

Sea lice and pesticide use in net pen salmon farming around the world

Stocking hundreds of thousands of fish in small areas (net pens) makes fish farms ideal and unnatural breeding grounds for lice - a small crustacean and a natural parasite on wild salmon. This significantly increases the number of lice in surrounding waters and the threat to out-migrating wild juvenile salmon. Pesticides used to control sea lice infestations, however, are also toxic to crustaceans including lobster, prawn, crab, shrimp, and krill.

Norway

Norway is the largest producer of net pen farmed salmon in the world and farmers are experiencing massive sea lice infestation levels on their fish as well as resistance to drug treatments. The Norwegian Directorate for Nature Management has estimated that in some fjords, 15 to 20 per cent of juvenile salmon succumb to lice infection and in October 2010 proposed that salmon stock in highly infested farms be slaughtered to prevent the further spread of sea lice.

Scotland

In Scotland, the quantity of chemicals used by fish farmers to treat sea lice infestations has risen dramatically since 2005 in accordance with rising infestation levels and resistance. According to a recent BBC Scotland investigation, Scottish government figures show that over the past five years, the industry used a broader range of chemicals and more of them.¹ A Member of Scottish Parliament commenting on the issue said, "The quantity of treatments or medicines that have been used by the aquaculture industry on the west coast has not doubled – which would be a matter of concern – or trebled. Since 2005, they have gone up by a factor of 10."²

Canada

In both British Columbia and New Brunswick where the majority of Canadian intensive open net pen salmon farming takes place, sea lice infestations are an ongoing problem but industry and government have yet to admit that sea lice from salmon farms contribute to the decline of wild stocks.

Meanwhile, the scientific evidence continues to mount. The most recent paper on the issue, *Sea Louse Infection of Juvenile Sockeye Salmon in Relation to Marine Salmon Farms on Canada's West Coast*³, provides the first link between salmon farms and elevated levels of sea lice on juvenile Fraser River sockeye salmon. Two papers published in October 2010, *Predation intensifies parasite exposure in a salmonid food chain*⁴ and *Coho salmon productivity in relation to salmon lice from infected prey and*

¹ <http://www.bbc.co.uk/news/uk-scotland-12297269>

² <http://www.pressandjournal.co.uk/Article.aspx/2128431?UserKey=#ixzz1DUzq7BS7>

³ http://www.watershed-watch.org/publications/files/Price_et_al-2011.pdf

⁴ <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2010.01887.x/abstract>

*salmon farms*⁵ suggest that sea lice from salmon farms may be dramatically affecting the health of coho salmon populations in the Broughton Archipelago.

In response to predictable sea lice outbreaks, the salmon farming industry resorts to the use of eco-toxic pesticides to kill the sea lice. Slice (active ingredient emamectin benzoate), which is administered in-feed, has been the drug of choice on Canadian salmon farms. (Please see below for an overview of each of the pesticides recently in use in Canada).

Due to the heavy reliance on Slice, sea lice on New Brunswick farms have developed resistance to the chemical. As a result, New Brunswick salmon farmers have received permission to use a number of other pesticides administered through a bath treatment. Bath treatments involve adding pesticides directly to the water (either in a net-pen enclosed with tarps or in a well boat). After treatment is finished, the pesticide-laden water is released into the marine environment. Pesticides used as bath treatments so far include Alphamax (active ingredient deltamethrin), Salmosan (active ingredient azamethiphos) and Interlox Paramove (hydrogen peroxide). Slice, Salmosan, and especially Alphamax are toxic not only to sea lice, but also to other crustaceans, including Lobsters. While Slice is currently approved for use and Salmosan has been in the past, there has been a history of reoccurring “emergency” approvals of aquaculture pesticides (emergency approvals do not require as extensive environmental testing as a full approval). Indeed, as noted below in relation to Slice, even when there is a full approval, the details of the approvals is not always made publicly available.

While sea lice in BC have not yet shown sign of resistance to Slice, such a resistance could develop at any time.

Pesticides used in the Canadian salmon aquaculture industry⁶

Slice (active ingredient emamectin benzoate): Slice is applied in-feed. When salmon ingest the treated feed, the drug is absorbed into the sea lice that are attached to the fish. Although Slice is used to treat sea lice, its effects are not specific to just sea lice. It is also toxic to other crustaceans-including lobster, prawn, crab, and shrimp. It affects their skeletal build-up. Also, because of its ability to accumulate in sediments, Slice could become toxic to other marine life. Slice is currently approved for use in the Canadian aquaculture industry. However, Health Canada has refused to release the approval criteria for Slice as much of the research was carried out by the manufacturer, is considered proprietary, and is not available to the public. Research on the environmental effects of Slice are still pending.

Salmosan (active ingredient azamethiphos): Salmosan is applied as a bath treatment. It is toxic to sea lice and other crustaceans, including lobster, prawn, crab, and shrimp. Further, lab studies have demonstrated that repeated short term exposure to Salmosan can harm lobsters. Salmosan has been in use in New Brunswick for a number of years. Its effectiveness has been variable. It had been approved for use in Canada prior to 2002, but has been used under emergency approvals since then.

⁵ <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2010.01889.x/abstract>

⁶ For more information on the potential impacts of each pesticide see: Burrige, Les, Judith Weis, Felipe Cabello, Jaime Pizarro and Katherine Bostick. 2010. Chemical use in salmon aquaculture: A review of current practices and possible environmental effects. *Aquaculture*. 306 (1-4): 7-23.

Alphamax (active ingredient deltamethrin)⁷: Alphamax is applied as a bath treatment. Deltamethrin, classified as 'super toxic', is a very potent pesticide and can kill sea lice in extremely low concentrations. Alphamax is highly toxic to other crustaceans as well and can kill lobster at concentrations as low as parts per billion or parts per trillion. Alphamax has received emergency approvals for use in Canada in 2009 and 2010.

Interox Paramove (hydrogen peroxide): Interox Paramove is applied as a bath treatment. It operates by forcing sea lice to detach from salmon, but is not effective against all stages of sea lice. It has recently been used in New Brunswick, especially in well-boats (though other bath treatments are used in well-boats as well).

⁷ For more information specific to Alphamax see: Fairchild, Wayne, Ken Doe, Paula Jackman, Jacqueline Arsenault, Jamie Aubé, Mélanie Losier and Art Cook. 2010. Acute and chronic toxicity of two formulations of the pyrethroid pesticide deltamethrin to an amphipod, sand shrimp and lobster larvae. Can. Tech. Rep. Fish. Aquat. Sci. 2876: vi + 34 p. <http://www.dfo-mpo.gc.ca/Library/339939.pdf>