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Recent studies have shown that, in British Columbia regardless of the presence or absence of salmon farms, there is wide variability in sea lice prevalence in coastal locations. Sea lice are naturally-occurring ocean parasites which attach themselves to both wild and farmed salmon (upon entry to the farm, salmon are 100% sea lice free). Sea lice levels can vary greatly from year to year. Research over the past decade shows lice levels are significantly linked with ocean conditions and variations in wild hosts.

Since the early 2000s, there has been much study on sea lice prevalence on B.C.'s wild and farm-raised salmon. This has provided researchers, and salmon farmers, with a much better understanding of trends of sea lice abundance in the ocean, and what environmental factors may drive the annual variability of sea lice. For example, in 2015, researchers noted an increase in sea lice prevalence on juvenile wild salmon compared to the previous year. This occurrence was quite similar to levels observed in 2003, 2005, 2006, and 2010, and much lower than levels observed in 2004.

Cumulative research has shown these trends in variability are linked to ocean conditions that are known to effect sea lice survival, reproduction and growth: primarily seawater salinity and temperature. However, sea lice prevalence on the coast has not been linked to influencing variability of wild salmon returns.

B.C. salmon farmers have again taken proactive and preventative measures to ensure their fish host low levels of sea lice as the spring 2016 out-migration of juvenile wild salmon approaches. Despite our current knowledge, some public concern remains about the potential effect of sea lice (from salmon farms) on B.C.'s wild salmon stocks.

To further explain the current understanding of sea lice prevalence and variability in B.C. waters, and the management actions taken by member companies of the BC Salmon Farmers Association (BCSFA), the Association is sharing the following information.

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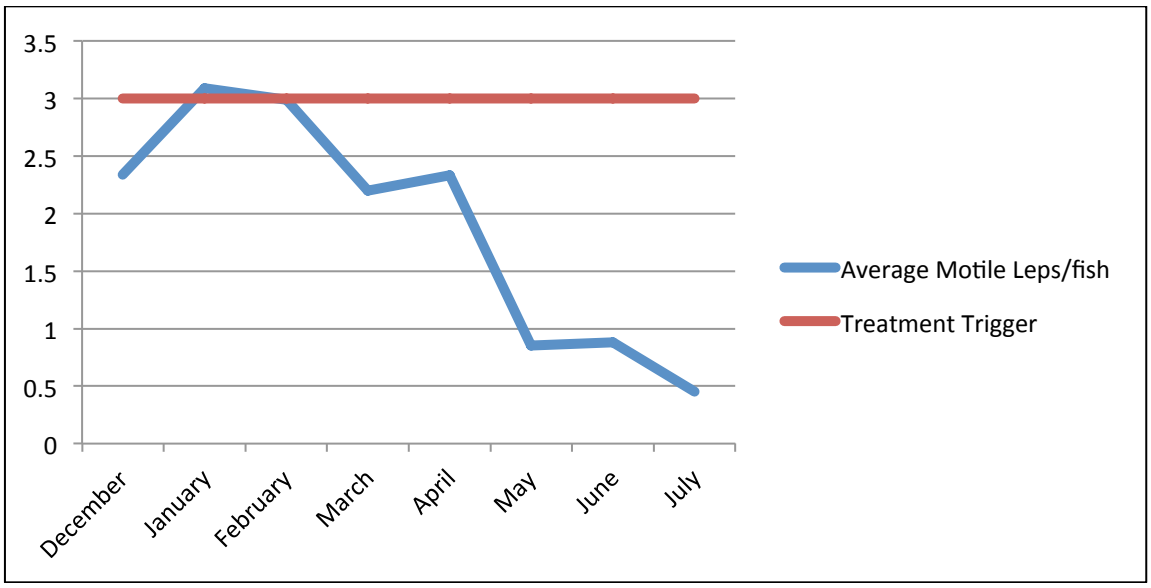
Q. Have salmon farmers lost control of sea lice in coastal B.C., particularly in the Broughton Archipelago region?

Sea lice on both farm-raised and wild salmon are not out of control. Elevated sea lice numbers were noted on some salmon farms during the 2015 out-migration season but numbers were location-dependent, they were not unprecedented and management measures were successful in returning sea lice numbers to low levels. Lice levels on farms were managed according to government-regulated thresholds throughout the out-migration period.

For example, the graph below shows the average number of motile sea lice per salmon on salmon farms in the Broughton Archipelago between December 2014 and July 2015.

*This graph is based on monitoring data of operating farms located in the Broughton Archipelago reported monthly.



In the Broughton Archipelago, the increase in sea lice that was noted after the autumn of 2014, and continued into early 2015, is thought to have been caused by high numbers of returning adult pink salmon (1.36 million compared to 0.56 million in 2013) that naturally host sea lice, and an unusually warm, dry winter causing increased water temperatures and salinities due to lack of run-off and rainfall. Both increased water temperature and salinity are ideal for sea lice to thrive.

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Sea lice levels on wild salmon were also elevated in several coastal regions of B.C. in 2015, near and away from salmon farms. Above average temperatures and salinity, in combination with the prevalence of wild hosts, are thought to again have been key in this trend. Annual variations of this magnitude have been previously recorded and are expected. It is known, and documented, that the levels of sea lice in the marine environment vary annually.

For example, fisheries researchers conducted studies in the spring of 2015 in the Broughton Archipelago, Quatsino Sound and Queen Charlotte Strait regions, to determine sea lice prevalence, abundance and intensity on wild fish. **A total of 52 sites were sampled over these three studies, sampling over 2,600 fish**. Links to the studies are below:

- Broughton Archipelago: http://www.marineharvest.ca/globalassets/canada/pdf/asc-dashboard-2016/broughton-archipelago-sea-lice-2015.pdf
- Port Hardy Region (Queen Charlotte Strait): http://www.marineharvest.ca/globalassets/canada/pdf/asc-dashboard-2015/sea-lice-study--goletas-channel-2015_final.pdf
- Quatsino Sound: http://www.marineharvest.ca/globalassets/canada/pdf/asc-dashboard-2015/quatsino-sound-sea-lice-2015.pdf

As these studies show, the prevalence of sea lice (percentage of fish found to have one or more sea lice compared to the total number of fish sampled) across all species sampled from April to June 2015 was:

- Broughton 25.9%,
- Quatsino 22.9%
- Queen Charlotte Strait 34%

To clarify: approximately 34% of fish sampled in the Queen Charlotte Strait hosted at least one sea louse.

A key point made by these studies is the fact that sea lice prevalence is not related to the presence or absence of a salmon farm in the vicinity of the sample site. For example, in the Broughton Archipelago study, researchers indicated that the an un-proportionally high number of sea lice were identified on fish collected from one sampling site (Alder

Point), which accounted for 65% of all the sea lice collected from the 22 study sites. Alder Point is not located next to a salmon farm.

Further to that point, in the Quatsino and Queen Charlotte Strait studies, comparisons could be made between sea lice on wild fish both in areas with and without salmon farms. For example, sea lice abundance in the Queen Charlotte Strait study was 5 times higher in the Goletas Channel (away from salmon farms) than in the Queen Charlotte Strait (next to farms).

These studies, when combined with data collected by salmon farmers, indicate that temperatures and salinities were higher than average in most coastal regions. These factors, paired with increased prevalence in wild sea lice hosts, create ideal conditions for sea lice.

Q. Have salmon farmers have made changes to their practices to allow sea lice levels to get out of control?

Salmon farmers are constantly improving practices based on science and experience, but core sea lice mitigation practices have remained consistent for over 10 years.

B.C.'s salmon farmers access a number of management tools, which help reduce sea lice on their fish and farms:

- Therapeutant treatments:
    - SLICE® (emamectin benzoate) is sparingly used by growers of Atlantic salmon at the most effective time of the year, through veterinary prescription.
    - Paramove® (hydrogen peroxide) is also available for use in some regions.
- Stocking and harvest timing is managed to help reduce sea lice populations on farms.

Salmon farmers are particularly diligent in applying management strategies during the out-migration period and in areas where more than one company has farms, a collaborative management approach is taken.

Farmers strategically time treatments in some cases to proactively manage sea lice numbers predicted to increase with out-migration timing. For example, in a 2013 study (Rogers et al.), scientists indicated that treatment during January or early February most likely would minimize sea louse abundance on Broughton farms during the March-June

juvenile wild salmon migration. In cases where it would be most beneficial, salmon farmers strategically time the treatment of their fish for sea lice around the out-migration period, in areas where numbers of wild juvenile salmon are high.

Farmers also increase sea lice monitoring to every two weeks during the out-migration period (March – June). Salmon farmers continue to be well informed on sea lice numbers on both farm-raised and wild fish. They have consistently been monitoring for sea lice monthly, and more frequently during the out-migration seasons, since the early 2000's.

In addition to sea lice numbers being reported publicly through Fisheries and Oceans Canada, salmon farmers have taken the additional step of reporting sea lice numbers, by farm, every month on their company websites. BCSFA provides a one-page access to all reports here: http://bcsalmonfarmers.ca/fish-health/ (scroll down to "reporting")

See DFO reports here: http://www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/lice-pou-eng.html.

There is a clear pattern of effective management of sea lice on B.C.'s farm-raised salmon, from year to year. In looking at the bigger picture, the graph below shows the average annual and seasonal rise and fall pattern of sea lice numbers on farm-raised salmon for all active salmon farming sites on B.C.'s coast. Increases are expected annually with fluctuations in returning salmon, other wild hosts, and optimal environmental conditions. However, the measures taken by salmon farmers to mitigate the rise in sea lice numbers (through treatments, and production management) has a clear impact upon decreasing those numbers, each year.

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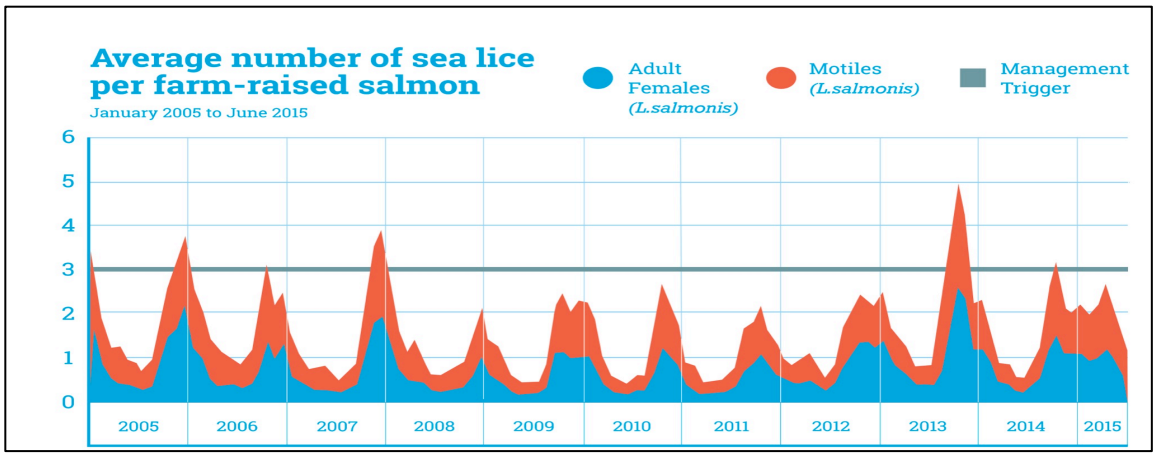

Q. Are sea lice on salmon farms influencing wild salmon returns?

There is no indication that sea lice levels have had any impact upon wild salmon returns. After 15 years of much study, there does not appear to be a link between the prevalence of sea lice in coastal B.C. and negative impacts on wild salmon stocks.

Sea lice levels vary seasonally, annually and regionally on both farmed and wild salmon. Additionally, the ratio of wild (adult) salmon to farm-raised salmon in B.C. has been suggested to be 1000:1 and wild salmon species naturally host sea lice (Saksida et al., 2015). Researchers have shown that Pink salmon, only at sea for one year, followed by chum salmon, are often the most heavily infected in the high seas and near shore. As adults, Pink salmon have been suggested to be the largest natural hosts for sea lice.

Controlled lab studies have shown that Pacific salmon are quite resistant to negative effects of sea lice, and the level of resistance to sea lice by salmon is species specific.

Based on trials, scientists (Nendick et al. (2011)) have reported that juvenile Pink salmon over 1 gram appear resistant to any negative effects of sea lice. There does appear to be an effect on Pink salmon under 0.7 grams. Jones et al. (2008) estimated that the lethal infection level for Pink salmon averaging less than 0.7 grams is 7.5 sea lice/gram or 5.25 sea lice per 0.7 gram smolt.

With respect to average juvenile Pink salmon size, in the 2015 Broughton study

previously mentioned, juvenile Pink salmon averaged between 1.5 and 5.9 grams in June. The Port Hardy study indicated that Pink juveniles sampled in April averaged 0.4 g but grew quickly to an average size of 1.67 g in May.

Similarly, Coho, Chinook and Sockeye salmon also have shown levels of resistance (Fast et al., 2002; Johnson and Albright, 1992, Jakob et al., 2013). Size of juveniles during out-migration, and ultimately sea lice resistance, is dependent upon species and month, as fish are larger in May and June. Juvenile Coho salmon enter the ocean at a much larger size, and averaged 11.3 grams in April and 12.4 grams in May.

In considering effects on a population scale, scientists (Marty et al. (2010)) examined wild and farmed salmon sea lice data over a 10-year period in the Broughton Archipelago, and found that the productivity of wild Pink salmon was not negatively associated with sea lice. Jones and Hargreaves (2007) assessed sea lice data collected in the same area (2005-2008) and estimated that salmon mortality related to sea lice ranged between 0 and 4.5% making a relatively minor contribution to the estimated 55-77% mortality levels that have been suggested to occur during a salmon's first 40 days in the marine environment (Heard, 1991).

Salmon returns fluctuate, in some cases drastically, from year to year and are very difficult to predict. For example, Pink salmon spend two years at sea and so returns of each run can be grouped into "even" and "odd" year returns. Below are numbers for pink returns during even (red) and odd (blue) years to the Broughton Archipelago between 1999 and 2014, based on DFO Escapement data. (The * denotes an anomaly for returns with 3,466,409 pinks returning to the Broughton Archipelago region in 2000. This number was not graphed for the purposes of maintaining scale).

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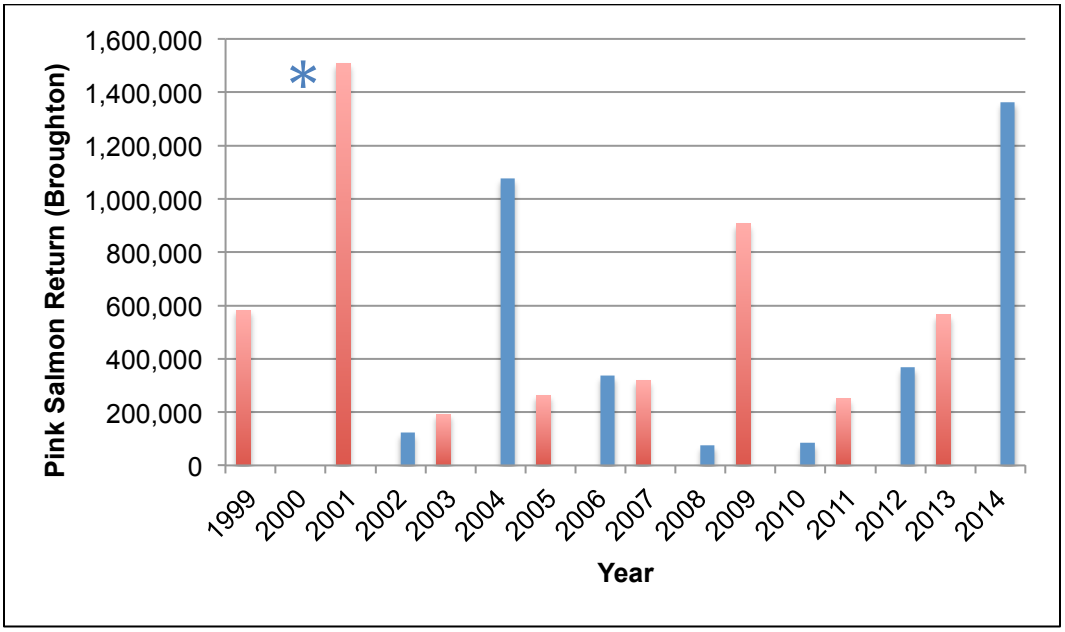

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