

# BioSeaLice- Effekt av elektrisk felt som barriere mot lakseluslarver (*Lepeophtheirus salmonis*)

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Luksekonferansen  
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## Background:

Sea lice / salmon lice (*Lepeophtheirus salmonis*)

Parasitic copepod

Arguably the dominant issue in Norwegian aquaculture

- Reduced performance following infection
- Skin damage disrupting osmoregulation
- Immuno-suppressive compounds
- Risk of secondary infection

Image credit: Kristin Westman



Free living stages detach from the fish

Lice can be spread by currents over large distance

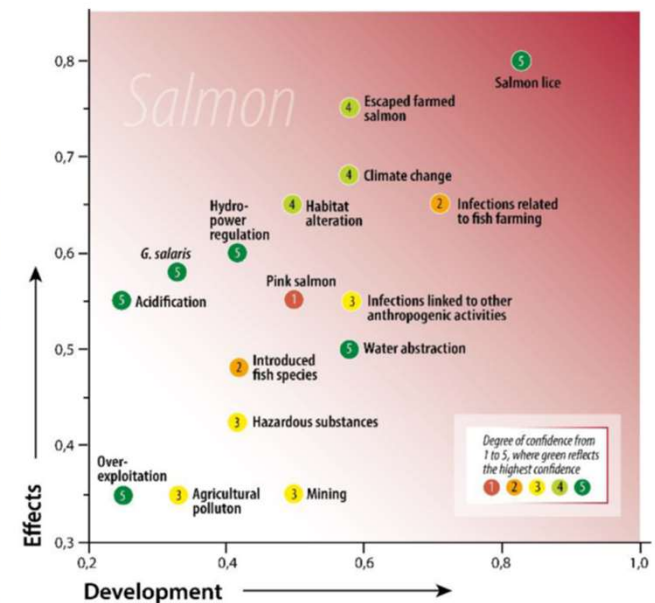
Risk of infecting wild fish (salmon and trout):

- As they migrate towards the sea, critical time in brackish water at the mouth of estuary during smoltification
- Stage where they are stressed, weakened, and most vulnerable to lice

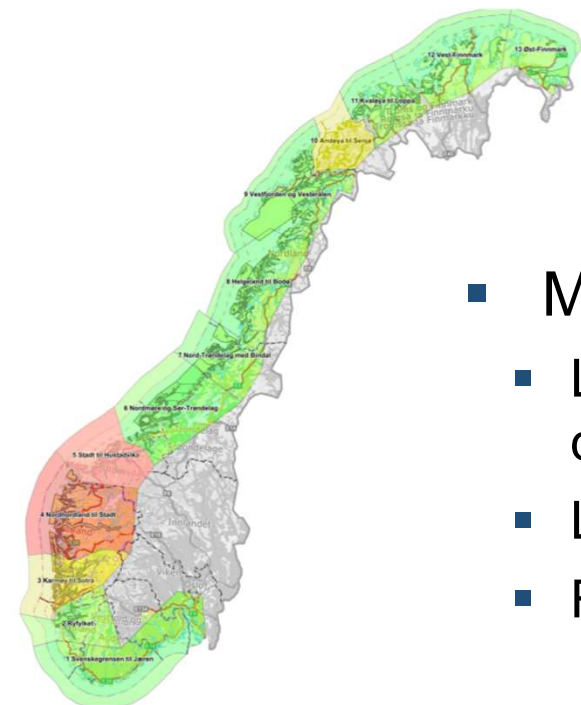


Ranking of 16 impact factors considered in 2023, according to their effects on wild Atlantic salmon stocks

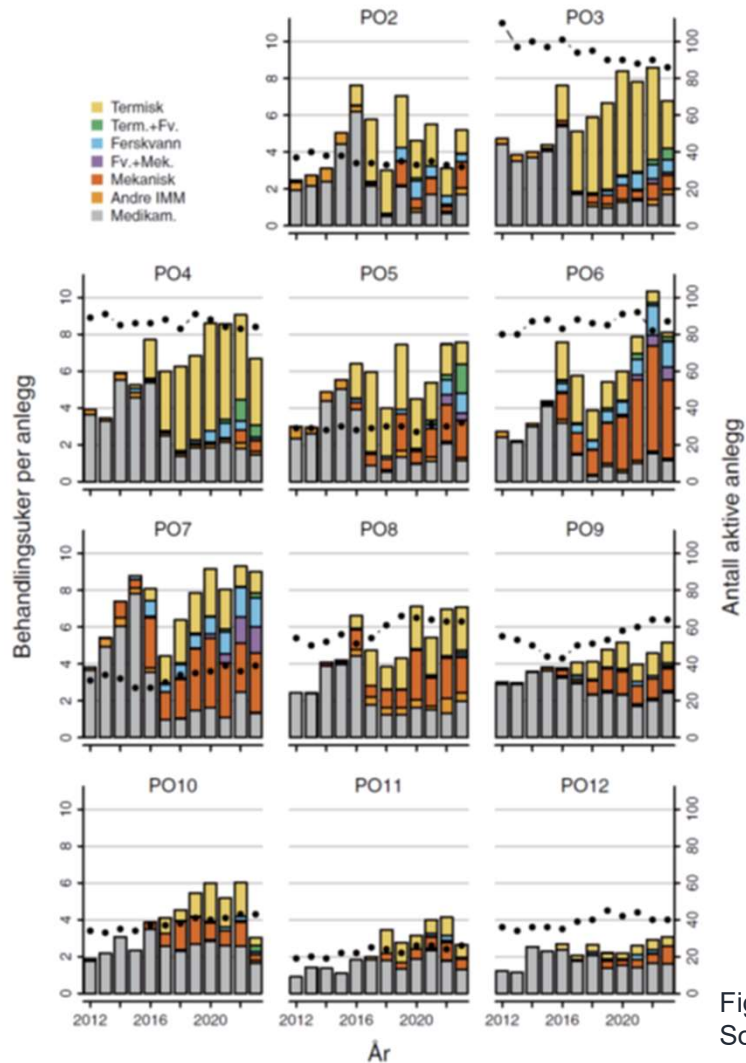
Credit: Norwegian Scientific Advisory Committee for Atlantic Salmon



- Resulted in a high regulatory impact
  - Traffic light system



- Mandatory lice-count and delousing procedures
  - Legal limit- 0.5 adult female lice per fish, or 0.2 per fish during spring smolt migration
  - Legal requirement to reduce numbers
  - Repeated delousing treatments over multiple weeks



- Different types of treatment used
  - Chemical treatment less useful as salmon lice is developing resistance
  - Treatment reliant on physical removal including temperature, freshwater or a combination
  
- Extremely stressful on the fish
  - Cessation of feeding
  - Mortalities
  - Scale loss; skin lesions
  - Secondary infections – rise of winter ulcers
  - Estimating milder welfare impact is difficult
  
- Record high mortalities in 2023 - (16.7% sea-phase)

Figure from: Fiskehelsesrapporten 2023  
Sommerset *et al.* 2024

- Urgent need for improved control methods
  - More efficient
  - Reduced welfare impact

Prevention

- Prevention through physical isolation - Limitations

Swim at the surface (Positive phototropic)

- Lice skirts
- Submerged cages
- Electric fences?

Low wattage electric fields around cage



Tormod H. Skålsvik fra Nova Sea på scenen i Stavanger. Foto: Stimm

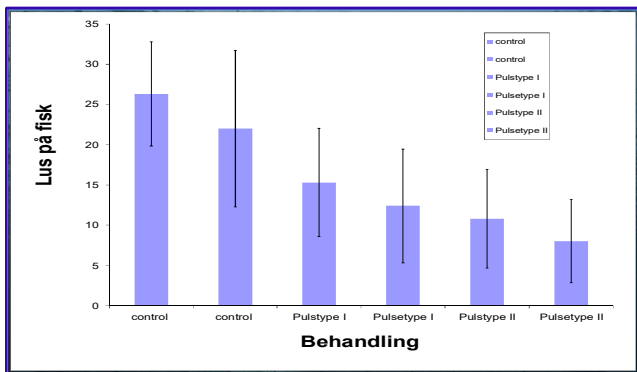
### Kvitt lusen – fikk nye problemer

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## Electric fences:

- Research effort for several years & promising results



- Seafarm Pulse Guard (SPG) – significant effect

- Patented Technology -Harbor (SPG) only supplier



- Still require more research to validate and optimise – BioSeaLice Collaboration NORCE - Harbor

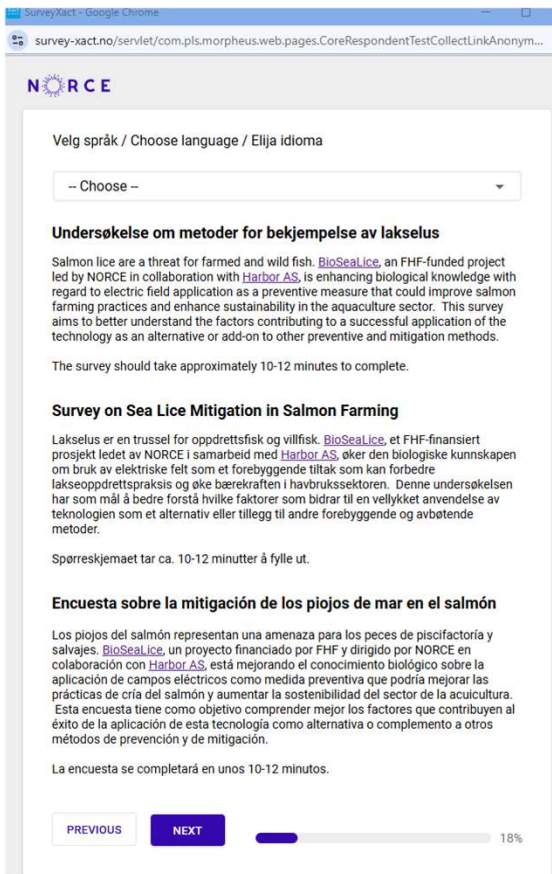




## BioSeaLice - Project initiated in Nov. 2024

- **Main goal:** Validate & improve the effectiveness of electric field/electric fence technology against sea lice
  - **Subgoal 1:** Knowledge map regarding the effects of electric fields
  - **Subgoal 2:** Investigate survivability and the physiological impact of various voltages at different salinity (conductivity) levels on salmon lice larvae (WP 2) – **Direct effect on lice**
  - **Subgoal 3:** Investigate the effect on the ability of the sea lice to attach to the host; or by reducing the severity of the infection once attached (WP3) – **Effect on infection**

## WP1- Knowledge gathering:



SurveyXact - Google Chrome

survey-xact.no/Servlet/com.pls.morpheus.web.pages.CoreRespondentTestCollectLinkAnonym...

NORCE

Velg språk / Choose language / Elija idioma

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**Undersøkelse om metoder for bekjempelse av lakselus**

Salmon lice are a threat for farmed and wild fish. [BioSeaLice](#), an FHF-funded project led by NORCE in collaboration with [Harbor AS](#), is enhancing biological knowledge with regard to electric field application as a preventive measure that could improve salmon farming practices and enhance sustainability in the aquaculture sector. This survey aims to better understand the factors contributing to a successful application of the technology as an alternative or add-on to other preventive and mitigation methods.

The survey should take approximately 10-12 minutes to complete.

**Survey on Sea Lice Mitigation in Salmon Farming**

Lakselus er en trussel for oppdrettsfisk og villfisk. [BioSeaLice](#), et FHF-finansiert prosjekt ledet av NORCE i samarbeid med [Harbor AS](#), øker den biologiske kunnskapen om bruk av elektriske felt som et forebyggende tiltak som kan forbedre lakseoppdrettspraksis og øke bærekraften i havbrukssektoren. Denne undersøkelsen har som mål å bedre forstå hvilke faktorer som bidrar til en vellykket anvendelse av teknologien som et alternativ eller tillegg til andre forebyggende og avbøtende metoder.

Spørreskjemaet tar ca. 10-12 minutter å fylle ut.

**Encuesta sobre la mitigación de los piojos de mar en el salmón**

Los piojos del salmón representan una amenaza para los peces de piscifactoría y salvajes. [BioSeaLice](#), un proyecto financiado por FHF y dirigido por NORCE en colaboración con [Harbor AS](#), está mejorando el conocimiento biológico sobre la aplicación de campos eléctricos como medida preventiva que podría mejorar las prácticas de cría del salmón y aumentar la sostenibilidad del sector de la acuicultura. Esta encuesta tiene como objetivo comprender mejor los factores que contribuyen al éxito de la aplicación de esta tecnología como alternativa o complemento a otros métodos de prevención y de mitigación.

La encuesta se completará en unos 10-12 minutos.

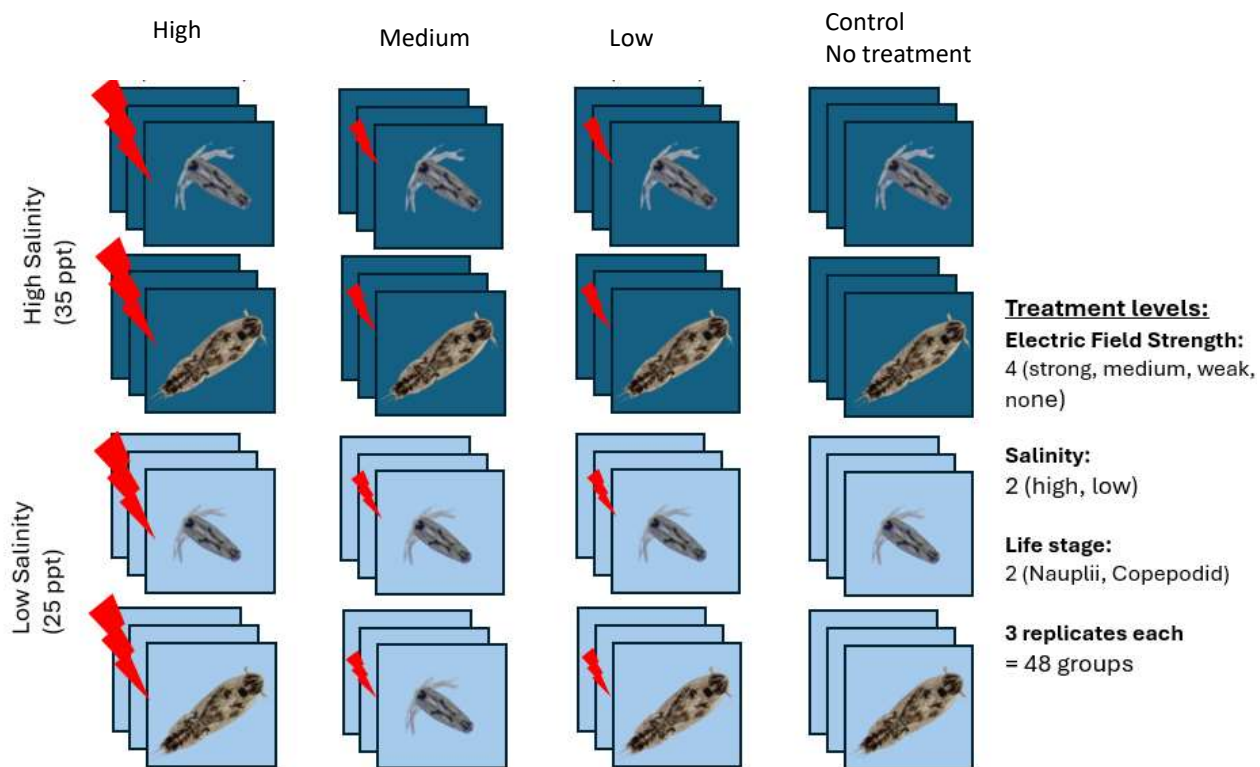
PREVIOUS NEXT 18%

- Literature study
- Anonymous survey
  - 5-10 minutes to complete
  - Available online
  - Three languages- Norwegian, English, and Spanish

- Access:
  - <https://svar.norceresearch.no/LinkCollector?key=M1E9P72MU53J>
  - Access through QR code
  - Or come see me



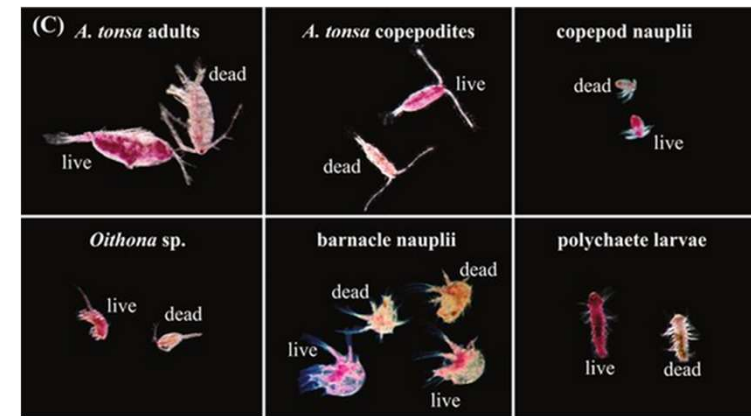
## WP2- Direct physiological effect:



- 4 intensities electric field
  - 3 voltages (electric field) + control
  - 2 Salinities
- 2 life stages
  - Nauplii
  - Copepodid
- 3 recovery times
  - 0 min.
  - 5 min.
  - 60 min. post-exposure

- Effect on activity

- Staining with neutral red & scanning samples using a flatbed scanner
- Quantitatively evaluated using machine learning
- Compare the inactive fraction in each treatment



Neutral red staining of zooplankton samples  
=> live/dead fraction of different taxonomic groups

- Effect on lice gene expression

- RNA purification and sequencing
- Compare gene expression profiles between treatment groups
- Complemented with targeted comparative gene expression analysis for specific genes

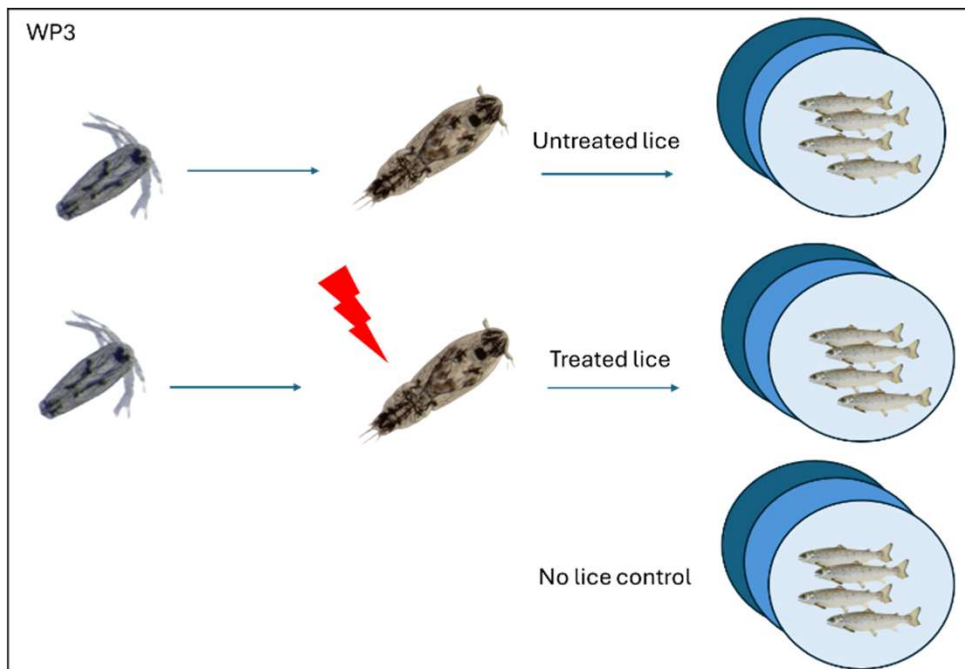
- Effect on phototaxis (light attraction)
  - High throughput behavioral recording system (Zantiks)
  - Infra-red illumination to record sea lice locomotion in dark
  - Lice larvae are placed at one end with a light source at the other end to stimulate phototaxis

Confirm benefit of electric current

Determine **most efficient dose**



## WP3- Effect on infections:



- Fish infection

- 3R- Reduction- measures

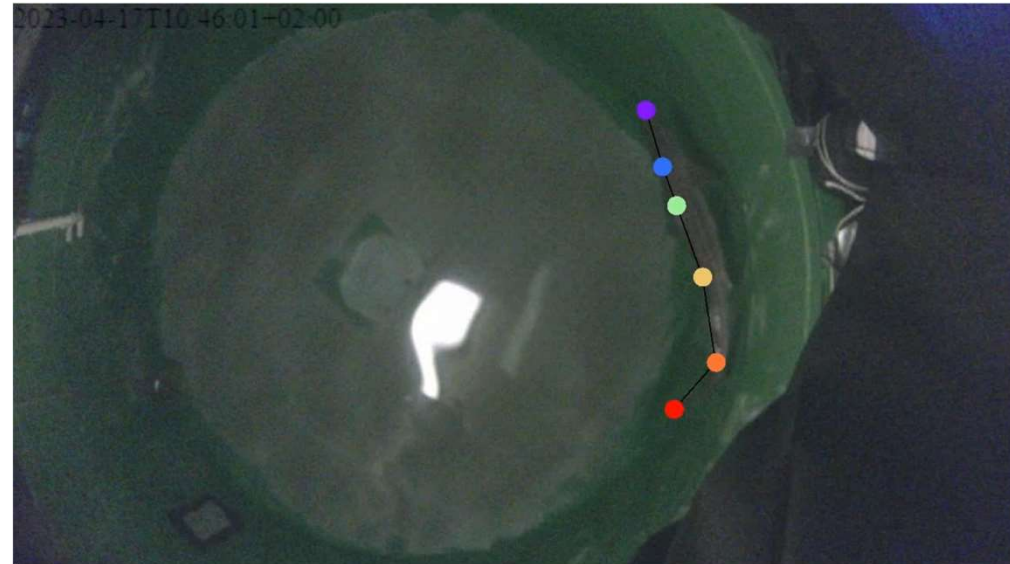
- Only the most effective treatment from WP2
- Only copepodid life-stage

## Severity of infection:

- Lice-counting
- Behavioral effect on the fish



DeepLabCut™  
a software package for  
animal pose estimation



- Effect on salmon gene expression
  - Spleen & anterior kidney
  - 5 immune-related genes in both organ that are known to be affected by lice



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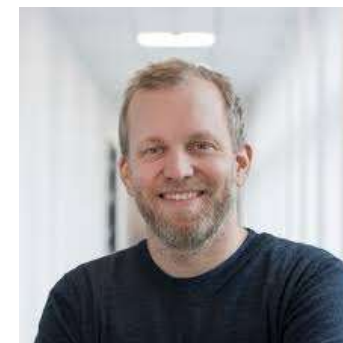
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I-Hao Chen  
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Takk for oppmerksomheten!

Please, don't forget our survey:

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