



CLARIFICATION ON OFFSHORE ARCTIC SURFCLAM AND OCEAN QUAHOG TAC'S

Context

A DFO Science advisory meeting to assess the status of arctic surfclam on Banquereau and ocean quahog on Sable Bank and in St. Mary's Bay was held at the Bedford Institute of Oceanography on 20 April 2007. Within the Science Advisory Report (DFO 2007a) that was developed as a product of this meeting, a table is presented showing a wide range of fishing mortality and TAC options for Banquereau surfclam (Table 2). The Science Advisory Report also contains a number of cautionary notes about $F=M$ as the basis for a strategy due to the life history of the species and other uncertainties related to its exploitation. In order to clarify the advice that was provided, Fisheries and Aquaculture Management (FAM) asked the following question on 25 September 2007: "In view of these considerations, what would be effective upper end of the range for the harvest strategy in relation to $F=M$ and $F=0.5M$?" Maritimes Science was asked to provide a response to this question by 21 October 2007. Given the short timeframe for response and the existing advisory framework for surfclam, a Special Science Response was considered to be appropriate.

Background

An assessment framework for arctic surfclam and ocean quahogs in the Maritimes Region was completed in 2007. Part one of the "Assessment and Management Strategy Framework for Banquereau Arctic Surfclam and Ocean Quahogs: Data Inputs" meeting was conducted on 17-18 January 2007. Part two of this assessment framework was focused on modeling and was conducted on 4-5 April 2007. Finally, the actual assessment of arctic surfclam on Banquereau and ocean quahog on Sable Bank and in St. Mary's Bay was conducted on 20 April 2007.

Response

The framework meeting agreed that the research survey biomass estimate was the best available data on which to base science advice on the Total Allowable Catch (TAC). The assessment meeting also determined that a constant fishing mortality approach to TAC recommendations was preferable to a constant yield approach. A range of fishing mortalities (F) used in the literature and the resulting TAC's were presented at the assessment meeting. A number of these were shown to be inappropriate for these stocks and were eliminated, and a range from that equivalent to an MCY level up to $F = M$ were presented in the Science Advisory Report (DFO 2007a).

The assessment meeting concluded that there are a number of uncertainties for these stocks. These include recruitment, life history parameters, spatial distribution of the resource and growth trends over time and space. There were also concerns about the lack of detailed information on the spatial distribution of the CPUE for the Banquereau surfclam fishery. As a result, it was concluded that the science advice should be conservative, i.e., set in the lower end of the range presented. DFO 2007b states 'that a conservative F level should be recommended at this time'. Setting a TAC at the upper end of the range increases the risk of detrimental

impacts on the stocks. The exact level of risk is unknown, but it would increase with higher levels of F . As the risk was unknown, the meeting did not establish exact constraints on the advice. This appears to have left FAM with questions about the acceptable range.

At the framework meeting, $F = M$ was the top of the range of F 's to be evaluated in the assessment, and the conclusion from the assessment was that this was too high a level to consider, as it would involve a high risk of detrimental effects in the long term. $F = 0.5M$ was felt to still contain considerable risk, and should only be considered if the survey frequency was greatly increased. $F \sim MCY$ was considered to be a conservative TAC level given the risks outlined above, and was considered to be an appropriate management target. F current was considered to be overly conservative, and the TAC could safely exceed this level. This does not come through in the comments in Table 2 of the SAR. The clarification provided within this Special Science Response should be considered to replace the comments in Table 2 of the SAR.

It should be noted that subsequent to the meeting and the Editorial Board on the Science Advisory Report, corrections to some of the biomass and yield estimates were identified. These do not significantly change the results of the assessment. The rationale for these corrections are included as Appendix 1.

Conclusions

When the Science Advisory Report (DFO 2007) stated that the TAC should be set in the lower end of the range shown for ocean quahogs on Sable and Arctic surfclams on Banquereau, the intent was to recommend a TAC around $F \sim MCY$. 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. $F = M$ was not considered to be a sustainable management target.

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Sources of Information

DFO, 2007a. Assessment of the ocean quahog (*Arctica islandica*) stocks on Sable Bank and St. Mary's Bay, and the Arctic surfclam (*Mactromeris polynyma*) stock on Banquereau. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/034.

DFO, 2007b. Proceedings of the Maritime Provinces Regional Advisory Process on for Banquereau Arctic Surfclam and Ocean Quahog on Sable Bank and in St. Mary's Bay; 20 April 2007. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2007/019.

Appendices

Appendix 1: Rationale for Post-Review Meeting Corrections to Survey Biomass and Yield Estimates.

In the offshore clam Science Advisory Report (SAR), Table 1 gave the simple random biomass estimate and confidence limits ($1,245,539 \pm 23,950$) for Banquereau surfclams, but the TAC estimates for Banquereau in Table 2 and 4 were based on the ACON biomass estimate of 1,453,939 which was not discussed in the SAR. Tables 2 and 4 should agree with the biomass estimate given in the Table 1. An error in the simple biomass calculation in table 1 was found. There were some deep and rocky tows included in the estimate that were outside the 90m contour that defined the survey area. The revised simple biomass estimate is $1,462,097 \pm 24,944$ t. Using this biomass changes tables 2 and 4 slightly.

In Table 4, the biomass estimate for St. Mary's Bay was rounded from 157, 843 t to 150,000 t while the biomass estimates for Banquereau and Sable were kept to a resolution of 1 t. The TAC estimates in Table 4 for St. Mary's Bay were revised using the full biomass estimate of 157,843 t

In an early version of the SAR, the MCY estimates were based on $MCY = 0.35MB_0$, but the expert opinion for inshore ocean quahogs recommended an MCY based on $0.33MB_0$. The MCY estimates in the SAR use $MCY = 0.33MB_0$

Revised tables:

Revised Table 1. B_{RV} estimates and confidence intervals for the three clam surveys assessed.

Survey	Year	Species	Biomass (t)	95% CI (t)
Banquereau	2004	Arctic surfclam	1,462,097	$\pm 24,944$
Sable Bank	2003	Ocean quahog	1,373,913	$\pm 21,516$
St. Mary's Bay	2002	Ocean quahog	157,843	$\pm 53,212$

Revised Table 2. Fishing mortality and TAC options for Banquereau.

Harvest Strategy	F	TAC (t)	Comment
F = M	0.08	116,968	Considered to be an upper limit of F with the current state of knowledge in the fishery. Fishing at this level would involve a risk of detrimental effects in the long term, and warrant more frequent surveys than currently proposed.
F = 0.5M	0.04	58,484	Reasonable, would be applying a fishing mortality equal to half the natural mortality rate
F ~ MCY	0.026	38,599	Conservative, equivalent to an MCY estimate ($0.33MB_0$) assuming B_{RV} is currently at B_0
F current	0.0164	24,000	Equivalent to the current TAC of 24,000 t.

Revised Table 4. Stock parameters and TACs for the range of Fishing mortalities considered.

Stock parameters				TAC (t)		
Stock	Species	Biomass (t)	M	F ~ MCY	F = 0.5M	F = M
Banquereau	Arctic surfclam	1,462,097	0.08	38,599	58,484	116,968
Sable Bank	Ocean quahog	1,373,913	0.03	13,602	20,609	41,217
St. Mary's Bay	Ocean quahog	157,843	0.045	2,344	3,551	7,103

Original Tables:Original Table 1. B_{RV} estimates and confidence intervals for the three clam surveys assessed.

Survey	Year	Species	Biomass (t)	95% CI
Banquereau	2004	Arctic surfclam	1,245,539	± 23,950 t
Sable Bank	2003	Ocean quahog	1,373,913	± 21,516 t
St. Mary's Bay	2002	Ocean quahog	157,843	± 53,212 t

Original Table 2. Fishing mortality and TAC options for Banquereau.

F	Level	TAC	Comment
F = M	0.08	116,313	Considered to be an upper limit of F with the current state of knowledge in the fishery. Fishing at this level would involve a risk of detrimental effects in the long term, and warrant more frequent surveys than currently proposed.
F = 0.5M	0.04	58,157	Reasonable, would be applying a fishing mortality equal to half the natural mortality rate
F ~ MCY	0.028	40,710	Conservative, equivalent to an MCY estimate (0.35MB ₀) assuming B_{RV} is currently at B_0
F current	0.0165	23,990	Equivalent to the current TAC of 24,000 t. This appears to be an overly conservative fishing mortality.

Original Table 4. Stock parameters and TACs for the range of Fishing mortalities considered.

Stock parameters				Resulting TAC		
Stock	Species	Biomass	M	F ~ MCY	F = 0.5M	F = M
Banquereau	Arctic surfclam	1,453,914	0.08	40,710	58,157	116,313
Sable Bank	Ocean quahog	1,373,913	0.03	14,426	20,609	41,217
St. Mary's Bay	Ocean quahog	150,000	0.045	2,363	3,375	6,750

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