Organic Carbon Sediment Accumulation and Nitrogen Excretion from Open Net-Pen Rainbow Trout at Port Mouton Bay

Friends of Port Mouton Bay
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Executive Summary

A scientific analysis of available data regarding the impact of fish farming at the Spectacle Island aquaculture site in Port Mouton Bay, Queens County, Nova Scotia discloses

> The accumulation of sediment for 400,000 Rainbow Trout at Spectacle Island site in Port Mouton Bay is as great or greater than what would be anticipated from 200,000 Atlantic Salmon at the same site.
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> The levels of dissolved nitrogen resulting from the farm operation are excessive for the conditions present in the Bay and have resulted in the accumulation of unacceptable levels of nuisance algae and eutrophication.
>
> The stocking level of 400,000 trout at this location is more than 10 times too large for the carrying capacity of the lease site.

Analysis

Hargrave (2009) provides a calculation of particulate organic carbon sedimentation from caged Atlantic Salmon at a site near Spectacle Island in Port Mouton Bay. We have adapted that analysis to Rainbow Trout which is the species recently cultured at this site. Nordi *et al* (2011) provide organic carbon sedimentation rates from caged Rainbow Trout in the Faroe Islands (Figure 1).

Trout differ substantially from Atlantic Salmon.

- The growth cycle for trout is 9 months compared to 18 months for salmon.
- The trout harvest weight is 1.9 kg compared to 4 kg for salmon.
- In feeding experiments, Rainbow Trout grew faster than Atlantic salmon and consumed more feed in all periods when measured as percentage of initial body weight (Refstie *et al*. 2000,[1]), an indication that the metabolic rate of trout is higher than that of Atlantic Salmon.

Refstie *et al*. 2000[1] pg. 54

Hargrave (2009) modelled the rate of sedimentation of carbon from waste feed and feces from 200,000 Atlantic Salmon as 22 - 29 g C/ m^2/ day^-. The levels of benthic organic enrichment observed for Atlantic Salmon within the Spectacle Island site were consistent with the modelled sedimentation rates of carbon in waste feed and feces where >85% of material released from the pens is calculated to reach the bottom (19 – 25 g C/ m^2/ day) within the median dispersion area around the lease which is 10 - 12 m depth with 4 cm/s average current speed. [2]

In contrast, Nordi measured 9.7 ± 2.6 g C/ m^2/ day of carbon accumulation in sediment for Rainbow Trout.[3]

Extrapolating from trout in the Faroe Islands farm site, there are several factors affecting the rate of accumulated sedimentation for trout at Port Mouton Bay :

- the number of trout
- the percentage of wastes that reach the seabed
- the depth and current speed of the Spectacle Island regime, and
- sedimentation rates expected for trout grown to harvest weight.

To arrive at an accurate comparison between Faroe Islands and Port Mouton Bay, the trout numbers are amplified from 270,000 in the Faroe Islands to 400,000 in Port Mouton Bay – a ratio of 1.48.

The sediment accumulation rate for the Faroe Islands trout grown to 0.6 – 0.95 kg is 9.7 ± 2.6 g C/ m^2/ day (above) amplified by 1.48 yields 14.4 ± 3.8 g C/ m^2/ day sedimentation accumulation rate for 400,000 trout.

Shallow depth and low current speed explain the greater accumulation of sediment at the Spectacle Island site. The depth at Spectacle Island is 10-12 m. At the Faroes Islands site – measurements were made in sediment traps at 20 m.

The mean peak current speed used by Hargrave is 4 cm/s at Spectacle Island (while the vector average or net speed is 1 cm/s due to re-circulation of currents as determined from current meter analyses). At the Faroes Islands site the mean current speed is 5.7 ± 5.7 cm/s.

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[2] Waste release calculations in 2005 involved several assumptions:50% of dry matter in feces was assumed to be organic C, 50% of this was assumed to be decomposed during the first 5 days (based on 5-day BOD of settled material) and fecal matter settling rates of 3 cm/s were assumed.

[3] Nordi *et al*, 2011, pg 228

The percentage of waste reaching the seabed at Spectacle Island site, Port Mouton Bay – 85% (Hargrave, 2009) is approximately double that at the Faroe Islands - 44%[4] (Nordi *et al*, 2011), . yielding a sediment accumulation estimate for trout of 28.8 ± 7.6 g C/ m^2/day$^-$ at Port Mouton Bay. ***This is more than 10 times greater than a level consistent with oxic conditions***. Oxic conditions are sustained at a level less than 2 g C/ $m^{2/}$ day (Hargrave *et al*, 2008). ***It follows that the currently employed stocking level of 400,000 trout is more than 10 times too large for the carrying capacity of the Port Mouton Bay lease site***. There is a further consideration that Faroes Island trout were not at harvest weight so that these sediment accumulation numbers are underestimated.

Hargrave concluded that the predicted average sedimentation rate of 22 - 29 g C/ m^2/ day for Atlantic salmon at Port Mouton Bay was more than 10 times higher than expected natural sedimentation which at a maximum during the late summer/fall might be 0.5 g C/ m^2/ day in similar coastal areas of Nova Scotia.

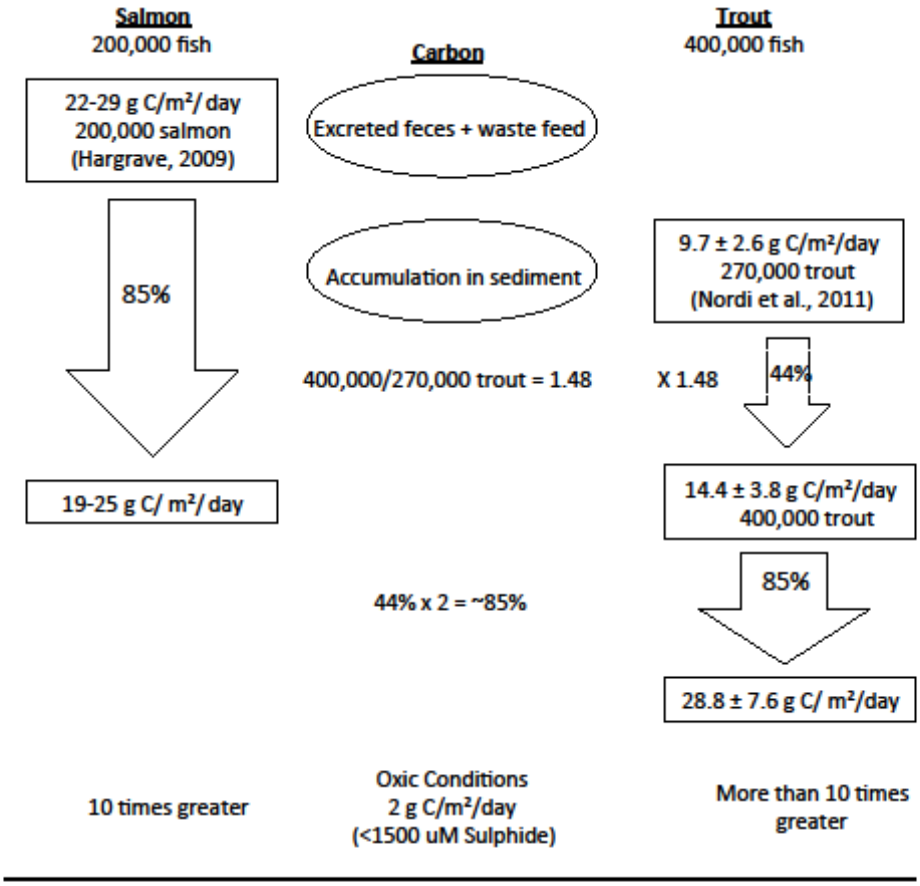
The accumulation of sediment for 400,000 Rainbow Trout at Spectacle Island site in Port Mouton Bay is as great or greater than for 200,000 Atlantic Salmon there.

It is further noted that the excretion of dissolved nitrogen for Rainbow trout is 50% greater than that for Atlantic salmon - 48 kg N/mt for Rainbow trout (Nordi *et al*. 2011) compared to 32 kg N/mt for Atlantic salmon (Strain *et al*, 1995). Dosdat et al. (1996) measured 72 kg N/mt excretion from smaller (100 g) Rainbow Trout. Excess dissolved nitrogen leads to nuisance algae and eutrophication

Figure 1 on the page following shows a graphic representation of the known excretions from the two species.

[4] Nordi *et al*, 2011, Fig. 10 : Of a 6.1% sedimentation rate, there is a 2.7% accumulation in sediment – 2.7/6.1 = 44% of the rate accumulates

Figure 1. Comparison of Salmon and Trout Excretion
Port Mouton Bay



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