

Sea lice management

Comparison of prevention and treatment methods against the salmon parasites *Lepeophtheirus salmonis* and *Caligus elongatus*.

Background

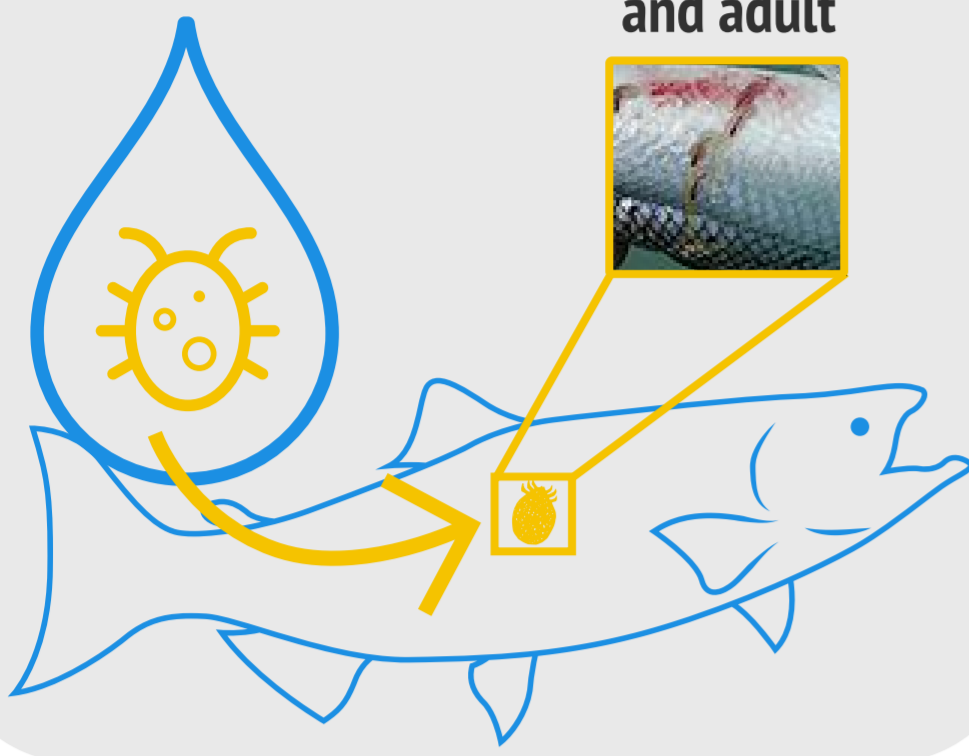
Sea lice

Larval stages are dispersed through the water. Parasitic pre-adult and adult stages attach onto salmon and feed on mucous, skin and tissues.

Sea lice cause open wounds, a lower immune capacity and can cause death

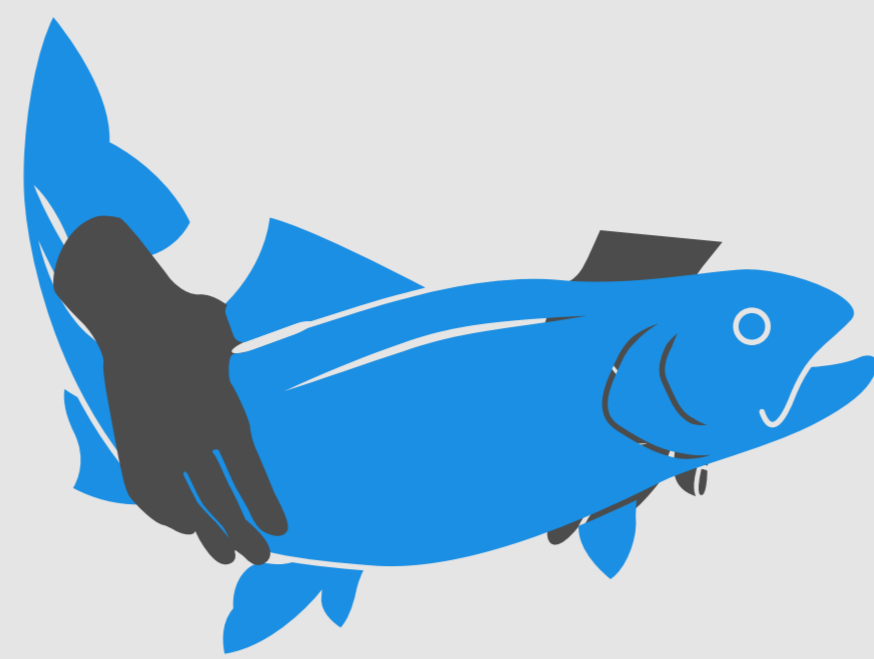
Free swimming larvae

Parasitic pre-adult and adult



Reduction in natural defences

The mucous layer present on the skin of fish is their natural protection against external parasites, including sea lice.



Common practices during salmon farming require the fish to be handled. Handling damages the fish's protective mucous, making them more vulnerable to sea lice.

Costs

Between 2012 and 2017, 10,130 delousing treatments occurred in Norway¹.



Sea lice have cost US\$4.36 billion from 2013 to 2019 to the salmon farming industry².



Site selection

Some areas have higher sea lice infection rates than others.

In 2012, sea lice levels in Shetland were on average >250% higher than the report level of a weekly average of 3 adult females per fish, whereas Orkney had very low rates³.

Note: since 2019, the report level is a weekly average of 2 adult females per fish



Careful selection of new farm locations using oceanographic modelling is needed to prevent farms being established in areas with known or likely sea lice infestations.

Fallow periods can greatly reduce the risk of recurring sea lice infestations, especially if co-ordinated amongst groups of farms.

Prevention

	Functional feed	Sea lice trap	Deep lights / feeding	Sea lice skirts	Snorkel nets	Electrical fence
How it works	Feed which contains ingredients that thicken the mucus layer, promote healing or repel copepods	Traps are placed around the pens which attract sea lice away from salmon using light and odorant	Salmon are attracted to depths without sea lice with light or feed	A fabric which covers the top of the net which prevents sea lice larvae from entering the sea pens	Salmon are forced to stay below the sea lice depth line using nets. They can only surface in one area to fill their swim bladder	Electrical pulses are transmitted through the water and inactivate lice before they attach onto salmon
Effectiveness	20% effective ⁴	In lab studies: 8% delousing, 20% effective in trapping unattached adults and 70% effective in trapping larvae ⁵	Effectiveness generally low as fish surface to fill swim bladder. Lights ineffective during the day ^{6,7}	Sea lice skirts have been found to be 30-80% effective ^{9,10}	Site dependent: 0-75% effective ¹¹	New technology, results are promising, 50-80% effective ¹²
Mortality risk	No risk known	No risk known	No risk known	No risk known	No risk known	No risk known
Injury risk	No risk known	No risk known	No risk known	No risk known	Increase in snout injuries ¹¹	No risk known
Other welfare concern	No concern known	No concern known	Salmon prefer to swim at the surface. This method alters natural behaviours ⁸	Oxygen can become depleted when using sea skirts. Monitoring water quality is important ¹⁰	Snorkel nets can affect salmon behaviour and prevent access to optimal water conditions ¹¹	No concern known
Environmental impact	No impact known	No impact known	No impact known	No impact known	No impact known	No impact known

Treatment

	Cleaner fish	Hydrogen peroxide	Chemotherapeutic	Laser	Thermolicer/Opticer	Mechanical
How it works	Cleaner fish are housed in the same sea pens as salmon and eat sea lice that are on the salmon	Infected salmon are exposed to hydrogen peroxide at concentrations which kill sea lice	Infected salmon are exposed to chemical via baths or feed	An underwater camera detects sea lice and a laser kills them	Salmon are pumped through heated/cooled water. Sea lice fall off	Salmon are pumped through water jets. Sea lice are dislodged
Effectiveness	Effectiveness is limited and depends on the species, the time and density of stocking and cleanliness of the nets ¹³	7.5-99% effective depending on: duration, concentration and previous treatments ¹⁶	13-96% effective depending on: duration, concentration and previous treatments ¹⁴	Research found no effectiveness ²³	19-100% effective on mobile lice; not effective on attached lice ^{1,19}	82-100% effective on mobile lice; effect on attached lice uncertain ¹
Mortality risk	Up to 100% of cleaner fish ¹⁵	Mortality can be over 50% ¹⁷	Mortality can be over 10% and on rare occasions, over 50% ¹	No risk known	Mortality can be over 25% ¹	Mortality can be over 10% ¹
Injury risk	Aggression between cleaner fish and salmon can lead to injuries for both salmon and cleaner fish ¹⁴	Gill lesions and gill necrosis. Damaged mucous layer ¹⁸	Gill damage ²⁰	No risk known	Cold water: injuries to skin and eyes. Injuries to fins during treatments >10 min ²⁴	Scale loss is very common ¹
Other welfare concern	Welfare of cleaner fish is often poor (lack of feed, enrichment) and cleaner fish can be subject to aggression ¹⁵	Physiological and oxidative stress. Decreased resistance to disease ¹⁹	Stressful procedure. Lethal to surrounding animals ²¹	No concern known	Warm water: colliding with tank, loss of equilibrium. Cold water: loss of movement, disrupted feeding ²⁵	Stressful procedure ¹
Environmental impact	Some cleaner fish are wild caught. This depletes wild populations ¹⁴	No impact known	Environmental pollution ²²	No impact known	No impact known	No impact known

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