STATUS OF SOUTHWEST NOVA SCOTIA INSHORE HARDSHELL CLAM STOCKS

Context

DFO Maritimes Science Branch was asked by Fisheries and Aquaculture Management Branch to provide advice on the status of hardshell clam stocks, principally Arctic surfclam (*Mactromeris polynyma)*, ocean quahog (*Arctica islandica*) and northern propeller clam (*Cyrtodaria siliqua*) within the Southwest Nova Scotia (SWNS) Inshore Hydraulic Dredge Hardshell Clam Areas. Further, advice was requested on what indicators may be recommended to monitor the future health of these stocks for a sustainable fishery. A response was requested by June 30, 2008. Given the short timeframe for response, a Special Science Response Process was considered to be appropriate.

Background

Both the 1983 and 1985 Canadian Industry Reports on surfclams and ocean quahogs (Chaisson and Rowell, 1985; Rowell and Chaission, 1983), and the 1998 Stock Status Report on ocean quahogs (DFO, 1998), identified concentrations of each species within the identified SWNS Inshore Hydraulic Dredge Hardshell Clam Areas. The 1998 Stock Status Report recommended at least four conservation provisions be incorporated into harvesting plans including bed by bed management and minimum sizes.

The SWNS Inshore Hydraulic Dredge Hardshell Clam Areas occur between Pennant Point southwest along the coast seaward from the 12 nautical mile (nm) headland to headland base line to 65^{o} 30'. Three limited entry < 45 foot hardshell clam hydraulic dredge licences are authorized by seasonal conditions of licences, to fish unlimited amounts of four species of hardshell clams including ocean quahog, bar clams, surfclams, and propeller clams in this area. Authorized ocean quahog quota access also exists within local baseline embayments on a seasonal basis, which is determined by survey biomass estimates that apply the recent hardshell clam framework assessment process.

A meeting of DFO scientists and fisheries managers was held on June 9, 2008 to review the available information. This Science Response will provide the primary information on the status of the resource and will be incorporated in the management strategy for the three SWNS inshore Hydraulic Dredge hardshell clam licence holders.

Response

Current Status

The status of hardshell clams in the inshore area (< 20 nm from the territorial sea baseline, Figure 1) is unknown at this time, with the exception of the areas inside of headlands. The inshore clam surveys in SWNS that were conducted from 1980 to 1982 only covered inside of headlands and, therefore, only ocean quahogs. In the same period (1980-1982), some survey

stations were conducted by the offshore survey on the part of western Roseway Bank that is included in the inshore area.

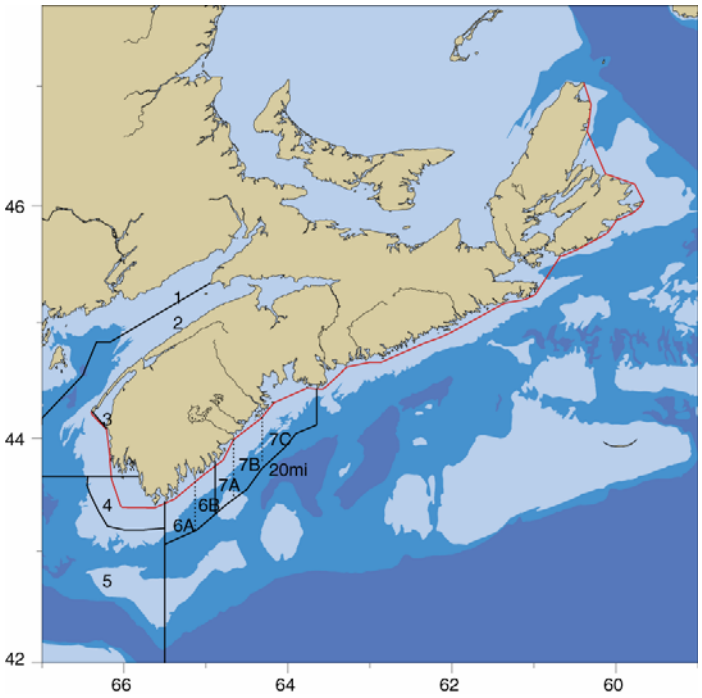

Figure 1. Inshore clam fishing areas in Maritimes Region. Red line is the Territorial Sea baseline.

Sustainable catch levels can be estimated for ocean quahogs for the surveyed areas, using the biomass estimates from the survey (Rowell and Chaisson, 1983), data from studies of the inshore ocean quahog population in St. Mary's Bay (Roddick et al., 2007), and the methods outlined in the DFO Expert Opinion (DFO, 2005). Using this approach, estimates of the sustainable catch of ocean quahogs for each of the surveyed areas are provided in Appendix A. However, these estimates do not contribute to our knowledge of the status of hardshell clams in the inshore area outside of headlands.

An analysis of the catch history for the inshore licenses shows that there has been low and sporadic effort in this fishery, with the species mix changing with market conditions. In the last five years, the largest annual landings have been 99 t total for all species, and 11 t for Arctic surfclams. The landings by year and species for the inshore fishery in Northwest Atlantic Fisheries Organization (NAFO) areas 4W and 4X are shown in Appendix B.

DFO Science does not have the data to draw any conclusions on the status of the hardshell clam stocks in the inshore areas of SWNS outside of the headlands.

Future Information Requirements

In order to assess the status of hardshell clam stocks within the SWNS Inshore Hydraulic Dredge Hardshell Clam Areas for the management of a sustainable fishery, information is required on the abundance, distribution, population structure, and sustainable exploitation rates of directed clam species, as well as on possible ecosystem interactions. At present, this information is lacking as there is currently a low level or lack of fishing activity on the hardshell clam stocks for which advice was requested, and survey data is limited.

Although commercial licenses have already been issued for this fishery, it has characteristics similar to those of a new fishery and may best be served using a similar approach. The approach being used for new fisheries in the Maritimes is to start with a brief period of time (<= 2 fishing seasons) to determine if commercial catch rates are possible and to collect information for scientific purposes (e.g., information on clam size structure and distribution). This initial stage is followed by a subsequent period (1–5 seasons) during which stock assessment indicators are developed and monitored.

For this fishery, it is recommended that information on the size of clams harvested and their distribution be collected during the next two seasons, in addition to information on fishery catch and effort. It is recommended that collection of fishery monitoring data be supplemented by a detailed research survey (possibly in 2009-2010), with subsequent surveys at frequencies as recommended below. A comparison of fishery monitoring data with research survey results would provide useful information on the effects of fishing in this area and could be used to guide the design of subsequent surveys. For this fishery, it is expected that periodic surveys combined with accurate catch data would provide indicators of biomass and exploitation rates that would be appropriate for management.

This approach is dependent on the assumption that the exploitation rates for each clam species fished would be low within the next few years of fishing. Limits on the level of fishing would help ensure low exploitation rates; however, DFO Science does not have the appropriate data at present upon which to recommend a suitable limit.

With a low exploitation rate, the fishery could be managed for long periods on a constant catch basis, with updates to the survey data conducted infrequently. At higher exploitation rates, however, survey frequency should also increase. This is the approach that was recommended for ocean quahogs in this area in 2005 (DFO, 2005). For ocean quahogs, the recommended survey frequency was ten years. For a faster growing species, such as the Arctic surfclam, the recommended survey frequency is 5 to 7 years.

Risks associated with allowing the fishery to proceed without estimates of current biomass include:

Impacts on Clam Stocks

Work with the offshore clam fishery and reports from other clam dredge fisheries show that when an area has been fished out commercially approximately 50% of the bottom in the area has been dredged (Roddick and Smith, 1999). This means that in the short term there is little risk of the fishing activity wiping out the population of clams or other species in the fished areas.

Risks associated with allowing the fishery to proceed without additional ecosystem information include:

Habitat Impacts

This issue has been studied for the offshore fishery, and the conclusions were that the immediate impacts of the dredges are large, but the area does recover after 3 to 5 years. (Gilkinson et al., 2003; 2005) The depths involved in the inshore area should shorten the recovery period, and the footprint of the fishery with a maximum of three vessels will be small.

Species at Risk

The gear has low levels of bycatch and operates on well sorted sandy bottom. The only species at risk that may be impacted would be the winter skate (*Leucoraja ocellata*). This species is listed as a species of special concern in NAFO Area 4X, which covers the inshore areas in SWNS. Bycatch of skates has been minimal in the offshore surveys, but winter skate are present in the SWNS clam fishing areas.

Conclusions

The status of hardshell clam stocks within the SWNS Inshore Hydraulic Dredge Hardshell Clam Areas is unknown, with the exception of the areas inside of headlands. Monitoring the health of these stocks can best be accomplished with periodic biomass surveys and accurate fishery data. It is recommended that vessels with adequate fishing experience be used to conduct biomass surveys for management purposes.

The risk of allowing a fishery to proceed over the next few years, with the intent of delimiting areas to be surveyed, is expected to be low assuming a low exploitation rate. A precautionary approach would be to limit the level of fishing to help ensure a low exploitation rate; however, DFO Science does not have the appropriate data at present upon which to recommend a suitable limit.

It is recommended that tow by tow information be recorded on a special science form, in addition to the regular fishing log, which will include start and end positions of the tow and blade width of the dredge used. The weight of the catch of large clam species caught, including Arctic surfclams (*Mactromeris polynyma*), Atlantic surfclams (*Spisula solidissima*), ocean quahogs (*Arctica islandica*), northern propellerclams (*Cyrtodaria siliqua*), and Greenland cockles (*Serripes groenlandicus*) should also be recorded, as well as by-catch. Observer coverage of at least two trips per vessel per year is recommended.

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Sources of Information

Chaission, D.W., and T.W. Rowell. 1985. Distribution, abundance, population structure, and meat yield of the ocean quahog (*Arctica islandica*) and Stimpson's surf Clam (*Spisula polynyma*) on the Scotian Shelf and Georges Bank. Canadian Industry Report of Fisheries and Aquatic Sciences 155.

DFO. 1998. Scotian Shelf Quahaug. DFO Science Stock Status Report C3-37 (1998).

DFO. 2005. The rationale for harvest advice on ocean quahogs (*Arctica islandica*). DFO Maritimes Region Expert Opinion 2005/04.

Gilkinson, K.D., D.C. Gordon, Jr., K. MacIsaac, D.L. McKeown, E.L.R. Kenchington, C. Bourbonnais, and W.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.

Gilkinson, K.D., D.C. Gordon, Jr., D. McKeown, D. Roddick, E.L.R. Kenchington, K. MacIsaac, C., Bourbonnais, and W.P. Vass. 2003. Susceptibility of soft corals (Anthozoa: *Gersemia rubiformis*, Ehrenberg, 1834) to capture by hydraulic clam dredges off eastern Canada: The significance of soft coral-shell associations. American Fisheries Society Symposium 41:383-390.

Gilkinson, K.D., G.B.J. Fader, D.C. Gordon, Jr., R. Charron, D. McKeown, D. Roddick, E.L.R. Kenchington, K. MacIsaac, C. Bourbonnais, W. P. Vass, and 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.

Roddick, D., and S. Smith. 1999. Assessment of the Banquereau Bank Arctic surfclam. DFO Canadian Stock Assessment Secretariat Research Document 99/69.

Roddick, D., K. Mombourquette, and R. Kilada. 2007. Survey for Ocean Quahogs (*Arctica islandica*) at the Mouth of St. Mary's Bay, Nova Scotia. DFO Canadian Stock Assessment Secretariat Research Document 2007/037.

Rowell, T.W., and D.R. Chaission 1983. Distribution and abundance of the ocean quahog (*Arctica islandica*) and Stimpson's surf Clam (*Spisula polynyma*) resource on the Scotian Shelf. Canadian Industry Report of Fisheries and Aquatic Sciences 142.

Appendices

Appendix A: Analysis of 1980's survey data.

Surveys for clam species on the Scotian Shelf were conducted from 1980-1982. These surveys concentrated on the inshore bays and the offshore banks. The areas from the headlands to 20 nm received little coverage. The surveys inside the headlands were published in Rowell and Chaisson (1983). The clam species found inside the headlands was the ocean quahog (*Arctica islandica*), with no other species found in commercial quantities. A Total Allowable Catch (TAC) for the areas surveyed was calculated using the formula for Maximum Constant Yield (MCY) from Expert Opinion 2005/04:

$$MCY = 0.33MB_0$$

Where B_0 is from Rowell and Chaisson (1983), and M (= 0.045) is the estimated natural mortality for ocean quahogs in St. Mary's Bay from Roddick et al. (2007), the closest population for which we have an estimate.

The resulting TAC estimates for ocean quahogs are:

Area	Original Biomass (t)	Corrected Biomass (t)[1]	MCY
St. Marys Bay[2]	157,843	157,843	2,344.0
Lobster Bay	720	1,030	15.3
Clark's Harbour	12,621	18,048	268.0
Barrington Bay	5,044	7,213	107.1
Port LaTour	3,751	5,364	79.7
Negro Harbour	2,368	3,386	50.3
Shelbourne	4,866	6,958	103.3
Shelbourne II	440	629	9.3
Jordan Bay	4,356	6,229	92.5
Green Harbour	28	40	0.6
Jordan/Green	333	476	7.1
Port Hebert	67	96	1.4
Port Joli	69	99	1.5
Port Mouton I	3,684	5,268	78.2
Port Mouton II	95	136	2.0
Port Mouton III	150	215	3.2
Medway Harbour	356	509	7.6
Green Bay	1,482	2,119	31.5
False LaHave	486	695	10.3
LaHave	585	837	12.4
Rose/ Lunenburg	1,098	1,570	23.3
Total	200,442	286,632	4,514.5

[1]Corrected biomass is from Errata note for Rowell and Chaission (1983).
[2]Biomass estimate for St. Mary's Bay is from Roddick et al. (2007).

Appendix B: Analysis of inshore clam landings in 4W and 4X, from the Maritimes Fisheries Information System (MARFIS), Zonal Interchange Format (ZIF) and other log data.

Landings of hardshell clams were constructed from three overlapping sources: an existing table of the early landings at the start of the fishery (1987-1994) that had been constructed from sales slip data (Table 1), landings in the ZIF database for 1993-2000 (Table 2), and landings in the MARFIS database for 2002 to the present (Table 3). Since in the MARFIS database the species codes and gear types were not always recorded properly, all species codes referring to clams were included in the extractions. The data was then examined manually to remove landings that were determined to not be inshore SWNS clam landings, i.e., landings from the offshore clam fleet, landings of unspecified mollusks where the gear was trawl and the target species was roundnose grenadier, landings in SWNB. The largest annual landings were 176 mt in 1995, of which 132 mt were ocean quahogs. The quality of the ZIF data is questionable. The data is from summary tables and there appears to be errors in coding species, (i.e., *Mercinaria* versus *Arctica*), gear_types etc. Using a similar procedure as used for the MARFIS data would improve the data quality, but at this time it was felt it would not add any more information that would help address the question asked.

Table 1. Inshore SWNS Arctic surfclam and ocean quahog landings for 1987-1994.

Year	Arctic Surfclam (t)	Ocean Quahog (t)
1987	1.0	4.5
1988	4.1	3.2
1989	17.4	3.7
1990	17.3	27.6
1991	16.7	17.9
1992	9.3	29.1
1993	1.6	5.8
1994	2.6	15.2
Average	8.8	13.4

Table 2. Inshore hardshell clam landings from the MARFIS database for 2002-2008.

	Round Weight (mt)				
Year	Northern Propellerclams	Ocean Quahogs	Arctic Surfclams	Clams, Unspecified	Grand Total
2002	8.3	42.8	8.2		59.4
2003	6.0	13.4	11.3	2.8	33.5
2004	3.6	20.0	17.1		40.7
2005	3.9	35.9	3.2		43.0
2006	0.2	0.3	0.3		0.8
Average	4.4	22.5	8.0	2.8	35.5

Table 3. Inshore hardshell clam landings from the ZIF database for 1993-2003.

	Round Weight (mt)			
Year	Quahaug	Arctic Surfclam	Unspecified Clam	Grand Total
1993	6.0	2.0		8.0
1994	24.2	2.7		26.9
1995	131.6	14.7	30.0	176.3
1996	8.3	1.8		10.1
2001	95.7	14.5		110.2
2002	51.0	8.2		59.2
2003	13.9	8.2	2.8	24.9
Average	47.2	7.4	16.4	59.4

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