

# Assessing the risk of Salmon Lice disease spreading in Norwegian salmon farms using Agent-based Modelling

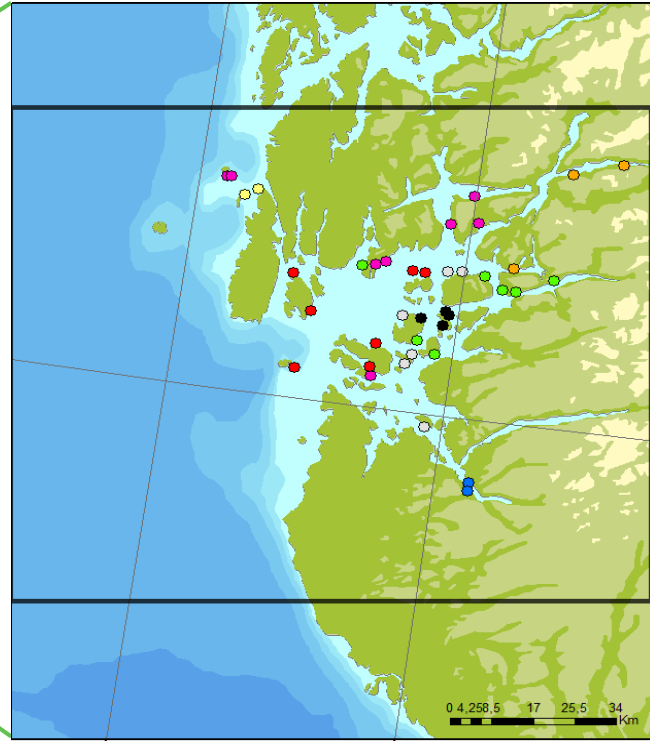
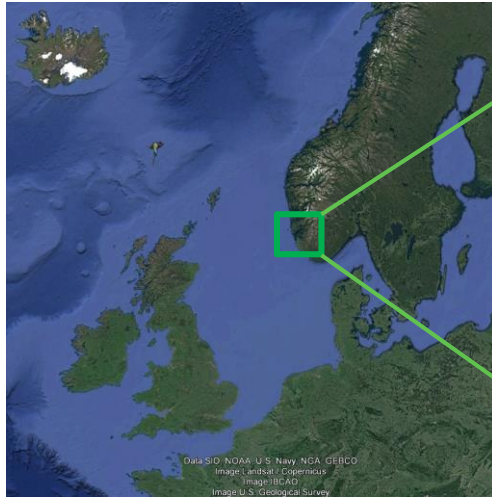
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The expert in **WATER ENVIRONMENTS**



In corporation with



# Case area: Rogaland, Norway

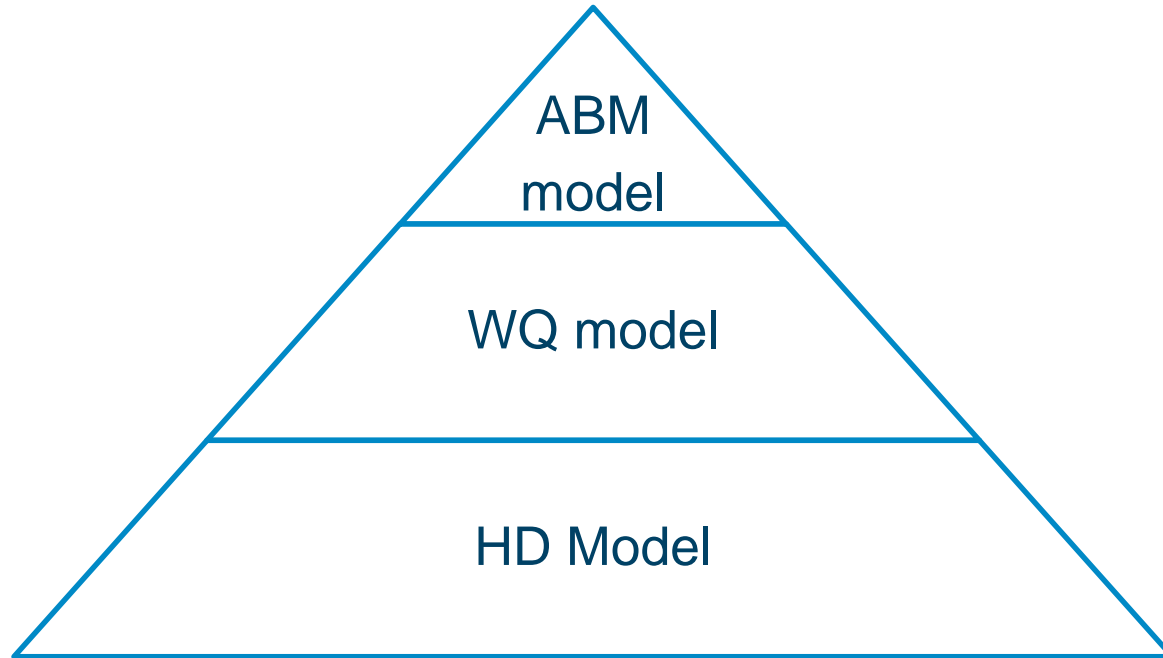


# Introducing the main character

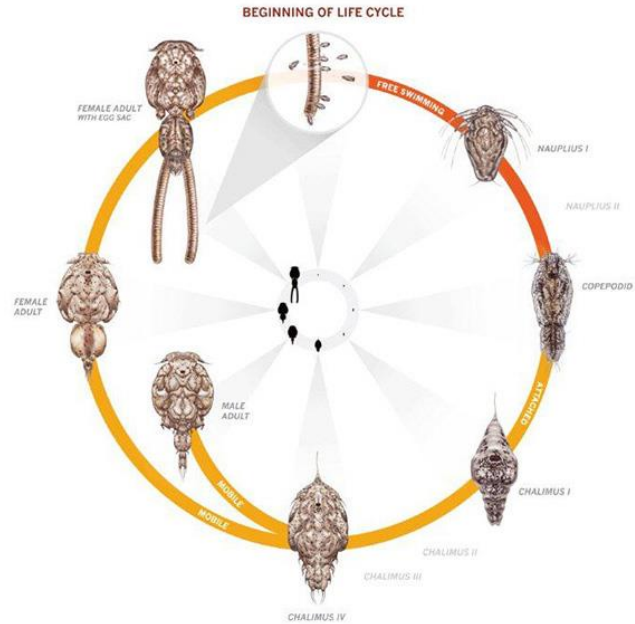


- Salmon lice (*Lepeophtheirus salmonis*)
- Ecto-parasite on salmonids
- Annual cost in Norway is 10 billion NOK
- Negative impact on wild salmon especially migrating smolts

# Basic concept



Its all about.....



# Salmon lice ABM and marine habitat connectivity

Demographic (ecological) connectivity: an exchange of individuals among local populations that can influence population demographics and dynamics. It can include:

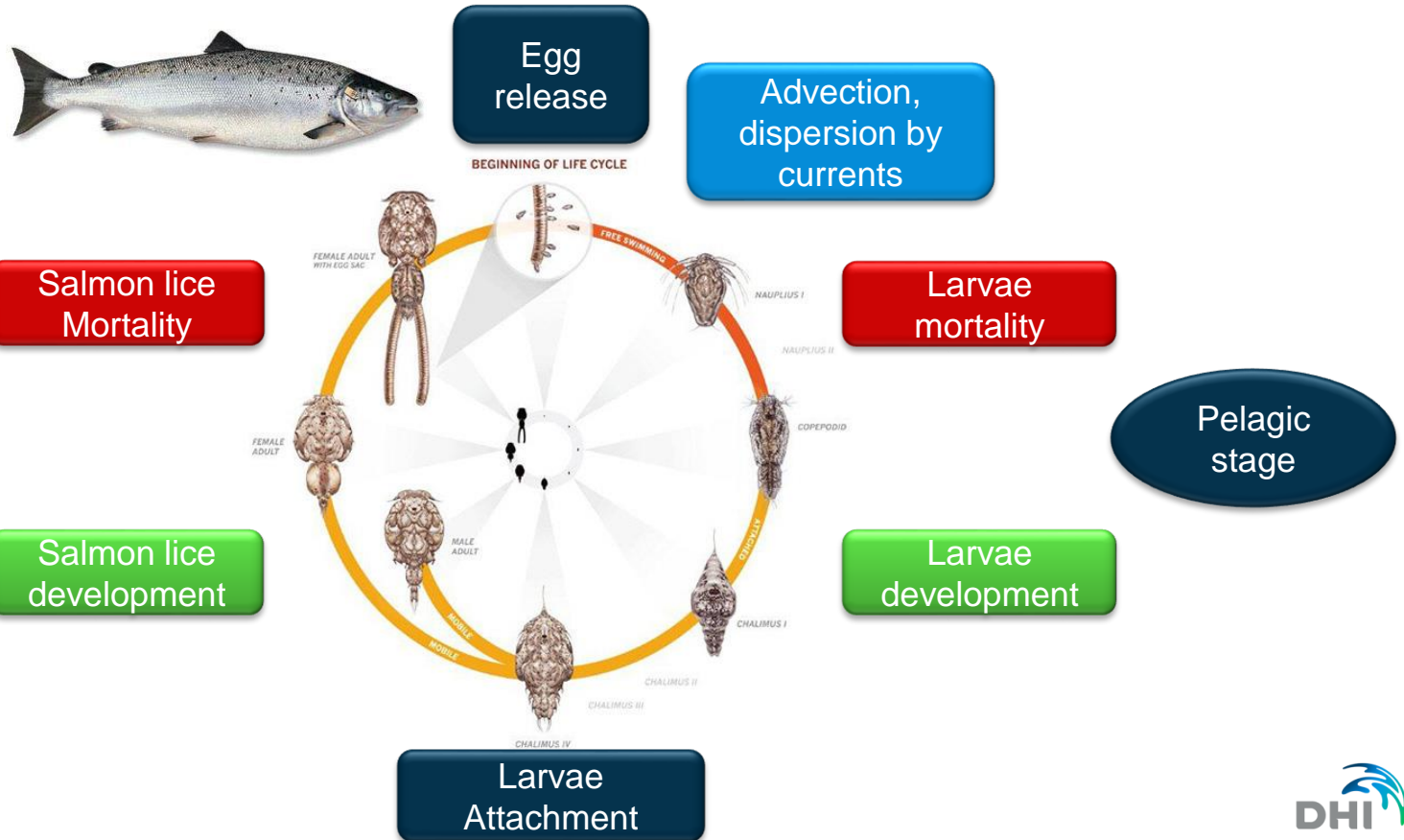
- Exchange of offspring between populations through larval dispersal;
- Recruitment of juveniles and survival of these juveniles to reproductive age;
- Any large-scale movement of juveniles and adults between locations.

# Modelling salmon lice in ABM Lab

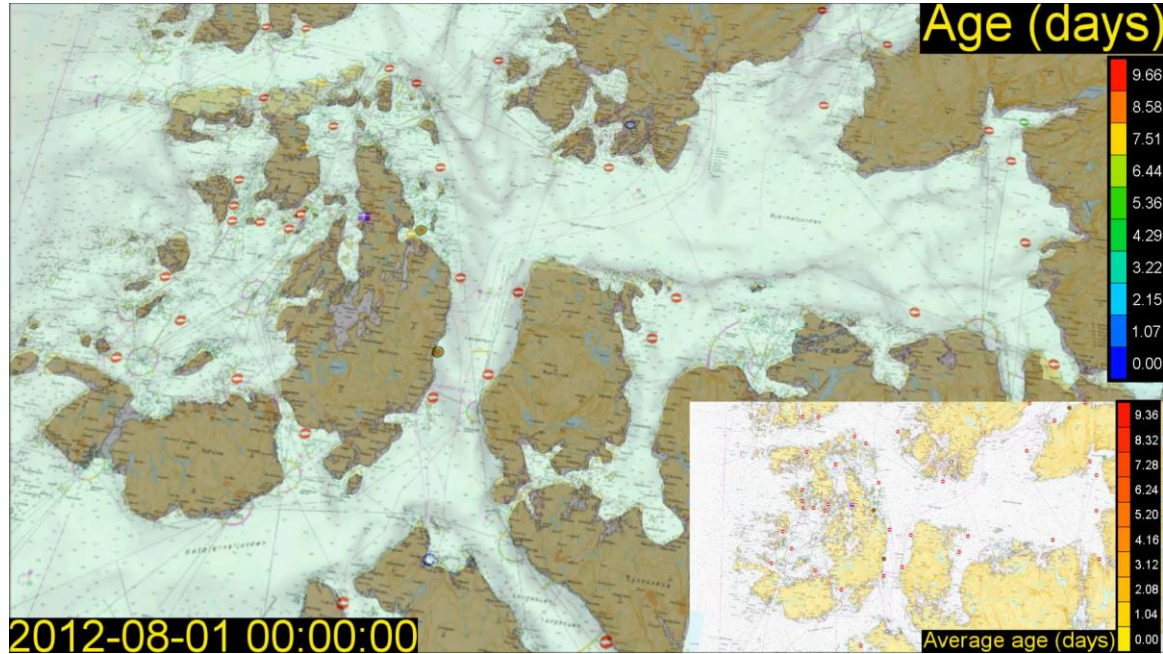
- **Agent-based modeling module coupled with the existing Eulerian ECO Lab framework**
  - Allows for a spatiotemporal representation of hydrology and water quality
  - while also capable of simulating higher trophic levels such as salmon lice on an individual level.
- **Governed by basic particle-tracking algorithms, but with “self-deciding” particles (agents).**
  - Agents can sense & react to Eulerian variables – and even affect/consume them!
  - Agents can be made to sense, and react to each other.
- **Allows the user to create customized larvae models and couple it with hydrodynamics and other environmental forcings with relative ease.**



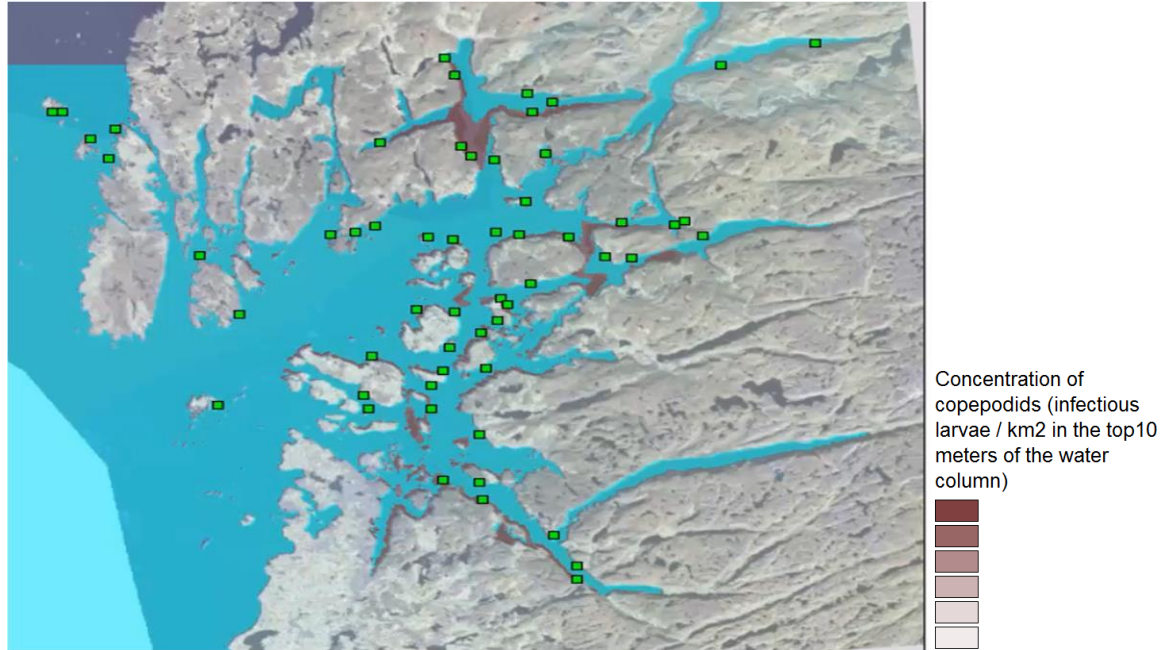
# Translating the life story into a conceptual model



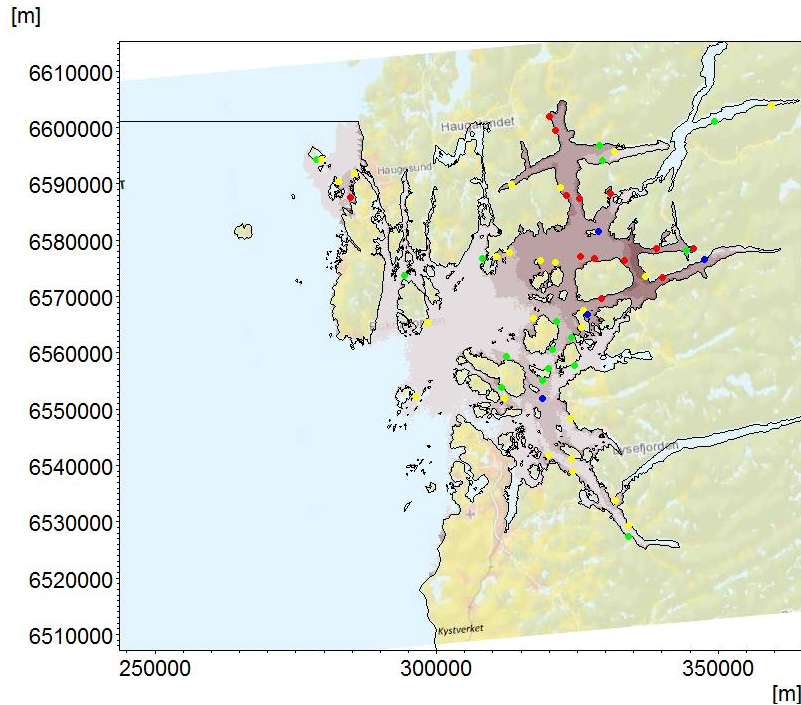
# Single farm release



# Multi farm release



# Site selection – Select sites with low risk of salmon lice

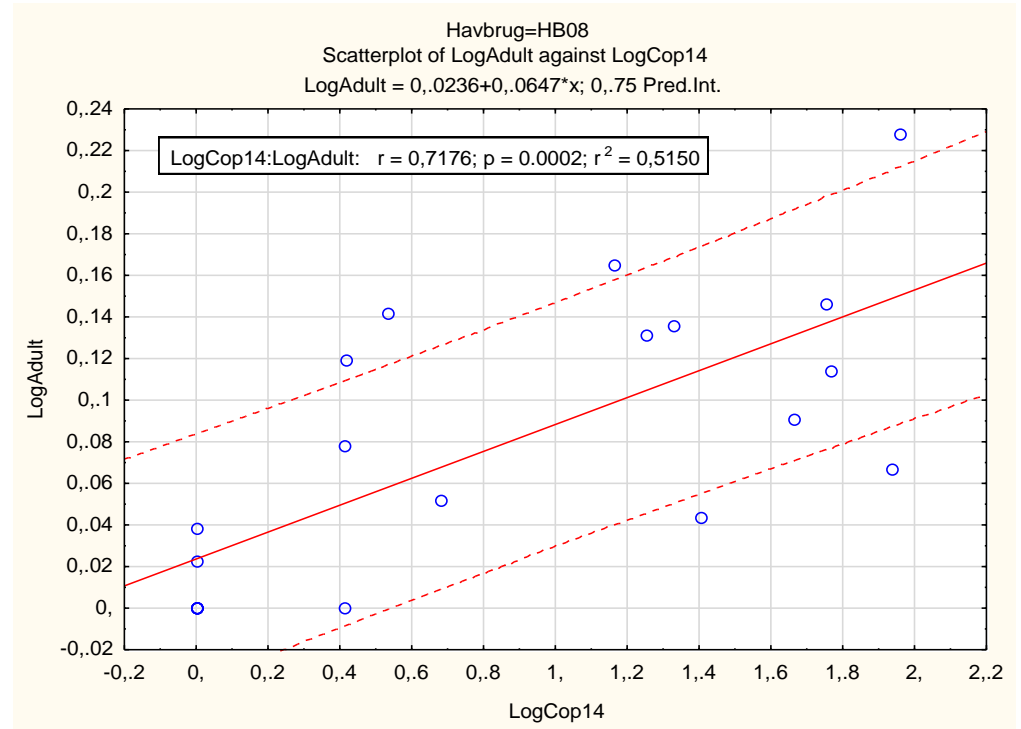


## Avg. no. of adult lice pr. salmon

<b>≥ 0.5</b>	At least one week with ≥ 0.5 adult females/salmon
<b>&lt; 0.5 and ≥ 0.2</b>	At least one week with ≥ 0.2 adult females/salmon (never > 0.5)
<b>&lt; 0.2</b>	Never > 0.2 adult females/salmon

# Can the model predict observed number of salmon lice on farmed fish?

- Modelled infection pressure (as number infectious copepodids) compared against weekly observed number of salmon lice on farmed fish
- In general there is a "good match"
- 85% of all observations of salmon lice is predicted with 75% certainty
- Still room for improvement especially when it comes to prediction of high salmon lice observations



# Way forward

- Salmon cage module
  - Work in progress to be finalized within two weeks
- Operational salmon lice forecast and warning system for all concessions and companies in Rogaland
  - Work in progress. The MIKE operation salmon lice forecast will be launched in 2017

**For more information:**

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