

Sea lice resistance

FHF901631, 2020-2025

BREEDERS TALK BLUE! - FOCUSING ON THE POTENTIAL AND OPPORTUNITIES OF GENE EDITING IN AQUACULTURE

WEBINAR 27.4.22



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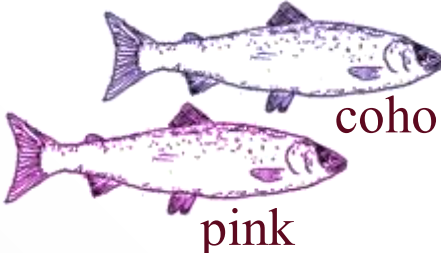
Sea lice

- Large cost
- Fish welfare
- No existing control measures are completely effective
- Genetic variation in resistance!

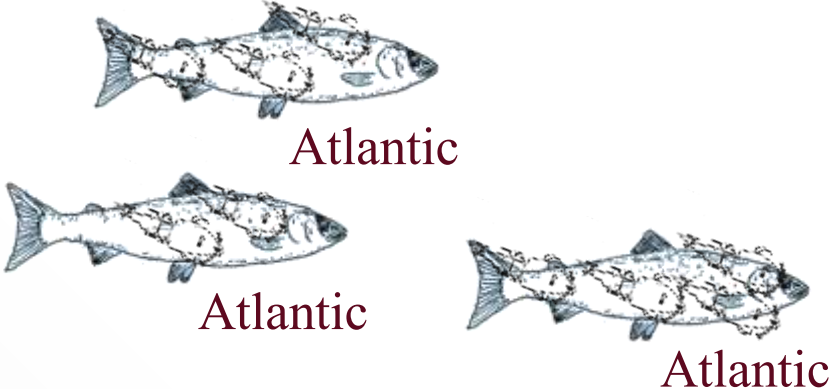
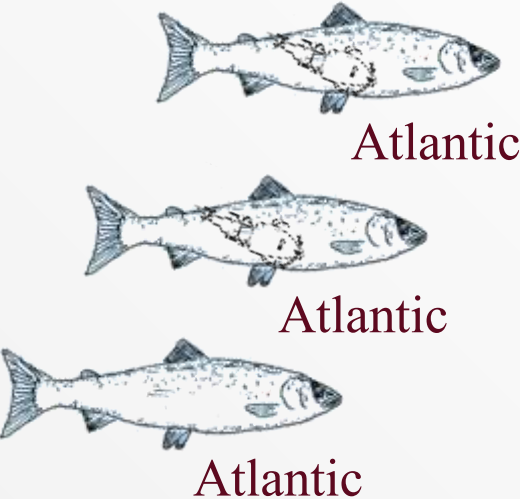
Photo: Francisca Samsing UoM & IMR

Genetic variation

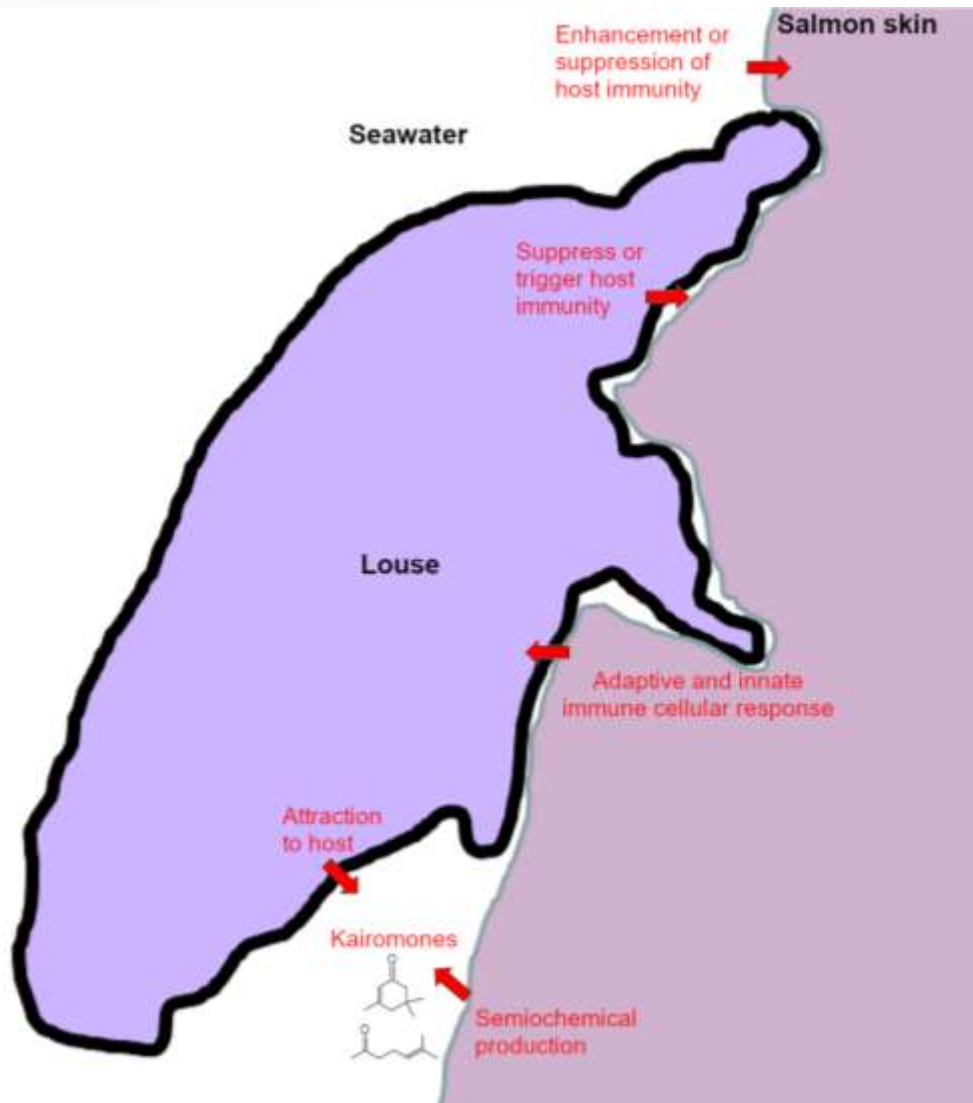
- Between species



- Within farmed Atlantic salmon



Different mechanisms of resistance in coho, pink & highly resistant Atlantic salmon?



Coho

- 24 hrs PI
 - Multifocal granulocytic infiltration
 - Non-specific epithelial hyperplasia
 - Melanin deposition
- 7 days PI
 - Above effects enhanced
 - Eosinophilic granular cell infiltration

If genes and mechanisms potentially involved in sea lice resistance are identified, gene editing can be used to test and prove that the genes have an effect and the potential for creating resistance in Atlantic salmon can be evaluated

Atlantic

- Rapid & large-scale immune gene activation



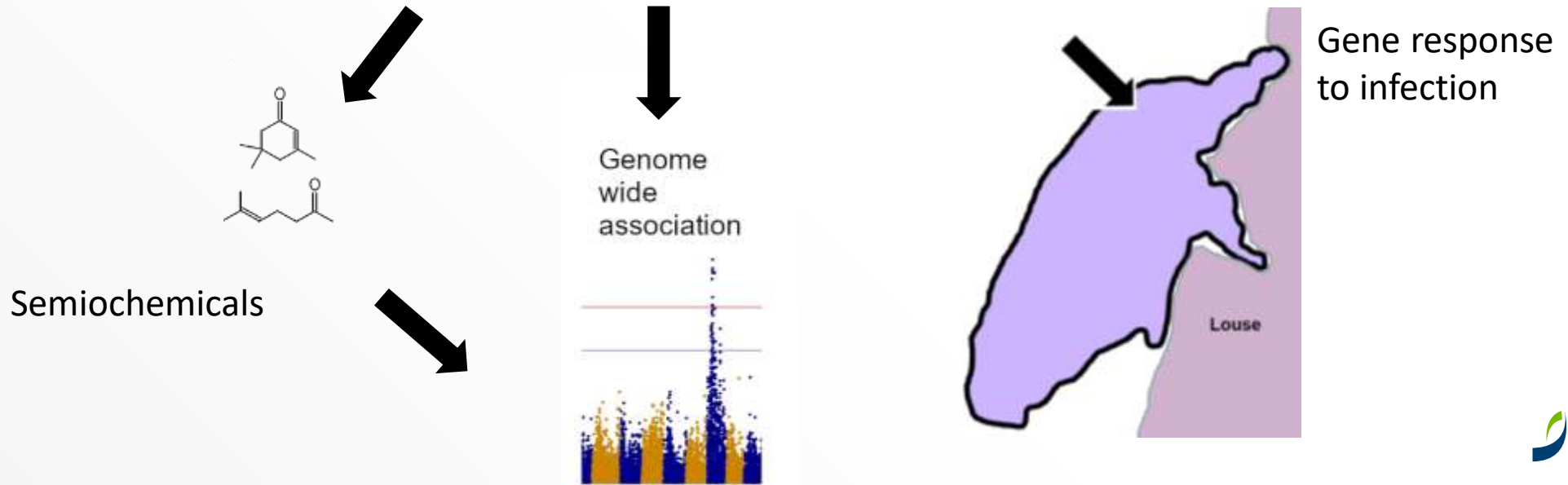
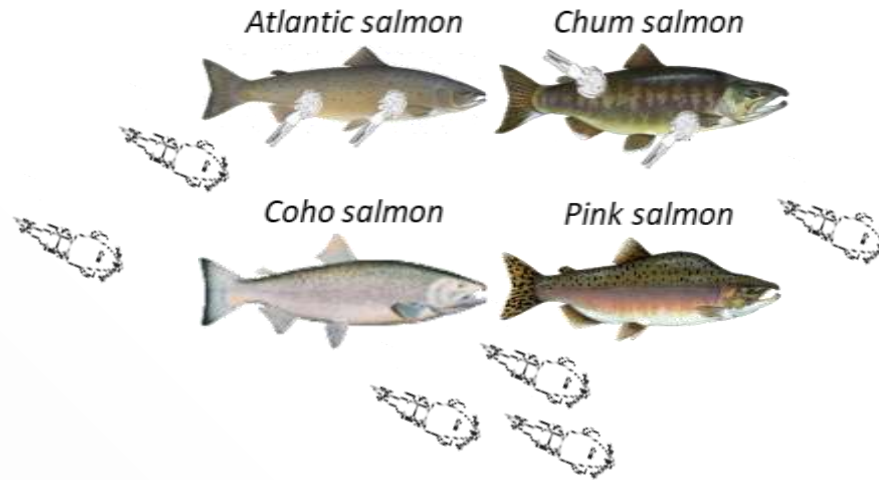
**“CrispResist”
Harnessing cross-species variation in sea lice
resistance**

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Increase the knowledge on genes and mechanisms affecting lice resistance in Pacific salmon

Application of knowledge (gene editing, genomic selection) to achieve high or full lice resistance in Atlantic salmon to reduce the necessity for delousing

Sea lice challenge test



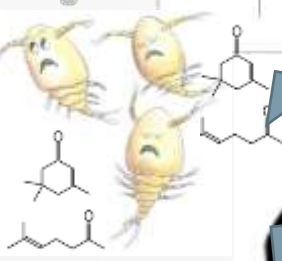
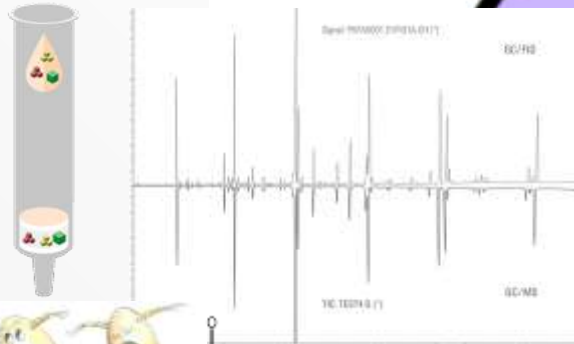
Compare within & between host species?



ROTHAMSTED RESEARCH

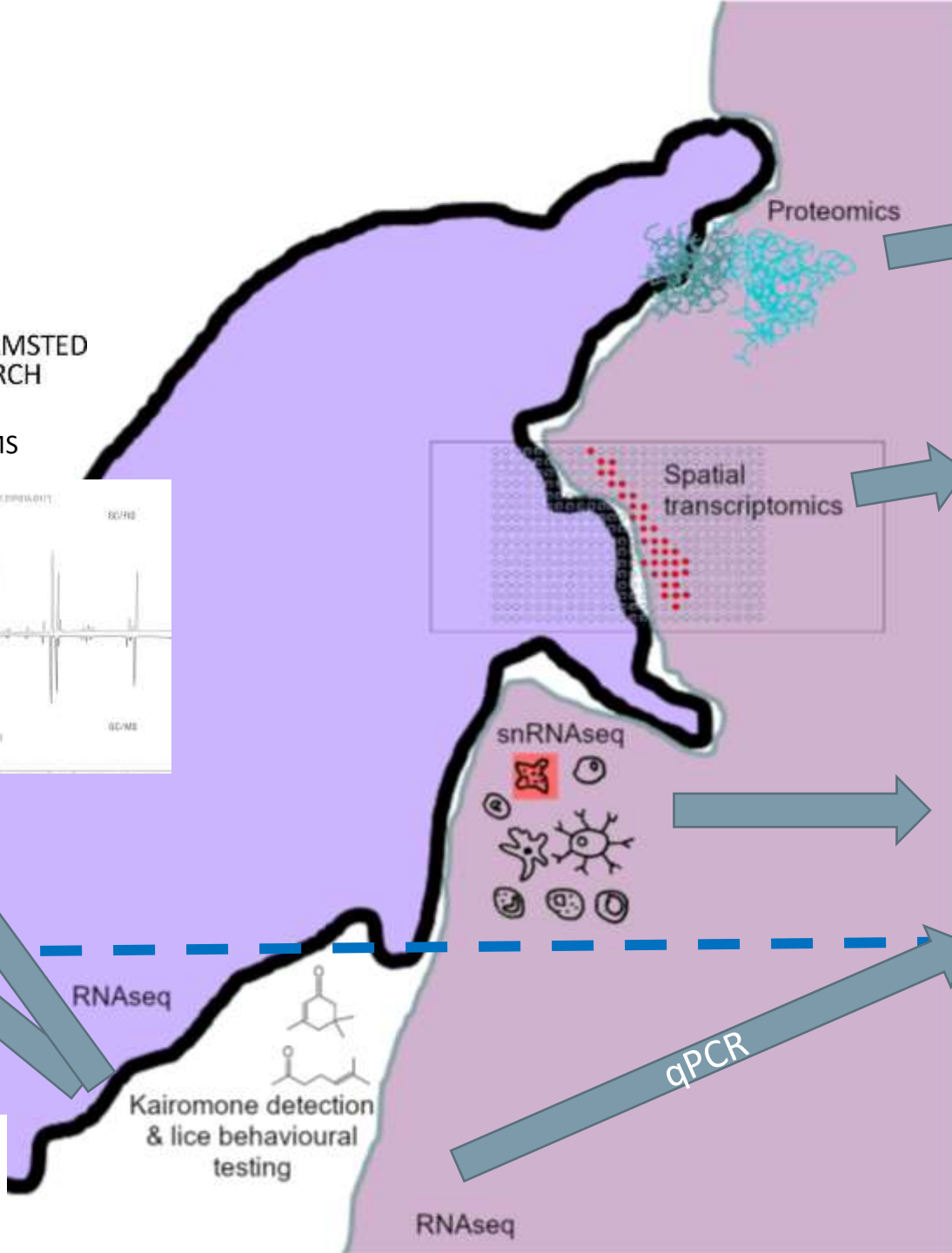
Solid phase extraction

GC-FID/GC-MS



Institute of Aquaculture
UNIVERSITY OF STIRLING

Bigelow Laboratory for Ocean Sciences



Proteomics

Spatial transcriptomics

snRNAseq

RNAseq

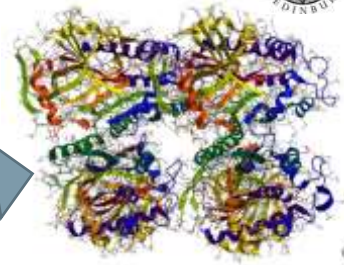
qPCR

Kairomone detection & lice behavioural testing

RNAseq

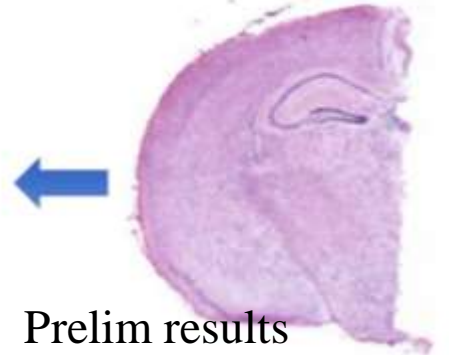
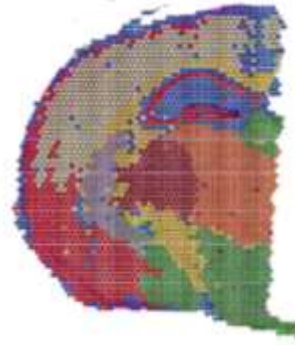


THE UNIVERSITY of EDINBURGH



Prelim ID of

- 3,437 proteins
- 582 louse proteins
- 397 both louse & salmon



Prelim results

- Candidate genes affecting kairomone production with higher expression in Atlantic salmon

UMAP_2

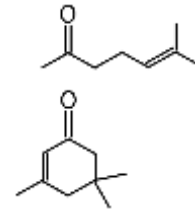
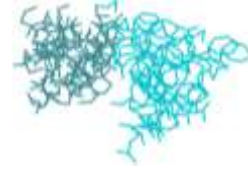
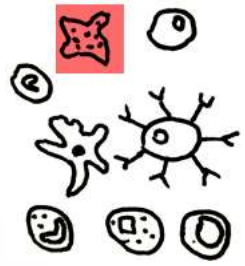
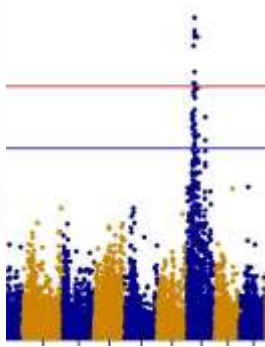
UMAP_1

Atl. + Atl. + Chum + Chum + Coho + Coho + Pink + Pink +

Prelim results

- 15 skin cell types mapped
- ~2229 genes/nucleus
- ~3583 unique molecular ids





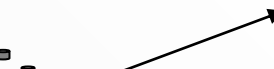
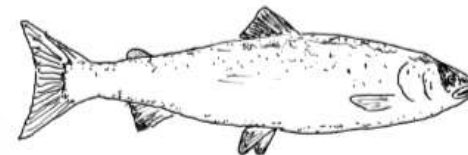
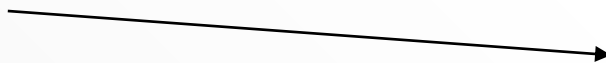
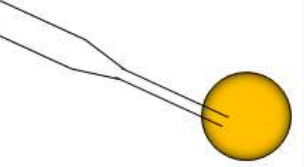
Candidate genes
...GAGCCGTCAATC...
...ATCAGGCATACC...



Proof of concept testing

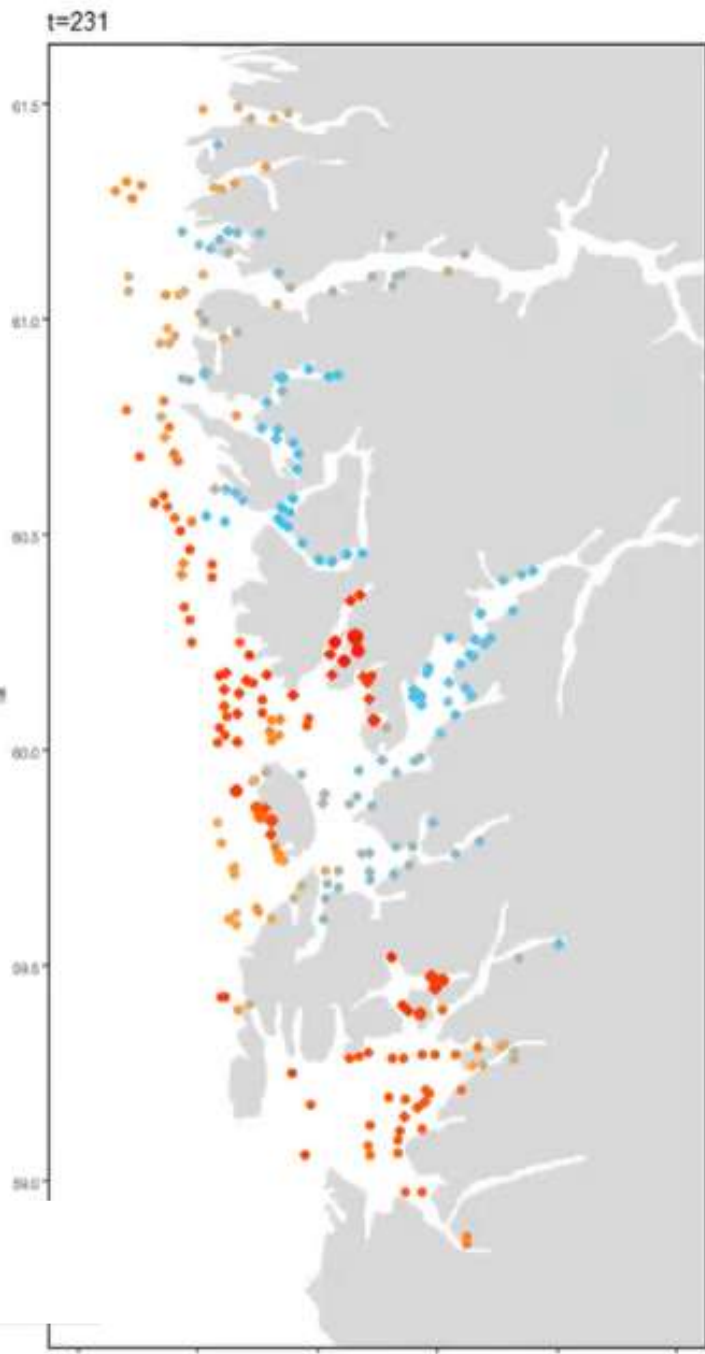
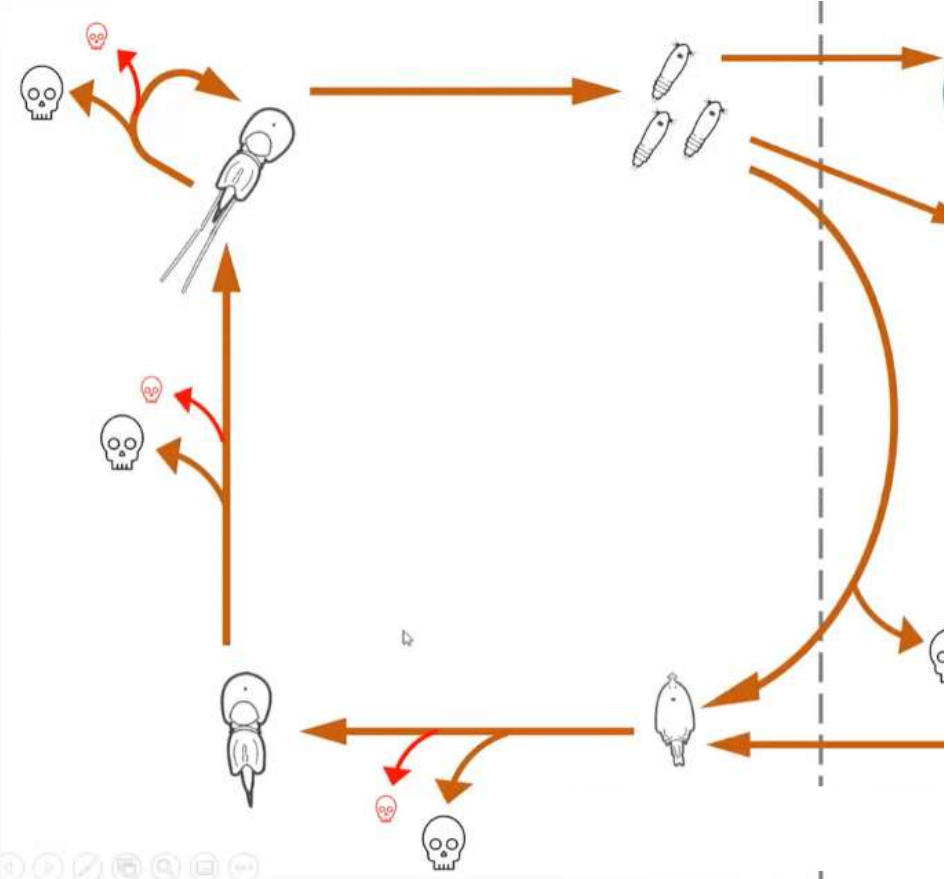


CRISPR **Cas9**



Potential of lice to counter-evolve

0 → 10yrs



Project deliveries

- New knowledge
- Strategies

→ Industry able to effectively tackle problem

