only be used efficiently in well-mixed sandy sediments, which is targeted through the use of Roxanne equipment aboard the fishing vessels (CSLP pers. comm.). The fishery then occurs in a small area of the bank in any given year, in relatively

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

shallow water that is subject to natural perturbation, and away from vulnerable components such as the Lilly Canyon - Carson Canyon and Virgin Rocks EBSAs. Given the slightly deeper depth of the experimental dredge impact study site on Banquereau, results suggest that habitats within the fishing area on Grand Bank will recover within approximately 10 years, while recovery of the benthic community, other than the targeted bivalve species, will take at least two years (Gilkinson *et al.* 2005). Enforcement of the Arctic surfclam TAC works to ensure the sustainable management of the Arctic surfclams and the other species of large, bioturbating bivalves.

Score: 95

There is a partial strategy in place to manage the main impacts of the fishery on the ecosystem, and information has been collected to help understand the functional relationships between the fishery and the components and elements of the ecosystem, so meeting the first scoring issue of SG 80. The IFMP has incorporated the available evidence to restrain impacts to ensure the fishery does not cause serious or irreversible harm, and evidence and plausible argument suggest the measures are likely to work, so meeting the second and third scoring issues of SG 100. The 100% VMS and dockside monitoring provide evidence that the measures are being implemented successfully. The fishery therefore meets three of the four requirements of the SG100, and scores 95.

Audit Trace References

Oceans Act 1997, Oceans Strategy 2002, DFO 2007b, DFO 2011c, Gilkinson *et al.* 2005.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
2.5.3	***Information / monitoring*** There is adequate knowledge of the impacts of the fishery on the ecosystem.	Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity). Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.	Information is adequate to broadly understand the key elements of the ecosystem. Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but may not have been investigated in detail. The main functions of the Components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known. Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred. Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated. The impacts of the fishery on target, Bycatch, Retained and ETP species and Habitats are identified and the main functions of these Components in the ecosystem are understood. Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred. Information is sufficient to support the development of strategies to manage ecosystem impacts.

Scoring Comments

Because of the nature of hydraulic dredging as a towed, bottom-fishing activity, the impact of the fishery is focused on the seabed, and there are no known impacts on the pelagic environment.

The importance of the various areas and elements of the Grand Bank ecosystem were reviewed through the Placentia Bay - Grand Banks LOMA process, and the Southeast Shoal and Tail of the Banks and Lilly Canyon - Carson Canyon EBSAs were listed in the group of possible EBSAs to be taken forward, for reasons including their overall benthic biomass, importance as a spawning area for various animals including bivalves and depleted fish species (DFO 2007b). Experimental data have determined that recovery of the majority of the community after dredging takes at least several years at impacted sites, and that the targeted bivalve species can take much longer (Gilkinson *et al.* 2005). However, the fishery covers only a small percentage of the bank each year, and the vessels move on well before an area is comprehensively swept by the gear (Roddick & Smith 1999). Moving on before an area is fully swept means that there will be areas of unimpacted ground from where the community can start the recovery

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

process through emigration (Kaiser *et al.* 2002; Roddick *et al.* 2007), and also means that the role of large clam species as bioturbators will not be eliminated from an area. Individuals of large fish species are expected to move out of the way of the narrow and slow-moving dredge gear, and this is reflected in the data available showing the extremely low levels of fish bycatch recorded from the survey (Roddick *et al.* 2011) or fishery (DFO 2010). There may be a small amount of unobserved mortality of fish species, but the quantities of observed fish bycatch mean that this mortality is highly unlikely to be anything other than negligible.

Vessels are monitored 100% of the time with VMS, while landings from the fishery are monitored 100% at the dock. There is only very limited observer coverage in the fishery, however. The long-term benthic impacts study from Banquereau will provide data to increase understanding of the long-term impacts of the fishery on habitats and recovery rates.

Score: 90

Information is sufficient to broadly understand the key elements of the Grand Banks ecosystem, and the main functions of the components of the ecosystem are known, so meeting the first and third scoring issues of SG 80. The main impacts of the fishery on these key ecosystem elements can be inferred from existing information and have been investigated, while sufficient information is available on the impacts of the fishery on retained, bycatch, ETP species and the habitats to allow the main consequences for the ecosystem to be inferred, satisfying the second and fourth scoring issue of SG 100. It is considered that sufficient data continue to be collected to detect any increase in risk level, so meeting the final scoring issue of SG 80. The fishery therefore scores 90 for this PI. The fishery would score higher if specific work was undertaken on Grand Bank.

Audit Trace References

DFO 2007b, DFO 2010, Gilkinson *et al.* 2005, Kaiser *et al.* 2002, Roddick & Smith 1999, Roddick *et al.* 2007, Roddick *et al.* 2011.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

Principle 3	The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable

3.1	Governance and Policy

3.1.1	**Legal and/or customary framework** The management system exists within an appropriate and effective legal and/or customary framework which ensures that it: - Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; - Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework.	The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2. The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system. Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery. The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2. The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery. The management system or fishery is attempting to comply in a timely fashion with binding judicial decisions arising from any legal challenges. The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective. The management system or fishery acts proactively to avoid legal disputes or rapidly implements binding judicial decisions arising from legal challenges. The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.

Scoring Comments

Canadian fisheries management has a well-established legislative and policy framework. As noted Section 6.1 above, the federal government has jurisdiction for seacoast and inland fisheries in Canada, and it has enacted several pieces of legislation that govern fisheries, the most important of which is the Fisheries Act. That Act grants authority for fisheries management to the Minster of Fisheries and Oceans as well as providing the power to enact regulations governing a wide variety of management measures of which

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

the Atlantic Fishery Regulations, 1985 and the Fishery (General) Regulations (1985) are the main legal instruments governing the fishery. Management measures are developed under the authority of the Act and the regulations and ministerial powers are delegated to officials of the DFO. All areas of management responsibilities and roles are clearly defined within the department and fishery management programs are delivered in an organized and controlled manner. There is an elaborate sanction and penalty structure in the Act and regulations; as well as a ticketing and court based program for the resolution of legal disputes. Government legislation and policy ensures the protection of aboriginal rights although there is no current participation in the offshore clam fishery by aboriginal people.

Several policy initiatives have been developed to guide decision-making in the management of fisheries in Canada, three of which are important for this assessment. The "Policy Framework for the Management of Fisheries on Canada's Atlantic Coast" (DFO 2004) envisions robust fisheries that include all stakeholders and which are biologically and economically sustainable. The "Sustainable Fisheries Framework" requires the incorporation of the precautionary and ecosystem approaches into fisheries management decisions (DFO 2009c). Finally, the "Aboriginal Fisheries Strategy" which is aimed at ensuring that aboriginal entitlements are respected in the development of stable fisheries management regimes for aboriginal peoples (DFO 1992).

Legal disputes respecting fishing are adjudicated quickly and fairly in a public forum through the Canadian judicial process and have been shown to be effective. For example, disputes regarding aboriginal fishing rights have been fairly resolved (R.v Sparrow, R.v Marshall) and have led to current legislation and policy that ensures the protection of aboriginal rights. While there is currently no aboriginal presence in the offshore clam fishery, the IFMP requires that First Nations representatives be advised of meetings and can attend at their discretion (DFO 2011c). The legal and policy framework has been otherwise tested on several occasions in such areas as licencing (Saulnier v The Royal Bank), fishing rights and allocation practices {Larocque v. Canada (Minister of Fisheries and Oceans)} and through numerous prosecutions in an open and transparent process. The system has quickly reacted to implement binding legal decisions.

Many disputes, legal and otherwise, are avoided through a proactive co-management advisory process and frequent communication between the regulator and the fishery participants.

All management regimes described are consistent with the United Nations Convention on the Law of the Sea (UN 1982) as well as with the main principles of the 1995 Food and Agriculture Organisation Code of Conduct for Responsible Fishing (FAO 1995).

Score: 100

The Canadian management system contains a legal and customary framework of legislation and policy guidelines that ensure consistency with national and international laws and standards aimed at achieving sustainable fisheries. The Canadian system for the settlement of legal disputes is fair and transparent, has been tested and proven to be effective. The system seeks to avoid disputes and respect legal and customary rights of participants through legislation and policy. The management system has been tested and proven to be effective. All scoring issues of SG 100 are met.

Audit Trace References

DFO 1992; DFO 2004, DFO 2009c, DFO 2011c, FAO 1995, Fisheries Act 1985, Territorial Sea Geographic Co-ordinates (Area 7) Order 1985, UN 1982.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.1.2	**Consultation, roles and responsibilities** The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood. The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained. The consultation process provides opportunity for all interested and affected parties to be involved.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used. The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.

Scoring Comments

The Offshore Clam Advisory Committee (OCAC) is the major consultative mechanism for the fishery. Sitting members of the committee include the single licence holder, the regulator (DFO), representatives of the processing sector, First Nations representatives as they wish, representatives of the Provinces of Nova Scotia and Newfoundland and Labrador, and other stakeholders and interested parties. Meetings of the advisory committee are open to the public, and minutes show that interested parties are able to participate. Formal terms of reference outline the structure and purpose of the committee, its administration and membership. The defined purpose of the committee is to provide input and advice to the DFO on the conservation, protection and management of the offshore clam resource. The committee serves as an open and public consultation forum on all issues affecting the offshore clam fishery on Canada's Atlantic coast. The roles and responsibilities of participants are well understood. Information is presented at the meetings of the committee where harvest levels and management measures are considered and recommendations to the regulator are formulated. Local knowledge and input is considered. The management system demonstrates consideration of the information obtained. The terms of reference for the committee require that it meet at least once a year or as otherwise called by the chair (DFO 2011c). The frequency of meetings has not been regular in past years, although that has improved with meetings having been held in 2009, 2010 and 2011. Minutes of meetings are kept, and circulated to members of the committee.

A second committee called the Offshore Clam Management Board (OCMB) is charged with the responsibility to oversee and direct the implementation of the management plan. This committee is composed of two representatives each of the two licence holding companies (both wholly owned by the client) and four representatives of DFO, two each from science and management. The OCMB is co-chaired by an industry member and DFO staff person. The functions and responsibilities of the board are clearly outlined. The terms of reference call for the Board to meet at least once per year and as often as it deems fit, but as with the OCAC, meetings have not been annual. Minutes are kept and circulated to members.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

Score: 65

Interested parties have been identified in the advisory process. The functions, structure, purpose and administration of the advisory committee are clearly outlined in the IFMP and well understood. The management system considers all information presented during the consultative process on key elements of the management of the stocks. The advisory committee process is open to the public and interested parties may register to receive notice of meetings and minutes. There is no provision to make the minutes more publically available to parties that may be interested in the deliberations of the advisory committee but who are not part of the advisory process.

All the scoring issues of SG 60 are met, as is the first of scoring issue of SG 80. However, as the OCAC has not met on a regular basis (including gaps of several years), it cannot be said that the process regularly seeks and accepts relevant information or that the process provides the opportunity for all interested and affected parties to be involved, as required by the last two of the three scoring issues of SG 80. Nor is there a mechanism to inform interested parties who are not already part of the advisory process of upcoming meetings or of the results of such meetings. A score of 65 is therefore awarded and a condition set.

Audit Trace References

DFO 2011c; Minutes of Meetings of OCAC 2001, 2009, 2010; Minutes of OCMB 2004, 2007, 2010; pers knowledge of DFO.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.1.3	**Long term objectives** The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach.	Long-term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are implicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.

Scoring Comments

Canadian fisheries management has a hierarchy of broad policy measures beginning with a solid legislative foundation through the Fisheries Act (1985) and several sets of associated regulations (see 6.4 above). From that legal framework flows an elaborate outline of policy goals, objectives, processes and procedures the most relevant of which are:

Four overarching objectives for fisheries management are outlined in the Atlantic Fisheries Policy Framework - conservation and sustainable use of marine resources and habitat; self-reliant fisheries contributing to the well-being of coastal communities; shared stewardship involving participants in fisheries management decision-making processes and a stable and transparent access and allocation approach through a rules-based process (DFO 2004).

The precautionary and ecosystem approaches are required to be incorporated into all fishery management decisions while protecting biodiversity and fisheries habitat by virtue of the "Sustainable Fisheries Framework" (DFO 2009c).

The "Policy to Manage the Impacts of Fishing on Sensitive Benthic Areas" requires the mitigation of the impacts of fishing on sensitive benthic areas or avoidance of impacts of fishing that are likely to cause serious or irreversible harm to sensitive marine habitat, communities and species (DFO 2009d).

Requirements and procedures for new fisheries are outlined in "The Emerging Species Policy". A cornerstone of the policy is the establishment of a scientific base with which stock responses to new fishing pressures can be assessed (DFO 2008b).

The Aboriginal Fisheries Strategy was developed to implement the Supreme Court of Canada decision that aboriginal people have a right to fish for food, social and ceremonial purposes, a right that takes priority, after conservation, over other users of the resource. The policy seeks to provide stability where DFO manages the fishery and where land claims settlements have not already put a fisheries management regime in place (DFO 1992).

These broad policy guidelines are implemented through fisheries specific objectives that are outlined in species management plans.

Score: 100

All scoring issues of SG 100 are met, there being a clear and explicit legislative and policy framework that guides decision-making in a manner consistent with the MSC Principles and Criteria, including the explicit outline and adoption of the precautionary approach that is required for all fisheries.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

Audit Trace References
DFO 1992, DFO 2004, DFO 2008b, DFO 2009c, DFO 2009d, Fisheries Act 1985;

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.1.4	**Incentives for sustainable fishing** The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices.

Scoring Comments

The individual quota system of fishing provides a quasi property right to the three licence holders. Such stability and security of access provide strong economic incentives to harvest for the long-term, maximize value and not volume, and minimize negative impacts on the stock and its ecosystem. A sense of stewardship is evident in the attitude of the licence holders, through their participation in the advisory process and in their voluntary involvement in research activities. For example, due to the intrusive nature of the fishing gear, the client has joined with DFO to conduct a multi-year collaborative research program to assess the impact of the gear on the bottom habitat and localized organisms. These studies have led to several peer reviewed scientific papers that outline the impacts for the short and long term. The client also participates in abundance surveys with the regulator to gather and analyse data for determining harvest strategies

There is also a detailed legislative penalty structure with significant financial penalties to deter negative behaviour.

Score: 80

The Enterprise Allocation approach to fishing encourages good practices and avoids overharvesting and waste. The client and its Captains take part in surveys, trials and gather information for assessments, while there are neither negative incentives nor subsidies in the fishery. The fishery therefore meets SG 80. As it was not evident that the management system explicitly considered incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices, the requirements of SG 100 are not met.

Audit Trace References

DFO 2011c, Joint Project Agreements (CSLP - DFO), Minutes of the OCAC and OCMB, pers. knowledge DFO

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

3.2	Fishery- specific management system			
3.2.1	**Fishery- specific objectives** The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system.	Short and long term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.	Well defined and measurable short and long term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.

Scoring Comments

Several major fishery-specific objectives are outlined in the IFMP (DFO 2011c):

- Ensure a biologically and economically sustainable offshore clam fishery
- Develop scientifically-based management plans
- Implement collaborative enforcement, monitoring and regulatory measures
- Foster cooperation between the licence holders and DFO to establish management measures that minimize the impacts of harvesting on the habitat

The IFMP goes on to identify management issues and approaches to achieve these objectives.

The IFMP also outlines ecosystem-based management thrusts to maintain the sustainability of ocean resources and the conservation of species and habitats, including those other ecosystem components that may not be utilized by humans. Objectives to achieve these goals include:

- Maintain areas of fishery disturbance to within identified limits (well-sorted sand bottoms) to preserve the diversity of benthic communities
- Prevent significant adverse alteration of coral communities on the Scotian Shelf and Slope by confining the fishery to waters shallower than those in which coral thrives.
- Prevent significant adverse alteration of benthic communities in the Gully Marine Protected Area (MPA) by maintaining safe distances from the area while harvesting offshore clams
- Minimize incidental mortality of non-target species
- Prevent the impact of human activity on spawning and breeding components by leaving 40-50% of the bottom of commercially fished areas undredged

Score: 80

Short and long term objectives are explicit in sections 4 and 5 of the IFMP and are consistent with achieving the outcomes of Principles 1 and 2 supporting a score of 80. The fishery does not meet SG 100 as it cannot be said that the long and short term objectives are operationally defined in such a way that the performance against the objective can be measured as required by the FAM (section 8.3.3).

Audit Trace References

DFO 2011c

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.2.2	**Decision-making processes** The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives.	There are informal decision-making processes that result in measures and strategies to achieve the fishery-specific objectives. Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives. Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. Decision-making processes use the precautionary approach and are based on best available information. Explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. Formal reporting to all interested stakeholders describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.

Scoring Comments

The Offshore Clam Advisory Committee (OCAC) serves as the forum for the discussion of issues on the management and development of the offshore clam fishery providing advice and recommendations to DFO. The decision making process is set out in the IFMP under Purpose and Administration (DFO 2011c). The committee reviews all available information including scientific advice and provides input for the content of the annual management plan, including but not limited to advice on the TAC, regulatory, conservation, compliance and licencing issues. Advice is analyzed by the DFO after which decisions are made and incorporated into the IFMP.

The Minister of DFO is the final decision maker with regard to access, allocations and TACs. Scientific stock status reports are published and made available on DFO websites and information and minutes are distributed to all stakeholders of the Advisory Committee. Management measures are distributed to all harvesters through licence conditions and through Notice to Harvesters bulletins via marine radio. The Offshore Clam Management Board composed of the regulator and the single licence holder deals with day-to-day management of the fishery.

The precautionary approach is required for all fisheries as a matter of policy as outlined in the "Sustainable Fisheries Framework." (DFO 2009c). An example of precautionary decision-making in this fishery is the setting of TACs based on a fishing mortality rate well below the rate of natural mortality.

Score: 80

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

There is a well-established decision making process that follows the precautionary approach based on the best available information and that has produced measures and strategies to achieve the fishery objectives. Explanations for action or lack thereof are circulated to stakeholders, directly at OCAC meetings and in scientific reports through the Canadian Science Advisory Secretariat (CSAS) system, thereby meeting all scoring issues of SG 80.

None of the issues of SG 100 are met as the decision-making processes has not yet responded to all issues that have been identified in relevant research and monitoring. Nor is there a formal reporting process to all stakeholders.

Audit Trace References

Canadian Science Advisory Reports, DFO 2009c, DFO 2011c.

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.2.3	**Compliance and enforcement** Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with.	Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective. Sanctions to deal with non-compliance exist and there is some evidence that they are applied. Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence. Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery. There is no evidence of systematic non-compliance.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules. Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence. There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.

Scoring Comments

DFO reports that there have been no violations in the offshore clam fishery for the past 5 years (DFO pers. comm.).

There is a comprehensive monitoring and surveillance system in place that covers the area of operation of the offshore clam fishery. Vessels are issued a licence containing an extensive list of conditions that is to be on board the vessel at all times for the information of the Captain and crew. Measures such as VMS, hail-in requirement, catch and information reporting, aircraft surveillance, at-sea boardings and 100% dockside weighing of catch ensure good coverage of the fishery. There are one to two observer trips each year in this fishery. A ticket and court-based sanction framework is outlined in the Fisheries Act and regulations with court based prosecution for serious offences through the Canadian Criminal Code (1985). Upon conviction maximum penalties of $500,000 and up to two years in jail may be imposed along with forfeiture of catch and equipment at the discretion of the court.

Score: 95

The Canadian monitoring, control and surveillance system in place for the offshore clam fishery is conducted by well-trained, professional, fishery officers. The coverage is broad and varied consisting of at-sea and dockside components and has been shown to be effective in enforcing the requirements and rules of the fishery. Offenders are pursued and the sanctions under the Fisheries Act are strong deterrents. The offshore clam fleet has not had any serious compliance issues. There is evidence that fishers comply with the management system and provide necessary information through logbooks, VMS and the dockside-monitoring program. However, the low level of observer coverage makes it difficult to conclude that there is a high level of confidence of compliance with the management scheme.

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

There is no evidence of systematic non-compliance. All but the third element of the 100 scoring guidelines are met for a score of 95.

Audit Trace References

Criminal Code 1985, DFO 2011a; DFO 2011c; Fisheries Act 1985

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.2.4	**Research plan** The fishery has a research plan that addresses the information needs of management.	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2. Research results are available to interested parties.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2. Research results are disseminated to all interested parties in a timely fashion.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2. Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.

Scoring Comments

Estimating stock biomass, recruitment levels and determining habitat impacts caused by hydraulic dredging are the principle challenges in the fishery. The IFMP outlines several research programs aimed at these challenges:

- Stock assessments are based on periodic surveys with updates based on analysis of data from commercial fishery and sampling data. The results of the surveys and analysis are subject to peer review at Regional Advisory Process meetings. The target frequency for the surveys is a 5-year cycle in each of the fishing areas. Sable Island Bank was surveyed in 2003 and Banquereau Bank in 2004 and 2010. All surveys are conducted through Joint Project Agreements (JPA) between the client and DFO.
- Resource studies have been ongoing since the 1980s with data indicating that clams reach an age of 40 years or more and size ranges for commercial purposes have been identified between 10-15 years old, well above the age of maturity. With regular recruitment it has been determined that an area may need to be left for 10-15 years before it could be re-harvested.
- With respect to the impact of the hydraulic dredge on the habitat, a multi-year collaborative research program on Banquereau Bank (conditions on the Grand Bank have been determined to be comparable) was begun in 1998 by DFO Science, the Geological Survey of Canada Atlantic and the licence holders. An experimental impact area was identified and dredged in 1998 and repeat surveys have been undertaken to assess recovery. Two DFO reports and three peer-reviewed scientific papers describing the results of the studies have been released. The studies have indicated that the habitat is capable of recovery over a reasonable time period.

Score: 90

The three major focuses of research are identified in section 2.5 of the IFMP and a strategic approach has been developed to address those areas. The scientific approach provides reliable and timely information sufficient to achieve the objectives of Principles 1 and 2.

The research plan is strategic (for example in aiming to research the biology and abundance of retained bycatch species with a view to establishing quota limits), and results are circulated to all interested parties and the public in a timely fashion, either directly to stakeholders, at advisory committee meetings or via the CSAS system on the DFO website. Both scoring issues of SG 80 are met, along with the second scoring issue of SG 100. A score of 90 is therefore awarded. The score would have been higher if the

	SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100

research went beyond the immediate short term needs of management to the creation of a strategic body of research relevant to long term needs as required by the FAM (section 8.3.15) for a 100 score.
Audit Trace References
DFO 2011c, Gilkinson *et al*. 2003, Gilkinson *et al.* 2005 and Gilkinson *et al*. 2011 (in review), Pers. knowledge of DFO

		SCORING GUIDEPOST 60	SCORING GUIDEPOST 80	SCORING GUIDEPOST 100
3.2.5	**Monitoring and management performance evaluation** There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system.	The fishery has in place mechanisms to evaluate some parts of the management system and is subject to occasional internal review.	The fishery has in place mechanisms to evaluate key parts of the management system and is subject to regular internal and occasional external review.	The fishery has in place mechanisms to evaluate all parts of the management system and is subject to regular internal and external review.

Scoring Comments

A general review to evaluate key parts of the management system is conducted at annual OCAC advisory committee deliberations meetings, attended by the licence holders, the regulator (DFO), representatives of the processing sector, First Nations representatives (as they wish), representatives of the Provinces of Nova Scotia and Newfoundland and Labrador, and other stakeholders and interested parties (DFO 2011c).

DFO is in the process of developing a "Fishery Checklist"- an internal diagnostic tool containing more than a 100 questions designed to assess a fishery's status against necessary elements of a sustainable fishery, which will be assist in reviewing the fishery against objectives.

With respect to external review, the Canadian Auditor General (AG) has the authority to review the fisheries management regime on an ad-hoc basis and has done so with respect to Atlantic shellfish and the protection of fish habitat (e.g. OAGC 1999, OAGC 2009). Also, Fisheries and Oceans committees from the Parliament and Senate of Canada occasionally conduct reviews of specific issues in the fishery, including the appearance of the Minister or officials of DFO and the industry as witnesses to the review.

Score: 80

The annual advisory committee reviews the key parts of the management system and there is occasional external review of the management system through the AG of Canada and parliamentary committees thereby meeting SG 80. The score on this indicator would have been higher if there was a regular review mechanism for the review of all parts of the management system against its objectives and if there was a provision for regular external review.

Audit Trace References

DFO 2011c, OAGC 1999, OAGC 2000, OAGC 2004, OAGC 2008, OAGC 2009.

16 APPENDIX B - STAKEHOLDER EVIDENCE FOR SITE VISIT

16.1 Letter from the Sierra Club of Canada, received on the 9th June, 2011.

Rob Blyth-Skyrme June 9, 2011
Banquereau and Grand Banks Arctic surf clam
Marine Stewardship Council Assessment

Dear Rob Blyth-Skyrme:

We write regarding the Banquereau and Grand Banks Arctic Surf Clam Assessment for Marine Stewardship Council certification. We view this assessment in the context of the history of commercial fisheries on Banquereau Bank and the Grand Bank over the past six decades and the position of the aforementioned surf clam fishery in relation to those other fisheries. Similarly we consider the historical context of commercial fisheries management policies and practices as followed by the Canadian Department of Fisheries and Oceans and the role they play in fostering renewability and sustainability as a coastal state in the North-west Atlantic.

It is our understanding that the Surf Clam fishery commenced in the late 1980s early 1990s just prior to the collapse of longstanding commercial groundfish fisheries such as cod and haddock. Those fisheries and others collapsed because of decades of overfishing – an outcome of both international and domestic unsustainable fisheries management practices. While other countries have taken steps to learn from these mistakes and adjust their fishery management policies accordingly, Canada, in our view, has not.

Despite almost two decades of moratoria on fishing for groundfish and other species Canadian fisheries management policy remains entrenched in managing each species individually while refusing to acknowledge the role of ecosystems in supporting healthy oceans and commercial fisheries. While there is much discussion about "ecosystem management" and identifying and closing "vulnerable marine ecosystems," little has been accomplished to realize such precautionary practices. Similarly Canadian fisheries management continues to ignore the negative effects of technological changes in fishing technologies. Rarely have the devastating negative effects of destructive fishing methods and technologies been examined and seldom addressed. According to official departmental policy "No fishing gear is inherently destructive." This despite the numerous studies and practical examples from various jurisdictions which show otherwise.

It is our understanding that the Arctic surf clam fishery involves towing large sleds across the ocean floor resulting in major disturbances of benthic habitat. The targeted species – Surf clams - are known to have long life cycles and are slow to reproduce. From our reading of the information available on their habitat it seems little is known of their roles within the ocean or ecosystem food webs and the effects their removal will have on recovery of the food web and the top predators contained within.

Similarly little is known about the affected marine environments both in terms of the environmental damage already to the benthic habitats and their roles for supporting recovery of the ocean food web and restoration of the ocean's health. Consequently we are very nervous about this and other assessments of fisheries which employ proven destructive technologies which, from numerous past experiences, we know will continue the environmental degradation of valuable marine habitats.

In that context we would encourage adopting the precautionary approach as outlined in the November 2006 United Nations General Assembly Protocol on Sustainable Fisheries and not certify this fishery as sustainable. Many of our members who reside in the Atlantic region have witnessed far too much destruction over the years to recommend otherwise.

Sincerely,

Fred Winsor PhD. (North-west Atlantic fisheries history)

Conservation Chair
Atlantic Canada Chapter
Sierra Club Canada
St. John's, Newfoundland

16.2 Information from the World Wildlife Fund, Canada, received on 17th June, 2011.

I would like to suggest the documents listed below for the consideration of the assessment team. The documents listed below address some of our concerns in regards to habitat and benthic ecosystem impacts associated to the gear utilized in this fishery. We are also concerned with the location where the fishery takes place as part of the Banquereau, and the Grand Banks' Southeast Shoal have been considered Ecologically and Biologically Significant Areas (EBSAs) by DFO and by scientific documents.

Relevant Documents:

A) On corals (including sea pens) and sponges from the area:

Kenchington, E.C., Lirette, C., Cogswell, A.A., Archambault, A., Archambault, P., Benoit, H., Bernier, D., Brodie, B., Fuller, S., Gilkinson, K., Levesque, M., Power, D., Siferd, T., Treble, M., & V. Wareham, 2010. Delineating Coral and Sponge Concentrations in the Biogeographic Regions of the East Coast of Canada Using Spatial Analyses. DFO Canadian Scientific Advisory Secretariat Research Document 2010/041. iv + 207 pp.

B) On trawling impact publications from the Grand Bank and Banquereau Bank:

DFO, 2006. Impacts of Trawl Gears and Scallop Dredges on Benthic Habitats, Populations and Communities. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/025.

Gilkinson, K., 2008, Reliability of Abundance Estimates of the Propellerclam (cyrtodaria siliqua) derived from their burrow openings: A case Study from Banquereau, Eastern Canada. Journal of Shellfish Research, vol. 27 (2): 289-295.

Gilkinson, K.D., Gordon Jr., D.C., Macisaac, K.G., McKeown, D.L., Kenchington, E.L.R., Bourbonnais, C. & P. Vass, 2005. Immediate impacts and recovery trajectories of macrofaunal communities following hydraulic clam dredging on Banquereau, Eastern Canada. ICES Journal of Marine Science 62: 925-947.

Gordon, Jr., D.C., Gilkinson, K.D., Kenchington, E.L.R., Kenchington, C., Bourbonnais, K.G., Macisaac, K.G., McKeown, D. L. W. P. Vass, 2004. Summary of the Grand Banks otter trawling experiment (1993-1995): Effects on benthic habitat and macrobenthic communities. Proceedings of the Symposium on Effects of Fishing Activities on Benthic Habitats: Linking Geology, Biology, Socioeconomics and Management, American Fisheries Society Special Publication 41:411-424.

Gilkinson, K.D., Gordon Jr., D.C., McKeown, D., Kenchington, E.L.R., Macisaac, K.G., Bourbonnais, C. & P. Vass, 2004. Impacts of hydraulic clam dredging on populations of soft corals (Anthozoa: Alcyonacea) on Banquereau, eastern Canada. Proceedings of the Symposium on Effects of Fishing Activities on Benthic Habitats: Linking Geology, Biology, Socieoeconomics and Management, American Fisheries Society Special Publication 41: 383-390.

Gilkinson, K.D., Fader, G.B.J., Gordon Jr., D.C., Charron, R., McKeown, D., Roddick, D., Kenchington, E.L.R., Macisaac, K., Bourbonnais, C., Vass, P. & Q. Liu, 2003. Immediate and longer-term impacts of hydraulic clam dredging on an offshore sandy seabed: effects on physical habitat and processes of recovery. Continental Shelf Research 23:1315-1336.

Kenchington, E., Prena, J., Gilkinson, K.D., Gordon Jr., D.C., Macisaac, K., Bourbonnais, C., Schwinghamer, P.J., Rowell, T.W., McKeown, D.L. & W.P.Vass, 2001. Effects of experimental otter trawling on the Grand Banks of Newfoundland. Canadian Journal of Fisheries and Aquatic Sciences 58:1043-1057.

C) As this fishery on the Grand Banks extends beyond Canadian Exclusive Economic Zone, please find below reference to an important report prepared by the Northwest Atlantic Fisheries Organization (NAFO) Working Group on Ecosystem Approach to Fisheries Management, specifically on Vulnerable Marine Ecosystems (VMEs) present in the NAFO area, including the Southeast Shoal:

NAFO SCS Doc. 08/10, Report of the NAFO Scientific Council Working Group on Ecosystem Approach to

Fisheries Management (WGEAFM), 2008, Serial No. N5511.

The report identifies the Grand Banks' Southeast Shoal as a potential VME due to its unique characteristics, as follows:

"Defined as the shallowest area on the southeastern Grand Banks, the Southeast Shoal is a candidate VME in the NRA, as identified by its "topographical features known to support vulnerable species, communities, or habitats".

The area's physical characteristics make it unique on the Grand Banks. It was the last area of the Grand Banks above sea level prior to the last glacial period, and as past beach habitat, it supports two possible relict bivalve populations, such as the wedge clam (*Mesoderma deauratum*) (Hutcheson and Steward, 1994). On the Grand Banks, the Southeast Shoal is also the only known offshore area for the spawning of 3NO capelin, a population that is at a low level and under moratorium. The area is important habitat for several other species under moratorium or at risk, including cod, American plaice, and striped wolffish. Characteristics, such as capelin spawning beds, flatfish (yellowtail flounder and American plaice) nurseries, and occurrence of long-lived bivalve populations, are a consequence of the physical characteristics and related habitat.

Maintaining the shallow, sandy habitat is important and one would not want to significantly alter the spawning and nursery areas. It is an area of high productivity and biodiversity, and is an important feeding area for several marine mammals, including humpback whales, as well as for various seabirds. It has been identified by Canada as part of an Ecologically and Biologically Significant Area (EBSA) on the southern Grand Bank. Although the area is shallow and much of the bottom is comprised of sand, the SE Shoal would still qualify under several of the criteria suggested in the FAO Guidelines for VMEs."[4]

In this context, it is also important to note relevant commitments undertaken by Canada under United Nations General Assembly resolutions on sustainable fisheries, namely, UNGA resolutions 61/105 (2006) and 64/72 (2009) to avoid and minimize significant adverse impacts of bottom fishing activities on vulnerable marine ecosystems. Relevant provisions of the FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas[5] should also be taken into account in the assessment of the fishery impacts, particularly, Paragraphs: 42, which defines VMEs; 47, which establishes criteria for impact assessments; and 63, on management and conservation tools that should be put in place to protect VMEs, such as fisheries closures and reducing or refraining from expanding the level or spatial extent of effort of vessels involved in deep-sea fisheries.

Even though the FAO Guidelines focus on deep-sea fisheries occurring in areas beyond national jurisdiction, its paragraph 10 encourages States to apply relevant provisions within areas of national jurisdiction. Furthermore, as the fishery in question also takes place in areas beyond Canadian EEZ, the standards adopted by the FAO Guidelines should be observed in the whole fishing footprint area. This is justifiable in the context of the United Nations Convention on the Law of the Sea (UNCLOS) and its implementing Agreement – the Fish Stocks Agreement (UNFSA), which Canada is also a contracting party. In accordance to UNCLOS, Canada has the duty to protect and preserve the marine environment and shall take measures to "protect and preserve rare or fragile ecosystems, as well as the habitat of depleted, threatened or endangered species and other forms of marine life"[6] within and beyond areas of national jurisdiction.

The Fish Stocks Agreement provides for the duty of states to, *inter alia*, apply the precautionary approach, assess the impacts of fishing not only on straddling and highly migratory target stocks, but also on species belonging to the same ecosystem or associated with or dependent upon the target stocks, and to protect marine biodiversity.[7]

D) On habitat impacts:

DFO, Maritime Provinces, "Expert Opinion on Clearwater/Deep Sea Clam Ocean Quahog Development Proposal", Expert Opinion 2002/03 (21 January 2003).

[4] NAFO SCS Doc. 08/10, Report of the NAFO Scientific Council Working Group on Ecosystem Approach to Fisheries Management (WGEAFM), 2008, Serial No. N5511.
[5] FAO, International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (Rome: FAO, 2009).
[6] United Nations Convention on the Law of the Sea [UNCLOS], Article 194 (5).
[7] UN Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks [UNFSA], Art. 5.

It is important to note that even though the Expert Opinion cited above refers to quahog fishery, the assessment of key habitat impacts undertaken in that document would also apply to the proposed Arctic surfclam fishery since the same gear type is being used on a similar bottom type (K. Gilkenson, pers. comm.). The Expert Opinion notes that:

"There will be substantial immediate impacts on habitat that will change seabed topography. Furrows will be excavated, sediment will be suspended and redeposited, and there will be a reduction in habitat structural complexity. However, it is expected that habitat should recover in several years, with the exception of the re-establishment of large mollusc burrows that will take on the order of 10-20 years or more."[8]

In addition, it was noted in this study that there are still uncertainties regarding the effects of hydraulic dredging on spawning grounds. The study observes that "There is a possibility that hydraulic dredging might affect fish spawning but the risk can not be assessed at this time."[9] Therefore the effects of this fishery on the endangered Atlantic cod spawning grounds on the Grand Banks' Southeast Shoal, as well as on other important habitat for threatened species, such as winter skate in the Banquereau should be further assessed.

E) On EBSAs:

DFO, 2007. Placentia Bay-Grand Banks Large Ocean Management Area Conservation Objectives. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/042.

This Science Advisory Report (2007/042) states that the Southeast Shoal and Tail of the Banks (area east of 51°W and south of 45°N, extending to the edge of Grand Bank) is an area that requires the highest priority conservation objectives in the Placentia Bay-Grand Banks Large Ocean Management Area (PBGB-LOMA). This report identified the Southeast Shoal and Tail of the Banks as an ecologically or biologically significant area (EBSA). It is noteworthy that the EBSA criteria developed by Canada conforms to the Convention on Biological Diversity's EBSA criteria[10] as adopted by the ninth CBD Conference of Parties (COP 9), decision IX/20, Annex I (http://www.cbd.int/doc/decisions/cop-09/cop-09-dec-20-en.pdf).

Due to the ecological importance of the Southeast Shoal, the CSAS report 2007/042 concluded that conservation objectives for the area must "[e]nsure that the features listed below are not altered and/or disrupted by human activities to the point they can no longer be considered a unique feature and/or fulfill the ecological function that initially triggered their identification as significant in the area:

• Area of highest overall benthic biomass on the Grand Banks
• Unique offshore capelin spawning
• Unique yellowtail nursery
• Unique shallow, sandy habitat with glacial history
• Cetacean aggregation and feeding
• Seabird aggregation and feeding
• American plaice (nursery habitat)
• Atlantic cod spawning
• Reproduction and survival of striped wolfish
• Unique relict populations of blue mussels and wedge clams"[11]

Therefore, it is important to ensure, through comprehensive assessments, that the fishery in question does not represent a threat to any of the features listed above. It should be noted that possible increased harvest capacity in the

[8] DFO, Maritime Provinces, "Expert Opinion on Clearwater/Deep Sea Clam Ocean Quahog Development Proposal", Expert Opinion 2002/03 (21 January 2003), at 2.
[9] Ibid., at 27.
[10] EBSAs "are geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surround areas or areas of similar ecological characteristics, or otherwise meet the criteria as identified in Annex I to the decision IX/20". The criteria include characteristics such as: uniqueness or rarity; special importance for life history stages of species; importance for threatened, endangered or declining species and /or habitats; vulnerability, fragility, sensitivity or slow recovery; biological productivity; biological diversity; and naturalness".

area can lead to further impacts.

As for the Scotian Shelf, the Banquereau and Eastern Shoal were identified as EBSAs by DFO[12] primarily due to its unique characteristics and fitness consequences.[13] The Eastern Shoal (which is located partially on the Banquereau) was further considered as an Area of Interest[14] (AOI) candidate. The area was selected as an AOI candidate due to its ecological and biological importance. As noted by DFO:

"Eastern Shoal appears to be particularly significant for winter skate, which is considered "threatened" by COSEWIC. The area is also important for cod, considered of "special concern" by COSEWIC. Atlantic, northern and spotted wolffishes (all listed under the *SARA*) also occur in this area.

Winter skate – The abundance of winter skate on the Eastern Scotian Shelf is estimated to have declined by more than 90% since the early 1970s and is now at a historically low level. Certain life history characteristics of this species make it vulnerable to exploitation and limit its ability to recover. Scientific surveys since 1970 indicate that the Eastern Shoal portion of Banquereau is a very important habitat for this species.

Atlantic cod – The Laurentian Channel component of this candidate AOI is an important overwintering habitat for the Sydney Bight and southern Gulf of St. Lawrence populations of Atlantic cod. Southern Gulf of St. Lawrence cod are thought to be at high risk of local extinction. Protecting this important mixing area may benefit both of these severely depleted populations. Cod was also once abundant on Eastern Shoal.

Wolffishes – This candidate AOI includes important habitat for the Atlantic wolffish, a large, solitary, nest-building benthic fish that has declined significantly since the 1970s. Northern and spotted wolffishes have also been found in this area. All three of these predator species are long lived and slow to mature, making them vulnerable and slow to recover from human disturbances."[15]

In addition, I would also like to concur with the concerns expressed by the Ecology Action Centre in an email to the assessment team dated 09 June 2011, particularly in regards to: the absence of independent and comprehensive impacts assessment, apart from a few DFO scientists assessments; absence of trophic level assessments; hydraulic fluid associated concerns; the need for closed areas; and concerns over potential increases in the harvesting capacity in the respective areas.

[12] P. Doherty and T. Horsman. 2007. Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion. Can. Tech. Rep. Fish. Aquat. Sci. 2774: 57 + xii pp.
[13] Ibid, at 7.
[14] First step towards the establishment of an *Oceans Act* marine protected area.
[15] DFO, Marine Protected Areas on the Eastern Scotian Shelf, Selecting the next Area of Interest, 2009 Consultation Booklet, at 12-13. See also, DFO, 2011., At Risk Species, State of the Scotian Shelf Report, online: < http://coinatlantic.ca/docs/species-at-risk.pdf>

16.3 Information from the Ecology Action Centre, received on 17th June, 2011.

We have been discussing our involvement in this fishery at EAC, and we do have major concerns that this fishery has even made it past pre-assessment given the destructive nature of the fishing gear and the maximum age of the target species.

- The hydraulic clam dredge has a high catch efficiency and completely destroys the seafloor, in some cases down to 18 inches. This disrupts numerous ecosystem processes, breaks the benthic food web as well as vastly changes any benthic pelagic coupling.

- To date, the fishery has been limited by a lack of harvesting capacity by Clearwater. Should harvesting capacity increase whether through new entrants to the fishery or through new vessels, the intensity and frequency of this fishery will certainly become unsustainable particularly given the amount of time needed for the target species to recruit to the fishery.

- We are also concerned that there is no fishery independent science being conducted on this fishery, and all science is done in conjunction with the fishery, with the exception of some impact studies completed by DFO. This not only limits the questions that can be asked during a research survey but it also severely limits the access to data. Despite the existence of enterprise allocations, this resource, and all fisheries resources in Canada, remain in the public domain.

- We are also concerned that we end up putting a significant amount of time into MSC stakeholder processes, and have yet to see meaningful conditions placed on fisheries that used destructive fishing gear. We are not sure we want to be engaged in the certification of the status quo - and in many cases MSC certification of Atlantic Canadian Fisheries has largely undermined much of our conservation work and is leading to consumer confusion given the level of public concern about fishing gear impacts on habitat and bycatch species. We can discuss this further this afternoon.

I know you are meeting with DFO this morning, and I am cognizant of the capacity of DFO scientists and managers to actually implement conditions and meet assessment timelines. There are some very specific issues relating to the fishery that should be included in discussions with DFO, particularly considering the current survey cycle. Previous survey analysis have showed considerable serial depletion of surf clams on the Scotian Shelf, particularly after "virgin" populations have been fished.

Aside from the bottom habitat disturbance issues, we suggest that a proper sensitivity analysis (along the lines of a real Management Strategy Evaluation) of the effect of a 4 (or is it 5?) year survey cycle on assessment advice. In other words, how much does a non-annual survey influence assessment uncertainty relative to other sources of uncertainty? It may not be that big a problem because of the very late age at recruitment to the fishery and the presumed very low M (natural mortality) for the target species, but this should be verified. This idea was only discussed superficially at the Framework Assessment meetings in 2007. Since that meeting there have been a few new methods developed to estimate sustainable yields for long-lived species (eg. MacCall. 2009. ICES J Mar Sci 66:2267-2271) it would be worthwhile exploring their utility for providing TAC advice in this kind of fishery - where a more traditional time-series based population model cannot be used due to the sparsity of survey data and strong biases in the CPUE data. As well, the low M should be examined in terms of historical predator populations - both groundfish and walrus used to prey quite heavily on clam populations on the Scotian Shelf. The Southeast Shoal of the Grand Banks is also a uniquely productive ecosystem. How does the removal of these shellfish affect potential recovery of groundfish (we don't expect the walrus to come back!). The current stock assessment framework does not include any trophic level analysis, and this is something that should be examined, particularly if the TAC is to increase or if there are new entrants to the fishery.

We also suggest that you ask for data on the amount of hydraulic fluid that is being used and what is being done to ensure proper disposal and that this is not being released into the marine environment. This is an issue that has been raised by fisheries observers.

To summarize, we do not feel that there is any grounds for the hydraulic clam fishery to be certified - and even if there were any indiciations that such a fishing method (which quite frankly can be equated to the use of dynamite in a sandy environment), there are significant improvements that need to be made to this fishery, including the addition of closed areas that are not fished - ever - to ensure that there is a control area to measure impacts and to ensure that some level

of ecosystem integrity is maintained. Clearwater has the ability to do this and should be willing to set aside no fish areas, given that it is already rotationally harvesting.

We can discuss further this afternoon.

All the best,

Susanna Fuller
Marine Conservation Coordinator
Ecology Action Centre

17 APPENDIX C – L ETTER OF SUPPORT FOR ACTION PLAN FROM DFO

Fisheries and Oceans / Pêches et Océans

P.O. Box 1035
Dartmouth, NS
B2Y 4T3

DEC 12 2011

Ms. Christine Penney
Director of Corporate Affairs
757 Bedford Highway
Bedford, Nova Scotia
B4A 3Z7

Re: Fisheries and Oceans Canada Support for Marine Stewardship Council Action Plan

Dear Ms. Penney,

This letter is to advise you that Fisheries and Oceans Canada Maritimes Region (DFO) agrees to support the Action Plan you have drafted for the Grand Bank Arctic Surf Clam fishery, with the caveat that DFO's contributions will be limited to actions that align with DFO annual work plan activities.

We expect that in the coming months, a more detailed Action work plan will define timelines and accountabilities that touch on areas of DFO authority. Please note that this work plan will be reviewed on an annual basis to assess its alignment to DFO's annual plans and priorities. As a result additional internal review will be required in advance of DFO commencing activities to support the Action Plan.

I would like to take this opportunity to applaud Clearwater Seafoods Limited Partnership for its on-going commitment to a sustainable fishery and I wish you all the best in your effort to become Marine Stewardship Council certified.

Yours sincerely,

Faith G. Scattolon
Regional Director-General
Maritimes Region

18 APPENDIX D – PEER REVIEW 1

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No P1 – no P2, P3 - generally**	**Conformity Assessment Body Response**
Justification: Some comments to consider on P3. P2 is generally good but please consider MSC definitions of "strategy" and "partial strategy". On P1, the fact that the reference points, harvest strategy, and harvest control rules are not explicit in the IFMP makes me question whether the relevant PIs achieve the MSC minimum standard.		The assessment team has addressed specific comments as they appear below.

If included

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No Yes**	**Conformity Assessment Body Response**
Justification: They are written in line with the MSC standard and timelines are appropriate. However there may be some additional conditions needed, based on my review.		The assessment team has addressed specific comments as they appear below.

:

Do you think the client action plan is sufficient to close the conditions raised?	**Yes/No Yes with one comment**	**Conformity Assessment Body Response**
Justification: Fine as written for Conditions 1 and 2 For Condition 3 I suggest adding "which conform to MSC requirements" after "to manage the stock" – as written it appears that the requirement to reduce exploitation rate as LRP is approached is not included.		This comment refers to Condition 2, rather than to Condition 3. The text of Condition 2 provides no doubt that the requirement of MSC certification is that the exploitation rate is reduced as the limit reference point is approached. The text "which conforms to MSC requirements" is considered to be self-evident and its inclusion is therefore unnecessary. Any annual surveillance assessment team will certainly consider how any proposed harvest control rule conforms to MSC requirements in assessing whether this condition has been met.

For reports using the Risk-Based Framework please follow the link.
For reports assessing enhanced fisheries please follow the link.

General Comments on the Assessment Report (optional)

The report was generally well documented, well argued and well written.

Some comments on introductory sections:
References. The Roddick et al 2010 Working Paper is now published as CSAS Research Document 2011/052.
IMM Ltd.: Thank you- this is noted and the reference checked and changed.

Section 5.1 (Management Unit), para 1 line 7. Surveys have not really been on a "rotating" basis but have occurred periodically over a 15 year period.

IMM Ltd.: The comment is noted and the sentence has been modified to read ‘several times’.

Section 5.2.3 Biomass and abundance. Tables 4 and 5 give a different area surveyed for Banquereau – why? and which is right?
IMM Ltd.: There is no explanation for this in the reference documents. A note has been added to the report at Section 5.2.3 saying that it is presumed that the difference is due to changes in the boundary definition of the survey between the publication of the two reports.

Section 5.2.4, Figure 9. What is the source of the “population” information? was it derived somehow from the “sample” information?
IMM Ltd.: Figure 9 and the related section 5.2.4 refer to ‘survey’ information rather than to ‘population’ information. Length data taken during the surveys were used to recreate a survey age distribution based on the sample age data that were collected later in laboratory aging. This is standard fisheries biology methodology and is described in the section.

Section 5.2.5 Assessment methods. Para 1, last sentence. I would say sources of uncertainty are “described” not “addressed” which implies something has been done to take account of each. The TAC is selected based on a cautious approach because of the multiple uncertainties.
IMM Ltd.: Agreed- a change has been made in the report.

Section 5.2.5 para 3. Is this whole analysis from Roddick 2007? I presume. That is not clear from the citation. I would cite this publication after first sentence if so.
IMM Ltd.: Yes, the analysis is from Roddick *et al* 2007, and so the citation has been moved up in the paragraph.

Section 5.2.5 para 4-5. See separate sheet on MCY – this approach needs to be described as the publication cited is not widely available. It is not clear from the description what the principle behind MCY is, separate from the calculations and analyses used to determine TACs in the fishery.
IMM Ltd.: Agreed. The relevant sections have been amended to include more information on MCY and some readily available references are included.

Section 5.2.8. Recruitment. Interesting analysis. It is good to see that recruitment under no exploitation has been fairly regular. However in other long-lived molluscs (eg geoducks), recruitment may be rare under exploitation – this is one of the big uncertainties in harvesting this population, as the team recognizes.
IMM Ltd.: This comment is noted and agreed.

Section 5.2.11 Stock status. Probably a quibble, but I would say “status based on last assessment is good” rather that “current status is good” because last assessment was in 2007 and last survey was 2004.
IMM Ltd.: This comment is noted. The text has been changed to include the 2010 survey, the results of which are now available.

Section 5.3 Management advice. Para 1. DFO should be strongly encouraged to post the IFMP on their web site – the management plan on the site quite old.
IMM Ltd.: Noted- a recommendation has been made in the reports at Section 5.3..

Section 7.1 Ecosystem characteristics. First line: “westernmost” should be “easternmost”.
IMM Ltd.: Thank you- quite correct!

Table 7 (and others if I have not flagged these). Should indicate source in the caption.
IMM Ltd.: These have been checked and citations inserted as appropriate.

Performance Indicator Review

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	Yes – although I would note in addition that evidence indicates no serial depletion	Yes	N/A	The rationale is generally well described. The second paragraph in the "Scoring Comments" is not really relevant. Stating that biomass is higher than previous surveys (para 1 line 6) gives the misleading impression that abundance has increased, which is not necessarily the case – phrase not needed, I suggest deleting. Statement that only two boats fishing ensures low fishing effort (para 1 line 8) is not relevant, fishing mortality is regulated by the TAC – delete. Science Advisory Report provides evidence that there has not been serial depletion – this is important.	The Scoring Comments have been modified to take into account information from the 2010 survey that has recently been published. The second paragraph describes the TAC setting approach, which relates to the fishing pressure that the stock is subjected to. These factors are considered relevant in the context of stock status. The text has been modified to include reference to the 2010 survey The reference to only two boats fishing has been deleted and the role of the TAC in controlling effort highlighted. Thank you- a note indicating that there is evidence that serial depletion is not occurring has been inserted.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No – the report does not mention that RPs are not referenced in the IFMP	No for LRP Probably not for TRP	Question whether fishery meets 60 for LRP	Three issues: - reference points are not referred to in the IFMP or available management documents - rationale behind MCY is not well explained, so can't confirm that this approach is equivalent to a target reference point - strictly speaking, the fishery does not meet 60 for LRP as there is no mention whatsoever of a LRP in the IFMP or other documentation See separate sheet	The use of implicit reference points is allowed within the MSC Standard (Certification Requirements, Section CB 2.3.2.1- MSC 2011). The assessment team considers that the absence of explicit mention of reference points in the IFMP does not, in itself, preclude the fishery from achieving a minimum score for this PI since there is documented evidence of the use of an acceptable proxy for the TRP in the management process. The rationale for MCY has now been detailed more fully. It is considered that the management strategy aims to achieve B_{MCY} as a target reference point. There is no LRP but the stock is clearly well above the point at which recruitment would be impaired, and above the default LRP as suggested by the MSC (Certification Requirements, Section CB 2.3.3.1- MSC 2011).
1.1.3				N/A, stock not depleted	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.1	No – the report does not mention that the harvest strategy is not descibed in the IFMP	No	N/A (no condition set)	The harvest strategy described in the certification report based on MCY (application of a low exploitation rate to estimated biomass) is nowhere referred to in the IFMP. It is probably an appropriate strategy but I question whether this lack of documented commitment to a strategy meets MSC requirements. If the strategy was properly documented, I think the score is generally OK although I question whether element 2 in the 100 (fully evaluated) and also element 3 (periodically reviewed and improved) are met, so would consider a score around 85-90. The text should identify the elements of the harvesting strategy and also address the various points of SG60, 80 etc – for example "responsive to the state of the stock" since survey frequency is relatively low.	The harvest strategy based on MCY is described in detail in the latest IFMP (DFO 2011c). It was used for the first time for Grand Bank in 2011 but is yet to be implemented for Banquereau, which has continued to retain an even more conservative TAC.
1.2.2	No – report does not mention that HCRs not referenced in IFMP	No	Yes	1. As above, the harvest control rule(s) are not referenced in the IFMP so I question whether this meets the MSC standard. An HCR to be used on an ongoing basis is not clearly outlined in the "Scoring Comments" either, although there is a description of recent practice. 2. As the draft report indicates, no HCR "which act to reduce exploitation rate" as LRP is approached is in place – there is only a fixed F applied to biomass estimates. Accordingly I question whether SG 60 is met. The wording of the condition would allow the fishery to meet the MSC standard.	The harvest control rules are described in the latest IFMP (DFO 2011c). The assessment team consider that since the fishery has been maintained at around an implicit target reference point and the stocks are well above the MSC default value for an implicit limit reference point of ½ B_{MSY} or 20% of B_0, this fishery is not in danger and meets the minimum MSC standard requirement. We consider that the lack of an explicit limit reference point is best dealt with by imposing a Condition.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.3	Generally, see comments	Not sure	N/A	This is generally good. It would be important here to explicitly say why the relatively low survey frequency is OK – I think it is, given the stock and fishery dynamics, but saying "it is perhaps at a frequency suitable for the stock" in the Scoring Justification is not convincing for the MSC standard. What has been the observer coverage? The fishery clearly meets 80 but the justification that it meets element 1 of the 100 should be stronger – it is true that information is pretty good, but the time series is relatively short and stock-recruitment dynamics under exploitation are not well known, compared to other exploited stocks.	The low frequency of surveys is not ideal but is a question of available resources and is taken into account by setting conservative TACs. The implications of this are considered in scoring other PIs – e.g. 1.2.3. This comment has been noted and the text has been modified
1.2.4	Yes	No	N/A	I question how it meets element 2 of 100 ("a probabilistic way"), element 3 ("tested" and "alternative hypotheses") and the "externally reviewed" part of element 4 – the framework has been externally reviewed but not the assessment per se, according to the draft report.	Agreed. The text has been modified and the score lowered from 95 to 85.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.1.1	Mostly – see comment	Yes	N/A	The "Scoring Comments" need to explain clearly how a bar spacing of 28 mm is OK for animals maturing at 28-29 mm (propellerclam, male cockle). I am assuming that this is because selection operates on shell height as much as shell width. Otherwise - OK	Dredge selectivity on bivalves in the Arctic surfclam fishery is primarily associated with shell height rather than shell length as this is the smallest shell dimension. For example, see the size-frequency distribution of Arctic surfclams taken in the 2006-2009 survey of Grand Bank (Figure 18, Roddick *et al.* 2011). A note to this effect has been included in the report.
2.1.2	Yes	Yes	N/A	Since there are no "main" bycatch species, the "if necessary" provision of the 80 SG can also be invoked, however, it is good to give the information here and it clearly supports the score.	Thank you, a note has been made on the lack of any main retained species in the report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.1.3	Generally – see comment	See comments – please consider	N/A	No information on actual landings of retained species is available in the reports. We only have some survey and observer information. Is this available and would it further improve the information base? Without it, I question whether "accurate and verifiable" information on catch is available. This would also help address element 4 in SG 8 (detect increased risk). "Broad age structure of the stocks" (scoring justification line 2) – can a citation be provided? Generally this seems OK although I am not totally convinced that information justifies a score above 80.	The landings data are understood to be confidential due to the very small number of vessels and the single company prosecuting the fishery. This is a standard DFO practice as described in Hillier *et al.* 2007 (Hillier, C.J., Gueret, D., Butterfield, S., & N. Pellegrin 2007. Fish harvesting activities within the proposed Gwaii Haanas National Marine Conservation Area. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2803: vii+ 65 pp.). Nevertheless, the data are collected and are available for management. In combination with information on the bycatch profile of the fishery, the assessment team considers that the data on the swept area of the fishery do suggest strongly that the fishery does not pose a risk to stocks of retained species. Broad age structure of the stocks- Kilada *et al.* 2009 provide information on the northern propellerclam stock on Banquereau, while Kilada *et al.* 2007 provide information on the Greenland cockle on Banquereau and Grand Bank, with the sample animals collected from the Arctic surfclam fishery. Although not comprehensive, these data are considered adequate to provide descriptive information on age structure of the stocks.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.2.1	Yes	Yes	N/A	Should note in scoring justification that there are no other "main" bycatch species. I believe that "non-catch" mortality (animals killed but not found in the bycatch) is best dealt with in the 2.5 series. It could stay here, as long as it is dealt with, but non-catch mortality by definition is not a bycatch issue. The evidence for a small footprint of the fishery relative to the distribution of impacted species is good to support the argument for a generally low non-catch impact.	A comment has been added noting that *E.parma* is the single main bycatch species. The MSC Guidance is that bycatch species should be interpreted as species in the catch that are not retained and that are discarded as well as those that die because of unobserved fishing mortality. However, the issue of unobserved mortality is now referred to in the PIs covering 2.2 (bycatch) and 2.5 (ecosystem).

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.2.2	Yes	No	N/A	The arrangements and very general objectives described do not meet the MSC definition of a "strategy" (FAM 7.1.22). A "strategy" would explicitly state what is being done to reduce bycatch, why, and what would be done if things get worse. They are at the limit of meeting a "partial strategy" (FAM 7.1.23) which implies awareness of the need to change if necessary, but I think 80 is justified because of the very low bycatch and obviously low impact on the only "main" bycatch species (which barely makes it as a "main" species). The first 3 objectives listed are better dealt with in 2.4 or 2.5 as they are almost never seen in the bycatch.	This comment on 'strategy' versus 'partial strategy' is not accepted. The MSC defines a strategy as "*a cohesive and strategic arrangement which may comprise one or more measures, an understanding of how it/they work to achieve an outcome and which should be designed to manage impact on that Component specifically. A strategy needs to be appropriate to the scale, intensity and cultural context of the fishery.... A strategy should contain mechanisms for the modification fishing practices in the light of the identification of unacceptable impacts*." The assessment team believes that the work undertaken to understand impacts has shown that the specific arrangements in the fishery (bar spacing, limited area impacted annually by the fishery) will work to manage and minimise impacts. The arrangements are appropriate to the scale of the fishery, and further modifications could be introduced through the IFMP if further issues were identified. Following consideration of this comment, the first three objectives have been deleted from PI 2.2.2, and added as objectives to PIs 2.4 (habitat) and 2.5 (ecosystem).

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.2.3	Generally – see comments	Yes	N/A	"the landed catch" (scoring comments para 2 line 1) is not of use for discarded species. "Sufficient data to detect increase in risk" (element 4 of SG 80) – given the low observer coverage, this fishery is at the limit for this. The small footprint compared to total benthic habitat gives confidence that risk is low.	The reference to landed catch is considered to be relevant in the context of bycatch, on the assumption that the two are related. For example, if it is assumed that all things are proportionate, it may be presumed that if the landed catch was to double, the bycatch would also double.
2.3.1	Yes	Yes	N/A	Note in scoring comments that there has been no recorded bycatch of any listed species.	Thank you, a comment to this effect has been made in the report.
2.3.2	Yes	Yes	N/A	Agree with draft	
2.3.3	Yes	Yes	N/A	Agree with draft	
2.4.1	Mostly but see comment	Yes	N/A	Section would be stronger if it started with a para that this is a habitat subject to a relatively high level of natural disturbance (see introduction section 7). Fishery impacts are generally of less concern in these high-energy habitats. I don't think citation of the MSC standard is needed in the scoring comments – this should be relatively well known and has been properly applied here. However no problem leaving it in.	Thank you- the first paragraph has been adjusted slightly to highlight the wave and tidal regime on Banquereau, and the conclusion that the well-sorted surface sediments are likely to be mobilised at frequent intervals. Although unusual, it was considered in this case that the MSC guidance would usefully direct readers on the thinking behind the scoring comments on impacts, and on the subsequent score.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.4.2	Yes	No	N/A	This does not meet the FAM definition of a "strategy" (7.1.22) so cannot make 100. I would question whether it makes the definition of a "partial strategy" (FAM 7.1.23) which would imply some recognition that there is a potential problem and a "cohesive arrangement" to deal with it. On this basis I question whether it makes the 80. It definitely makes 60. Gilkinson et al 2005 state that industry leaves harvested areas "fallow" for 10 years before re-harvesting – although the rationale is to allow the target species to recover, this probably is a strategy with positive impacts for habitats and ecosystems. Is this strategy still in place?	The comment on 'strategy' is not accepted. It is considered that the arrangements do constitute a strategy on the basis that the experimental work on Banquereau was specifically targeted at understanding the impacts of the fishery on the seabed and benthic species- the results indicated that recovery of those features should occur comparatively quickly, and certainly within a timeframe that is compatible with the fishery impacts. It is understood that the 10 year fallowing period is still in effect.
2.4.3	Yes	Yes	N/A	The standard for 100 requires "particular attention to the occurrence of vulnerable habitat types" – these have been pretty well mapped on the eastern Scotian Shelf (and the fishery does not go into them) so the argument for a high score is further justified.	Thank you- a note of the avoidance of vulnerable habitat types has been included. The score has not changed as a result.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.5.1	Generally, but could be more effectively organised (see comments)	Yes	N/A	This section is hard to write. It is useful to first identify the ecosystem issues to be addressed, then address them one by one. "Key" elements should also be identified at the start (MSC FAM 7.6.5). In this case, non-catch impacts on biodiversity, effect of removing target species on food webs or bioturbation, etc., would be among the potential ecosystem impacts. Gilkinson et al 2005 (near the end of the paper) provide a good description of the possible structuring role of large clams in benthic ecosystems – their removal could impact ecosystem structure and function. Although uncertainties about just how important this role is are high, this issue should be mentioned and addressed. I think the small footprint of the fishery relative to the extent of benthic ecosystems is a good argument for the scoring – however it should be recognized that hydraulic dredges do have a significant impact on benthic communities where they operate – see Gilkinson et al 2005. The fact that this area was identified as a candidate EBSA (see 2.5.3) needs to be addressed. My understanding is that the candidates were never formalised, and that this area only qualified on one of 5 criteria.	The authors have approached the ecosystem section by excluding some potential ecosystem impacts (sedimentation and other pelagic impacts, and impacts on demersal fish species), before focusing on the seabed, which is where impacts might be expected. The role of clams as bioturbators is discussed. The report discusses the EBSA designation, and a note is now included in this PI. A mention of the Area of Interest process is also included.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.5.2	Yes	No	N/A	As with habitat, the situation does not meet the definition of a "strategy" (MSC) or a "partial strategy". These require some explicit recognition in the IFMP or other documentation of a need for action. It meets the 60 with no problem. The 10-year "fallow" strategy, if still in place (see 2.4.2) would support ecosystem rebuilding.	The comment on strategy versus partial strategy is accepted, and a change made to the report. The other scoring issues of SG100 are, though, considered to have been met. The fishery has undertaken a thorough review of the impacts on benthic habitats and communities through work undertaken on Banquereau, and no long term or serious impacts have been detected. In combination with the limited range of water depth and habitat type in which the gear can be worked, and the very small footprint of the fishery, this is considered to provide for the development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm (SG100, scoring issue 2); the measures are considered likely to work based on plausible argument involving the results from Banquereau (SG100, scoring issue 3), and there is evidence from VMS data that the measures (the limited fishery area) are being implemented (SG100, scoring issue 4). If the fishery extended over a large area, took large quantities of bycatch or had removed a high percentage of the stock then a much more involved strategy would be required, but this is not the case. The score has been revised to 95.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.5.3	Mostly but see suggestions – could be better organized	No	N/A	This section would benefit from organisation by potential impact and element (see 2.5.1). It is currently difficult to fit the information to the standard. The fact that it was identified as a candidate EBSA needs to be addressed. The text needs to focus more on information available. Some potentially useful additional references are provided on separate sheet.	As for comments related to PI 2.5.1, the comments on style are noted. The candidate EBSA designation confers no special status to the site. The site was also not taken forward as an Area of Interest following a consultation in 2009. These were dealt with under PI 2.5.1. The additional references were examined, thank you, but not used. The section was instead rewritten to focus more on data availability.
				A general comment on P3 – the Canadian system is generally well known in relation to the MSC standard and this draft is generally consistent with other certification reports (but see comments)	
3.1.1	Yes	Yes	N/A	Agree with draft	
3.1.2	Yes	Yes	Yes	Are stakeholders invited to, or advised of, meetings of the management bodies to which they can participate? If the meetings are simply "open" but not advised, opportunities to participate are even more restricted than indicated.	The assessment team understands that the DFO maintains a list of stakeholders who have expressed an interest in the OCAC, and that those stakeholders are contacted prior to OCAC meetings. In order to promote this approach, a recommendation has been made that advance notice of the time and place of advisory committee meetings, and the minutes of such meetings, should be circulated to all interested parties on request or posted on the DFO website.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
3.1.3	Yes	Yes	N/A	Agree with draft	
3.1.4	Yes	Yes	N/A	Agree with draft	
3.2.1	Yes	Yes	N/A	Agree with draft	
3.2.2	Yes	Yes	N/A	Agree with draft although last sentence in scoring comments should probably be something like: An example of precautionary decision-making in this fishery is the setting of TACs based on a fishing mortality rate well below the rate of natural mortality.	The suggested wording has been accepted.
3.2.3	Generally but see comment	Yes	N/A	The initial statement that there have been very few violations raises more questions than it answers – for what, when? this may not be known in detail but it would be good to give a few examples and a rough estimate of how many over what time period.	DFO has now advised that there have been no violations in the offshore clam fishery for the past 5 years. A comment to this effect has been placed in the report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
3.2.4	Yes	No	N/A	I don't think the situation described meets the MSC definition of a "research plan" as per FAM 8.3.13. We have a list of possible projects in the IFMP and an indication that which ones get funded will be decided later. I don't see the "strategic approach" to addressing priorities in the IFMP. Accordingly I am not convinced that it meets element 1 of SG 80. Yes there has been some good research. Reliable, timely, disseminated – OK.	DFO has identified stock biomass estimates, recruitment and bottom disturbance as the major issues in the fishery. The research and studies conducted are focused on those issues and were accordingly judged to be strategic in that they are pro-active, anticipatory and identify gaps in knowledge driven by management needs that are relevant to the scale and intensity of the fishery and the issues requiring research as required by the FAM.
3.2.5	Yes	Yes	N/A	Agree with draft	

19 APPENDIX E - PEER REVIEW 2

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No YES**	**Conformity Assessment Body Response**
Justification: While the overall conclusion that the fisheries on both Banquereau (BB) and Grand Bank (GB) are certifiable with Conditions, is appropriate, there are some issues that need to be addressed including possible additional conditions.		The assessment team has responded to specific points made by the reviewer in the table below.

If included:

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No NO**	**Conformity Assessment Body Response**
Justification: While generally satisfactory, for both the Banquereau and Grand Bank documents more detail regarding the limit reference point in Condition for 1.1.2 should have been included. Based on the 2nd bullet of the condition ("The limit reference point is set above …") it appears that the reference point is in relation to biomass. This should actually be 'exploitable' biomass and should be explicitly stated.		This comment, and several below, highlight the importance of carefully defining biomass terms. The term 'exploitable biomass' is not clear but seems to imply that portion of the stock that is economic to harvest, which is not what is required in the context of managing and conserving the stock. The IFMP uses the term 'harvestable biomass (fishable biomass >75g/m^2)', which is clearly defined, appropriate for managing the stock and is not dependent on the vagaries of market conditions and the economics of exploitation. More details of the limit reference point are not necessary in Condition 1 since it states that they must be 'appropriate for the stock'
For Conditions associated with both PI 1.1.2, there should be a requirement that the limit reference point be included in the Harvest control Rules to be developed within 1.2.2, and there should be a requirement for the limit reference point and the Harvest Control Rules to be included in an updated IFMP (perhaps by the 3rd annual audit) so as to ensure their active application in the fishery so as to ensure an ongoing meeting of the SG80 guideposts.		The limit reference point will be included in the Harvest Control Rules since Condition 2 requires 'that the exploitation rate is reduced as limit reference points are approached'. Once operational, new harvest control rules would be expected to be included in management documents.
With regard to the Condition associated with 3.1.2, it is stated in the scoring rationale " The advisory committee process is open to the public and provides an opportunity for all interested parties to participate." However, the assessment text (page 40 – Banquereau; page 42 – Grand Bank) states that although meetings of the OCAC are open to the public, "only members of the committee are permitted to address the agenda unless specifically allowed by the chair." This is considered to potentially limit the "opportunity for all interested and affected parties to be involved" (3rd bullet of Condition (both reports)) and as such should be specifically considered in development of the Condition.		The text "*only members of the committee are permitted to address the agenda unless specifically allowed by the chair*." has been removed from the document. This is not listed in the terms of reference for the OCAC as provided in the latest IFMP (DFO 2011c). The assessment team can also find no other reference to it, and it unfairly infers that members of the public are prevented from speaking at OCAC meetings. In fact, OCAC minutes show that interested parties are allowed to contribute to meetings, and, in any case, a responsibility of the Chair at any meeting is to manage the participation of those attending in an orderly manner, as doubtless occurs at OCAC meetings. The text of the Condition has not been modified.

Do you think the client action plan is sufficient to close the conditions raised?	**Yes/No YES**	**Conformity Assessment Body Response**
Justification: The Action Plans, as stated, are adequate to address the Conditions as stated but will require modification depending on		Based on the answers provided to other points made in this review, the assessment team does not feel it is necessary or appropriate to adjust the text of the three Conditions.

adjustments made in relation to the Condition issues noted above as well as any additional or modified conditions arising from the peer review comments.	

For reports using the Risk-Based Framework please follow the link.

For reports assessing enhanced fisheries please follow the link.

General Comments on the Assessment Report (optional)

Overall, both assessment documents (Banquereau and Grand Bank) are well structured with generally adequate information provided so as to allow for evaluation against the PI Guideposts. There are, however, some issues that should be addressed as indicated in the Any Other Comments Section below. Some are quite minor while some are considered to be critically important as they could have potential important impacts regarding scoring of a number of PIs.

It is recommended that the assessment team examine the issues raised in the Any Other Comments Section before reviewing the specific PI scoring comments.

Performance Indicator Review

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
Example:1.1.2	*No*	*No*	*NA*	*The certifier gave a score of 80 for this PI. The 80 scoring guidepost asks for a target reference point that is consistent with maintaining the stock at Bmsy or above, however the target reference point given for this fishery is Bpa, with no indication of how this is consistent with a Bmsy level.*	
1.1.1	Yes	Yes	NA	A score of 100 was assigned and this is considered appropriate. However, the Scoring Comments need to be redone taking remarks in the Any Other Comments Section below pertaining to the F~MSY approach including the calculation of the various Fs in both documents. The "convincing arguments" that the stock is still at or near the virgin biomass level should be included in the Scoring Comments. For BB, the Scoring Comments state "This would have allowed an increase in the TAC to 38,599 t …." This is incorrect based on the IFMP criterion of 75g/m^3 density.	The assessment team has responded to the comments in the 'any other comments' section below. The report has deleted the reference to a tonnage figure on the basis of the ongoing management discussions and uncertainty over the TAC that will be set in future.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No	No	No (see Overall Opinion comments above)	The Scoring Comments suggest that only two vessels prosecuting the fishery is a "restriction" on fishing effort. The only restriction is the TAC (and market conditions) since more vessels could easily be licenced by DFO at any time. The Scoring Comments suggest that the fishery would detect a decline in biomass but since the vessels move from location to location and only return to previously fished grounds every 10 years or so, systematic declines would not be detected far enough in advance to ensure no impeding of reproductive output. While the F~MCY approach is more conservative than the MSC recommendation of MSY, it's application is inappropriate (see Any Other Comments Section below) and as such, the 3rd scoring criterion of SG 80 is not met. As such, an additional Condition should be developed that requires the target to be in relation to exploitable biomass rather than commercial viability.	While it is accepted that other vessels (up to a maximum of two) could be engaged in the fishery, albeit at considerable cost to CSLP, the point that it is the TAC that ultimately restricts effort is also accepted, although the TAC has not been taken in recent years A change has been made to the assessment documents. This point is also accepted- a change has been made to the assessment documents noting that a significant reduction in biomass should be detected by surveys before reproductive output was affected. . The comment is partially addressed in the 'Any other comments' section below'. The assessment team does not agree that an additional condition is required, as there is already considerable precaution set in to the management approach (assuming the survey gear is 100% efficient, fishing vessels moving on before an area is fished to exhaustion). Further, as noted by the peer reviewer, the economic situation may change and more or less of the stock may be exploitable in future, rendering the results of an analysis based on 'exploitable biomass' difficult to interpret.
1.1.3	Yes	Yes	NA	Nothing further to add.	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.1	YES	YES	NA	It would be helpful, in the Scoring Comments for both BB and GB, to include the specifics regarding the age at 50% maturity and the age at 50% selectivity so as to clearly demonstrate the number of years of spawning before recruitment to the fishery. The 5th bullet of the Scorring Comments suggests exploitation rates of 1-2% per year but these need to be re-estimated based on RV exploitable biomass rather than RV total biomass.	The Grand Bank report under PI 1.2.1 now notes the age at 50% maturity (5.3 years) and the age at 50% selectivity (22.9 years). The Banquereau report under PI 1.2.1 now notes the age at 50% maturity (6.7 – 8.3 years) and the age at 50% selectivity (approximately 16.5 years). The text has been modified to read "(1-2% of the research vessel total biomass per year)".
1.2.2	No	No	No (see Overall Opinion comments above).	As described in the Any Other Comments Section, there are problems with the application of the reference exploitation levels that need to be addressed. The Scoring Comments need to be modified to take the issues raised into account. Additional Condition(s) need to be considered in relation to these issues. Since it is questionable whether the application is correct, it is incorrect to state that the fishery is "managed on a very precautionary basis…" or that the TAC is "conservatively set" Since there are no well defined Harvest Control Rules, it cannot be said that the 3rd element of SG80 is met. Scores of 65 are more appropriate for both fisheries.	Extensive comments have been included in the 'Any other comments' section on this area. The TAC-setting approach since 2004 has been based on F_{MSY}/600,000t, which is more conservative than the F ~ MCY = 0.33M, which is now the recommended management strategy for the offshore clam fisheries as laid out in the 2011 IFMP. This, in turn, is more conservative than the default MSC approach of using F_{MSY}. As such, the assessment team considers that an extra condition is not required, and a rescoring of the fishery from 70 is not required. The assessment team considers that the management approach is very precautionary and that the TAC is conservatively set. The maintenance of the stock at a level that approximates the virgin biomass level confirms that this is the case.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.3	No	No	NA	It is not well demonstrated that "A comprehensive range of information on … stock abundance and productivity … is available as is required to meet the first element of SG100. For Banquereau there have only been 3 surveys over a span of 23 years and there are a number of reasons cited as to why the 3 surveys are not directly comparable. For GB there has only been 1 survey and it was conducted over a 3-year span. Questions were raised as to the apprpriateness of combining the information due to differences in the surveys. As such, while a good variety of information is available, there are considerable uncertainties such that information cannot be considered "comprehensive". Since there has only been 1 survey of the GB area, it cannot be stated that the stock abundance is "regularly monitored" as is required in element 2 of SG80. It has not been demonstrated for either stock that indicators are monitored with "sufficient frequency" to support the harvest control rule. A score of no higher than 80 is warranted for Banquereau while a score of 70 is warranted for Grand Bank thus necessitating a development of a Condition pertaining to research surveys.	The Grand Bank was surveyed in 1996-1997 as well as 2006-2009. The first survey results were never formally published because of the demise of the scientist in charge at that time (CSAS res doc 2011/052). The exploitable resource was, though, estimated at 504,000 t at that time (IFMP), which is comparable with the 548,763 t estimated at >75 g/m^2 in the 2006-09 survey (2010 GB SAR). In the context of the broad range of information available, the low exploitation level of the fishery and very limited fished area, the assessment team considers that the information available is comprehensive. The text has been modified slightly in 1.2.3. to reflect that the stock has been surveyed twice, although only very basic data are available on the first survey. The assessment team continues to believe that the fisheries should be awarded scores of 90 for this PI.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.4	No	No	NA	The assessment does not fully take uncertainty into account. There are measurable uncertainties surrounding the biomass estimates but these are not considered when developing the recommended TAC. There are also uncertainities related to M but there was no apparent consideration of these in the derivation of the 2.64% exploitation target. There are also a number of uncertainties associated with the use of point estimates that have not been considered. That the 3 surveys on Banquereau are considered to not be directly comparable attests to this. The meeting described in DFO (2007b) was sponsored by DFO and attended by only 2 non-DFO persons. This cannot be considered as an external peer review (see for comparison PI 3.2.5). This especially so when the lack of agreement on the 0.33 value is considered but was used subsequently regardless. As such, the 4th element of SG100 has not been met. Uncertainty has not been considered in a probabilistic way and thus Element 2 of SG100 has not been met. The Scoring Comments suggest that incidental mortality has been considered in the assessment. It has been recognized but not specifically considered. The generic MCY equation ($MCY=xF_{0.1}B_0$) allows for M to be substituted for $F_{0.1}$ and this (0.08) is (fortuitously) close to $F_{0.1}$ for Banquereau (0.07) when incidental mortality is included. However, incidental mortality was not explicitly considered in the derivation of the quota recommendations. A score no higher than 85 is warranted for both areas.	Some of these points have already been discussed and taken into account in the allocation of scores in other PIs. Thus the uncertainties associated with M have been dealt with in 1.2.3, while the need for caution in setting the TAC because of the low frequency of surveys has been noted in several places. Both the scoring comments and the text have been modified to clarify the situation regarding incidental mortality but this was one of the factors contributing to a lower score for 1.2.3. The assessment team notes the concerns regarding the RAP process but consider that this provides very good opportunities for detailed consideration of the scientific and management issues but a consensus cannot always be expected. We agree that the 2nd and 4th elements of SG100 are not fully met and have reduced the score accordingly.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.1.1	Yes	Yes	NA	Nothing further to add.	
2.1.2	Yes	No	NA	It is not considered that the 3rd Element of SG100 has been met as there is no comprehensive strategy to manage retained species and so it is unknown if there is adequate information available to support any such strategy or to evaluate how effective it might be.	Both the Grand Bank and Banquereau fisheries have only ever been scored 80 for this PI. A 'comprehensive strategy' is not required in order for this PI to score 80.
2.1.3	Yes	Yes	NA	Nothing further to add.	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.2.1	Yes	Yes	NA	Somewhere in 2.2 consideration should given to unaccounted mortality of fish species due to water pressure from the nozzles (see Any Other Comments Section below) but since it is not measured, it cannot be determined if this would consititute a "main" bycatch or not. If the fish are small, they may not since the 5% is based on weight but the numbers might be significant none-the-less.	Bycatch data show that the fish species taken in greatest quantities on Banquereau were thorny skate (0.03% of the survey catch [13.8 kg out of 52,114 kg]) and seasnail *Liparis* sp. (0.06% of the commercial catch [0.5 kg out of 841 kg]), while on Grand Bank the fish species taken most frequently was sand lance (0.06% of the survey catch [14.4 kg out of 25,882 kg] and 0.09% of the commercial catch [1.4 kg out of 1,663 kg]); these quantities are negligible. It may be noted that the survey gear has a smaller bar spacing (23 – 28 mm) than commercial gear (28 – 32 mm), and so may be expected to retain greater quantities of small fish than the commercial gear; however, the quantities recorded are still tiny. Although it is inevitable that a quantity of unobserved mortality of fish species will occur, it is considered highly unlikely that those numbers would be significant, given the very low actual bycatch. A comment to this effect has been noted in the both assessment reports.
2.2.2	Yes	Yes	NA	Nothing further to add.	
2.2.3	Yes	Yes	NA	Nothing further to add.	
2.3.1	Yes	Yes	NA	Nothing further to add.	
2.3.2	Yes	Yes	NA	Nothing further to add.	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.3.3	Yes	Yes	NA	Nothing further to add.	
2.4.1	Yes	Yes	NA	Gordon *et al.* 2002 is not included in the Audit Trace References	This has now been corrected.
2.4.2	Yes	Yes	NA	Nothing further to add.	
2.4.3	Yes	Yes	NA	Nothing further to add.	
2.5.1	Yes	Yes	NA	Consideration should be given here to the possible impact (unmeasured mortality) on juvenile commercial fish as well as small non-commercial species as suggested in the Any Other Comments Section below.	As noted against the peer review comments for PI 2.2.1, the amounts of fish bycatch are negligible, and the potential quantities of unobserved mortality are therefore also likely to be tiny. A comment to this effect has been added to the text for PI 2.5.1.
2.5.2	Yes	Yes	NA	Nothing further to add.	
2.5.3	Yes	Yes	NA	The Scoring Comments should be modified to include consideration of smaller fish species as well as juveniles.	Again, as noted against the peer review comments for PI 2.2.1, the amounts of fish bycatch are negligible, and the potential quantities of unobserved mortality are therefore also likely to be tiny. A comment to this effect has been added to the text for PI 2.5.1.
3.1.1	Yes	Yes	NA	Nothing further to add.	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
3.1.2	Yes	Yes	No (see Overall Opinion comments above)	The Scoring Comments indicate that the committee (OCAC) serves as an "open and public consultation" but non-members are only permitted to address agenda items with permission of the Chair. The assessment team should consider this as a shortcoming that should be addressed through an additional or modified Condition. Minutes are kept but are only available to committee members. This too should be addressed with an additional or modified Condition.	As noted earlier, the text "*only members of the committee are permitted to address the agenda unless specifically allowed by the chair*." has been removed from the document. This is not listed in the terms of reference for the OCAC as provided in the latest IFMP (DFO 2011c). The assessment team can find no other reference to it, and it unfairly infers that members of the public are prevented from speaking at OCAC meetings. In fact, a responsibility of the Chair at any meeting is to manage the participation of those attending in an orderly manner, as doubtless occurs at OCAC meetings. A recommendation has been made in the report that the minutes should be placed on the DFO website or made available upon request to DFO.
3.1.3	No	No	NA	Since all of the policies, frameworks, etc. in place can be over-ridden as a result on the considerable ministerial discretion afforded via the Fisheries Act, the "and required by" part of SG100 is not met. A score of 90-95 is more appropriate for both fisheries.	The Fishery Assessment Methodology notes that the focus of this Performance Indicator is the use or otherwise of the precautionary approach within the policy context. It goes on to say that the PI is not concerned with the operational implementation of the PA within the day-to-day management of the fishery itself but is more about the "high or broad management policy context." The team does not consider a possible ministerial "over-ride" of any particular decision or policy guideline an impediment to a 100 score on this PI.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
3.1.4	Yes	Yes	NA	Nothing further to add.	
3.2.1	Yes	Yes	NA	Nothing further to add.	
3.2.2	Yes	Yes	NA	Nothing further to add.	
3.2.3	No	No	NA	In PI 2.3.2 and 2.3.3 it was noted that the last scoring element of SG100 had not been met due to the low observer coverage. Here too a higher level of observer coverage would be needed to support the perspective that "a high degree of confidence that the fishers…" as is required under Element 3 of SG100. A score of 95 would be more appropriate for both fisheries.	The team notes the comment and agrees that the third element of the 100 score is not met. The score has been reduced to 95 and the text has been amended accordingly in both the Grand Bank and Banquereau fishery assessment reports.
3.2.4	Yes	Yes	NA	The Scoring Comments suggest that "Recruitment studies have been going on since the 1980s…" but there are no details of this provided in Section 5.2.8 of either document. Additional information to support this statement should be included.	Research has been undertaken on the Arctic surfclam resource of Grand Bank and Banquereau since the inception of the fishery in the 1980s (IFMP 2011). A change from 'recruitment studies to 'resource' studies has been made in the assessment documents.
3.2.5	Yes	Yes	NA	It should be noted that the FRCC has been disbanded and the text modified accordingly.	The reference to the FRCC has been deleted.

Any Other Comments

Comments	Conformity Assessment Body Response
In all instances, the province of Newfoundland should be Newfoundland and Labrador. Similarly, the DFO Region is Newfoundland and Labrador rather than Newfoundland.	The text has been modified where appropriate, although it may be noted that the IFMP is entitled "Offshore Clam IFMP for Maritimes and Newfoundland Regions", and so this has not been changed where the IFMP is referred to.
The citations in the text including the Audit Trace References should be carefully checked so as to ensure they are all included in the "Other Information Sources". For example, Taggart *et al.* (1994) is cited in the Grand Bank (GB) document but not included in the bibliography (Taggart, C. T., J. Anderson, C. Bishop, E. Colbourne, J. Hutchings, G. Lilly, J. Morgan, E. Murphy, R. Myers, G. Rose, and P. Shelton. 1994. Overview of cod stocks, biology, and environment in the Northwest Atlantic region of Newfoundland, with emphasis on northern cod. Cod and Climate Changes. ICES Marine Sciences Symposium, 198: 140-157). There are references made to e.g., DFO, pers. comm. but it is unclear whether the information was obtained during the site visit meetings or speaking with a specific individual at DFO. These should be clarified.	The citations have been checked and it is thought that they have now all been included in the bibliography, including the Taggart *et al.* 1994 reference. All the (DFO pers. com.) references refer to comments made during the site visit meeting. Such comments have been made non-attributable by design.
In the Grand Bank document (page 26) SeaScan is credited to Sonavision Ltd., but it should be credited to Seatronics Ltd.	This has been corrected.
"Broadhead" wolffish is more commonly referred to as "northern" wolffish when speaking of it in the context of SARA and this practice should be followed in the documents so as to eliminate any possible confusion.	This has been changed.
On page 49 of the Banquereau document it is suggested that the groundfish collapse on Scotian Shelf was due, in part, to foreign fishing fleets. This is incorrect as there were no foreign fleets fishing in the area (except some fishing for silver hake by the USSR). This is only an issue for the Grand Banks. On page 51 of the Grand Bank document it refers to a moratorium in 1993. This is incorrect. A moratorium was placed on northern cod in July, 1992 and the other GB closures began in 1994. In that same section of the GB document, it is stated that the catch of northern cod was >1 million t in 1968. This estimate is for cod in all of 2GHJ3KLMNPs. Northern cod is the stock in NAFO divisions 2J3KL only and the reported landings in that year were 810,014 t (http://www.dfo-mpo.gc.ca/CSAS/Csas/publications/resdocs-docrech/2010/2010_103_e.pdf). Also on page 51 of the GB document it suggests that haddock was one of the dominant species prior to the collapses in the late 1980s. This is incorrect. The haddock stock collapsed back in the 1960s and has never recovered since. It has been suggested that the haddock niche was taken over by yellowtail flounder. Prior to the collapse, the stocks that dominated were cod,	The reference to foreign fishing fleets in the Banquereau document has been removed. The date of the moratorium has been corrected, and the references and data made specific to northern cod. The reference to haddock has been removed and other species included. The ACON software package calculated biomass by contouring (interpolating) the data within

American plaice, yellowtail flounder, witch flounder and redfish. In both documents, it states that "simple statistics were used… while ACON…" to derive biomass estimates but no further details are provided. More detail is necessary regarding both the "simple statistics" used as well as ACON especially since ACON does not provide confidence intervals. For example, Roddick *et al.* (2007) provide details.	defined boundaries and between survey locations using an inverse distance formula. Essentially, the package creates new point biomass data within the survey grid using the real survey data to create an estimate of overall biomass. This is now described in the assessment reports.
All tables and figures should be checked carefully (both documents) so as to ensure that the proper sources have been identified.	The sources have now been cited in the legends for all tables and figures..
In both documents, it is stated that the surveys are considered to "provide good estimates of fishable biomass…" Neither DFO (2010) nor Roddick *et al.* (2007) cited in the Banquereau (B) document make such a statement. The Roddick *et al.* (2010) document (draft) could not be checked. It is also unclear what 'fishable' biomass actually refers to. Since the selectivities are different for the commercial and research gears, it presumably does not refer to 'exploitable' biomass but is 'total' biomass. This should be clarified.	The Roddick 2007 report cited state that the estimate of natural mortality (M) of 0.08 was considered reasonable / appropriate. There is no comment on the estimation of fishable biomass. The assessment reports have been modified by deleting this statement. This section has now been amended considerably to include the 2010 survey assessment (DFO, 2012), which does not provide reliable biomass estimates.
Maximum Constant Yield (MCY) figures prominently in both assessments. It would be better if some additional information associated with this could be provided within the document rather than just referencing the Ministry of Fisheries (2007) document in a footnote. The inclusion of a short appendix would be helpful in this regard.	Agreed. The relevant sections have been amended to include more information on MCY and some better, more readily available, references are included
The re-ordering of the sub-sections of 5.2 (Assessments and Stock Status) should be considered for both documents so as to improve the information flow. It is suggested that the re-ordering be as; 5.2.1 (stocks), 5.2.2 (catch), 5.2.3 (RV biomass/abundance), 5.2.4 (RV sizes), 5.2.8 (recruitment), 5.2.9 (M), 5.2.5 (assessment models), 5.2.7 (F), 5.2.10 (incidental M (should this actually be incidental F since it results from fishing?)), 5.2.11 (stock status), 5.2.6 (BRPs).	This comment is noted but it is considered that the information flow is acceptable, and consistent with a large number of other assessment reports that have followed a similar outline.
There are a number of issues surrounding the MCY approach that could potentially impact a number of PIs, especially those associated with Principle 1. As such, an overall discussion of the concerns is provided here and references made to this section as appropriate when considering the scoring of each PI.	The assessment team has responded to specific comments as they appear in the text below.
It is stated in both documents that the application of F~MCY and specifically F=0.33M was determined to be appropriate as per DFO (2007a). That was not the case. The referenced document actually makes reference to a 2005 Expert Opinion document (DFO, 2005. Expert Opinion on the Rationale for Harvest Advice on Ocean Quahogs (*Arctica islandica*). DFO Maritimes Region Expert Opinion 2005/04). The	While the exact process for adopting a particular TAC appears slightly different between different DFO documents, the Grand Bank SAR (DFO 2010) states: "*The Framework* (DFO 2007d) *recommended a constant F approach; A science Response to clarify the advice* (DFO 2007c) *stated that as F approaches 0.5 M, increased stock risk could be expected. As a result, the Banquereau assessment* ***adopted Fmcy – 0.33M as an appropriate F****. This was*

EO document is in the very grey literature and could not be located through searching Google or the DFO web site. The rationale for selecting 0.33 was apparently that it was considered to approximate 2/3 MSY but it is unclear if this document was subject to any peer review at all. Another reference (DFO, 2007d) in both BBand GB documents specifically states "It was agreed that the fishing mortality, F, should be a function, a, of natural mortality, M. Agreement was **NOT** reached on a specific level of a." (bold and capitals inserted by reviewer). "A value of a=1.0 (F=M) was considered the upper limit and the current level (a=0.25) was considered to be at the low end. Other potential values were 0.33 (MCY approach) and 0.5 (MSY approach)." Nonetheless, a value of 0.33 has been subsequently applied (e.g., DFO (2007c)) although specific rationale for this is unclear. All of the above is not to say that the selection of F~MCY or a=0.33 is inappropriate but to indicate that its selection was not as clear cut as the BB and GB assessment documents under review suggest, and perhaps most importantly, not necessarily supported during any peer review. As such, there are possibly more uncertainties surrounding the application of a 2.64%B_{RV} protocol than have been considered when scoring against PI Guideposts. Overall, it is important for the assessment team to thoroughly examine all associated documentation and develop a chronology of development of the 0.33 application for inclusion as an appendix to both assessment documents and for consideration during any PI scoring re-evaluations. In addition to questions concerning the development of the specifics of the F~MCY strategy, there are also questions surrounding its application. In the Banquereau document (page 32) and the Grand Bank document (page 32) it states "TAC … is based on harvesting a percentage (the exploitation rate) of the estimated harvestable biomass (i.e. the biomass > 75 g/m2), which is intended to optimize yield and not expose the resource to risk of over-exploitation." For GB, the TAC was revised down to 14,756 t (DFO, 2011d) specifically based on this. However, for B, the available documentation (DFO 2007a, c) suggests that the 2.64% exploitation was applied to the total RV biomass (38,599 t is 2.64 % of 1,462,097 t) although the IFMP (2011c) does indicate the application of 2.64% to the harvestable biomass (>75 g/m^3). The BB document (page 32-33, 36) goes on to indicate that the current TAC of 24,000 t represents a fishing mortality (actually exploitation rate since is ratio of C/B) of 0.0164 and the current average catch would give an F of 0.012, again both estimates using total RV (2004) biomass. In the GB document (page 33) the estimates of F (0.016 for TAC and 0.006 for average catches) again are based on total RV biomass rather than the biomass corresponding to the 75 g/m^3 criterion. These require clarification and correction as appropriate. A more generic question pertains to the validity of the use of the 75 g/m^3 criterion in	*considered a relatively risk-neutral point given the survey frequency and biological characteristics of the stock.* " It is considered that the assessment documents accurately reflect this official DFO publication. Roddick et al 2007 indeed states that F = 0.33M was recommended for inshore ocean quahogs. However, this decision is not specifically referred to or even inferred in the consideration of the adoption of F = 0.33 M for Arctic surfclams. The assessment team agrees that the use of F~MCY or a=0.33 is appropriate. The text of the report has been modified to reflect the somewhat unclear process by which the Banquereau TAC was derived and the F~MCY or a=0.33 figure was adopted and is now incorporated in the 2011 IFMP. The Banquereau and Grand Bank documents have relied on the Science Advisory Reports and the IFMP. The IFMP, Section 1.8 (Management style) states: '*The TAC is primarily based on harvesting a percentage (exploitation rate) of an estimate of the harvestable biomass (fishable biomass > 75 g/m2) and is intended to optimize yield and not expose the resource to risk of over-exploitation. A fishing mortality (F) target at Maximum Constant Yield (MCY) is estimated to be one-third of natural mortality (M). Fmcy is applied to the harvestable biomass, such that the TAC is set at 2.64% of the harvestable biomass.* MCY calculation and uses the full biomass rather than the economically exploitable biomass, this figure is not currently used in management. The actual TAC of 24,000 t was established in 2004 through two methods (Roddick *et al*. 2007); the first was MSY-based and used the model MSY = 0.5 MBo, (Bo = virgin biomass, M estimated by M=3/T_{max}, where T_{max} is the maximum age corresponding to the 95 percentile for the distribution of ages in the population). However, it was recognized that this approach made some assumptions, especially that of equilibrium conditions, that probably do not hold. Furthermore, the estimates were based on very limited data. As a result, the estimate of MSY was probably not very accurate. The second method assumed biomass was a finite resource, and made no assumptions about natural mortality, growth or recruitment. The level of exploitation (TAC) that would enable the estimated 600,000 t resource to last 10, 20 or 25 years was simply calculated as 60,000 t, 30,000 t or 24,000 t. The most precautionary level of exploitation was chosen as 25 years/24,000 t. While both these approaches have considerable limitations, the approach was precautionary and it is apparent that the stock was maintained at high levels. For Banquereau, the fishery has so far retained the *status quo* TAC of 24,000t but with the MCY approach now written into the IFMP as the

the first place. Both documents (page 32) make reference to the "estimated harvestable biomass (i.e. the biomass >75 g/m^3 …". This "harvestable biomass" is actually the total RV biomass associated with an economically viable density for the fishery and as such it is an economics-based criterion rather than one based on any biological/conservation rationales. This approach could lead to significant problems. For example, if the same overall biomass existed in each area under assessment, but the fishery area and the area within which the biomass was located was much smaller such that the density throughout the area was all >75 g/m^3, then that alone would result in a higher TAC. Any change in markets that resulted in a increase or decrease of the threshold economically viable density could result in a decrease or increase in the TAC without any change in the biomass. Additionally, the 75 g/m^3 density evaluations based on RV data includes both pre-recruit (to the fishery) as well as recruited (to the fishery) sizes. It is possible, that some of these densities may be made up of pre-recruit sizes mainly or only. This too points to potential problems with this approach. In determining a TAC, an exploitation rate should be applied to the exploitable portion of the total biomass or abundance only (that is, that portion of the RV biomass that is available to the commercial gear). The Ministry of Fisheries (2007) document specifically refers to B_0 as being an estimate of the "virgin recruited biomass" (page 27) in the calculation of MCY; in other words, the "recruited" or exploitable portion of the overall biomass. The correct approach for Arctic surfclam in both BB and GB is to apply the formula MCY = $0.33MB_{RV}$ to only the exploitable portion of the total RV biomass and this should be reflected in the IFMP. Adequate biological information is collected during the research surveys and selectivity ogives are available for both the GB and BBfisheries such that RV based exploitable biomass can be estimated. The assessment team should have considered this during scoring of various PIs. The 2007 Ministry of Fisheries document defines MCY=x$F_{0.1}B_0$ but indicates that in the absence of information on $F_{0.1}$, the use of M is acceptable. In both documents (Figure 12), $F_{0.1}$ that specifically accounts for 15% incidental mortality of clams passing through the dredge is shown to be 0.07. While this is close to M=0.08, it's specific use should be considered to as to explicitly account for the incidental mortality in establishing TACs. Section 7 deals with Ecosystem considerations and provides supporting information for the scoring of the PIs under Principle 2. Under sub-section 7.2 of both documents there is consideration of both retained and discarded species. There is reference to	recommended fishing strategy, and implemented for the first time in the Grand Bank fishery in 2011, the assessment team understands that it may be adopted for the Banquereau fishery in 2012. However, with changes to the gear and assessment methods used for the 2010 Banquereau survey, the most recent fishable biomass estimates are considered to be unreliable (DFO 2012). These issues are now better described in the assessment report. Stock density on the ground is clearly a major factor in determining how much is or can be physically removed from each bank in a profitable manner. The Banquereau stock is concentrated into areas of higher density (only 152,000 t (11%) of the stock is in a density of < 100 g/m2) than the Grand Bank stock (almost 570,000 t (51%) of the stock is in a density of < 75 g/m2), but Arctic surfclam are slow growing, and are essentially immobile once settled. As such, the density or distribution is unlikely to change significantly within a short period. It is considered that the science and management are appropriate for the fishery The problem with pre-recruits is taken into account in the latest Banquereau report (DFO, 2012) where the survey biomass is corrected for the selectivity of the dredges The assessment team has, indeed, considered this point, but DFO 2007d states: "*It was noted that the survey measures fishable biomass as it is using commercial gear*." The fishable biomass is therefore considered to be the same as the survey biomass, and the assessment report has therefore not been modified as a result of this comment. However, in the most recent DFO report for Banquereau (DFO 2012) this problem with pre-recruits is taken into account as the survey biomass is corrected for the selectivity of the dredges. The assessment team agrees that incidental mortality is important and should be considered in the setting of TACs. This is an interesting idea but since $F_{0.1}$ (with 15% incidental mortality) is close to M it makes little practical difference which is used and the fishery managers have, in any case, always stressed the need for caution and opted for TACs well below MCY ($0.33MB_0$). However, the text of 1.2.3 has been amended to stress the need to consider incidental mortality in the setting of TACs. As noted against the specific comments for PI 2.2.1, it is considered that the very low levels of bycatch recorded in both survey and commercial catches will result in negligible impacts on fish species. It is also highly unlikely that any unobserved mortality would result in

unobserved mortality (e.g., Gilkinson *et al.* 2005) for invertebrates. On page 48 (GB) and page 44 (BB) there is reference to fish escaping from the dredge so not being by-caught. However, nowhere is there consideration of possible unobserved mortality of small non-commercial fish or juvenile commercial fish species caused by water pressure from the nozzles. While this may or may not be a significant issue, it is important that the assessment team consider the matter as part of the assessments and scoring. This could be important with regard to overall ecosystem function. Also, it is indicated (page 52 – GB; page 49 – BB) that the surfclam fishery is highly unlikely to be retarding the recovery of groundfish species or the ecosystem more generally through critically reducing the abundance of prey items." This may be the case but questions such as 'is it possible that unaccounted mortality of juvenile groundfish could be impeding recovery?' could be posed.	anything other than negligible impacts, given the level of observed bycatch. Comments to this effect have been made in the scoring comments for PI 2.2.1, PI 2.5.2 and PI 2.5.3.

20 APPENDIX F - STAKEHOLDER COMMENTS

20.1 Letter from WWF International, dated 25th May 2012.

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Re: Comments to the Public Comment Draft Reports for the Grand Bank and Banquereau Arctic surf clam fishery assessments

Dear Dr Blyth-Skyrme,

WWF actively engages as a stakeholder in a number of MSC fishery assessments to improve fisheries sustainability.

WWF has carefully considered the Public Comment Draft Report for the Grand Bank and Banquereau Arctic surf clam fishery assessments. We are concerned that the draft reports do not adequately assess principle 2 and more specifically the impact of the fishery on habitat structure and function. As the majority of the Arctic surf clam fishery occurs within defined ecologically and biologically significant areas (EBSA) and it is the first hydraulic dredge fishery in the world recommended to be MSC certified, this precedent-setting certification is of concern to WWF.

We were surprised by the high scores for both fisheries on the habitat performance indicators considering the potentially severe effect of hydraulic dredging on seabed habitat. Given the limited knowledge on recovery trajectories and the severe damage to the seabed following hydraulic dredging, we urge the assessment team to reconsider their assessment of the habitat component.

IMM Comment: The assessment team scored the fishery against the MSC Standard according to the information available, which we consider is credible and covers many of the major areas of interest to the assessment process. We do not agree that knowledge is particularly limited, as specific work has been undertaken to understand the effects of hydraulic dredging in Arctic surfclam habitat on Banquereau. We agree that the scores for Principle 2 in particular were high, but the team considers that, despite the potential impact of the gear, the scientific understanding of the fishery and its overall low impact (at the scale of the region or bioregion) on the specific habitats of the Grand Bank and Banquereau justifies those scores, with the work undertaken on Banquereau allowing that fishery to score a little higher for P2 than in the Grand Bank fishery. More comments are provided on specific points below.

2.4.1 Status The fishery does not cause serious or irreversible harm to habitat structure considered on a regional or bioregional basis, and function

Surprisingly, the assessment team concludes that there is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm (SG100). The assessment team argues that the footprint of the fisheries is small as hydraulic dredging is undertaken in sandy sediments subject to natural perturbation (storms) and the fisheries annually cover a small area of the available surf clam habitat.

IMM Comment: The assessment team considers that the score is justified for both the Grand Bank and Banquereau Arctic surfclam fisheries. As stated in the reports, the MSC defines 'serious and irreversible' as "*Serious harm relates to gross change in habitat types or abundances, and disruption of the role of the habitats. Irreversibility relates to changes that are expected to take much longer to recover than the dynamics in unfished situations would imply (e.g. some sort of regime change is implied from which recovery may not automatically occur) ... The full extent of the habitats shall be considered in assessing the status of habitats and the impacts of fishing, and not just the part of the habitats that overlap with the fishery*". Further, the Guidance to the Certification Requirements states: "*Examples of serious or irreversible harm include local or global extinction, serious recruitment overfishing, habitat loss on scales that have widespread detrimental consequences for the ecosystem services provided by the habitat (e.g. gross change in species composition of dependent species), and loss of resilience resulting in trophic cascades, fishery mediated regime shifts, etc.*".

The MSC's definition of 'serious and irreversible' is critical in assessing the impact of the Arctic surfclam fishery on habitat, as are the habitat type, the likelihood of natural perturbation (tidal disturbance, as well as wave disturbance), and the annual swept area of the fisheries in question (mean annual swept area of the Grand Bank and Banquereau fisheries to date are 0.1% and 1.4%, respectively, although these figures do not consider any repeated dredging over the same sites, nor all of the shallow bank habitat of the same or similar type within the region or bioregion). These factors combine to mean that the assessment team considered there to be "evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm", so meeting the SG 100.

However, the factory freezer vessels used in this fishery work at depths between 50 and 80 m (Gilkinson 2005). Natural perturbation at this depth is less and recovery at this depth is slow. Also the impact of a storm on the seabed is significantly different from the impact of hydraulic clam dredging on habitat and benthic communities. Hydraulic dredging liquefies the seabed to a depth of up to 30 cm and reduces the abundance, biomass and diversity of benthos (Gilkinson et al 2005).

IMM Comment: Natural disturbance at commercial Arctic surfclam depths is very likely to be less (than at shallower depths), as inferred from comparison of the results of studies at 80 m depth on Banquereau and 40 m depth on Sable Bank (as reported in this assessment report), but natural disturbance may nevertheless still occur on the very exposed offshore banks in question, including through tidal action. In fact, enormous volumes of material can be mobilised by physical processes, and communities in exposed sites tend to be defined by and adapted to perturbation. The evidence from specific studies on Banquereau is that the visual evidence of hydraulic dredge tracks had disappeared within one year from a site at 80 m depth (as deep as Arctic surfclam beds are commercially targeted, with most beds being in the 50 – 70 m range). Although the same experimental tracks were still barely detectable with side-scan sonar after 10 years, the team contends that, in combination with the very limited swept areas of both fisheries, this cannot be considered to represent 'serious or irreversible harm' (as defined by the MSC) to the habitat structure and function of these exposed, soft-sediment sites.

The footprint of hydraulic dredges may be relatively small (in terms of area covered), but hydraulic clam dredges produce the most severe effects on seabed habitat of any gear type[16]. The assessment team is tasked to assess the risk that the clam fisheries cause serious or irreversible harm to habitat structure and function. Risk is, broadly speaking, the product of consequence and probability. Given that the fisheries sweep 0.4% of the available Arctic surf clam habitat annually, the probability of serious or irreversible harm may be reasonably low. However, the consequence/impact of hydraulic dredging is significant.

[16] Gilkinson, K.D. et al (2005). Immediate impacts and recovery trajectories of macro faunal communities following hydraulic clam dredging on Manquereau, eastern Canada. ICES Journal of Marine Science, V 62, pp. 925-947.

IMM Comment: The assessment team agrees that the potential risk to some habitats from hydraulic dredging is considerable. However, evidence from the disturbance study on Banquereau is that surf clam habitat (i.e. well-mixed sand) is not particularly sensitive to disturbance (in comparison to, say, cold water coral reefs or deep and sheltered muddy sites), while the annual swept area of the fisheries is very small. As such, we have assessed the risk of 'serious or irreversible harm' posed by the Arctic surfclam fishery to relevant habitats on a regional or bioregional scale to be very low.

Also, the MSC standard does not require an assessment of the cumulative impact of (other) fisheries on the Arctic surf clam habitat. Currently two of four vessels prosecute the fishery in both areas. If the intensity and frequency of the fisheries increase the probability of serious harm will also increase. It is important to note that in accordance with the Science Advisory (CSAS) Report 2007/042[17] the Southeast Shoal and Tail of the Banks area (east of 51oW and south of 45oN, extending to the edge of Grand Bank) requires the highest priority conservation objectives in the Placentia Bay-Grand Banks Large Ocean Management Area (PBGB-LOMA). This report identified the Southeast Shoal and Tail of the Banks as an ecologically or biologically significant area (EBSA). It is noteworthy that the EBSA criteria developed by Canada conforms to the Convention on Biological Diversity's (CBD) EBSA criteria[18] as adopted by the ninth CBD Conference of Parties (COP 9), decision IX/20, Annex I (http://www.cbd.int/doc/decisions/cop-09/cop-09-dec-20-en.pdf).

IMM Comment: It is correct that other fisheries may impact the habitats of Banquereau and Grand Bank, but we would again comment that Arctic surfclam habitat is not very sensitive to fishing impacts in comparison to deeper or more sheltered areas and the swept areas of both fisheries are small, while the status of the long-lived Arctic surfclam populations (i.e. probably near to the virgin biomass level on both banks) also strongly suggests that the fisheries are not causing serious or irreversible harm to habitats.

In regards to the impact of the Arctic surfclam fisheries, it is possible that the number of vessels can be doubled from the present 2 to a total of 4 on the basis of the available licenses, but the total intensity of the fishery is ultimately limited by the TAC set rather than the number of vessels fishing. In recent years, the fishery has focused more on Banquereau, where the TAC has been largely taken, while only limited amounts of surfclam have been taken on the Grand Bank. If both fisheries are certified, and if the TACs were raised significantly during the course of their certifications, then the risk posed to habitats by the fisheries would be reassessed during the course of surveillance audits.

Due to the ecological importance of the Southeast Shoal, the CSAS report 2007/042 concluded that conservation objectives for the area must "ensure that the features listed below are not altered and/or disrupted by human activities to the point they can no longer be considered a unique feature and/or fulfill the ecological function that initially triggered their identification as significant in the area:

- Area of highest overall benthic biomass on the Grand Banks
- Unique offshore capelin spawning
- Unique yellowtail nursery
- Unique shallow, sandy habitat with glacial history
- Cetacean aggregation and feeding
- Seabird aggregation and feeding
- American plaice (nursery habitat)
- Atlantic cod spawning

[17] DFO, 2007. Placentia Bay-Grand Banks Large Ocean Management Area Conservation Objectives. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/042.

[18] EBSAs "are geographically or oceanographically discrete areas that provide important services to one or more species / populations of an ecosystem or to the ecosystem as a whole, compared to other surround areas or areas of similar ecological characteristics, or otherwise meet the criteria as identified in Annex I to the decision IX/20". The criteria include characteristics such as: uniqueness or rarity; special importance for life history stages of species; importance for threatened, endangered or declining species and /or habitats; vulnerability, fragility, sensitivity or slow recovery; biological productivity; biological diversity; and naturalness".

• Reproduction and survival of striped wolffish
• Unique relict populations of blue mussels and wedge clams"[19]

The Grand Banks Assessment report (Intertek Moody Marine, Ref: 82351/v3) refers to the EBSA classification, noting that 'there is no guidance as to whether the present ecosystem should be protected or whether the aim should be to restore an ecosystem from a point in history" (pp. 54). It is important to note that in accordance to Decision X/29 of the UN Convention on Biological Diversity (CBD), noted that the application of the EBSA criteria presents a tool towards the implementation of ecosystem approaches through the identification of areas and features of the marine environment that are important for conservation and sustainable use of marine and coastal biodiversity. Besides, it also noted that areas that meet the EBSA criteria may require enhanced conservation and management measures, which can be achieved through a variety of means, including marine protected areas and impact assessments.

IMM Comment: The assessment team contends that the comment 'there is no guidance on whether the present ecosystem should be protected, or whether the aim should be to restore an ecosystem from a point in history' is still valid in the context of aiming to implement an ecosystem approach to conservation and sustainable use. And, while areas that meet the EBSA criteria may require enhanced conservation at some point, to our knowledge there is no such requirement for specific management to be in place at the present time. However, if the fisheries are certified and if such management was introduced during the course of the certification, then those changes would need to be considered during future surveillance audits. However, it is noteworthy that, as reported in this report, the fishery was screened-out (i.e. it was not considered to be an impacting activity) in a DFO analysis of all activities potentially impacting spawning cod in the Southeast Shoal and Tail of the Banks EBSA (DFO 2009f), while the quantities of the other EBSA-listed species in bycatch and scientific survey data are either tiny or completely absent.

With respect to vulnerable marine ecosystems (VMEs), the Grand Banks Assessment Report did not address VME concerns as part of its P2 considerations. In fact, it states that 'no specific work has been undertaken to determine the impact of the Arctic surf clam fishery on the seabed habitat of Grand Bank" (pp. 95). It has been highlighted in a previous WWF communication letter that the Northwest Atlantic Fisheries Organization (NAFO) has been undertaking research to identify VMEs in its regulatory area, including on the Grand Banks. In 2008, NAFO's Scientific Council Working Group on Ecosystem Approach to Fisheries Management identified the Southeast Shoal and adjacent Shelf Edge/Canyons as VMEs (NAFO SCS Doc. 08/10). Paragraph 119 (a) of the United Nations resolution 64/72 establishes that flag states can only undertake bottom fishing activities after impact assessments have been conducted in accordance with the criteria established by the FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO Guidelines).

IMM Comment: Thank you for the information on the VME classification of the Southeast Shoal and adjacent Shelf Edge/Canyons. As confirmed in a follow-up e-mail, it is noted that the NAFO report indicates that the VME has not progressed past the 'candidate VME' stage. It is our understanding that this means that the area is not therefore afforded any specific protection. However, as with other elements of the P2 (and P1 and P3) assessment undertaken for this fishery, if the fishery was certified and if changes occurred to the VME classification of the site, then those changes would be considered as part of the routine surveillance audit process. Other comments on the information needed or recommended for an impact assessment approach are included below.

In view of these developments of international law, undertaking comprehensive impact assessments should be a P2 condition for this certification to ensure that the Grand Bank Arctic Surf Clam Fishery does not impact ecologically or biologically significant areas and vulnerable marine ecosystems (as defined by Paragraph 42 of the FAO Guidelines). Due to the characteristics of the fishing method in the area (bottom fishing), and in accordance with generally accepted standards under international law, WWF recommends that these impact assessments follow the criteria established by Paragraph 47 of the FAO Guidelines. Under the FAO criteria, impact assessments should address, inter alia:

[19] DFO, 2007, supra note 17.

IMM Comment: Further comment on the applicability of the VME process is provided above and below. It may be noted, though, that the impact assessment approach described above is closely mirrored by the work undertaken by DFO in assessing the fishery and its impact on stock and the environment:

"i. Type(s) of fishing conducted or contemplated, including vessels and gear types, fishing areas, target and potential bycatch species, fishing effort levels and duration of fishing (harvesting plan); **IMM Comment**: This information is clearly described in various DFO publications, including the area-specific CSAS reports (Roddick et al. 2007, 2011) and the IFMP (DFO 2011c).

ii. best available scientific and technical information on the current state of fishery resources and baseline information on the ecosystems, habitats and communities in the fishing area, against which future changes are to be compared; **IMM Comment:** Again, the CSAS report and the IFMP contain this information, while relevant research work undertaken on Banquereau is reported in Gilkinson et al. 2005 and partially in DFO 2010, and is due to be updated following a resurvey of the Banquereau site in 2008 (publication of the results from the latest survey has been delayed, although the assessment team was provided with an update by DFO scientists during the site visit).

iii. identification, description and mapping of VMEs known or likely to occur in the fishing area; **IMM Comment:** The Grand Bank LOMA process has identified the EBSAs on the Grand Banks. These are reported in the Grand Bank assessment report as DFO (2007b). As noted above, the Southeast Shoal and adjacent Shelf Edge/Canyons Candidate VME is listed in NAFO SCS Doc. 08/10.

iv. data and methods used to identify, describe and assess the impacts of the activity, the identification of gaps in knowledge, and an evaluation of uncertainties in the information presented in the assessment; **IMM Comment:** The scientific work undertaken on Banquereau is highly specific to understanding the impacts of the fishery on habitats and species that are encountered, and are described in Gilkinson et al .2005,). Gaps in knowledge are being addressed through an ongoing research programme, including through the resurvey of the Banquereau experimental dredge site (results to be published soon), and as listed in the latest IFMP (DFO 2011c), while the programme and any results are considered in the Offshore Clams Advisory Committee forum, which is open to the public.

v. identification, description and evaluation of the occurrence, scale and duration of likely impacts, including cumulative impacts of activities covered by the assessment on VMEs and low-productivity fishery resources in the fishing area; **IMM Comment:** While the specific assessment of the impact of the fishery on VME components has not, to our knowledge, been undertaken, and data are collected that would make this a relatively simple task, there is nothing in the available data that suggests that this fishery is a concern or should be a priority for detailed attention. In fact, as reported, the impact of the fishery on cod spawning in the Southeast Shoal and Tail of the Banks was screened-out in an assessment of impacting activities, while bycatch levels of the EBSA and VME listed species in the fishery are tiny or non-existent.

vi. risk assessment of likely impacts by the fishing operations to determine which impacts are likely to be significant adverse impacts, particularly impacts on VMEs and low-productivity fishery resources;[20] and; **IMM Comment:** Again, the fishery was screened out in an assessment of likely impacting activities on cod spawning. While other species are EBSA-listed, such species are either caught in tiny quantities or are absent in bycatch, while, given the gear type and swept area, there is no indication that the fishery presents a risk of mortality or significant disruption of behaviours to other EBSA-listed species such as seabirds, cetaceans or other ETP species.

vii. the proposed mitigation and management measures to be used to prevent significant adverse impacts on VMEs and ensure long-term conservation and sustainable utilization of low-productivity fishery resources, and the measures to be used to monitor effects of the fishing operations."[21] **IMM Comment:** These are well described in the IFMP and the assessment team has interpreted the results as being not significant from the data provided in the various DFO reports specific to these fisheries.

[20] For a risk-management framework model see K. Martin-Smith, "A Risk-Management Framework for Avoiding Significant Adverse Impacts of Bottom Fishing Gear on Vulnerable Marine Ecosystems", (2009) 16 CCAMLR Science 177-193.
[21] FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas, Rome, 2009. Para. 47.

It is important to note that the FAO Guidelines can also be implemented in marine areas within national jurisdiction (Paragraph 10). In fact, the United Nations General Assembly resolution 66/68 (2011) noted the "adoption by coastal States of conservation measures regarding their continental shelf to address the impacts of bottom fishing on vulnerable marine ecosystems, as well as their efforts to ensure compliance with those measures" (Para. 124). Giving a 100 score to habitat status in the absence of a comprehensive prior impact assessment is contrary to the Precautionary Approach. In this context, it is important to highlight that in a recent Advisory Opinion of the International Tribunal for the Law of the Sea, the chamber recognized "a trend towards making this approach part of customary international law" (ITLOS, Case 17, Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, 2011) and therefore legally binding.

IMM Comment: The team was unable to find any evidence that the assessment approach listed above is currently a requirement in Canadian national waters or for fisheries managed nationally. If the fisheries are certified and new measures were introduced, though, then such measures would need to be considered during the surveillance audit process.

2.4.2 Management Strategy There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types
Grand Bank: 80, Banquereau: 100

The fisheries leave harvested areas fallow for 10 years before re-harvesting to allow the target species to recover. The assessment team considers the fallowing period a strategy to manage habitat impacts, but a strategy should be designed to manage impact on the habitat component specifically (GCB3.3.1.b). A habitat strategy should at least comprise protection and avoidance of the identified EBSA.

IMM Comment: The assessment reports have been modified to take account of the fact that the TAC setting process limits the potential for the fisheries to impact significantly larger areas of habitat than are currently being fished. However, it may be noted that the MSC defines a comprehensive strategy (i.e. at the SG 100 level) as "*a complete and tested strategy made up of linked monitoring, analyses, and management measures and responses*", but that to meet the requirement at SG100 "*this may simply comprise a statement of intent about continuing to have no impact and ongoing monitoring to ensure that no impact occurs*". While there is no such statement in this case, it is considered that the work undertaken on Banquereau specifically to determine the impact of the Arctic surfclam fishery, together with setting the TAC at a level which limits the swept area of the fishery and the 10-year fallowing period, is sufficient to justify the high marks for these fisheries in the context of efforts undertaken to understand the impacts and ensure they are within acceptable limits (with the Banquereau work allowing the Banquereau fishery to score higher than the Grand Bank fishery). With regards to the EBSA, we are again not aware of there being a requirement for fisheries managers to take account of the EBSA listing, while the evidence is also that the fishery does not, in any case, impact listed species or habitats significantly.

2.4.3 Information/monitoring Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types

Not much is known about the environmental impacts of hydraulic clam dredging even though this technology has been in use in the Northwest Atlantic since the 1940s (Gilkinson et al 2005). Even less is known about the impacts of hydraulic clam dredging on benthic communities in deeper offshore areas. A score of 80 and 95 does not reflect this limited knowledge on impacts and recovery trajectories.

IMM Comment: As a potentially impacting activity, hydraulic dredging has not been much studied in comparison to some other fishing gears (e.g. otter trawling, long-lining). However, this is to a large extent related to the much more common use of such gears than hydraulic dredging in commercial fisheries. And, although not well studied in general, the work that was undertaken on Banquereau, specifically to understand the effects of this specific fishery on Arctic surfclam habitats, has been very useful in providing relevant information. In fact, it is somewhat unusual that the assessment team has been able in this case to review the

results of an impact study that is specific to the fishery in assessment and the habitats in which it operates- for many fisheries, the effects have to be inferred from studies of similar fisheries that occur in similar habitats. With this in mind, it is pertinent to highlight that the IFMP (DFO 2007) states "*As a result of this ten year study [on Banquereau], the effects of hydraulic clam dredging are now better understood compared with many other gear typed used throughout the Canadian fisheries*.". The higher score for Banquereau reflects the better information on habitats which is available from Banquereau in comparison to Grand Bank.

2.5.1 Ecosystem status There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types
Grand Bank: 90; Banquereau: 100

The Banquereau Assessment report (Intertek Moody Marine, Ref. 82351/v3) acknowledges that part of the Banquereau was selected as an EBSA and a candidate Area of Interest for a new MPA, but it states that the ESSIM initiative has not progressed beyond the proposal stage and that "other areas were more favoured for designation of EBSAs" (pp.93). It is important to note, however, that a new initiative is taking place on the Scotian Shelf, the Scotian Shelf bioregional MPA network planning, in accordance with the National Framework for Canada's Network of Marine Protected Areas (adopted in September 2011). Under the National Framework, one of the criteria for selecting the design of the network is the EBSA criteria. Even if the Banquereau is not included in the MPA network design, it would be recommended that a comprehensive impact assessment is undertaken to ensure adequate conservation of marine biodiversity (see comments on section 2.4.1 above).

IMM Comment: The fishery can only be scored on the basis of the management framework that is in place at the time of the assessment. In what we believe is an absence of any specific management requirements regarding the EBSA or VME, the assessment team believes that both the Banquereau and Grand Bank fisheries are appropriately scored (noting that, in any case, there is credible evidence that the fisheries do not significantly impact EBSA-listed species or occur within the VME). However, if the fisheries are certified, then the implications of any new measures being introduced during the course of the certifications would be assessed during the normal audit process.

As for the Grand Banks, see comments under section 2.4.1 above.

The Arctic clam fisheries are the first hydraulic dredge fisheries to be recommended for certification. The conclusions of these clam assessments are thus not harmonized with other hydraulic dredge fisheries. However, it would be informative to review the evaluation, scoring and particularly conditions of already certified trawl and dredge fisheries. Several examples of already certified trawl and dredge fisheries in the region are provided in the table below. All of the certified fisheries score lower on the habitat criteria than the clam fisheries in assessment, while the impact of hydraulic dredge on habitat is more severe.

	Grand Bank, Newfoundland Hydraulic dredge	Banquereau, Scotian Shelf Hydraulic dredge	Eastern Canada offshore scallop Dredge	OCI Grand Bank yellowtail flounder Trawl	Canadian offshore northern shrimp Trawl	Scotian shelf shrimp Trawl
Average P2	87.7	91.3	83	81	82	84
2.4.1	100	100	75 (pre FAM)	80	60	60
2.4.2	80	100		80	60	80
2.4.3	80	95		70	70	70

IMM Comment: In response to the points made above, the assessment team contends that the swept area of the Arctic surfclam fishery and the habitat types encountered must be taken in to account in any assessment of 'severity', and, that when compared against the other fisheries mentioned, we

cannot agree with the view that the impact of the hydraulic dredge fishery is more severe than other certified fisheries. In fact, the low annual swept area of the Arctic surfclam fisheries, as a fraction of the regional or bioregional area covered by the habitats, together with the knowledge of effects of this fishery as provided through a specific study (not available in the other fisheries cited in the above table), justify the higher scores awarded.

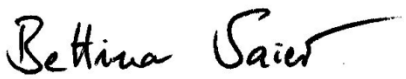
The assessment team also does not believe that the fact that the Banquereau and Grand Bank fisheries are the first hydraulic dredge fisheries to pursue MSC-certification is a reason to score the fisheries down. With regard to the mention of a precedent being set in the first paragraph of the WWF comments, this is to some extent true in that the assessment team clearly believe that it is possible to certify the Grand Bank and Banquereau hydraulic dredge fisheries (albeit, with some conditions of certification), but we do not believe that we have set a precedent that hydraulic dredge fisheries should be scored highly- the scores recommended here are on the basis of the understanding of these specific fisheries and their impacts. With regards to harmonisation with other fisheries, though, MSC guidance is that harmonisation is specific to overlapping fisheries (i.e. two or more fisheries assessing some, or all, of the same aspects of MSC Principles 1, 2 and/or 3 within their respective units of certification), rather than on the basis of the gear type alone. As such, should other hydraulic dredge fisheries in different areas and targeting different species seek certification then those fisheries would need to be scored on the basis of the knowledge of their impacts, rather than on how the Banquereau and Grand Bank fisheries are scored.

In conclusion, the assessment of Principle 2 and the assessment of the habitat PIs specifically are not precautionary or adequate and do not reflect the intent of Principle 2, which is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem. We look forward to a more precautionary assessment of Principle 2.

IMM Comment: The overall focus of Principle 2 is "Fishing operations should be managed to maintain the structure, productivity, function and diversity of the ecosystem on which the fishery depends.", while the term 'restrain' is used specifically with regard to the ecosystem management component, PI 2.5.2, where at the SG 100 level the wording is "This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm." We believe that the management does indeed prevent serious or irreversible harm, as defined in the MSC Standard, from occurring, and have scored the Banquereau fishery accordingly, while information is not as specific to the Grand Bank fishery and so a score of 80 was given for PI 2.5.2 there.

Thank you for the opportunity to provide comments.

Sincerely,



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20.2 Letter from the MSC, undated.

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SUBJECT: MSC Review and Report on Compliance with the scheme requirements

Dear Rob Blyth-Skyrme

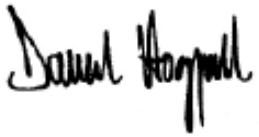
Please find below the results of our partial review of compliance with scheme requirements.

CAB	Intertek Moody Marine
Lead Auditor	Rob Blyth-Skyrme
Fishery Name	Clearwater Seafoods Banquereau and Grand Bank Arctic Surf Clam Hydraulic Dredge Fishery
Document Reviewed	Public Comment Draft Report Posted

Ref	Type	Page	Requirement	Reference	Details
TO.391	Major	51/56	CR-V1.1-27.12.1.2	The possibility of vessels fishing outside the unit of certification.	It is mentioned in the report that "Although it is possible for Arctic surfclams to be taken by gears other than hydraulic dredges (for example, in groundfish trawls), the quantities taken will inevitably be extremely small and essentially inconsequential." The report does not provide a detailed explanation of how these clams are handled (i.e. discarded or processed, etc.) once caught
TO.392	Major		CR-V1.1-27.12.1.3	The CAB shall determine if the systems of tracking and tracing in the fishery are sufficient to make sure all fish and fish products identified and sold as certified by the fishery originate from the certified fishery. The CAB shall consider the following points and their associated risk for the integrity of certified products. The opportunity of substitution of certified with non-certified fish prior or at landing.	As per TO.0391

TO.390	Major	59/64	CR-V1.1-27.6.3	The CAB shall document the rationale for the target eligibility date and include an assessment regarding how the assessed risks to the traceability system in the fishery are adequately addressed by the applicant to give confidence in this date.	The rationale for the target eligibility date is not given in the report.
TO.393	Guidance	59/64	CR-V1.1-27.12.1	The CAB shall determine if the systems of tracking and tracing in the fishery are sufficient to make sure all fish and fish products identified and sold as certified by the fishery originate from the certified fishery. The CAB shall consider the following points and their associated risk for the integrity of certified products.	The traceability section of the report does not clarify whether there are traceability systems in place during onboard processing to segregate any Arctic surfclams caught by other methods (e.g. in groundfish trawls) as referenced in the report (pg 51 for Clearwater and pg 56 for Grandbanks report)
TO.394					

This report is provided for action by the CAB and ASI in order to improve consistency with the MSC scheme requirements; MSC does not review all work products submitted by Conformity Assessment Bodies and this review should not be considered a checking service. If any clarification is required, please contact Jodi Bostrom on +44 (0)20 7246 8934 for more information.



Best regards,
Dan Hoggarth
Fisheries Oversight Director
Marine Stewardship Council

cc: Accreditation Services International

IMM Comments in response to the MSC:

TO 391: A note has been added to the report in Section 13.1, Traceability within the fishery, to make it clear that the Arctic surfclam vessels operating in this fishery are highly specialised for fishing with hydraulic dredges. As such, unless modified (at considerable expense), there is no possibility of these vessels using a fishing gear other than the assessed hydraulic dredge to catch Arctic surfclams. The text of Section 8 has also been modified to better reflect the fishery's situation.

TO 392: Trans-shipment is banned within the Arctic surfclam fishery, and no instances of this requirement being broken were reported to the assessment team by DFO. No other fishing vessels are permitted to retain Arctic surfclam. A comment has also been added in Section 13.1 to note that landings are 100% monitored. In combination with the features of the fishery as noted against To 391, the assessment team is confident that "*systems of tracking and tracing in the fishery are sufficient to make sure all fish and fish products identified and sold as certified by the fishery originate from the certified fishery.*" (CR 27.12.1).

TO 393: The MSC allows for the TED for a fishery to be "*Any date prior to the certification of the fishery up to a maximum of six months prior to the publication of the most recent Public Comment Draft Report. This date should be linked to: c. Any other logical date with regard to the applicant fishery.*" (CR 27.6.1.2).

In this case, the Public Comment Draft Reports for both fisheries were published on April 26th, 2012. The earliest TED that can be set is therefore October 26th, 2011, and this is a logical date in that the client has confirmed that it would provide the most benefit to the fishery from certification. A note to this effect has been included at Section 13.5 of this report.

TO 394: It is the assessment team's contention that the answers as provided to TO 391 and TO 392 apply to and satisfy this query also.

21 APPENDIX G - REGISTERED COMPANIES / VESSELS WITHIN THE UOC

Upon certification, the following would be eligible to sell MSC certified product

- Clearwater Seafoods Limited Partnership.

22 APPENDIX H - DETERMINATION OF SURVEILLANCE LEVEL

After each certification, surveillance and re-certification assessment, the certification body shall determine the level at which subsequent surveillance of the fishery shall be undertaken. A surveillance audit may be conducted as either an "on-site" or "offsite audit". This is determined by using criteria set out by the MSC:

Criteria	Surveillance Score	Grand Bank Surfclam
1. Default Assessment Tree		
Yes	0	0
No	2	-
2. Number of Conditions		
Zero Conditions	0	-
1-5 Conditions	1	1
>5 Conditions	2	-
3. Principle Level Scores		
≥ 85	0	0
<85	2	-
4. Conditions on outcome PIs?		
Yes	2	0
No	0	0
Total		1

The Grand Bank surfclam fishery receives a total surveillance score of 1.

Using the table below, the surveillance score is used to determine the surveillance level appropriate to the fishery:

			Years after certification or re-certification			
Surveillance score	**Surveillance level**		**Year 1**	**Year 2**	**Year 3**	**Year 4**
2 or more	Normal surveillance		On-site surveillance audit	On-site surveillance audit	On-site surveillance audit	On-site surveillance audit & recertification visit
1	Remote surveillance	Option 1	Off-site surveillance audit	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit & recertification visit
		Option 2	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit	
0	Reduced surveillance		Review new information	On-site surveillance audit	Review new information	On-site surveillance audit & recertification visit

The Grand Bank surfclam fishery will be eligible for remote surveillance audits. The first surveillance announcement will indicate whether the first surveillance audit will be an on-site or an off-site surveillance audit.