REVIEW OF CUMULATIVE EFFECTS REPORT FOR PORT MOUTON, NOVA SCOTIA

Context

DFO Maritimes Science was asked by the Maritimes Habitat Protection and Sustainable Development (HPSD) Division to review a document entitled *Cumulative Effects of Two Aquaculture Sites in Port Mouton Bay* (Friends of Port Mouton Bay, 2008) on 18 September, 2008. Given that this report has been submitted to DFO as part of a broader Canadian Environmental Assessment process (led by Transport Canada), and since DFO Maritimes Science has provided information and advice on the same Port Mouton aquaculture site proposal previously (DFO, 2007), it was determined that the Maritimes DFO Science review of this document would be conducted using the Science Special Response Process. The document was reviewed internally within DFO Maritimes Science and this response represents the conclusions drawn from the internal review.

Background

The HPSD Division received an application for the establishment of a 29 hectare marine finfish aquaculture site in Port Mouton Bay, Nova Scotia in 2007. Transport Canada is currently leading an environmental assessment of the proposed site.

DFO Science produced a National Science Advisory Report on Finfish Cage Aquaculture in the Marine Environment in 2005 (DFO, 2005), and DFO Maritimes Science provided information and advice to HPSD on this site application in 2007 (DFO, 2007). This current response is considered to be supplemental to those two previous advisory reports. This report was generated through an internal regional review process under a tight timeline, and it should be considered in that context.

Port Mouton Bay is located in southeastern Nova Scotia (Figure 1). The shoreline is quite rocky, typical of the granitic shores found along Nova Scotia in that area. Much of the population in the area of Port Mouton lives along the coast.

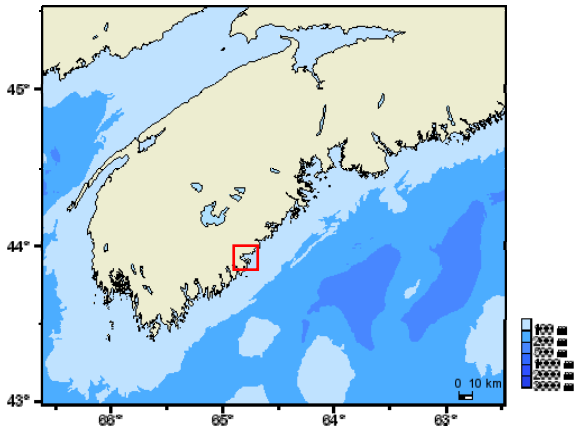

Figure 1. Location of Port Mouton Bay.

Analysis and Responses

The report entitled *Cumulative Effects of Two Aquaculture Sites in Port Mouton Bay* is organized into three parts: (i) nuisance algae, (ii) dissolved oxygen in the waters of Port Mouton Bay, 9 and 10 September 2008, and (iii) surface drifters at proposed aquaculture site near Port Mouton Island.

Nuisance Algae

Research has shown that the presence of nuisance algae can be linked to eutrophication from the run-off of nitrogen from land-use, but the evidence for such a link with aquaculture is presently quite tenuous. There are a number of communities along the eastern seaboard that show increasing densities of opportunistic green and brown seaweeds that are exploiting increased levels of nitrogen. For example, *Pilayella* build up was detected around Lockeport two years ago, as was *Pilayella* build up near Middle River more recently. Large amounts of *Pilayella* and *Ectocarpus* also have been detected in sheltered bays in the Bras d'Or Lakes over the last few years. This is considered a sign of general coastal eutrophication. For Port Mouton, there is insufficient data to show any direct causality between the increase of nuisance algae and the presence of the salmon aquaculture farm.

Macroalgae are intentionally introduced at some finfish aquaculture sites to utilize dissolved nitrogen wastes as a value-added aquaculture product (Integrated MultiTrophic Aquaculture). The question that needs to be answered is whether or not the nuisance algae are located close enough to the farms for a cause-effect link to be possible given the dilution and flushing characteristics of the site. The drifter data provides information only on near-surface flow conditions (not at the full depth of the water column) and many of the results appear to be more closely linked to wind forcing than to the expected tidal-flow directions. From a scientific standpoint, the evidence to directly link the presence of nuisance algae with aquaculture appears to be lacking. However, the potential for aquaculture to contribute to nuisance algae is a topic that may warrant further investigation. For example, stable isotope studies may help to determine the linkage between a potential nutrient source and a macrophyte bloom; however, these pathways should also be put in context of the overall magnitudes of nutrient inputs from a variety of potential sources, including aquaculture, industry, residential developments, and agriculture.

Dissolved Oxygen

The oxygen data collected for the Port Mouton area is limited, and little of these data are presented in the report under review. For example, the vertical profiles, which would be a useful addition, have not been provided. In addition, there is no description of the natural variability in oxygen levels and whether the detected levels fall within, above, or below the natural variance. Results have been presented only for the area of interest and not for any other comparative sites (e.g., control sites). Canadian Council of Fisheries and Aquaculture Ministers (CCFAM) guidelines should be treated in the context that many coastal areas have natural dissolved oxygen levels that are below the CCFAM limits; hence, the impacts of human activities should be considered in the context of deviations from local norms rather than a global threshold.

Although oxygen concentration in the sea can be much lower than saturation for a variety of reasons, most invertebrates do not appear to be significantly affected until extremely low concentrations (about 2-3 ml/L or 3-4 mg/L) are reached (Diaz and Rosenberg 1995; Hargrave et al. 2008). A more extensive oxygen survey (area, depth and time) would be required before

any attempt could be made to link depleted levels with the existing aquaculture activities. Some idea of the organic loading on the bottom would also help interpretation.

Surface Drifters

The drifter data, although somewhat useful on its own, would perhaps be more valuable if it could be put into a more comprehensive context of circulation within the area. Also, as mentioned above, the drifter data provides information only on near-surface flow conditions (not at the full depth of the water column) and many of the results appear to be more closely linked to wind forcing than to the expected tidal-flow directions. Comparison of the drifter data with current meter data may help to determine if it is consistent with the currents during comparable wind conditions. If so then an estimate of the frequency of these conditions could be made, and from this it may be possible to generate the frequency of nutrient flux to the shore. On 7 July 2008, wind speed was 10-30 km/hour at Lunenburg and Yarmouth and the direction was west to northwest, which could have held the drifters against the tide, moving them directly west depending on the time of release. The dissolved fraction of wastes from aquaculture sites are strongly influenced by current, and considerable dilution and mixing would be expected.

Conclusions

There is nothing in the report entitled *Cumulative Effects of Two Aquaculture Sites in Port Mouton Bay* (Friends of Port Mouton Bay 2008) to suggest that conditions exceed the present aquaculture siting guidelines nor do they contradict the earlier science review (DFO 2007). However, the report does demonstrate the importance of being able to identify direct cause and effect relationships. This requires a cumulative effects and ecosystem-based approach, i.e., taking natural variation and all coastal activities into consideration - not just aquaculture. These approaches require substantial background information on spatial and temporal patterns for all relevant indicators and processes.

Contributors

Peter Cranford (primary author)	DFO Maritimes Science
Eddy Kennedy (reviewer)	DFO Maritimes Science
Tim Milligan (contributor)	DFO Maritimes Science
Fred Page (contributor)	DFO Maritimes Science
Shawn Robsinson (contributor)	DFO Maritimes Science
Herb Vandermeulen (contributor)	DFO Maritimes Science
Tana Worcester (editor)	DFO Maritimes Science

Approved By

Mike Sinclair
Regional Director, Science
Dartmouth, NS
(902) 426-3490

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Sources of Information

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This Report is Available from the:

Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
PO Box 1006, Station B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Telephone: 902-426-7070
Fax: 902-426-5435
E-Mail: XMARMRAP@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

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