

## THE BOTTOM LINE

### **Response of the Georgian Bay Association to the Northern Ontario Aquaculture Association Fact Sheet: *Phosphorus Output from Cage Aquaculture in Ontario, July 2012***

The Northern Ontario's Aquaculture Association's (NOAA's) most recent Fact Sheet, *Phosphorus Output from Cage Culture in Ontario, July 2012*, appears to contain a number of questionable and unsubstantiated assertions which allege that the effect of the cage culture of rainbow trout in Lake Huron is minimal or non-existent. Allegations contained in industry initiated fact sheets should always be scrutinized carefully and with skepticism as they are usually self-serving.

**Freedom of speech notwithstanding, it is incomprehensible that the NOAA could declare there is no objective scientific evidence of any significant, negative environmental impacts of its industry. In fact, evidence on the negative environmental impacts of open net aquaculture in Lake Huron does exist.**

- There is the case of the net pen operation located in La Cloche Channel where the undesirable anoxic (low oxygen) condition of the water was attributed to this operation and was documented by Hamblin and Gale (2002) and Clerk et al. (2004) in two refereed journals.
- At the net pen farm located in nearby Grassy Narrows, Milne (2008) documented that it took approximately nine years, after operations ceased in 1999, for most of the accumulated fish deposits and excess feed to dissipate and that some detectable deposits of fish manure on the lake bed near the cage location still remained. Close to 1/3 of the phosphorus occurring in the surrounding waters was attributed to this fish farm.
- The net pen farm located in the embayment known as Lake Wolsey, has also resulted in turning the lake-wide total phosphorus concentration from the naturally oligotrophic, meaning low concentration which supports the normal low plant growth characteristic of healthy lakes, to levels well into the mesotrophic range, meaning moderate levels of phosphorus resulting in the moderate overgrowth of plants. In other words, phosphorus levels reached the "the impacted water quality" range, as documented by Hamblin and Gale (2002) and Milne (2012).
- Hamblin and Gale (2002) also documented that near-farm phosphorus concentrations had reached hypereutrophic levels in Lake Wolsey, meaning the water was determined to be excessively rich in phosphorus, a nutrient which supports excessive plant growth. This is a concern since such nutrient rich waters are at risk for the growth of algal blooms, oxygen deficiency and can become generally undesirable for drinking water and other needs.

It should be noted that the *Canada-US 2012 Great Lakes Water Quality Agreement's Annex 4 on Nutrients (Environment Canada, 2012)* states as a lake ecosystem objective, that the waters of Lake Huron should be maintained in an oligotrophic state and that algal species which produce toxins that pose a threat to humans or ecosystem health, such as cyanobacteria, should be maintained at healthy levels in the nearshore waters of Lake Huron. According to the *Lake*

*Huron Bi-national Partnership, (2011)*, a massive wildlife die-off occurred in Georgian Bay in 2011. Net pen aquaculture is operated in nearshore waters. Since phosphorus contributes to water quality conditions that can facilitate the growth of algae, it would be responsible and prudent to be concerned about the phosphorus loading into nearshore waters including phosphorus from fish farm operations. Negative environmental impacts, associated with fish farm operations have been documented and have led to ongoing research in Canada and internationally on ways to minimize or eliminate the negative environmental impacts of aquaculture.

**The NOAA states that concerns about phosphorus from fish farms have been based on a “misrepresentation of reality” and asserts that “Aqua-Cage Fisheries [farm] has the equivalent impact on Parry Sound as the annual leaf litter from about 80 hectares of deciduous forest”.**

- In reality, Milne found that leaf litter did not release nearly the amount of bioavailable nutrients, such as phosphorus, as the fish farm did, and that leaf litter accounted for only 0.3% of the 1,130 kg of phosphorus input to Lake Wolsey (2012).

**The NOAA claims that leaf litter is much more harmful than fish waste because of the volatile compounds it releases on decomposition”.**

- Considering the positive contribution of trees to the environment, comparing the impact of phosphorus released in an artificially created environment which has been inserted into an ecosystem, to volatile compounds which have been released from leaves in evolved, adapted ecosystems, would seem to be an invalid comparison.

**While the NOAA is correct in stating that one of the most frequently cited concerns is the amount of phosphorus released into the environment by cage farms and the potential deleterious impact of this on water quality and the lake ecosystem, it suggests that these concerns are based on misrepresentations of reality. Contrary to its allegations**

- The calculations used by the critics of the freshwater net pen industry for determining the total phosphorus load into Lake Huron from aquaculture operations are not “based on a gross overestimation of phosphorus content in feed, poorer feed conversion than those actually achieved by commercial fish farms, or a poor understanding of the fate of the phosphorus in the ecosystem”. Concerns are based on the fact that
  - Fish farm operators appear to overfeed and manually feed fish rather than implement the use of mechanical feeders in conjunction with underwater cameras which would not only minimize the environmental impact of overfeeding but also reduce their feed costs.
  - In the case of manual feeding, the most diligent strategies to control overfeeding are imprecise and may, in some cases, include bonuses to employees when low FCR’s are achieved. This would seem to confirm there is inconsistency in achieving optimal FCR’s. (Feed Conversion Ratios are measurements of the efficiency at which feed mass is converted into body mass.)
  - Inadvertent overfeeding appears to be sufficient to support escaped fish, as evidenced by the large numbers of sport fisherman observed immediately adjacent to these cages.

- In light of manual and overfeeding practices and the presence of escaped fish, one must question the validity of feed conversion ratio calculations in open net as a valid measurement of the actual amount of feed and phosphorus being loaded into the water.

**The NOAA states that, “The real effect on the ecosystem is ignored” that “Lake Huron is an oligotrophic ecosystem in which several nutrients are probably limiting growth of the natural food chain.”**

In fact, The Canada-US 2012 Great Lakes Water Quality Agreement: Annex 4 on Nutrients, (*Environment Canada, 2012*) states as a lake ecosystem objective that the waters of Lake Huron be maintained in an oligotrophic state. There is sufficient natural loading of phosphorus to maintain a healthy oligotrophic ecosystem without the addition of excess phosphorus from the aquaculture industry.

**The NOAA states that phosphorus is a nutrient, not a toxic compound and that “too much is a problem but too little is also a problem.”**

- Additional phosphorus from fish farms does not benefit the ecosystem of Lake Huron as seems to be implied, nor is it inert. Apatate phosphorous can degrade and become soluble under certain conditions. Close to one third of excreted phosphorus is soluble.

**The NOAA acknowledges that phosphorus is a problem which can lead to excess nuisance algae growth and other eutrophication problems. In defense of the status quo, it states that algae have not been observed at current cage sites.**

- In fact, while, blue-green algae may blow to and thrive along shorelines and in areas where the water is shallow, slow moving, and warm, they may also be present below the surface in deeper cooler water. This will continue to be a valid area of public concern since blue-green algae have been a problem, having appeared in many areas in the Great Lakes, and pose significant risks to humans and wildlife as previously discussed herein. Until scientific investigation validates that the risk to the public is non-existent, it would be socially irresponsible to minimize or ignore this potential threat to public safety.

**The NOAA suggests that it is a cheap trick to compare fish farm waste to human and terrestrial farm animal waste.**

- To our knowledge, fish farm waste has not been compared to human sewage other than comparing the large amounts of detrimental phosphorus contained in fish farm waste to the relatively modest amounts of phosphorus discharge loads from municipal sewage treatment plants. We are not aware of any intention to reference disease organisms, odour, or other nasty compounds as suggested by the NOAA’s claim.

**The NOAA claims that there is a lack of measured effect of aquaculture related phosphorus on water quality.**

- In fact, there are several cases of the measured effect of aquaculture related phosphorus to water quality, noted previously herein.

**The NOAA tried to make a strong case for farming trout in Georgian Bay based on extensive on-site scientific observation and analysis in the Experimental Lakes Area (ELA).**

- The ecosystems of the ELA lakes are so unlike those of Lake Huron that the findings of the ELA experiments cannot be transferred to Lake Huron.
- In fact, lakes that are suitable for net pen aquaculture are those having high rates of sedimentation so that any phosphorus remaining after rapid flushing is buried in the sediment load. Georgian Bay is certainly not one of those lakes as it has both a very long flushing time and extremely low sedimentation rates.

**The NOAA states the phosphorus content of trout feed has “tremendously decreased over the past 30 years”.**

- While this may be true, according to Moccia et al. (2007), the fact remains that phosphorus still composes 3% of fish manure, 40% of which is soluble, (Podemski, 2011).

**The NOAA asserts that a large portion of the phosphorus in feed is indigestible and excreted in an “environmentally inert form”. The inference seems to be that if the fish cannot digest the phosphorus, other biota such as benthic organisms and bacteria cannot either.**

- There is no observational evidence for this. In fact, Milne (2008) measured a 2 cm per year decrease in the thickness of the manure pile on the bottom of the decommissioned Grassy Narrows farm and documented the “impacted water quality” as previously discussed.

**The NOAA states that Ontario fish farmers have “partnered with, (Canadian experts) and opened their doors to world-class scientists and experts from the Federal and Provincial Governments, and from leading Canadian universities,” and that Ontario fish farmers have been active players in research aimed at making sure that their enterprises are as environmentally sustainable as possible.** It would be reasonable to expect the NOAA has access to the most recent information and technologies being utilized elsewhere in Canada to successfully address and reduce the environmental impacts of fish farming.

- It is regrettable that these newer, sustainable and less polluting fish farm technologies as outlined by ECO (2012) have not been universally implemented.

Those concerned with sustaining the natural resource industry and preserving the life of aquatic ecosystems are more than justified in their efforts to reduce negative impacts of the aquaculture industry when farming practice is in open net pens that discharge all waste directly into the Great Lakes. So far Canada continues to lag far behind the advancements ever occurring in the aquaculture industry by other countries. Net pen methods of culturing fish are old and swiftly becoming outdated as more and more water quality concerns are documented. As Canada grows its industry, it behooves it well to support, even become a leader, in the implementation of ever advancing technologies using closed-contained systems to eventually replace the net pens. Only then will a win-win solution be reached ensuring both the preservation of Canada’s waters and the economic growth of the fish industry well into the future.

## References

- Azevedo, P.A., C.L. Podemski, R.H. Hesslein, S.E.M. Kasian, D.L. Findlay, and D.P. Bureau. 2011. Estimation of waste outputs by a rainbow trout cage farm using a nutritional approach and monitoring of lake water quality. *Aquaculture*, 311: 175-186.
- Clerk, S., Selbie, D. T., and Smol, J. P. 2004. Cage aquaculture and water-quality changes in the LaCloche Channel, Lake Huron, Canada: a paleolimnological assessment. *Canadian Journal of Fisheries and Aquatic Sciences* 61:1691-1701.
- ECO 2011/12 Annual Report Part 2, October 2012. Losing Our Touch. Supplement Section 2.3.1
- Environment Canada, The 2012 Great lakes Water quality Agreement <http://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=A1C62826&offset=5&toc=show>, (2012).
- Fisheries and Oceans, Use of High-Quality Trout Feeds to Improve Growth Performance and Decrease Phosphorus Waste, Aquaculture Collaborative Research and Development Program (ACRDP) Fact Sheet, Issue 1, April, 2009.
- Hamblin, P. F. and Gale, P. 2002. Water Quality Modeling of Caged Aquaculture Impacts in Lake Wolsey, North Channel of Lake Huron. *Journal of Great Lakes Research* 28:32-43.
- Health Canada, 2008. <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/cyanobacter-eng.php> JGLR, 2007. Volume 33, Coastal Indicators Supplement 3. pp 1-320.
- Hinderer, Julie M. and Michael W. Murray. 2011 Feast and Famine in the Great Lakes: How Nutrients and Invasive Species Interact to Overwhelm the Coasts and Starve Offshore Waters Report to National Wildlife Foundation. p 44.
- Lake Huron Binational Partnership, 2011 Annual Report, [www.binational.net/lamp/lh\\_ar\\_2011\\_en.pdf](http://www.binational.net/lamp/lh_ar_2011_en.pdf), (2011).
- Milne, J.E. 2012, Monitoring and Modeling Total Phosphorus Contributions to a Freshwater Lake with Cage-Aquaculture, (M.Sc. dissertation, University of Guelph), 2012.
- Milne, J. E. 2008. Spatial and temporal observations of fish waste at a discontinued aquaculture site Lake Huron, North Channel, Ontario. Burlington, Ontario, Canada: Environment Canada, Water Science and Technology Branch Report No. 08-292. 19 p.
- Rich Moccia, David Bevan and Gregor Reid. 2007. Composition of Fecal Waste from Commercial Trout Farms in Ontario: Macro and Micro Nutrient Analyses and Recommendations for Recycling, Report to OSAWG