



[Home](#) > [Aquaculture](#) > [Sea Lice](#)

## Facts About Sea Lice

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### Issue

There continues to be surges of (mis)information circulated about sea lice and its impact on aquaculture and wild salmon stocks in British Columbia. In an effort to encourage public understanding, DFO has developed the following Questions & Answers.

### General Information

#### What are sea lice?

Sea lice are very small, salt-water crustaceans with soft bodies, which are ordinarily enclosed within a hard, protective outer shell. They attach themselves to a host fish's skin, fins, or gills, where they stay and feed on the mucous layer secreted by a fish's skin.

Two species of sea lice have been observed in British Columbia's Broughton Archipelago since monitoring began in the area in 2001. *Lepeophtheirus salmonis* is commonly found on wild and farmed salmon and has been reported throughout the Pacific in areas including the high seas and coastal areas of Russia, Alaska and Canada. *Caligus clemensi* is found on several species of fish and occasionally on farmed salmon.

#### What treatments are available for sea lice?

Emamectin benzoate (SLICE®) which was available under Emergency Drug Release (EDR) to control sea lice numbers on Atlantic salmon farms, has recently been approved by Health Canada for sale in Canada. It is orally administered and delivered to salmon through fish feed. SLICE® targets developing, immature, and adult stages of sea lice, eliminating them from the fish. Health Canada's stringent conditions regarding the use of SLICE® assures the safety and quality of the products entering the consumer market. There are no health risks associated with the consumption of SLICE® treated salmon.

#### Is it safe to eat salmon treated with SLICE®?

Yes, it is safe to eat salmon that has been treated with SLICE®. Health Canada has set stringent conditions regarding the use of SLICE®, in order to safeguard the safety and quality of products entering the food chain.

#### Are sea lice only found on farmed salmon?

No, sea lice can also be found on wild salmon and many other species of wild fish. Sea lice are very common on all Pacific salmon adults during their return migration to freshwater lakes and streams in which they were born. Commercial fishermen, recreational fishers, and First Nations people are all accustomed to seeing sea lice on wild adult Pacific salmon returning from sea to spawn.

#### Will eating salmon infected with sea lice make me sick?

No, there is no risk to human health. Sea lice live on the outside of the fish and feed on the slippery mucus on the skin of the fish. They would not affect human health if eaten, and usually the lice fall off or are cleaned off during harvesting or processing activities before the fish even reaches the consumer.

## Science

### **Are fish farms in the Broughton Archipelago causing a dramatic increase in sea lice levels?**

No. Since 1953, there have been significant fluctuations in the number of pink salmon returns. This was long before salmon farms were introduced to the area in 1987.

Ongoing research conducted by DFO is showing that the levels of sea lice found on wild Pacific salmon in the archipelago have declined consistently each year since 2004.

It is also important to note that there are two sources of sea lice in the Broughton Archipelago, from natural sources (e.g.: the marine environment), and potentially from salmon farms. Sea lice existed on wild salmon for tens of thousands of years before the first salmon farm was established in Canada and wild salmon have adapted to them.

Sea lice levels are carefully controlled on BC salmon farms, thereby reducing the risk of infecting fish living outside the farm to a negligible amount.

The Province of British Columbia (BC) has a comprehensive health management program for salmon aquaculture, which uses a precautionary approach. BC's Ministry of Agriculture and Lands (BC MAL) regularly release *Compliance and Enforcement and Fish Health Reports*. These reports consistently indicate that BC's aquaculture industry is upholding a high level of environmental standards and is serious about co-existing with wild salmon stocks. The 2007 Fish Health Report identified no new disease findings that had not already been reported in wild, hatchery-reared or research salmonids in BC.

The reports are available on the BC MAL's website at: [http://www.al.gov.bc.ca/ahc/fish\\_health/](http://www.al.gov.bc.ca/ahc/fish_health/) and [http://www.al.gov.bc.ca/fisheries/aqua\\_report](http://www.al.gov.bc.ca/fisheries/aqua_report)

### **What is the health of pink salmon populations in the Broughton Archipelago?**

DFO has been monitoring pink salmon in the Broughton Archipelago since 1953. Pink salmon populations in this region are highly variable and cyclical in nature. Recent DFO studies (Brooks and Jones, 2008 and Riddell et al., 2008) indicate there are years where pink salmon abundance are extremely low followed by a gradual increase to – as in recent years – an extremely high abundance. This variability is an aspect of pink salmon population dynamics and is well-documented to have occurred prior to the establishment of the salmon aquaculture industry on the BC coast.

Pink salmon returns are very strong coast-wide in 2009. Some rivers on Vancouver Island are seeing record returns, including the Quinsam and Glendale Rivers in the Broughton Archipelago which are seeing very high abundance. In fact, directed commercial fisheries for pink salmon were opened to seine and gill net fish harvesters in this area on August 31, 2009. While both of these river systems are located in different geographic areas, they are both close to two of the highest density salmon farming areas on the BC coast.

Pink salmon have a two-year life cycle and went to sea as fry in 2008 when ocean conditions were thought to be generally favourable for salmon.

In terms of coast-wide pink populations, Fraser River pinks are tracking above the 12.4 million forecast level and are likely to reach abundance levels of 17.5 million or greater. Previous maximum returns for Fraser River pink salmon was 26 million, with an average return of 11.6 million (1959-2007). In the North Coast, fisheries near Kitimat saw a record catch of 6.55 million pinks this year.

### **What does DFO research suggest in the debate on the potential impact of sea lice from salmon farms on wild salmon stocks?**

Since 2003, DFO and others (e.g.: the Pacific Salmon Forum), have conducted extensive field and

laboratory research into the potential origins of sea lice and their relationship to the health of wild salmon populations in the Broughton Archipelago.

DFO research has not been able to demonstrate a link between the levels of sea lice that may be present on the farms and the number of wild adult pink salmon returning to the Broughton Archipelago. Large fluctuations in abundance are typical among pink salmon populations and there are many potential sources of at-sea mortality. Monitoring results from DFO's Pink Salmon Action Plan can be found at this [link](#). Additional information related to DFO's scientific findings to support Sustainable Aquaculture Research in BC can be found at this [link](#). DFO prepared a report on scientific research related to the environmental interactions between finfish aquaculture and aquatic ecosystems for the Special Committee on Sustainable Aquaculture of the British Columbia Legislature in December 2006. The full report and a Power Point presentation can be found at this [link](#).

In January 2009, the Pacific Salmon Forum presented its final report and recommendations to the Government of British Columbia following four years of extensive, collaborative scientific research. The report was released publicly on February 5, 2009 and can be accessed at this [link](#). DFO scientists collaborated with the Pacific Salmon Forum on its research and contributed to its work.

### **Is it true that DFO research supports claims that sea lice from salmon farms is broadly infecting and harming wild pink salmon stocks in the Broughton Archipelago?**

No, this is not true. In fact, DFO scientists at the Pacific Biological Station have conducted laboratory research on the impact of sea lice on juvenile pink salmon from the Quinsam and Glendale rivers. Juvenile pink salmon were studied in three size categories (0.3 gm, 0.7 gm and 2.4 gm) and exposed to high, medium and low intensities of sea lice to study rates of infection and its effect.

This 2008 study by DFO scientists indicated that, in a controlled laboratory setting, deliberate exposure to high concentrations of sea lice can contribute to some mortality of very small juvenile wild pink salmon, that is, lighter than 0.3 grams. No mortality was observed in larger fish exposed to sea lice in this study (0.7 or 2.4 grams). Pink salmon in the wild are approximately 0.3 gm when they initially enter the marine environment, as demonstrated by sampling in the BA since 2003. The larger size categories of juvenile pink salmon are consistent with past research conducted in this DFO laboratory. This laboratory study is the first time that a DFO has found a direct link between sea lice infection and juvenile salmon mortality.

Laboratory observations that sea lice can lead to some mortality on small pink salmon are consistent with many statements from NGOs and other researchers. It is important to note that many other sources of mortality could be involved in the natural environment, predation by other species, ocean climate, and habitat loss. It is also possible that other wild fish species may be a source of sea lice infecting juvenile pink salmon.

DFO is currently examining its extensive information on the distribution of juvenile pink and chum salmon from field studies to determine where they are and their proximity to salmon farms in the BA.

The results of a subsequent DFO study, concerning the application of the lethal threshold to wild juvenile pink salmon in the Broughton Archipelago, have been accepted by *Diseases of Aquatic Organisms* and will be published in 2009.

### **Is it true that sea lice are killing juvenile sockeye salmon?**

No. Sea lice from salmon farms cannot singularly explain the extremely poor marine survival of Fraser River sockeye. Sockeye returns to the Skeena River in northern British Columbia were also significantly lower than anticipated this year and the migration route of juvenile sockeye from this river system does not take them anywhere near fish farms.

We also know that the majority of sea lice found on juvenile sockeye in the Strait of Georgia where the Fraser River salmon migrate are not the same sea lice species reported on BC salmon farms.

Juvenile sockeye that migrate past salmon farms in the Discovery Islands are significantly larger than pink salmon – 5 to 10 grams in size - when they migrate into the ocean, well beyond the threshold for susceptibility to sea lice.

### **What is being done internationally on the subject of sea lice?**

As in Canada, the governments of other countries such as Ireland, Norway, the United Kingdom and Scotland, are working collaboratively with industry and special interest groups on ways to effectively manage and monitor sea lice in order to minimize the risk of infection for both farmed salmon and wild fish.

Scientists from around the globe are also working collaboratively within a network of international sea lice researchers, to understand possible linkages between sea lice, wild stocks and farmed salmon.

Since 2003, DFO has conducted sea lice studies, contributing to a growing body of scientific knowledge. Canada is recognized internationally as a world-leader on sea lice research, with a research and management approach informed by previous and current levels of international scientific knowledge and on-the-farm practices.

### **Management**

#### **What is Canada doing to ensure the sustainability of the salmon fishing industry?**

DFO and British Columbia's Ministry of Agriculture and Lands (BCMAL), are committed to the protection of the marine environment and wild salmon stocks. As the lead federal agency for aquaculture DFO supports specific scientific research, monitor wild salmon stocks, and enforce protective, environmental regulations.

Provincially, BCMAL ensures salmon harvesters conduct regular monthly monitoring and documentation of sea lice levels on their farms, implements fish health management plans as a condition of license, conduct sea lice audits, and evaluates sea lice abundance from salmon farms supporting integrated area management of sea lice populations.

Active discussions and the participation of all stakeholders in developing further risk reduction strategies will only serve to enhance the work currently being done by industry and science to protect the marine environment and wild salmon stocks.

#### **What is required of industry to ensure the safe management of sea lice?**

Salmon farming companies in the Broughton Archipelago have developed a joint management plan for spring 2009 that will effectively provide a fallow route for juvenile salmon.

In addition, every salmon farm in B.C. is required to have a fish health management plan in place as a condition of its operating licence. Sea lice monitoring is mandatory in this plan and all producers are required to report their sampling results to the provincial Ministry of Agriculture and Lands (B.C. MAL).

For more information on BC MAL's 'Fish Health Management Plan' please visit:  
[http://www.al.gov.bc.ca/ahc/fish\\_health/fish\\_health\\_management\\_plan.htm](http://www.al.gov.bc.ca/ahc/fish_health/fish_health_management_plan.htm)

#### **What actions are being taken to monitor the salmon farming industry?**

DFO works closely with the Province of British Columbia to ensure the salmon farming industry is managed in a responsible way, minimizing impacts on the environment and other marine life. The BC Ministry of Agriculture and Lands is responsible for the day-to-day management of salmon aquaculture which includes fish health monitoring.

In 2003, BC MAL implemented a *Sea Lice Management Strategy* that requires each farm to submit a sea lice response plan that includes monitoring and reporting sea lice levels. They have set precautionary

levels for sea lice on farms (average of three adult lice per fish).

The BC salmon farming industry have been operating in a responsible manner to minimize the effects of sea lice on the aquaculture environment. They have been compliant with precautionary levels and treat the fish to minimize the risk of infecting fish living outside the farm. Licensed aquatic veterinarians are consulted to administer environmentally sound treatments. In fact the industry has been voluntarily pre-treating fish to minimize the risk of infection.

### **Are sea lice from salmon farms in the Broughton Archipelago responsible for poor returns of wild sockeye stocks in BC this year?**

No. Wild sockeye salmon population declines have occurred all along the B.C. coast in 2008 and 2009. Sea lice from salmon farms cannot singularly explain the extremely poor marine survival of Fraser River sockeye. Declines are more likely related to broad geographic scale conditions in the ocean and are not limited to the Broughton region. Sockeye returns to the Skeena River in northern British Columbia were also significantly lower than anticipated this year and the migration route of juvenile sockeye from this river system does not take them anywhere near fish farms.

DFO also knows that the majority of sea lice found on juvenile sockeye in the Strait of Georgia where the Fraser River salmon migrate are not the same sea lice species reported on BC salmon farms.

Juvenile sockeye that do migrate past salmon farms in the Discovery Islands are significantly larger than pink salmon – 5 to 10 grams in size - when they migrate into the ocean, well beyond the threshold for susceptibility to sea lice.

### **What is DFO doing to monitor sea lice?**

DFO research has demonstrated the presence of different species of sea lice in the Strait of Georgia. There is some uncertainty about the interaction of different species of salmon with different species of sea lice: some species of sea lice are associated with wild salmon populations, while others are associated with farmed fish. DFO acknowledges that more research is necessary to understand these differences and interactions.

DFO has undertaken significant scientific research on sea lice levels in the BA, the impacts of sea lice on juvenile salmon, and the adult returns of pink and chum salmon for the past several years. Through its monitoring programs, DFO has increased its efforts in recent years in determining the incidence and severity of sea lice infection rates of juvenile salmon in the Broughton Archipelago area.

DFO's research shows that sea lice in the Broughton Archipelago are being controlled, that sea lice are not decimating juvenile pink and chum salmon, and that the returns of adult pink and chum salmon are not showing marked declines. In fact, recent returns continue to increase from the poor returns acknowledged in 2002 and 2003.

### **With the assortment of opinions on sea lice, what should the public believe?**

There are different and dissenting opinions on the status of sea lice in the Broughton Archipelago. Many researchers and environmental organizations believe that salmon farms are causing poor returns of adult wild salmon stocks, and that if salmon farms were eliminated, the sea lice problem would be too. This is just not factual. Much research exists that lays to rest the all-encompassing claim that sea lice is putting all wild salmon at risk.

On March 12, 2008, BC scientist, Dr. Brian Harvey, released a report entitled *Science and Sea Lice: What Do We Know?* This review summarized 87 peer reviewed scientific papers published between 2004 and 2008, many from BC. In his introduction Dr. Harvey makes several points concerning sea lice research, one in particular was, "At present there is no scientific consensus on whether sea lice from farmed salmon are causing the demise of wild pink and chum populations".

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