

Rapportering Såddmedel inom SLU Vattenforum 2020

Projektets titel

Fiskhälsa i Fokus

Namn på sökande och institutionstillhörighet

SLU Aqua Elin Dahlgren, Helena Strömberg och Josefin Sundin

VFM Lo Persson

Kort summering av projektets syfte

Genom möten och workshop skapa ett format för samverkan med fokus på fiskhälsa i Östersjön samt formulera en uttalad strategi för att tackla en övergripande Östersjöproblematik gällande hälsoläget för ett flertal fiskarter.

Genomförande och resultat

Workshop Fiskhälsa i fokus genomförd 1/12 2020

Sammanfattande diskussion från WS arbetsgrupper sammanställd och kommunicerad till mötesdeltagare.

Förslag på format för samverkansstruktur/plattform för frågor kopplat till fiskhälsa inom SLU är sammanställd och kommunicerad med WS deltagare samt SLU vattenforum via mail och muntlig kommunikation.

Eventuellt nästa steg i/fortsättning av projektet

Resultat från WS och efterföljande diskussioner visar att det vore önskvärt med en uppföljande aktivitet med fokus på sätta en samverkansplattform, förslagsvis via Vattenforums websida. För fortsatt arbete med samverkan för fiskhälsa inom SLU vore det lämpligt med en funktion av "spindel i nätet" för vilket lämplig finansiering behöver identifieras.

Sammanfattning av hur projektet bidragit till att stärka samarbetet om vatten på SLU, mellan ämnesområden, institutioner och forskargrupper, och/eller ökat möjligheterna till att attrahera finansiering för framtida forskningsprogram med fokus på vatten på SLU

Med 30 talet deltagare med representanter från flertalet fakulteter inom SLU har genomförd WS identifierat ett behov av en samverkans struktur inom SLU och identifierat vägar fram för fortsatt arbete.

Kortare ekonomisk redovisning (hur mycket medel har nyttjats och till vad)

Samtliga medel (50 000) har nyttjats till arbetskostnad för sökanden i samband med förberedelse, genomförande och dokumentation av WS.

Increased collaboration across SLU with regards to fish health

Seed money was provided from Vattenforum during 2020 to support an effort to increase the collaboration among researchers at SLU involved in work connected to fish health. The money was used to arrange a three-hour workshop to facilitate collaboration among relevant parties within the water framework at SLU. Elin Dahlgren, Josefin Sundin, and Helena Strömberg at the department of Aquatic Resources (Aqua), and Lo Persson from the department of Wildlife, Fish and Environmental Studies organized the workshop.

Background

At SLU, a lot of work is carried out within the water framework that is, or could be, connected to fish health. This work includes parasites, diet, sickness, eco-toxins, pharmaceuticals, algae toxins, vitamins, and environmental communication. In addition, movement and behavior of fish in their environment are affected by their health status, hence work related to these topics also has connections to fish health.

The work at SLU with connections to fish health, has so far been carried out as separate parts within environmental monitoring or as specific research questions. There is a lot to gain from increased collaboration, such as better opportunities to push relevant research questions; to identify new challenges; and to write stronger applications. Increased collaboration would also simplify coordination of activities (such as sampling) that could increase the total output of our efforts.

The workshop

The workshop took place between 9:00-12:00 on Tuesday the 1st of Dec 2020 and about 30 people from the VH, S, and NJ faculties participated. The protocol of the workshop, including a list of participants, can be found in appendix 1. The workshop started with a short introduction by the organizers, followed by three shorter presentations by invited speakers.

- Lo Persson, VFM *Salmon health* (appendix 2)
- Stefan Örn presented, BVF *Integrated freshwater fish health in the Great lakes* (appendix 3)
- Maria Ovegård, SLU Aqua *Cod health* (appendix 4).

After the presentations, there was time for discussion among the participants to get to know each other better, to set common grounds for future work and to discuss how increased collaboration could be facilitated.

Summary of the workshop discussions

The lack of coordination and missing expertise on fish health were issues identified by many participants. There are a lot of sampling activity going on across SLU, for example, the coastal fish surveys, which contributes great potential to coordinate sampling for additional fish health topics.

To enable increased and continued collaboration, several ideas were put forward. The need of some sort of platform was central. A platform could be a common website or a Teams room for example, where information can be shared and contact information, including expertise and available infrastructure, can be found. In addition, the workshop was highly appreciated and there is a desire to make this workshop an annual recurring event to keep people in contact and up to date on what is going on across SLU in terms of fish health.

Future perspectives

The participation at the workshop indicates large commitment and engagement in the fish health topic by the participants. This is promising for the future work regarding fish health at SLU. A fish health platform at SLU, would facilitate information sharing and enable identification of potential collaborators and available infrastructure. To maintain a platform, funding is needed for a person to coordinate the information and update contact information etc. Request about funding from the faculties is suggested to be put forward through Vattenforum.

Another option, is to create a platform or similar within SLU Aquaculture. There are plans for a follow-up workshop during the spring 2021 with focus on health issues within aquaculture but the workshop will also include potential interactions with wild fish in terms of transmission of pathogens and such. Due to the connection to wild fish, there is potential to keep a broader network also within Aquaculture, which might be a good opportunity until funding for another common fish health platform is secured.

Protocol workshop Fish health, 1 Dec 2020, 9.00-12.00

Arranged by Elin Dahlgren, Helena Strömberg, Josefin Sundin, all at SLU Aqua, and Lo Persson SLU VFM.

In total 31 participants from across SLU were present at the digital workshop (table 1).

9.00 Introduction

Elin introduced the workshop and all participants introduced themselves briefly.

9.15 – 10.15 Invited presentations

Lo Persson from the Dept. of Wildlife, Fish and Environmental studies (VFM) presented “Salmon health” where she gave an update on current status of fish health related to wild salmon and the research/interests of VFM and Aqua (according to her knowledge). She also touched upon fish health in aquaculture.

Stefan Örn from the Dept. of Biomedical Science and Veterinarian Public Health, presented “Integrated freshwater fish health in the Great lakes” and described his plans for future sampling in the great lakes (Vänern, Vättern, Hjälmaren and Mälaren).

Maria Ovegård from the Dept. of Aquatic Resources (Aqua) presented “Cod health” where she gave an update on the status for cod populations in Swedish waters including the health status.

10.15 – 10.30 Break

10.30 – 11.00 Sub-group discussions in break out rooms

The participants were split into four break out rooms for more detailed discussions. The participants introduced themselves and their connection to fish health in more detail and the groups were then asked to discuss the need for, and potential benefits of, increased collaboration.

- Participants’ interest in issues regarding fish health, current projects
- Complementary relevant fish health perspectives (in relation to previous presentations)
- Need of/potential with coordination of fish health within SLU

Notes from group 1:

- A freshwater fish health program is missing and has been lacking for a long time
- Long monitoring time series are needed
- Fish health is becoming worse, but certain chemicals have decreased, there are other pollutants to consider
- How does bad status in an individual affect population viability? This connection needs to be done and we have a lot of data
- What is happening regarding M74 at the moment?

Notes from group 2:

- Coastal fish survey collects a lot of data, could be used more in issues related to fish health
- Provides good opportunity for collection of material/data
- People with expertise in ecotoxicology has increased substantially at SLU – use their competence for fish health issues, perhaps create a sub-group for this?
- Work on different species without collaboration makes fish health a fragmented topic at SLU, risk of missing general patterns and potential synergies

Notes from group 3:

- General discussion about fish health and interesting topics for the group
- M74 and thiamine
- Algal toxins
- Brominated dioxins
- Farmed Arctic charr and reproductive problems

Notes from group 4:

- How fish health affects stock assessment (e.g. M74 is taken into account in salmon stock assessment but what about other issues/species?)
- Interaction between farmed fish and wild fish and spread of disease/parasites etc. between the two
 - o Screening of all brood stock fish
 - o Anthropogenic transfer of pathogens with fishing gear, stock fish etc.
 - o Differences in cage farming at sea and in freshwater
- Severe health problems for salmon in Vindelälven, good river for monitoring of salmon health due to existing infrastructure
- Lack of competence at SLU with regards to fish disease, step in the right direction with new Norwegian professor (15%)

11.00 – 11.15 Whole group feedback discussion (sum up sub group discussions)

All groups reported the main things they had discussed. In general, people are very positive to increased collaboration.

Josefin introduced the next discussion about wants & needs regarding fish health at SLU and how to move forward.

11.15 – 11.30 Sub-group discussions in break out rooms

- Group suggestions on relevant topic (or go with suggestions below)
- What would you like to gain from increased SLU cooperation regarding fish health?
- Suggestions on how to increase SLU cooperation regarding fish health?
- Is there interest in future shared research? Suggestions on future relevant calls?
- Suggestions on how to keep contact /share information.

Notes from group 1:

- SLU Platform where interested people can sign up. Presentations for each person so that it is clear who knows what. There can also be subgroups in the platform where people working on similar topics can work together in smaller groups
- The platform can be a website with seminars, news posting, call for joint funding applications
- Think ecosystem if we have a platform, also water quality
- A coordinator for the SLU fish health platform is needed!
- When we have organized us within SLU, SVA, HaV and University of Gothenburg could also be invited to collaborate
- A simpler platform in Teams for an easy way of communication

Notes from group 2:

- Need for coordination to increase the possibilities for collaboration (not enough time for each researcher to keep track of all potential collaborators/related competences/topics)
- A place for internal collaboration, like a platform across faculties
- Could also be a sub-group of the water forum at SLU with a link to a fish health website (or similar) at the SLU water forum site, where competences in relation to fish health can be accessed and potentially also new material and information
- List with people and their competences with regards to fish health could be useful but hard to keep up to date
- Workshop is a good format to get an overview, could also be a good opportunity to update potential lists
- Write an SLU Aqua report from the workshop to be distributed across SLU (not only internal)

Notes from group 3:

- Fish health too wide to be effective? – divide into smaller sub groups that can work together (e.g. salmon and M74, coastal cod issues)
- Create a list or something with key competences, available infrastructure, specific interests – the list needs to be searchable
- Annual workshop, good to get an overview of what is going on across SLU regarding fish health

Notes from group 4:

- What do we want with our monitoring? What data are we collecting and why?
- Platform? Should talk to people running other platforms.
- Increased collaboration would improve:
 - o Interdisciplinary work
 - o Enable comparative studies
 - o Make available facilities more visible

11.30 – 11:45 Whole group feedback discussion (sum up sub group discussions)

All groups reported the main things they had discussed. There is a need for coordination across SLU: suggestions included some sort of platform/website/or list of people and their competences. In addition, an overview of available facilities could be useful. Annual workshop would also be good to get an overview of activities and people related to fish health.

11.45 – 12.00 Short summary of the day and how we move forward

Helena summarised the day and thanked all participants. We will write a protocol/report from the workshop and look into possibilities for funding for a coordinator that could put together a website (linked to from Water forum).

Table 1. List of participants with their area of interest, affiliation, and role at the workshop.

Name	Area of interest	Department*	Role
Elin Dahlgren		Aqua	Organizer
Josefin Sundin	Eel health, pharmaceuticals	Aqua	Organizer
Helena Strömberg		Aqua	Organizer
Lo Persson	Salmon health	VFM	Organizer/invited
Stefan Örn	Ecotox	BVF	Invited
Maria Ovegård	Cod health	Aqua	Invited
Anders Alanärä	Aquatic ecology	VFM	Participant
Anti Vasemägi	Genetics	Aqua	Participant
Caroline Ek	Salmon health	SLU Aqua/University of Gävle	Participant
Linda Vikström	Connectivity and fish health	VFM	Participant
Gustav Hellström	Salmon health	VFM	Participant
Noora Mustamäki	Fish health in national reference areas	Aqua	Participant
Michele Casini	Fish condition	Aqua	Participant
Anna Norman Haldén	Aquaculture	BVF	Participant
Douglas Jones	Salmon health	Aqua	Participant
Serena Donadi	General	Aqua	Participant
Anders Kiessling	Aquaculture, pathogen transfer between farming and wild fish	HUV	Participant
Martin Ogonowski	Anthropogenic pollutants	Aqua	Participant
Kerstin Holmgren	General	Aqua	Participant
Jens Olsson	General	Aqua	Participant
Erin Mc Callum	Anthropogenic pollutants	VFM	Participant
Hege Sande	Cod, condition	Aqua	Participant
Henrik Jeuthe	Aquaculture	HUGEN	Participant
Joacim Hjelm	General	Aqua	Participant
Rebecca Whitlock	Salmon health	Aqua	Participant
Stina Drakare	Algal blooms, coordinator for FOMA programme	MVM	Participant
Monica Mion	(joined meeting after presentations)	Aqua	Participant
Anna-Karin Dahlberg	(joined meeting after presentations)	MVM	Participant
Kartik Baruah	(joined meeting after presentations)	HUV	Participant
Øystein Evensen	(joined meeting after presentations)	NMBU - Norges miljø- og biovitenskapelige universitet	Participant
John Persson	(joined meeting after presentations)	Aqua	Participant

*¹) Aqua = Dept. of Aquatic Resources, VFM = Dept. of Wildlife, Fish, and Environmental studies, BVF = Department of Biomedical Sciences and Veterinary Public Health, HUV = Dept. of Animal Nutrition and Management, HUGEN = Dept. of Animal Breeding and Genetics, MVM = Department of Aquatic Sciences and Assessment



SCIENCE AND
EDUCATION **FOR**
SUSTAINABLE
LIFE

Salmon health

Lo Persson, VFM Umeå
Elin Dahlgren, Aqua Drottningholm
2020-12-01



Red Skin Disease (RSD)

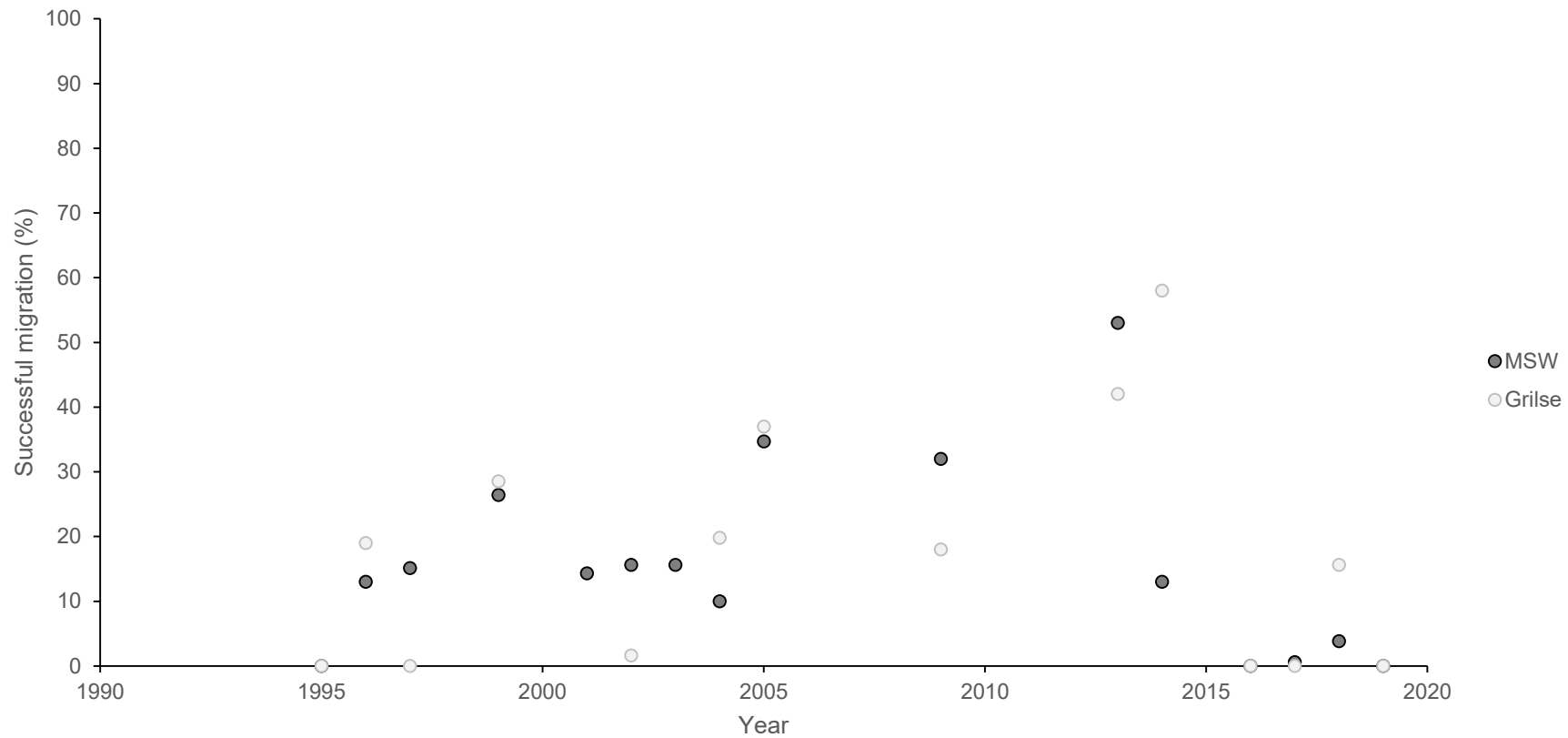


Tagging studies

- Upstream migration
- Difficult areas



Tagging studies



M74 – a reproductive disorder

Current situation wild salmon health

Dept.	Health issue	Tools	Knowledge	Other
Aqua	M74	Monitoring programs, DCF, thiamine & M74, biobank scales.	Ecotoxicology, health biomarkers, stable isotopes, genetics	Interest in non invasive sampling, scales.
VFM	Red skin disease, various effects of pollution	Tagging studies, genetics	Ecological and behavioural aspects, ecotoxicology, modelling	Monitoring of salmon health Vindelälven?

Hatchery-reared and farmed fish

- Different/similar aspects of salmon health
- Fungus (saprolegnia)
- Flavobacteria
- Develop:
 - New treatments
 - Use of existing treatments



More pieces to the puzzle...

- Who works with salmon?
- Other species- similar problems?
- Other potential connections?
- Cooperation
 - Within SLU
 - Sweden
 - Outside of Sweden



Thank you!

Book "Sveriges sötvattensfiskar"
by photographer Jörgen Wiklund
and Mats Ottosson.



Stefan Örn

Aquatic ecotoxicology

*Department of Biomedical Sciences and Veterinary Public Health (BVF)
SLU, Uppsala*

Field studies

Wild fish

- Intersex
- Env Pollutants
- ARB

In situ studies

Sewage treatment plants

- EDC
- Treatment technology
- Ozonation pharma

Laboratory studies

Chemicals & Env samples Toxicity

- Zebrafish
- Pond snail
- Frogs

Integrated freshwater fish health in the Great Lakes

SLU-EMA 2020 (2021)

Environmental Monitoring and Assessment – A Non-Toxic Environment

Stefan Örn (SLU-BVF), Sara Bergek (SLU-Aqua), Joachim Sturve (GU)

Swe-EPA/HaV Marine program:

Integrerad kustfiskövervakning

Subprograms:

- Population data (SLU-Aqua)
- Environmental pollutants (NRM)
- **Fish health & repro** (GU) (eelpout & perch)

Integrated freshwater fish health in the Great Lakes

Freshwater program:

Subprograms:

- Population data (SLU-Aqua)
- Env pollutants (ref lakes, Great Lakes?)
- Fish health (-)

Swe-EPA/HaV Marine program:

*Integrerad kustfiskövervakning
Kustfisk hälsa (eelpout & perch)*

Subprograms:

- Population data (SLU-Aqua)
- Environmental pollutants (NRM)
- Fish health & repro (GU)

Integrated freshwater fish health in the Great Lakes

- Vänern, Vättern, Mälaren, Hjälmaren
- Perch (*Perca fluviatilis*)
 - Prevalence Great Lakes (indicator Coastal fish)
 - Established methodology (Coastal fish health)
 - Established health data (Coastal fish health)
 - Environmental pollutants (Great lakes? + Coastal fish health)

SLU-EMA 2020: Lutz Ahrens Env pollutants Great Lakes surface water



Prospective future

- **Integration of fish samplings?**
- **SLU Fish health lab?**
- **Collaboration SLU Fish Health**



Towards understanding the health of cod in Swedish waters

- The cod stock situations in short
- Ongoing research and sampling on cod health

Reconditioning of cod and parasites affecting growth

Cod sensitivity to global climate change

Additional sampling of cod in SVEA surveys

- Long term cod health monitoring?

Maria Ovegård, Environmental analyst, PhD
SLU, Institute of Aquatic Resources

- **North Sea Atlantic cod (Skagerrak)**

Targeted cod fishing is still important. Risk of having reduced reproductive capacity due to unsustainable harvest.

- **Possible local coastal stocks in Skagerrak**

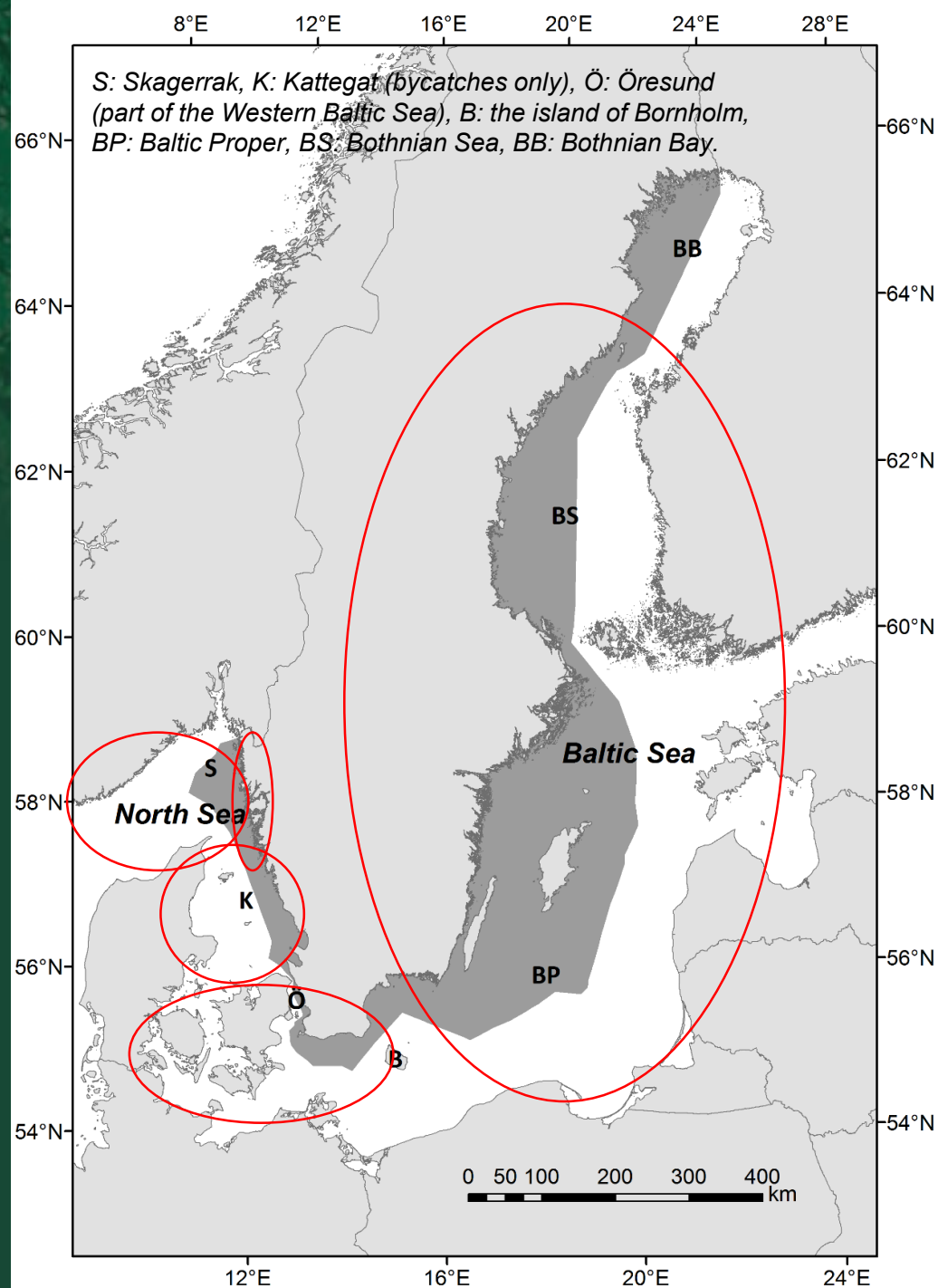
Spawning subpopulations have severely been depleted. One year olds disappear from the system, but why and where?

- **Kattegatt**

Strongly depleted, decline since WWII.

- **Western Baltic stock**

Long term decline.



- Eastern Baltic stock

Thin and in low condition, decline in growth, signs of starvation.

No simple answer to why

-Overfishing, increased predation

-Climate change, temperature increase, acidification, lower salinity etc.

-Hypoxia in cod habitats which decreases reproductive success, less growth and condition, affecting prey availability, competition.

-Thiamine deficiency (Engelhardt et al., 2020).

-Chemicals, pollutants, pharmaceuticals

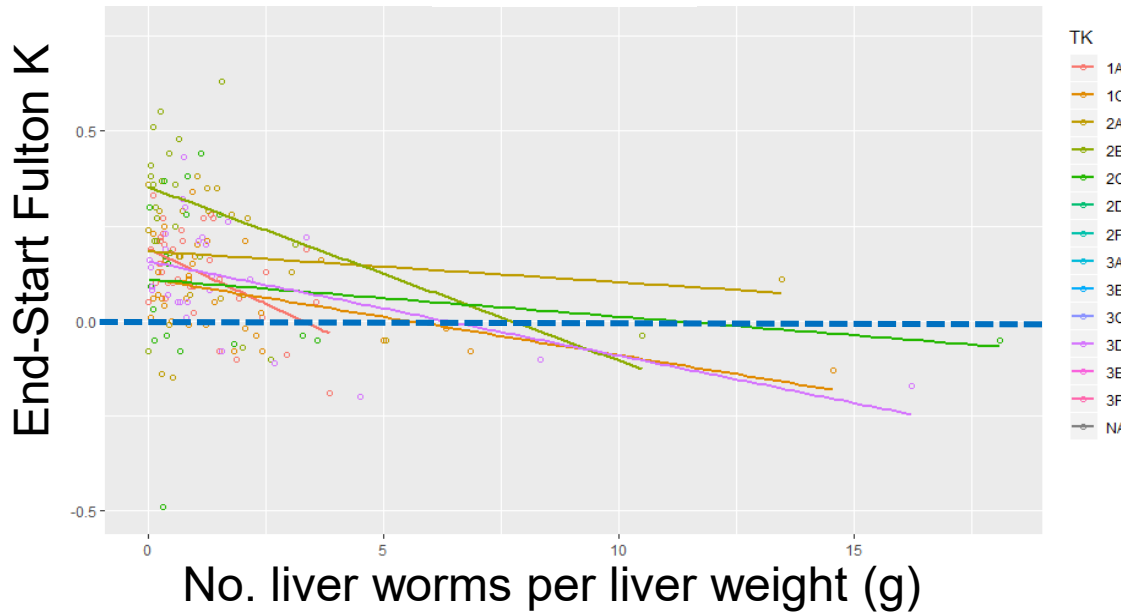
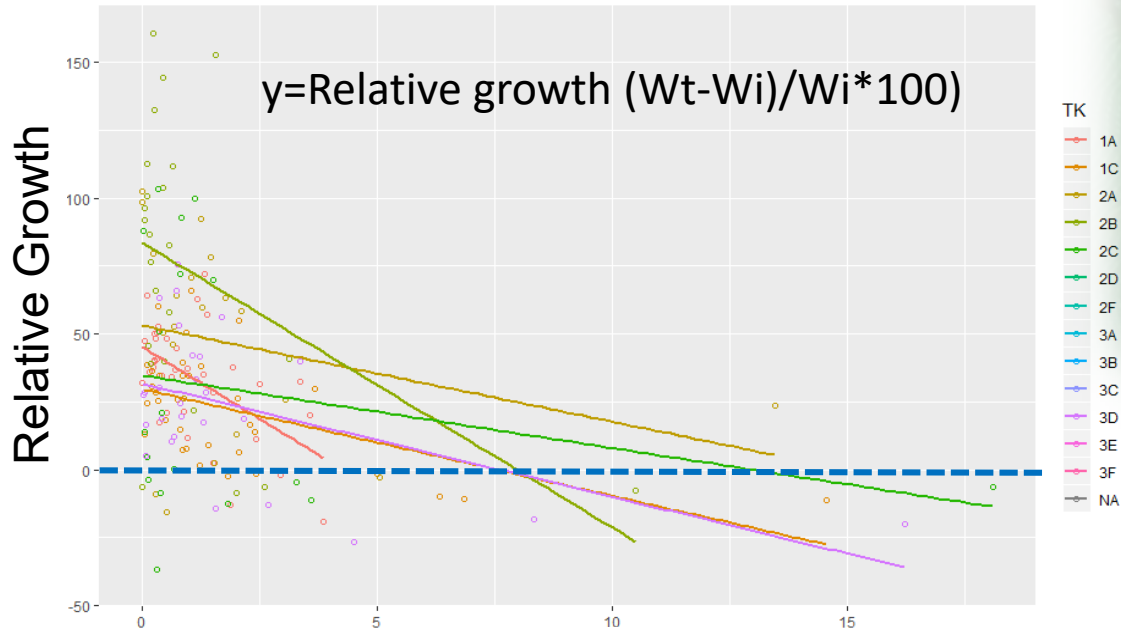
-Increased parasitism (pers. observation)

etc.

Recondition of low conditioned cod and parasites affecting growth





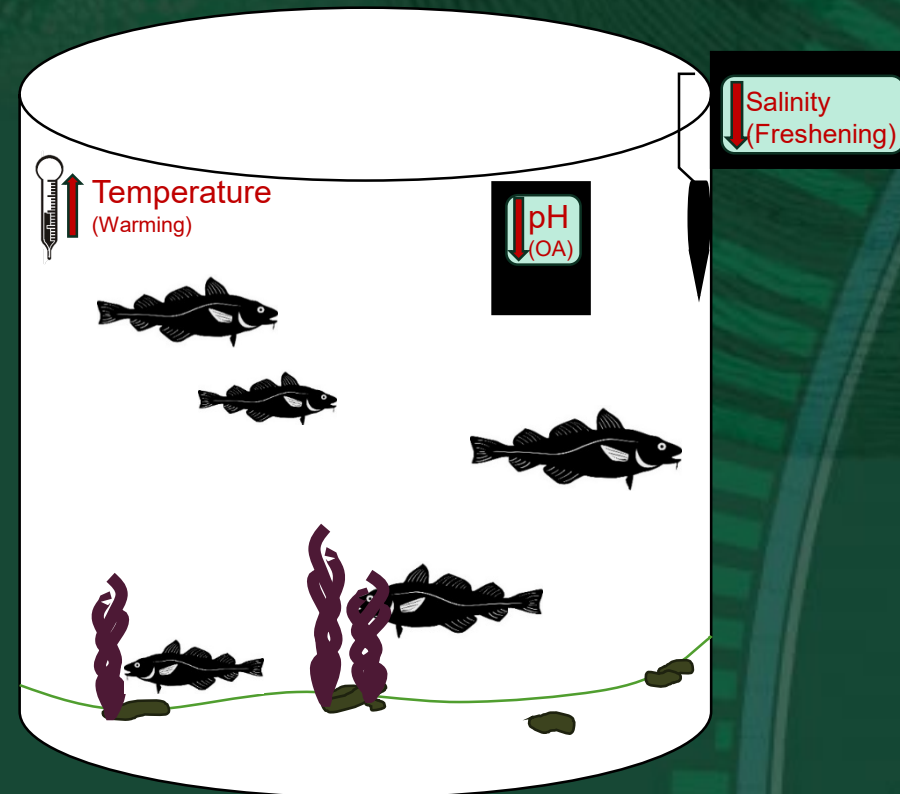


Fed with
thawed herring
for approx.
two months



Cod sensitivity to global climate change

- Laboratory study
 - Do global climate change factors influence cod?
 - If so, do differences occur in the stress response of different populations?
- 4 week experimental period
- Five treatment groups- 20 tanks
 - Control, Freshening, Warming, Ocean acidification, and Combined (Cumulative) treatments
- Two locations
 - West coast and Baltic sea
 - Fin clips taken for DNA analysis
- Measure fish stress via physiological response variables
 - Respirometry → Oxygen consumption over 24hr period
 - Oxidative stress → Liver proteins



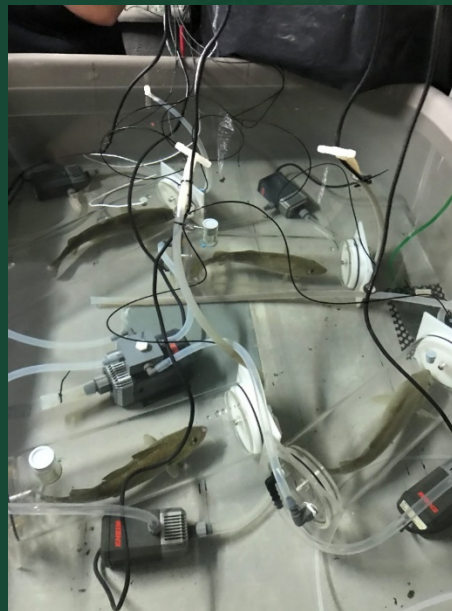
Experiment room
where fish spend 4
weeks = "exposure
period"



Respirometry
chambers
measure O₂
consumption over
24hrs



Removed from
respirometers,
terminated, and livers
dissected for oxidative
stress analyses





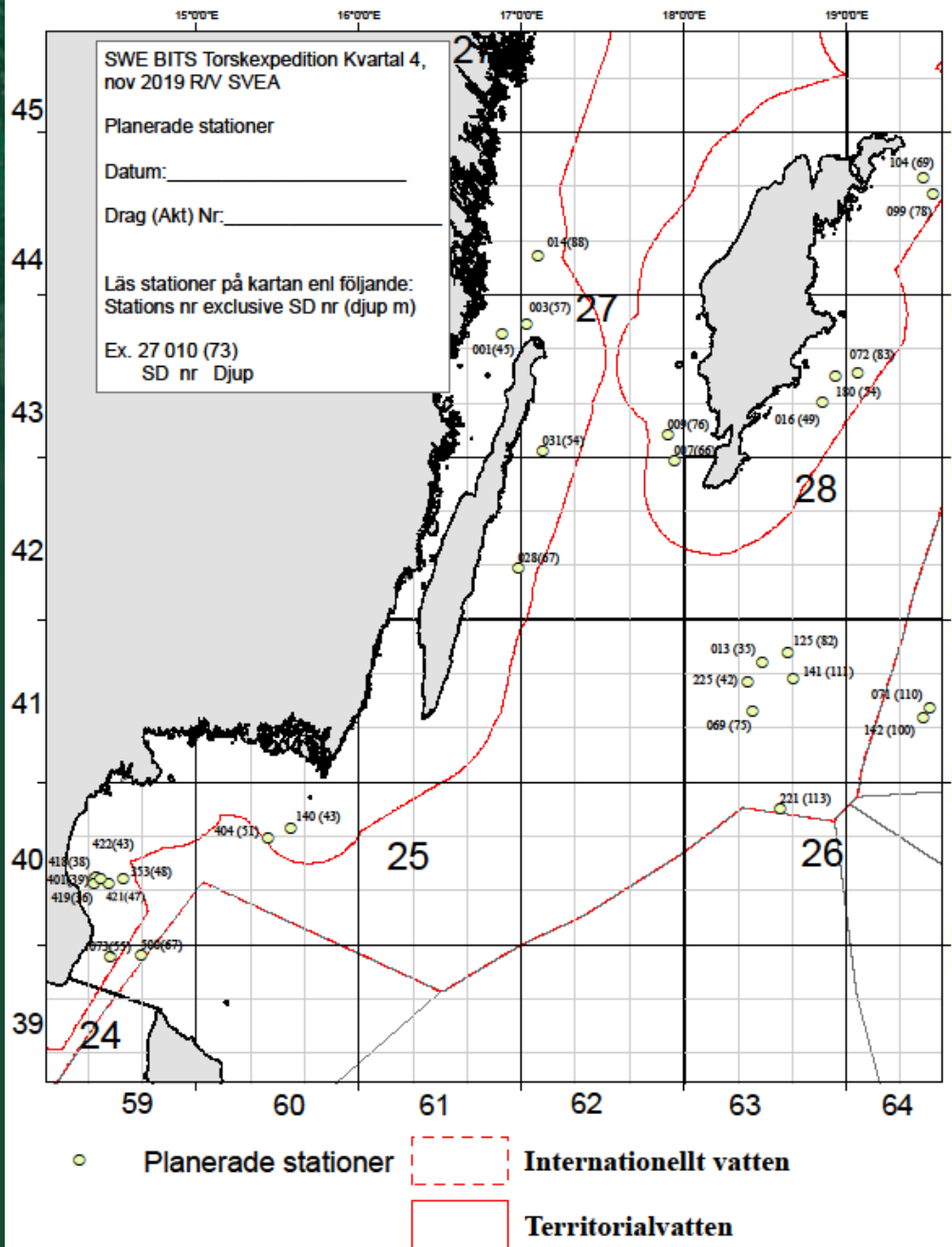
r/v SVEA surveys

SVA in cooperation with SLU

(financed by HaV 2020, 2021)

- Gonads - histopathology
- Liver - histopathology, parasites
- Blood - red and white blood cells, indicate toxicity or infections
- Bacteria (kidney and wounds)
- Virus (if signs of infection)

(2021 Pharmaceuticals in cod, SLU)





Thank you for your attention

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