

# Final report from NFR project

## Concerted action – Lice International (CALI)

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### SUMMARY

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The project has been a continuation of a former platform between Canada, Ireland, Scotland and Norway (Compare Lice). The project has arranged 4 meetings with the participants and comparative experiments have been undertaken.

The results of the experiments and the overall cooperation effort were presented at Sea Lice 2010 in Victoria with 4 oral and 2 posters. Not all the results from the presentation had been developed within the project but the project was dedicated to network between all participants and facilitated the presentations. The two posters sums up the comparative work on sentinel cages and hydrodynamic modelling done in the project.

### GOALS AND SUB GOALS

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Compare experimental methods of estimating sea lice impact used in one or more countries  
Continue the platform established and create an umbrella for the research projects in Norway, Scotland, Ireland and Canada in the described field.

Sub-goals

1. Do comparative experimental field work in country of best practise.
2. Bring the participants together in workshops to discuss results from the respective countries both from within this project and other.
3. Write comparative reports and articles combining the knowledge from all the participants and geographical areas.

### RESULTS

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#### 1. EXPERIMENTAL FIELD WORK

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This proposal brought together key institutes in the development of dispersal models for sea lice and the methods used to validate these. The collaboration between these institutes, in particular co-ordination of the work to ensure that outcomes from the regions are comparable and hence supportive of each other has been valuable.

Two methods have been used in the field, sentinel cages and hydrodynamic modelling.

##### *Sentinel cages*

From the trials carried out in Scotland, Norway, Ireland and Canada the initial findings suggest that while the design and size of the various national cages differ slightly, observed louse settlement on fish is sufficiently similar to allow data comparisons among participating countries to be carried out. While further data collection and statistical analysis should be carried out, the CALI program has demonstrated that standardising methodology across nations allows datasets to be combined and examined resulting in more robust conclusions to be drawn and effect advice on future integrated sea lice management strategies (Pert et al, 2010).

##### *Hydrodynamic modelling*

The systems modelled vary in scale, complexity, climate and ecology. The modelling and parameterisations have benefited from the extensive international collaboration between these countries including novel hydrodynamic modelling to cope with the complex geography of fjordic systems, modelling of wind forcing and models of lice biology. A general finding across

these differing systems is the weather and/or flow-dependent formation of concentrations of larval lice at locations that are distant from their source (Murray et al. 2010).

#### *Vertical migration of free swimming salmon lice larvae*

During the second meeting (see below) behavior of free swimming larvae were defined as one of the important areas for further research and was put on the short list. From contacts in Canada the project was able to borrow a 10m long plankton mesh column designed to stand in the water. The column could be partitioned of for each meter and planktonic sub samples could be taken from the column. By stocking the column with salmon lice nauplii and copepodids an idea of vertical position and migration could be elucidated. In November 2009 we were able to do a short preliminary test and found that both nauplii and copepodids aggregated at the surface at day (fig 1). The same results were also shown for dark conditions. This was not in line with older research. Since we only were able to do one test the experiments needs to be duplicated in a full set design.

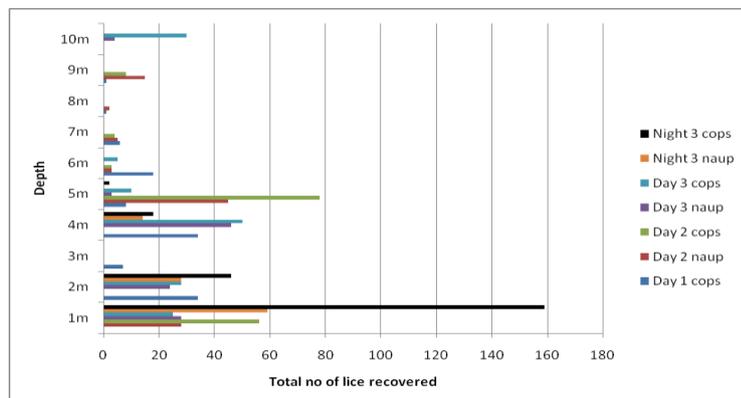


Fig 1: total no of nauplii and copepodids recovered from vertical sea lice column at day and night and different depths.

## 2. MEETINGS

There have been three scheduled meetings and one extra in the project period.

#### *Utrecht, June 29th to July 1st 2008*

The meeting was held in Utrecht with participants from all countries. The main aim of the first meeting was to give a status for surveillance already undertaken and research in each country. Plans were also made for applying for new projects and how to proceed with the project.

#### *Ørlandet, August 12th to 13th 2009*

The meeting had focus on two issues: status of the sea lice surveillance and research in all participating countries and a discussion on lack of biological knowledge common to all countries especially to fine tune the predictions and modelling.

#### **The following issues were agreed upon:**

We need to get better background data on several biological parameters concerning mortality of sea lice. Especially mortality related to physical parameters (salinity, temperature), egg to copepodid time and survival and the subsequent viability regarding for instance prehistory of salinity and temperature.

We also need to bring the biology from relative to absolute for total production of eggs, variation in fecundity at varying physical conditions (S, T), daylight and residual effects of chemical treatment.

The behaviour of free swimming larvae is vital to the outcome of the models. We need to elucidate on how the vertical distribution varies (see column experiments over), effect of surface

layer and step salinity gradients. All the above issues needs to be put into a time and space context. The possible avoidance of low salinity also needs to be addressed.

Column experiments can clarify the day night migration of nauplii and copepodids at full strength salinity and salinity gradients. Results from Canada suggest that the larvae will follow a fish. This has not been tested elsewhere. The chemical response can also be important and the possible aggregation or clustering should be looked into.

While using sentinel cages the total volume of sea water exposure needs to be established.

Generally several of the issues discussed needs to be scientifically quantified.

**Three “Larger questions” were defined:**

1. What is the quantified coupling from farm output over to the possible settlement on wild fish?
2. What is the overall rise in total settlement on wild fish due to production of sea lice in fish farms?
3. What is the background production of sea lice larvae on wild fish?

*Austevoll, November 2009 – extra experiments undertaken not described in the original proposal.*

Participants from Ireland, Scotland and Norway were able to meet up for a short week and undertake the described experiments with vertical column borrowed from Canada. Other Norwegian institutes were also invited but unfortunately were unable to attend due to lack of funding.

*Tofino, May 12th to 13th 2010 – final meeting*

The 8<sup>th</sup> international sea lice meeting was held in Victoria, Canada May 9-12<sup>th</sup> 2010. The project funded participants from Scotland and Norway to present the data so far. The final meeting was then held in Tofino including a visit to a salmon farm on the west coast of Vancouver Island. The farm were doing sea lice registration at the time of the visit. Even though the concentration of sea lice knowledge and competence must be said to be high with all the expert present only one sea louse was found.

In the subsequent final meeting the results from the project were summed up as follows:

1. All countries and more specifically the institutes participating are currently involved in both monitoring and research in several areas, concerning the effect of sea lice on both wild and farmed stocks of salmonid fish.
2. The initial Compare Lice project has made it possible for the participants to view the methods used first hand in three of the countries and the CALI project had made it possible to validate some methods used and develop them further.
3. Further cooperation will facilitate a realistic comparison of these methods in all environments and transfer of methods if necessary.
4. A platform and meeting forum need to be set up to coordinate such an effort.
5. Within a few years the participants see the need for a workshop on sea lice related issues.

### **3. COMPARATIVE REPORTS**

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The results so far have been presented as posters and oral presentations (see publication list amendments). If time and funding allows the data will be taken further into publications.

Other activities:

The discussions from meetings have led to a proposal for new scientific project (LEPS: Physical and biological factors affecting salmon lice dispersal) but this was not funded.