

2014 Environmental Monitoring Program Results at Spectacle Island Aquaculture Site, Port Mouton Bay, Nova Scotia

The Nova Scotia Aquaculture Environmental Monitoring Program (EMP) monitors the environmental impact of marine finfish and shellfish farms in Nova Scotia. Site surveys include sediment sampling, video recordings and field observations.

All sites undergo “Level I” monitoring, and can be subject to additional monitoring (Level II and III) if sulphide levels are hypoxic B or anoxic. (For details, see the Standard Operating Procedure document at: <http://www.novascotia.ca/fish/documents/ns-emp-sops-july2014.pdf> and, Appendix A - Classification of Sediment)

The Environmental Monitoring Program (EMP) survey at the Spectacle Island site was carried out on July 16, 2014 by the industry. The collection procedures and laboratory analyses of samples were audited by the EMP Supervisor at NS Department of Fisheries and Aquaculture. Three observers from FPMB (Clyde Fisher, Richard Broome, and Ron Loucks) were also present on the boat. At this time FPMB took sediment samples for copper analysis.

FPMB requested and received the official results of the 2014 EMP survey from the Department of Fisheries and Aquaculture. Summary of EMP results is as follows:

EMP 2014 - Sulphides

The July 16th EMP sulphide results from the Level I survey of positions adjacent to cages yielded an Hypoxic B (very polluted) classification for the site. (The Hypoxic B classification corresponds to a 70-90% loss of biodiversity in sediment life). Because of this degraded state, a Level II survey from positions up to 50 m away from the cages was done by industry on August 28, 2014.

Sulphide data for the 2014 Level I survey found most data points in the Hypoxic (polluted) category with one data point in the Anoxic (grossly polluted) category (Figure 1). These data are similar to sulphide data of previous years when the site was operational (2002-9). The 2014 Level II survey sulphide data found two of 10 data points in the Hypoxic A (polluted) category.

The 2013 sulphide data were not audited and in our view, are questionable due to lack of correspondence to other measures and field observations.

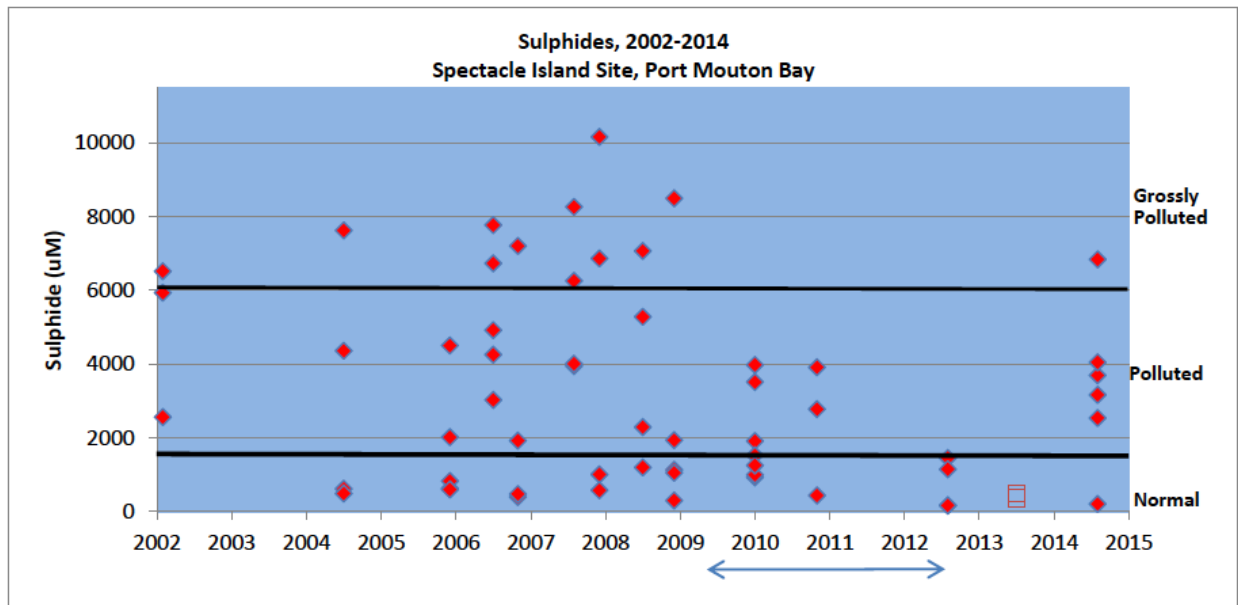


Figure 1. Sulphide data near cages at the Spectacle Island aquaculture site 2002-14. The site was not operational - fallowed, between mid-2009 and mid-2012.

FPMB 2014 - Copper

In July, FPMB once again collected sediment samples to test for copper levels at the finfish farm site. Results for 2014, and previous years, are as follows:

Sediment copper levels at the farm site in July 2014 were significantly higher than previous years and several times higher (up to 15 times higher) than the Canadian Council Ministers of Environment (CCME) Sediment Guideline (18.7 mg/kg) for protection of marine life (Figure 2).

Stations 20, 21 and 23 were on the lease site during the period of fish farm fallow (2009-12). Station 24 is approximately 400 m from the lease site towards Carters Beach and Station 28 is near Port Mouton Island approximately 2 km distant from the aquaculture site.

The pattern of copper levels persisting during the period of fish farm fallow at the Spectacle Island site supports the fact that copper is a non-degradable element. A 5-year DFO research study in the Bay of Fundy showed that copper levels persisted for at least 5 years after a farm site was abandoned (Smith et al. 2005).

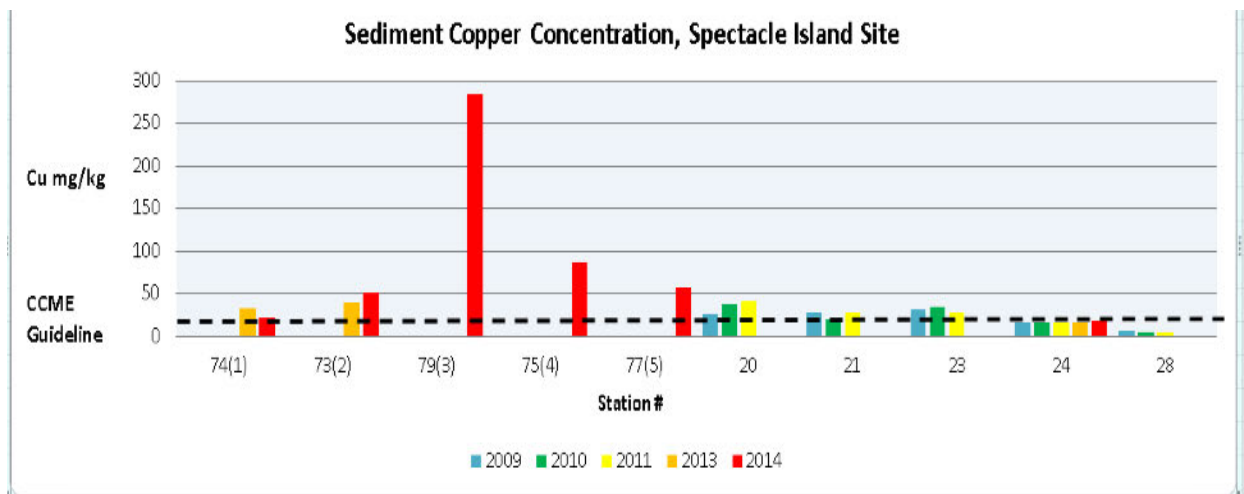


Figure 2. Sediment copper levels near cages 2009-11 and 2013-14. Site was not operational between mid-2009 and mid-2012.

EMP - 2014 Bacteria (*Beggiatoa*)

Videos of the seabed were recorded at all stations in both Level I and Level II surveys. White bacterial cover (*Beggiatoa*) was widespread near the cages at all 5 stations in July 2014. (*Beggiatoa* thrive in sulfur-rich, oxygen-depleted environments.) Of 10 stations up to 50 m distant from the cages sampled in August 2014, bacterial cover was widespread at 3 stations and patchy at another station (Figure 3).



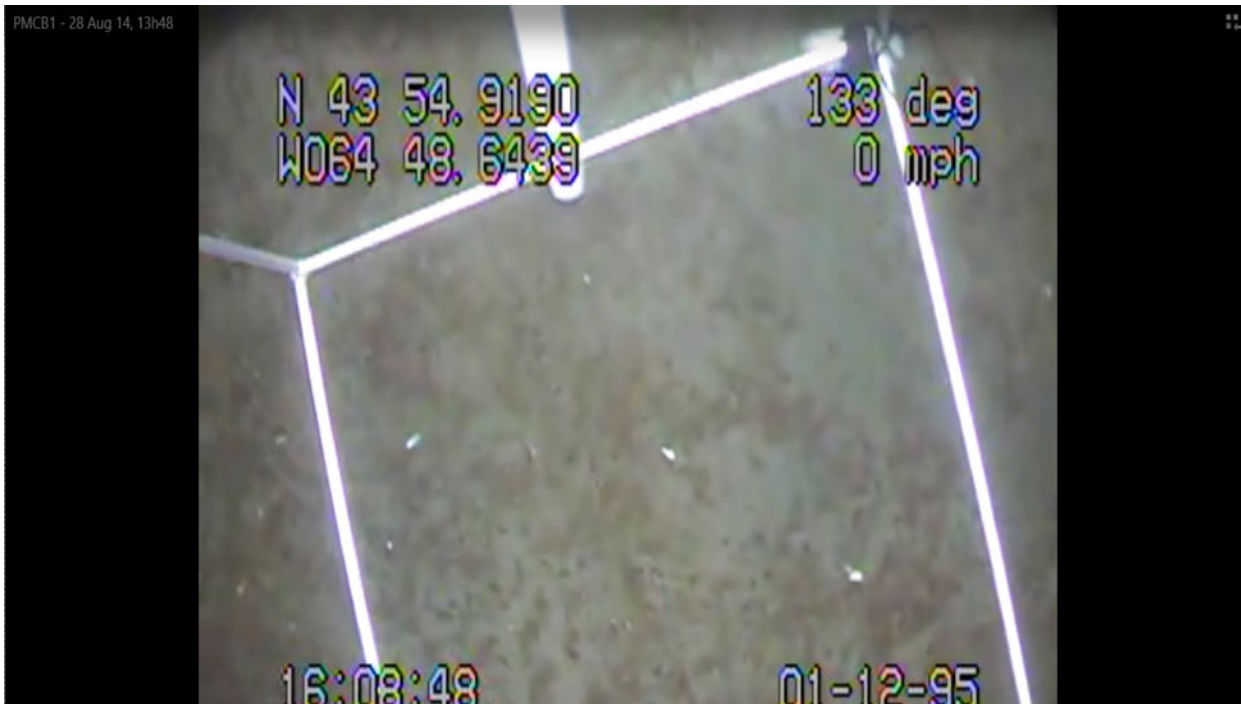


Figure 3. Screenshots from video of seabed showing widespread *Beggiatoa* (white) bacteria near a cage (above) and approximately 50 m from a cage (below). (Videos provided by NS Aquaculture Environmental Monitoring Program)

Appendix A - Classification of Sediment

Reproduced from page 7 of the *Standard Operating Procedures for Environmental Monitoring of Marine Aquaculture Sites in Nova Scotia*

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Table 2. Sediment classification thresholds and determination guide

Sediment classification	Minimum proportion of station means within each sulfide threshold range to determine sediment classification		Sulfide concentration thresholds (µM)	Monitoring prompted
	A	B		
Oxic	A	≥ 0.50	< 750	
	B	≥ 0.50	750 - 1500	
Hypoxic	A	≥ 0.50	1500 - 3000	
	B	≥ 0.50	3000 - 6000	Level II
Anoxic		≥ 0.70	> 6000	Level II, Level III

*Note: The classification indicating the most adverse sediment condition will be assigned to a site when sulfide data suggests even distribution between two classifications.