Volume 3, August 2004

# Fact Sheet

## Sea Lice and Wild - Farmed Salmon Interactions

### Does farmed salmon cause sea lice infestations and consequently cause a decline in wild salmon stock?

Though frequently asked, all evidence to date is based upon correlations and not "cause-effect" relationships. However, it now appears possible, through the development of a new and innovative tool, to trace the origin of newly settled sea lice during their infectious stages on wild / farmed fish as part of an AquaNet-funded project. This is a significant step closer to a definitive answer.

"Being able to measure any interaction between wild and farmed salmon with respect to sea lice infestation will help contribute to a sustainable aquaculture sector", states Dr. McKinley, AquaNet's Executive Scientific Director and Professor at the University of British Columbia. As a lead Canadian scientist on sea lice research, he has witnessed the contradictory views about the transfer of sea lice between farmed and wild fish in Canada and elsewhere. "This new research can be used to trace the origin of sea lice and help determine the best location for salmon farm sites and how to best mitigate the risk of any sea lice infestations."

The research is part of a cluster of AquaNet projects that involves international research collaborations in Norway, Scotland, and Ireland; coordinated with complementary federally and provincially-funded research initiatives. The goal is to develop a risk factor model for estimating the infestation levels on farmed/wild fish stocks and determining a subsequent mitigative strategy.

Photos Courtesy: Dr. John Burka, Dr. Kevin Butterworth, AquaNet

AquaNet

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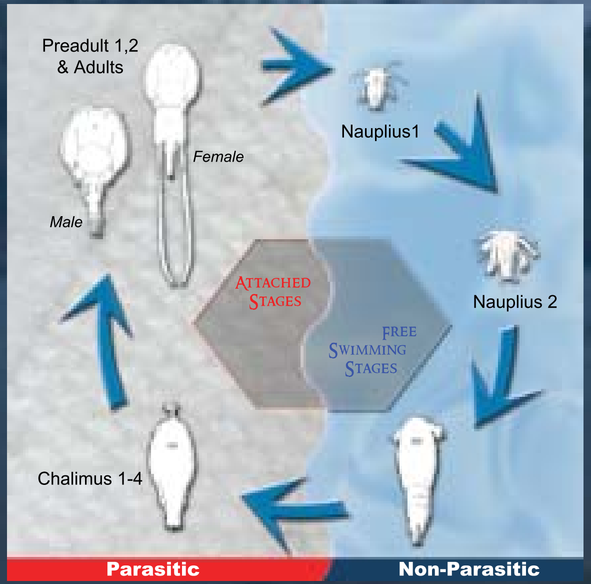
Sea lice is a generic term for a number of species of small parasitic copepods that are commonly found on marine fish. Copepods, from the Greek words, *kope* (meaning "oar") and *podos* (meaning "foot"), referring to the sea louse's broad paddle-like swimming, are zooplankton, microscopic organisms that eat other plankton. Zooplankton forms part of the first link in the marine food chain.

Sea lice are highly specialised copepods that feed and reproduce whilst attached to a host. There are many other parasitic copepods, which can be found on a wide range of marine and fresh water fish. Some are species specific, and some can parasitize more than one species of fish. *Lepeophtheirus salmonis*, commonly referred to as "salmon louse" as it is found on farmed and wild salmon, feeds predominantly on the mucus of the salmon, and sometimes on the skin. The salmon louse has 10 life history stages, each characterised by a moult (transformation) that takes it from egg to adult. The eggs and larval stages live in the water column, and are at the mercy of the currents and tides.



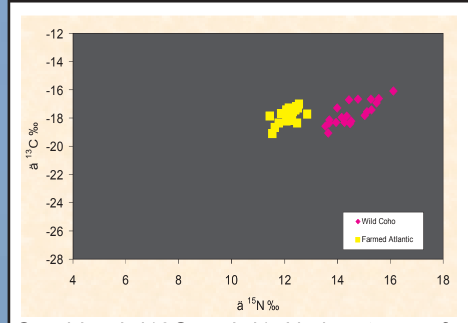

However, once the free-swimming *copepodid* stage is reached by the young louse, it is able to attach onto a host, where it grows to the adult stage and is able to produce eggs that are subsequently released into the water column, completing the life cycle.

Sea lice occur naturally in the aquatic environment and salmon can normally coexist with the parasite. At low levels they do not pose a serious risk to fish health. Some species, especially the sea trout (*Salmo trutta*), are more prone to infection, while Coho salmon (*Oncorhynchus kisutch*) are less susceptible than either Chinook (*O. tshawytscha*) or Atlantic salmon (*Salmo salar*).

To better understand the risk of sea lice infestations, and develop a risk assessment and mitigation model, AquaNet's researchers and their collaborating scientists have focused on four components, namely

### 1. Determination of risk of infestation on out-migrating smolts.

Using innovative telemetry technology, an international team of Canadian and Norwegian researchers has identified the migratory speed and path of salmon in a Norwegian fjord that contains salmon farms, and assessed the probability of infestation levels at various locations along the migratory path.




*Combined d13C and d15N signatures of L. salmonis collected off Atlantic salmon, (S. salar) from commercial salmon farms compared to L. salmonis samples collected from wild Coho salmon (O. kisutch) on the west coast of Canada in the Pacific Ocean.*

### 2. Determination of the effect of various infestation levels on swimming performance of wild/farmed fish.

The effects of different lice loads on swimming ability and reproductive activity of different salmonid species were accurately measured, to identify impacts at the sub-lethal level and be able to predict the point at which it leads to mortality in the affected fish, relating lice loads to fish size and other factors affecting fish immune responses.

### 3. Development and evaluation of a cause - effect methodology.

Until recently, tracing the origin or movement of animals between biomes has been limited and focused on a few species, using genetic markers or telemetry devises. The technique of using isotope ratios, initially applied in paleo-ecological sciences in so-called "carbon dating", is gaining increased popularity in modern ecological research by using the intrinsic tissue characteristics to trace the origin or migration of animals. Staple isotope signatures in the tissue reflect those of local food webs. Hence, animals that move between isotopically different food sources retain the information for a certain time, thus enabling origin and migration routes to be traced.

Adapting this technique to sea lice using carbon and nitrogen staple isotope ratios, AquaNet researchers have been able to discriminate between the sea lice collected from commercially reared Atlantic salmon in the Pacific and from wild Pacific Coho salmon, reflecting the different local conditions between the migrant wild and the farmed salmon. It now appears possible to differentiate between sea lice originating from wild/farmed fish. Further studies will ultimately help guide coastal management and the siting of farms.

## 4. Risk assessment of developing resistance to sea lice treatments.

Led by Dr. John Burka, professor at the Atlantic Veterinary Institute at the University of Prince Edward Island, this project is focused on sea lice resistance to chemotherapeutants used to treat infestations on farms, investigating if a heightened risk exists for developing resistance to the few treatments currently available in Canada. A lack of validated alternative control tactics when resistance develops could substantially increase economical and environmental costs. Rather, an integrated pest management strategy is needed that includes risk avoidance mitigation approaches, which will build on knowledge about differences between sea lice populations and patterns of gene flow between farms and regions.

The overall goal is to build locally calibrated models for both Atlantic and Pacific coasts that describe louse population dynamics, to predict the consequences that these parasites have on the stocks of wild/farmed salmon and to develop risk mitigation strategies. The model will significantly advance the ability to effectively position farms, minimise their potential impact in contributing to increased sea lice burdens on wild/farmed fish populations, and reduce costs to salmon farms through improved pest management strategies.

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