The salmon louse, *Lepeophtheirus salmonis*, is a naturally occurring parasite of wild salmon and sea trout. The parasite infects farmed salmon, and infestations can cause considerable stress to the animals and substantial economic losses to the industry. Sea lice have also been implicated in the decline of wild salmon and sea trout stocks. Fisheries Research Services (FRS) has an on-going project in Loch Torridon to investigate the dynamics of sea lice in the loch, and their interactions with farmed and wild salmonids.

**Life Cycle of the Salmon Louse**

The life cycle of *L. salmonis* consists of 10 stages. The first three stages are planktonic and non-feeding, and the later stages occur when the louse is attached to, and feeding off, a host fish. The first two stages are nauplius I and II, and the third stage, the copepodid, is the free-swimming, infective stage. The four chalimus, two pre-adult and the adult stages develop only if the parasite is successful in finding a host.

During a study in Loch Torridon FRS scientists investigated epidemiology by focusing on the following aspects:

- collecting and analysing plankton samples for sea lice larvae;
- modelling sea lice larvae transport;
- monitoring sea lice numbers on returning wild sea trout;
- collating the numbers of sea lice present at fish farms in the loch.

**Planktonic Sea Lice**

FRS began sampling for sea lice at the shoreline near the mouth of the River Shieldaig in 1999. Sampling has continued there and has been extended to the mouths of other rivers in the Torridon system. High densities of sea lice larvae have been found at some river mouths (Shieldaig and Balgy) when local fish farms are in their second year of production, whereas only low densities were recorded at other river mouths (Torridon and Corrie). Generally, sea lice numbers at fish farms are greater in the second year of the two year production cycle.

To complement the shoreline work, sea lice sampling in the open waters of the loch began in the autumn of 2001, and, as with the shoreline sampling, is still continuing. Open-water sampling has shown that, generally, whenever there were gravid (egg-bearing) sea lice at the local fish farms, larvae were also present in the surrounding water. Nauplii did not aggregate in the upper five metres of the water column, whereas significantly greater densities of copepodids were found at the surface than at 1, 2.5, or 5 m depths. Samples
collected in Loch Shieldaig and Upper Loch Torridon showed that significantly more nauplii were found in the vicinity of fish farms than elsewhere in the loch, and that greatest densities of copepodids were collected near the mouth of the River Shieldaig. The low proportion of nauplii recovered near the head of Loch Shieldaig, and the absence of the naupliar stage in shoreline samples, suggests that the infective larvae recovered at the mouth of the River Shieldaig were transported there from elsewhere.

**Modelling Sea Lice Larvae**
Hydrodynamic particle-tracking models have been developed at FRS to investigate the movement and dispersion of sea lice larvae in Loch Torridon waters. These models take into account the biology and behaviour of the larvae and water currents, and have been used to run simulations based on fieldwork data. The simulations have highlighted the importance of wind-driven currents in the dispersal transport mechanism of sea lice larvae.

**Attached Sea Lice**
Levels of lice infestation on early-returning sea trout post-smolts in the River Shieldaig have been measured since 1999 by electro-fishing between the fish trap and the sea in late spring and early summer. This has shown that greater numbers of post-smolts return early, infected with sea lice, when the local fish farms are in the second year of the production cycle.

**Conclusion**
This study combines observations of lice attached to sea trout post-smolts with densities of lice larvae in the water of Loch Shieldaig. Models of water movements in the loch provide indications of processes that could account for the apparent link observed between sea lice infestations on farmed fish and lice on wild fish. Movement of planktonic infective stages of lice larvae by water currents could be a mechanism whereby uninfected stock at farms can become infected from adjacent farms, or from wild fish. Improved understanding of the processes involved will allow better definition of Management Areas, and lead to enhanced strategies for lice management.

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For further information see:

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Revie, C.W., Gettinby, G., Treasurer, J.W., Grant, A.N. and Reid, S.W.J. 2002. Sea lice infestations on farmed Atlantic salmon in Scotland and the use of ectoparasitic treatments. Veterinary Record, 151, 753-757.