Skinnhelse som indikator på næringshelse

Lofotseminar

07.06.2021

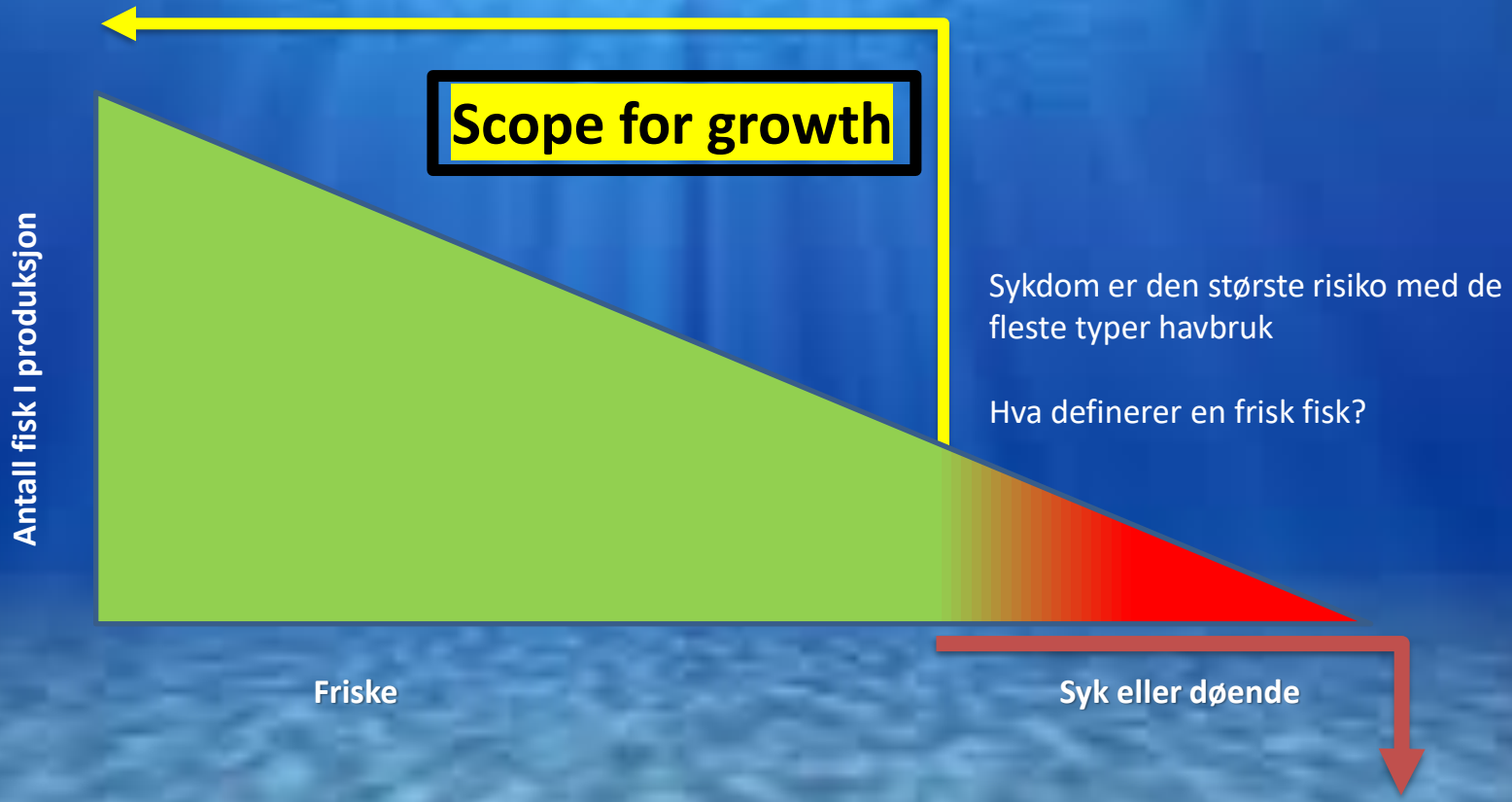
Prof. Karin Pittman
BIO
Univ i Bergen
og QuantiDoc AS

Vårt hovedbudskap: lag *helsestandarder*

-for integrering i forvaltning

-for sertifisering av fiskevelferd

-for økomerker og forbrukeromdømme



Sykdom er den største risiko med de fleste typer havbruk

Hva definerer en frisk fisk?

Fokus på klinisk sykdom

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De første oppdrettskveite fra ca juni 1986
Hyltropollen, Austevoll havbruksstasjon

Leif Berg, Victor Øiestad og Karin Pittman

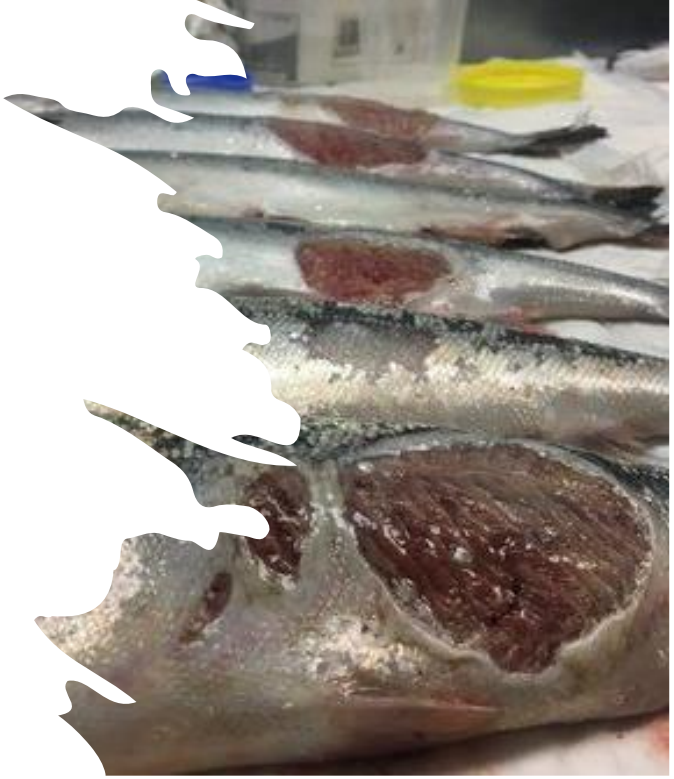
Solid arbeid gir grobunn for videreutvikling av ny næring

Foto: Bergens Tidende

Foto: NTB Naturbruk Vg1 - Oppdrett av marine fiskearter - NDLA

SKINNHELSEN I LAKSEOPPDRETT

Indikator på næringshelse?



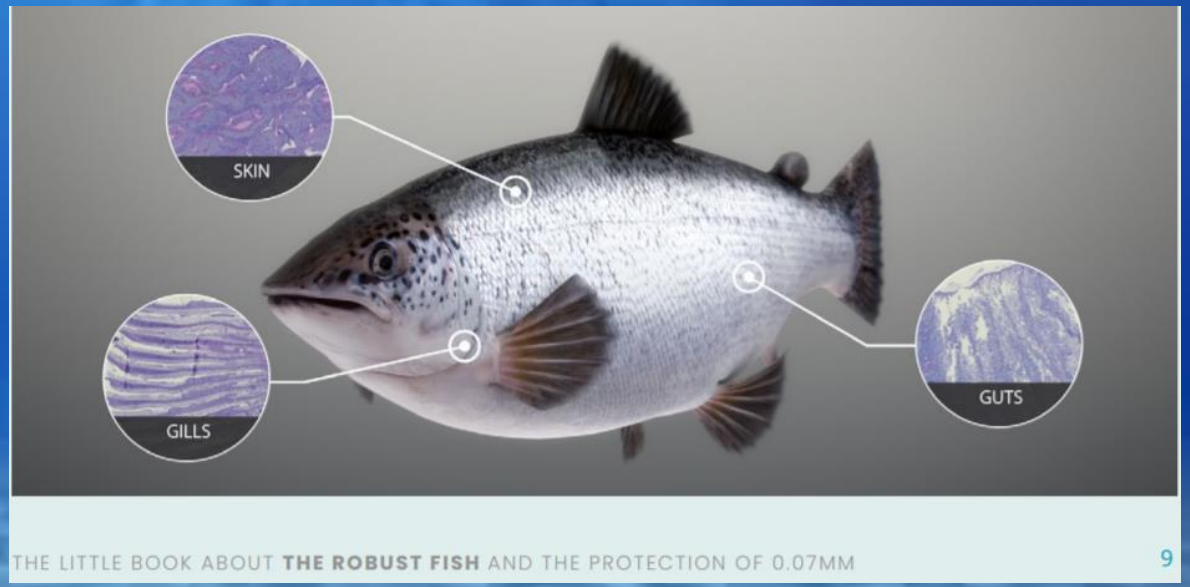
Bilder:

https://fiskehelse.wordpress.com/2012/03/28/vintersar/

https://www.kyst.no/article/fiskehelsetjenester-med-tips-for-aa-unngaa-vintersaar/

https://marinhelse.no/tenacibaculum/

Akvatiske dyr har sitt immunsystem på *utsiden (skinn og gjelleslimlagene) og utsiden (tarm mucosa) og det er viktig hele livet*



Skinnets slimlaget = Skjoldet
Gjellenes slimlag = Sikkerhetsvakt
Tarmens slimlag = Fundamentet

-

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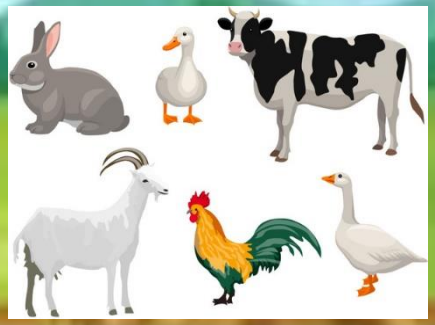
https://www.quantidoc.no/home.html
Svendsen & Bøgwald 1997

Etter 40 år med intensive oppdrett
kjenner vi fisken som et dyr bedre enn vi gjør fra millenier med fiskeri

Aquaculture ≠ Agriculture under water



Farm animals

50-70 %

% Total Lifetime in Egg/Womb/Protected stable environment

0%

Harvest

Sperm meets egg

Fish/shrimp

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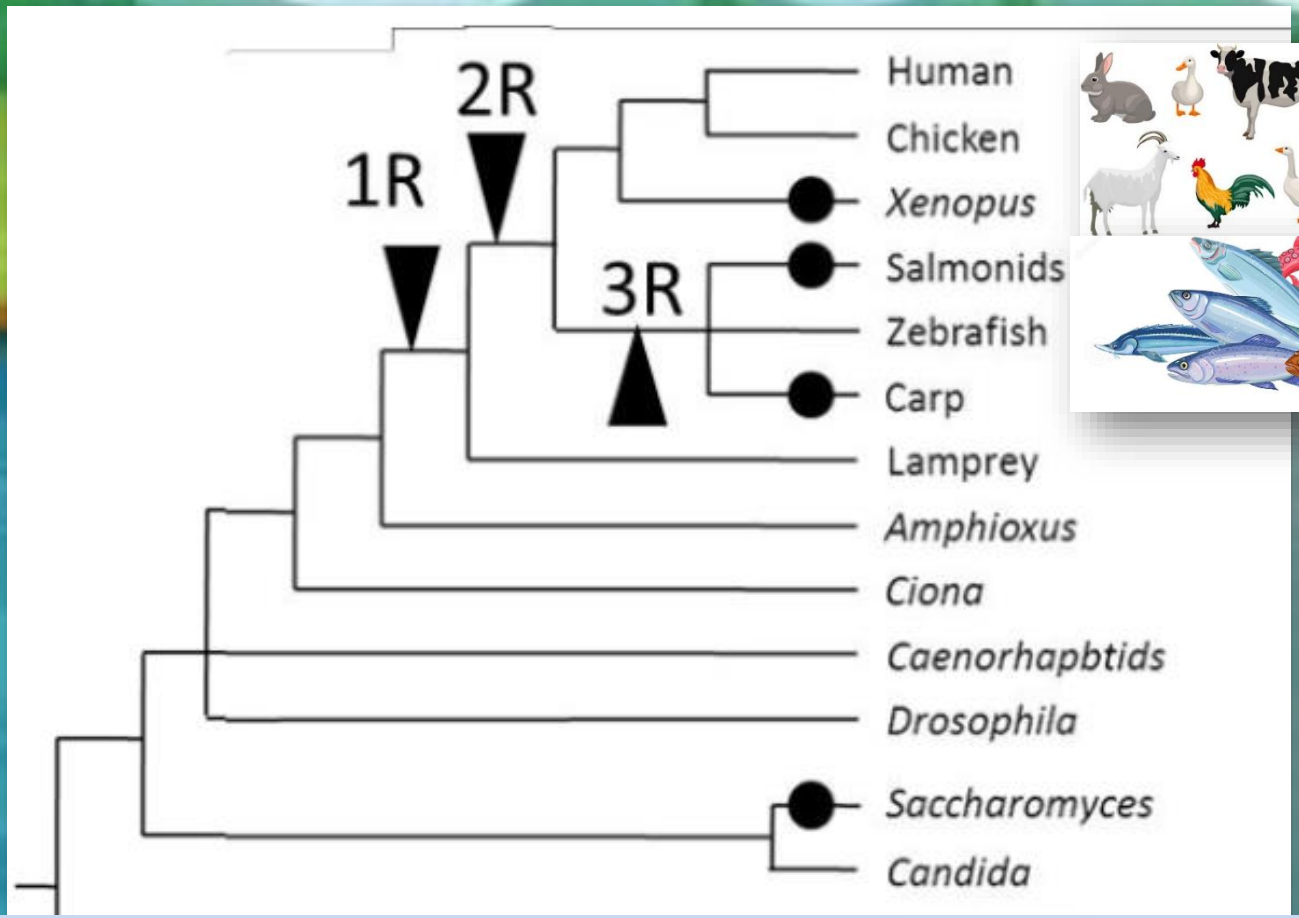
Aquaculture ≠ Agriculture under water



Whole-genome duplication (WGD) events during eukaryotic evolution. 1R, 2R, and 3R indicate first, second, and third-rounds of WGD in vertebrate evolution, respectively. From: Carmona-Antoñanzas 2014 adapted from Sato and Nishida, 2010

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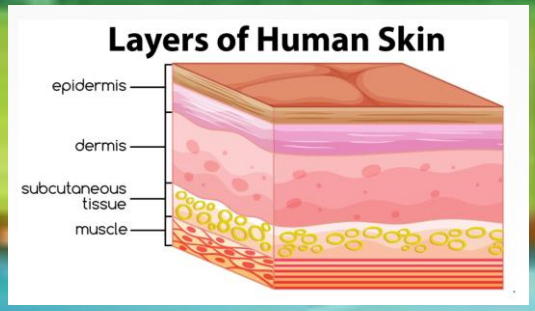
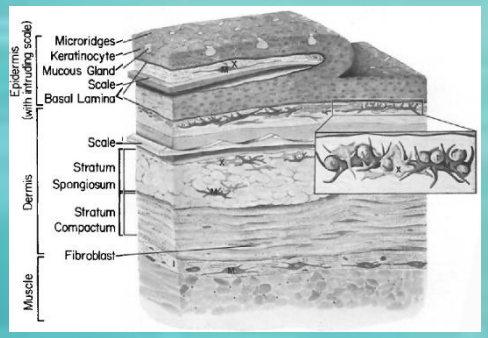
Aquaculture ≠ Agriculture under water

Land animals:
Dry skin



Aquatic animals = Slimy skin/gills = mucous epithelium = immune system on the outside

Fish:
Slimy skin



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Aquaculture ≠ Agriculture under water

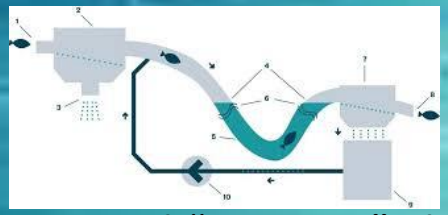
Land animals:
- Depend on stable environment for embryo development to young form,
- 2R genome with “known” gene functions
- Dry skin, slimy lungs and guts= **mucosal protection *inside***

Aquatic animals:
- Develop in variable environment to young form
- 3R genome with “unknown” gene functions
- Slimy skin, gills, guts = **mucosal protection *outside and inside***

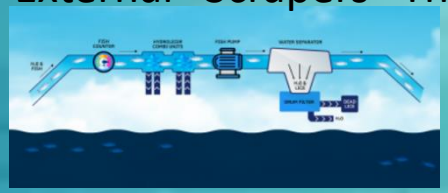
Aquaculture ≠ Agriculture under water

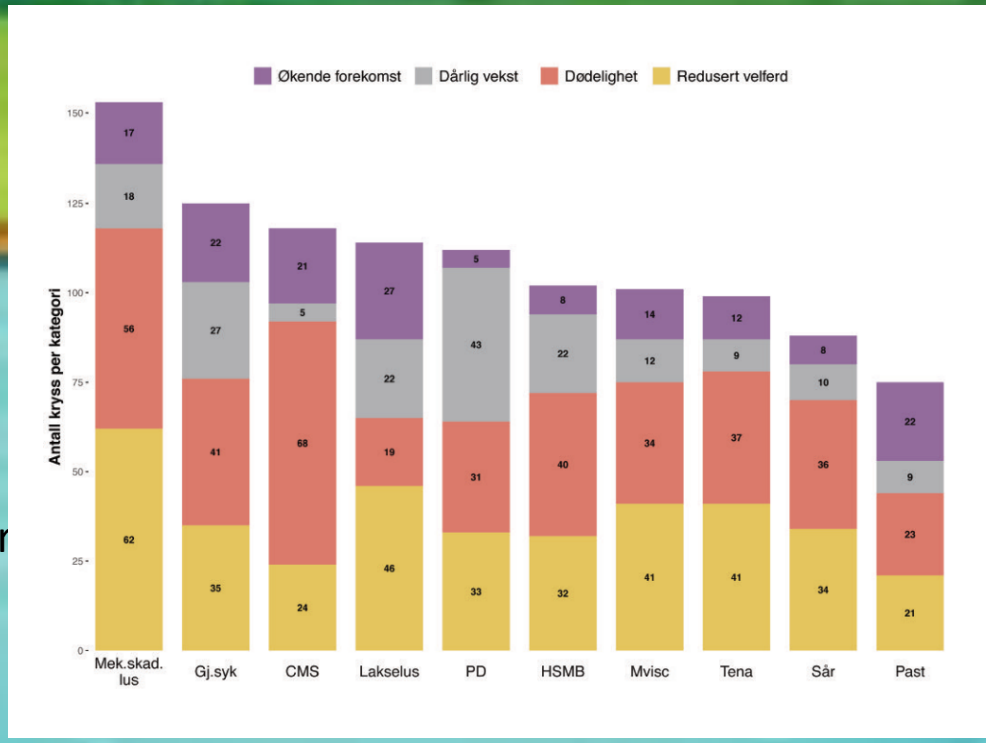
Ectoparasite Treatment

- Ectoparasites can be controlled using a variety of different drugs in a variety of different formulations
  - Sprays
  - Dips
  - Pour-ons
  - Shampoos
  - Dusts or powders
  - Foggers
  - Oral products
  - Spot-ons
  - Injectables
- See Table 15-4 for forms of ectoparasites and their advantages/disadvantages



External “Scrapers” Thermolicer and hydr





Result?:

#1 of Top ten problems for fish farms

>27% mortality

Technology focus: Hydrolicer – non-medicinal sea lice management (sustainableaquaculture.com)

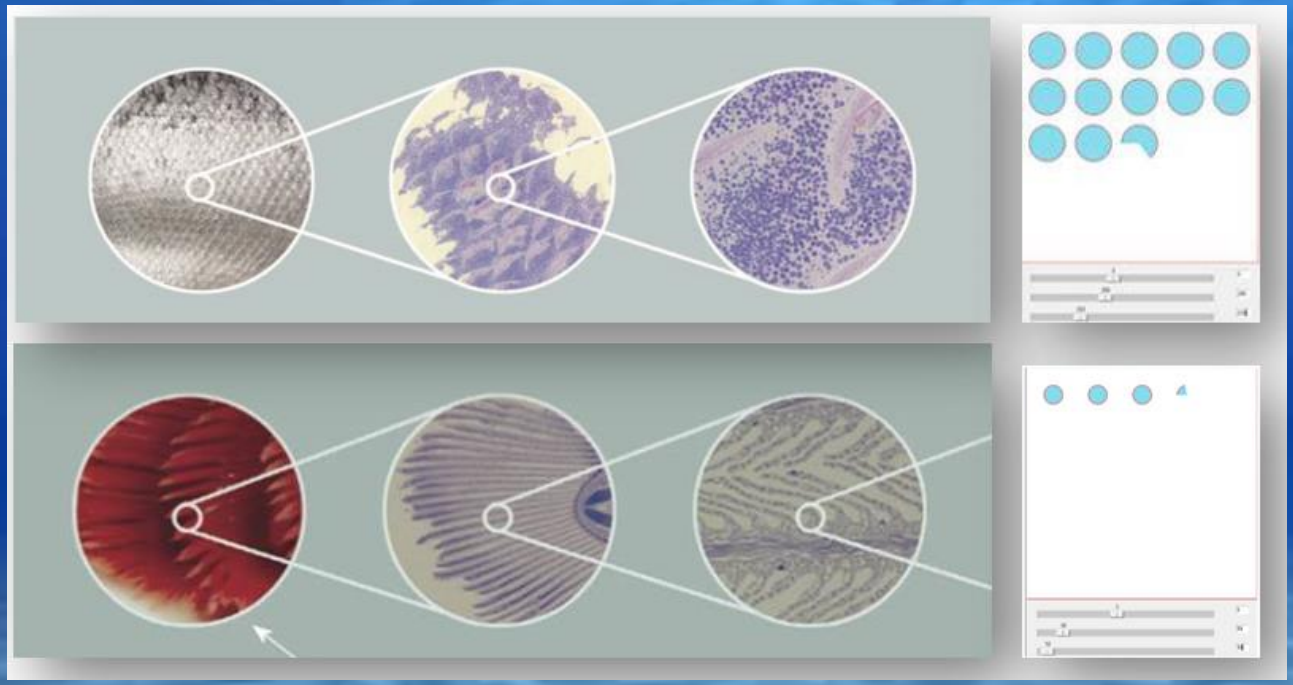
What is a thermolicer? | Scottish Salmon Producers Organisation

PPT - Fundamentals of Pharmacology for Veterinary Technicians PowerPoint Presentation - ID:544937 (slideserve.com)

Fiskehelserapporten 2020.pdf (uib.no)

Når begynte fisken å mistrives? Når begynte skjoldet å reag

Tap av Norsk oppdrettslaks i 2020 var 60.3 million laks,
86.5% dødfisk, 5.8% 'avvist', 7.7% 'andre' and 0.01% rømt



Dicer App v2
Riktig størelse, an
tetthet, kompens
patchiness

Blå prikker = slimceller = slimfabrikkene i skjoldet
- sanser stress og patogener
- gir ut antiparasitiske, antibacterielle, antivirale og antisopp stoffer
- endringer er ***tidlig varsel på forsvar fra fisken***

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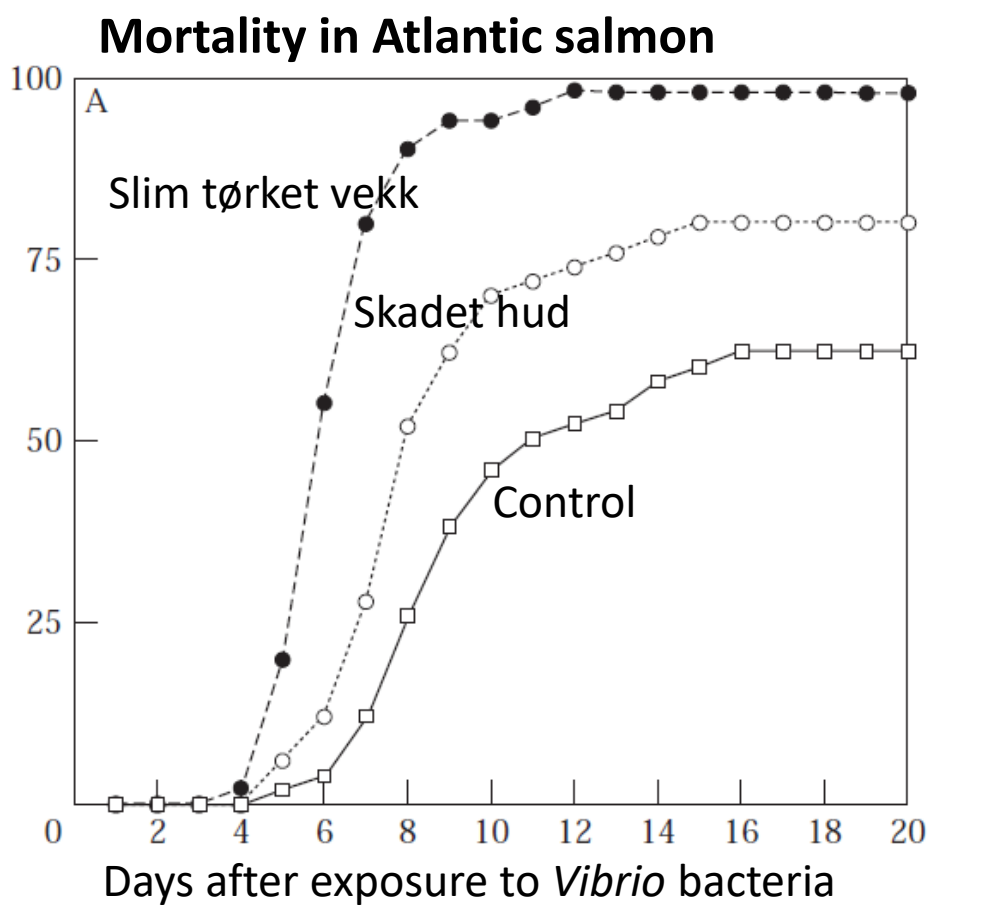
Slime is Pro-Active

substance	antibacterial	antifungal	antiviral	antiparasitic
H2A peptider	√	√		
H1 oncorhyncin2	√	√		
H6 oncorhyncin3	√	√		
pleurocidin	√	√		
Sal-2	√	√		
complement factors	Antigen-antibody	Antigen-antibody	Antigen-antibody	Antigen-antibody
hydrolytic enzymes (proteases etc)	degrade	degrade	degrade	degrade
IgM, IgT	basic antibodies	basic antibodies	basic antibodies	basic antibodies
lectins	pathogen recognition	pathogen recognition	pathogen recognition	pathogen recognition
mucus extract			√	√
interferon			√	

It is painfully simple:
fish health is better with a good mucous layer



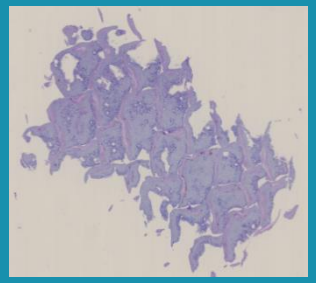
Det er såre enkelt –

fiskens helse er bedre med et godt slimlag

From: Svendsen and Bøgwald 1997

GENERATION STUDY

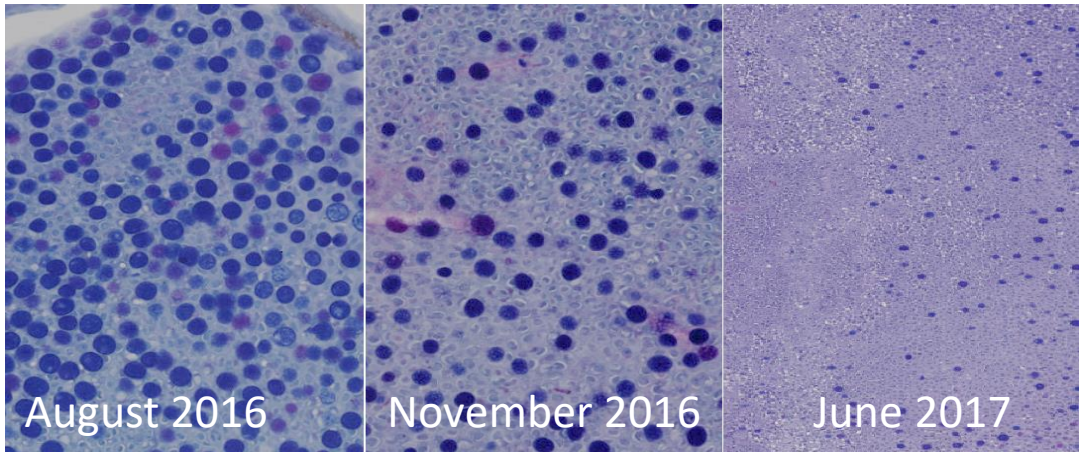
Skinn

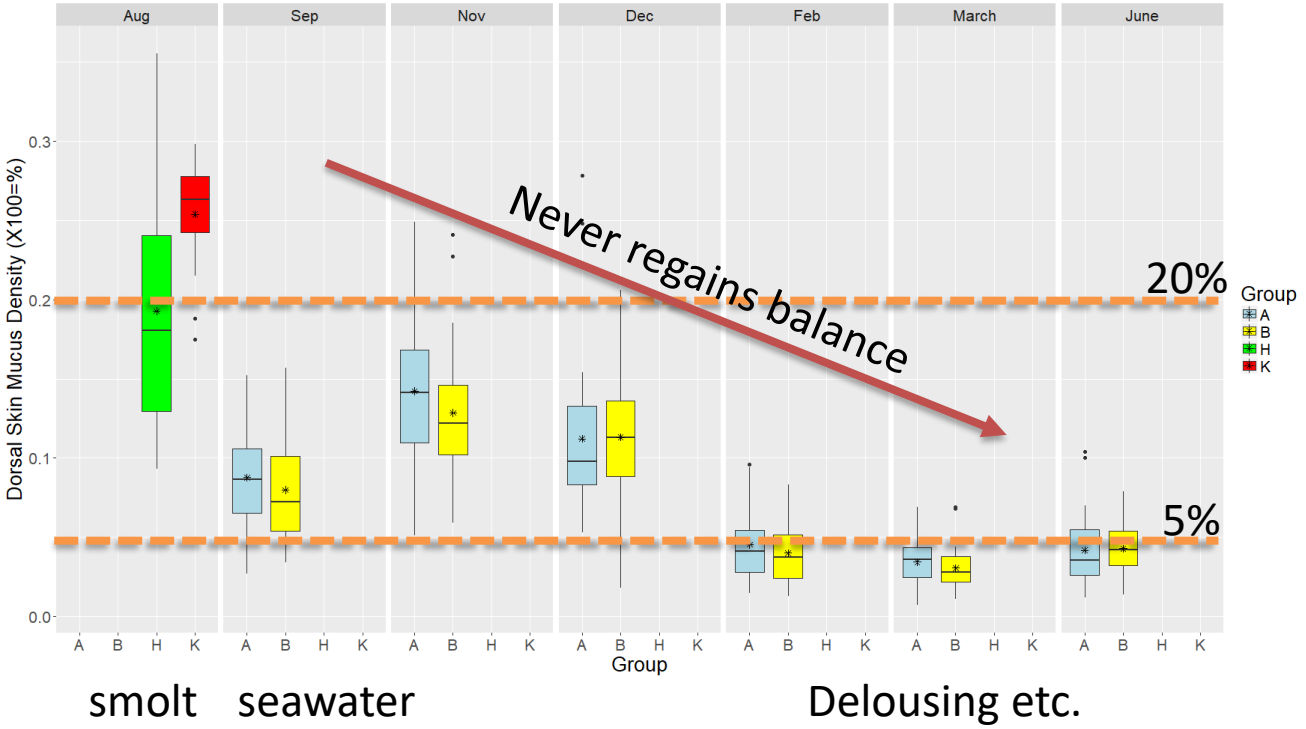


Smolt opphav viktig

Stress fra transport, handtering, trengning, avkusing

gjentatt stress = gjentatt svekkelse av immunforsvaret





CAC2016G-Integrert lusehåndtering – test av ulikekombinasjoner forebyggende tiltak mot lakselus
Partners: Marine Harvest, Skretting, Inst of Marine Research, FHF, Quantidoc

Quantidoc

QuantiDoc's Veribarr™ Technology har store fordeler over traditionell histologi på hud, gjeller og tarm.

Comparison	Histological quantification of mucous cells	Veribarr™ on mucous cells (design-based stereology, 3D from 2D)
Length or area	1-2 mm running length	1-2 cm^2 surface area
Unit of measure	Relative to existing structures	Universally applicable
Orientation of section	Very important	Not important
Standardization	- No standardized units - Not directly comparable across treatment and organs	- Standardized reporting - Comparable across treatment and organs
Qualitative or quantitative	Qualitative and quantitative	Quantitative
Method	Manual	Semi-automated
Bias	Biased unless random rules applied	Unbiased

(Table modified from Dang *et al.* 2020, Table 4).

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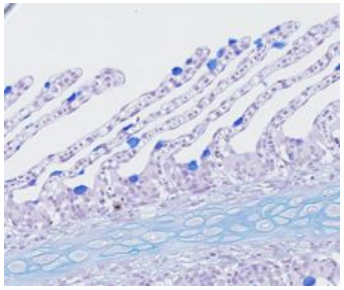
Quantifying Robustness

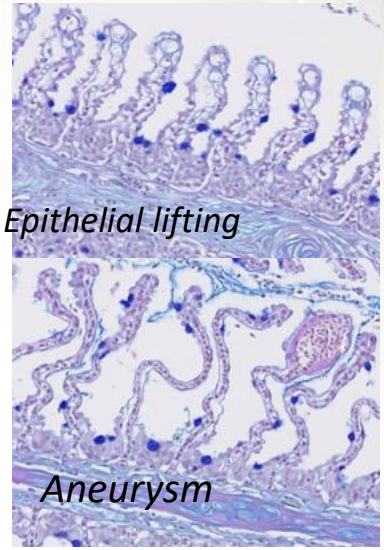
Currently working on new product development and *devices*

Gill changes in association with commercial H_2O_2 treatment

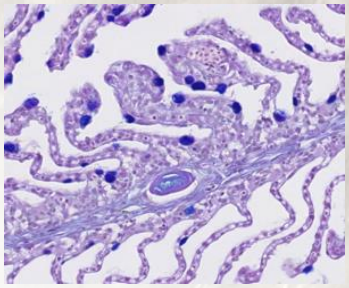
Day -1



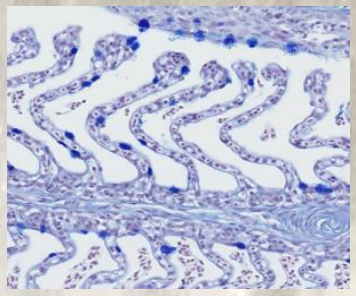
Day 4

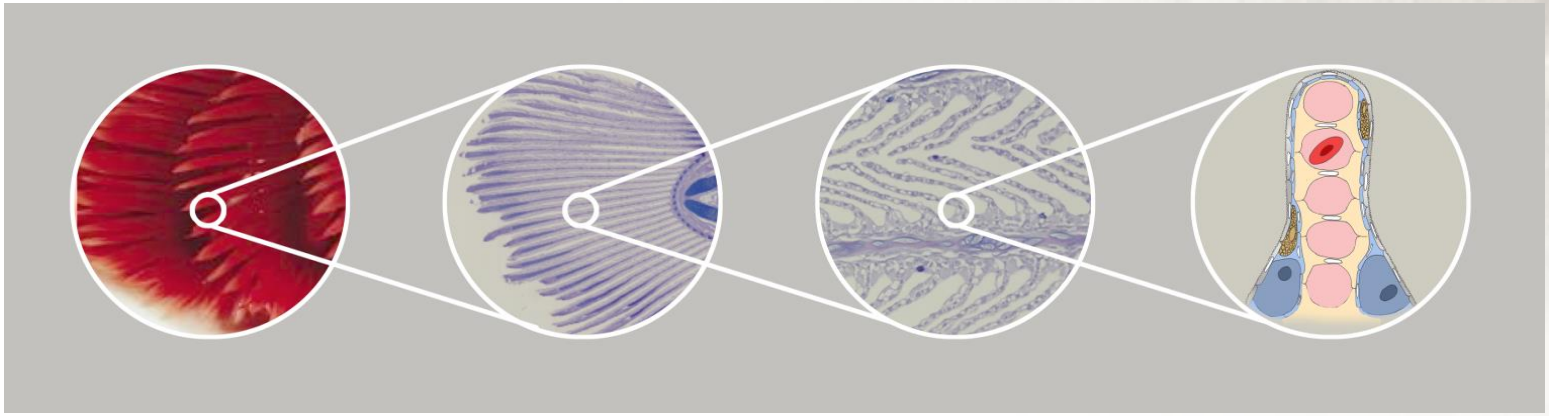


Day 11



Day 18





Fra Rantty 2016

GENERATION STUDY

Gills

50% of fish surface area

Freshwater

Origin differences

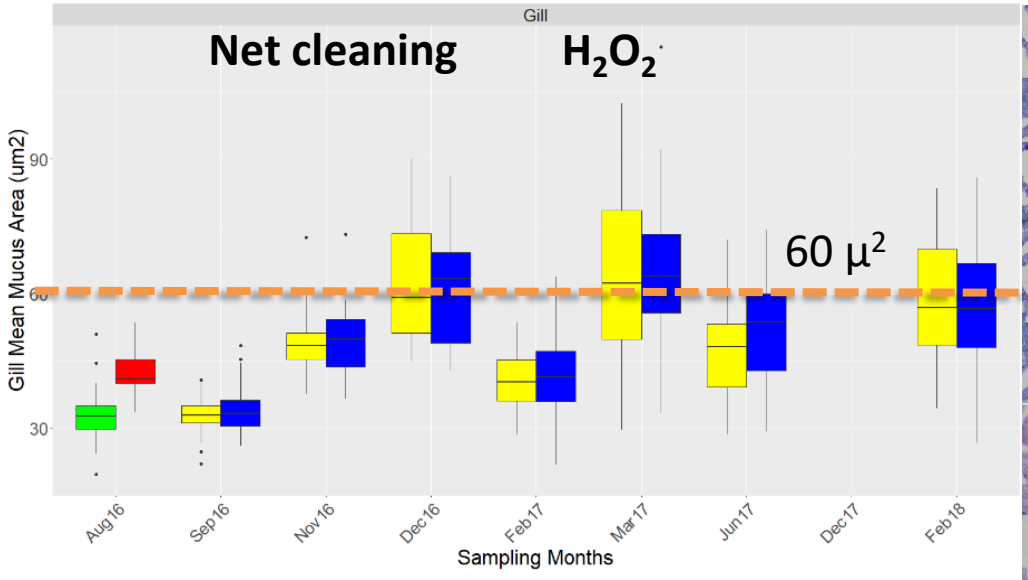
Seawater

Stars with a bit of «drying» then comes net changes, particles and delousing

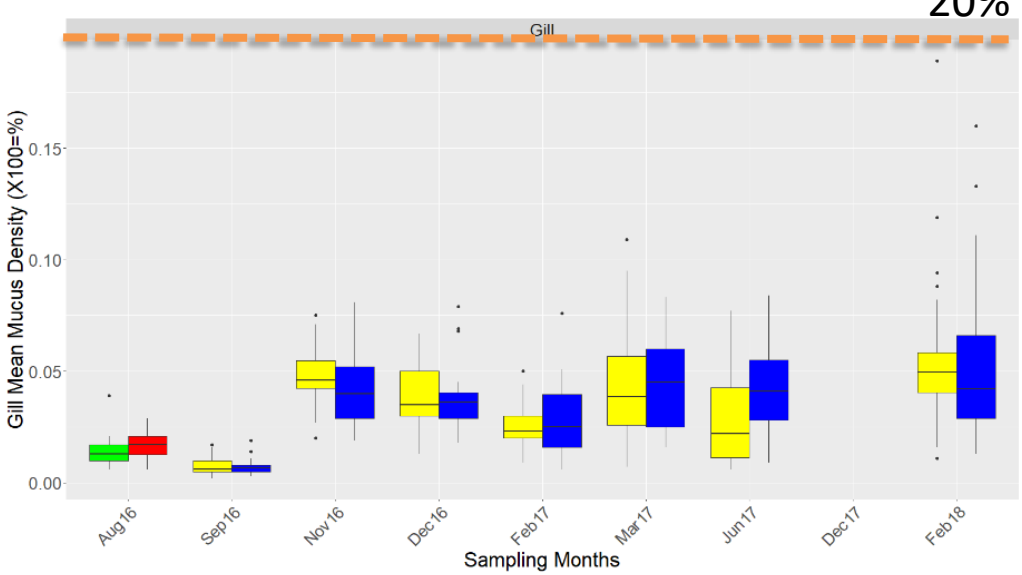
Significant differences within Gill Score 0-1

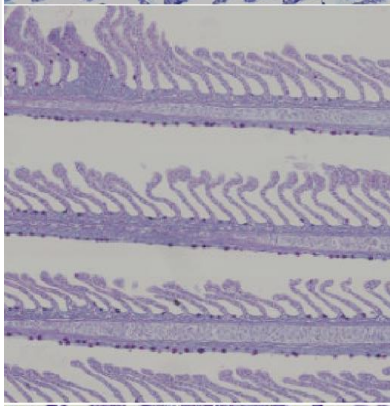
n=30-45 under each box
2 treatments in triplicate
with Marine Harvest, Skretting, FHF, IMR, NIFES og Quantidoc

Lamellar mucous cell size (μ^2)



Lamellar mucous cell volumetric density (%)





Quantidoc

Aquaculture needs an “auditable indicator” for outer health of fish

Auditable (etterprøvbare) standarder er MÅLBARE med et kvantitet
-baseres på bevis, forskning og god praksis

- **Er brukervennlig, forståelig, kan tolkes konsekvent**
- **Hjelper til med forbedring av kvalitet, rutiner, produskjnsplanlegging:**

https://www.academia.edu/16555877/International_principles_for_healthcare_standards_b

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Så hva skjer om man anvender en standard over tid?

17.0 Physical Health

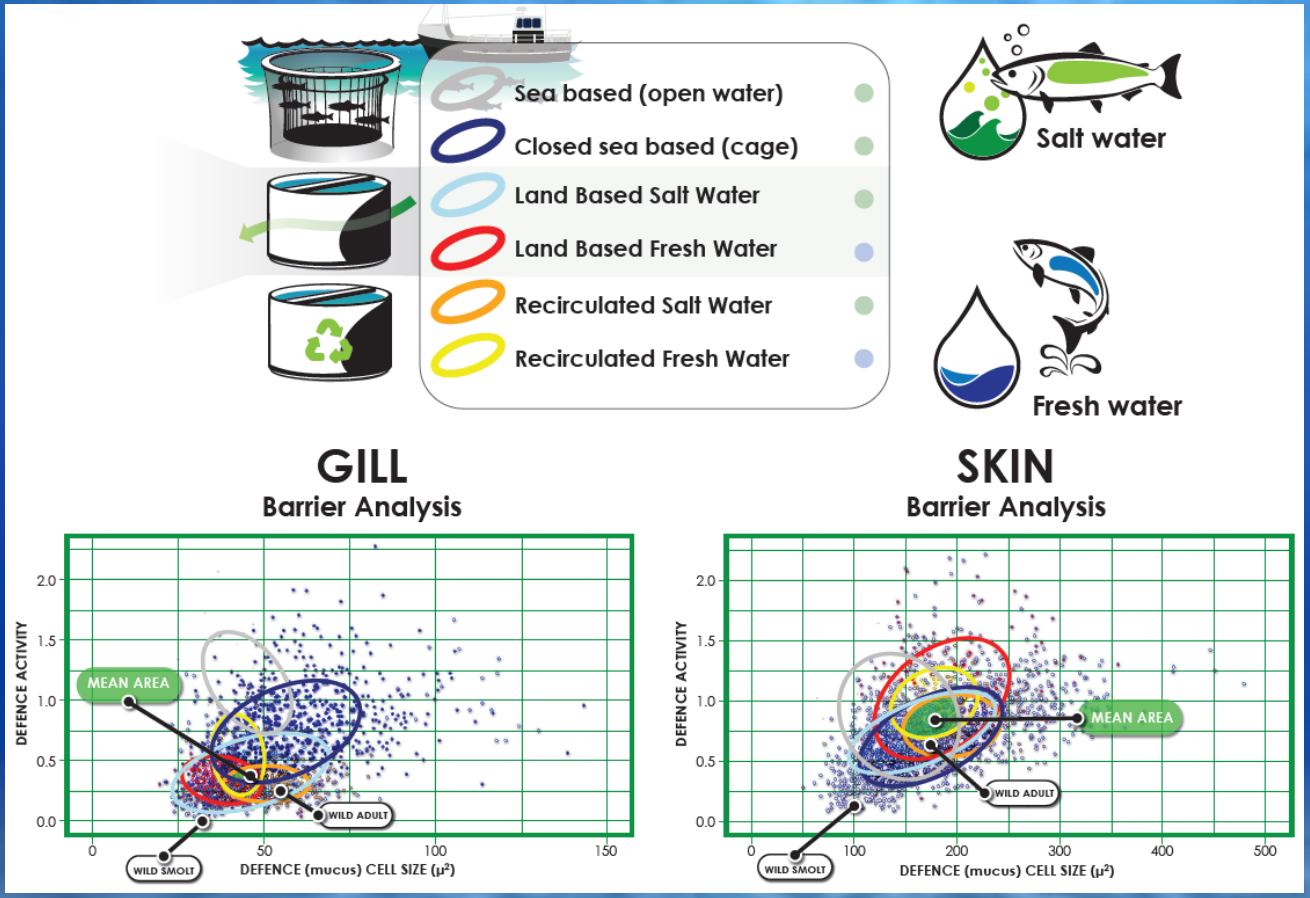
17.1 Gill
N=0

17.2 Skin condition
N=0

17.3 Snout, scales and fin damage
N=0

Få eller ingen fisk-baserte helseindikatorer
Men mange for sykdom **etter at helsen er tapt**

List of directly auditable indicators from:
Aquaculture Stewardship Council (ASC) Global Aquaculture Alliance (GAA)/Best Aquaculture Practices (BAP) Global GAP Royal Society for the Prevention of Cruelty to Animals (RSPCA)- Farmed Atlantic Salmon Scottish Salmon Producers Organisation (SSPO)



Standardization improves understanding of and limits for barrier health

(Skin N=~2000

Gills N=~1000)

Veribarr

Verification of **barr**iers
Veribarr™ Grid

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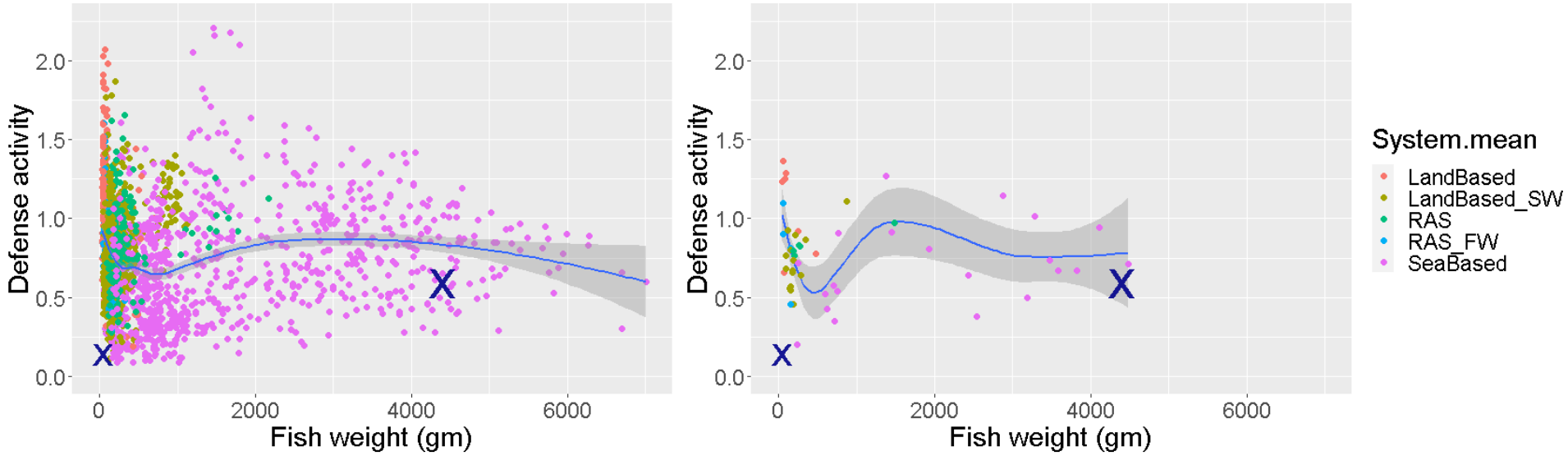
Universitas Bergensis

Forsvarsaktivitet i lakseskinn i kommersiell havbruk (n=2126, N=52)



Defence activity= (1000*Mucus density)/Mucus cell size (um2)

x –wild Salmo salar smolt (n=27), **X** – wild adult salmon (n=7)

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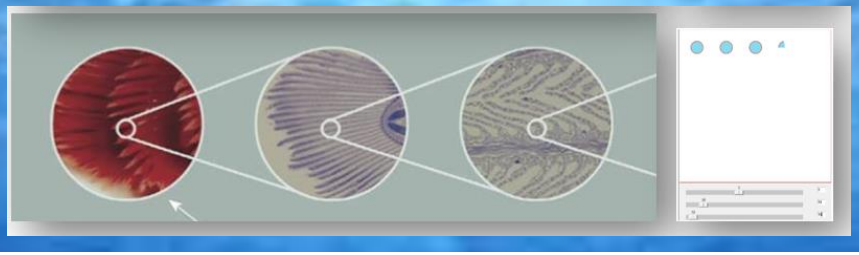
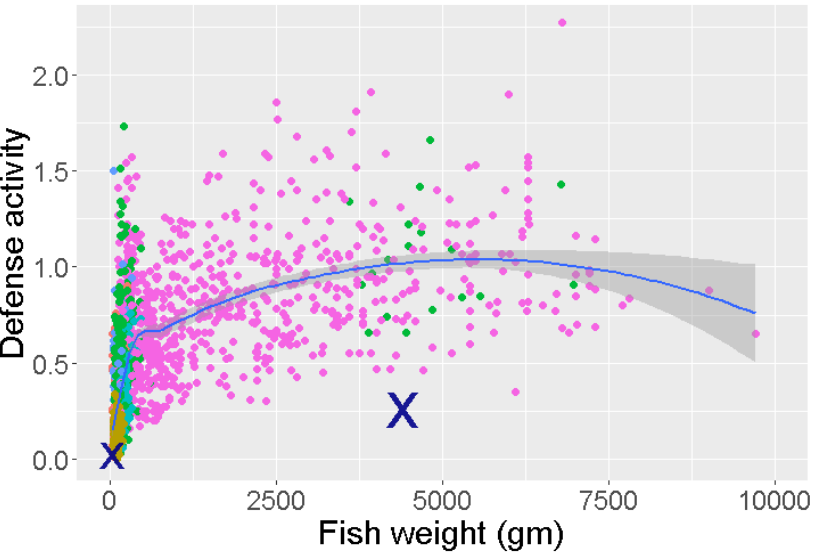
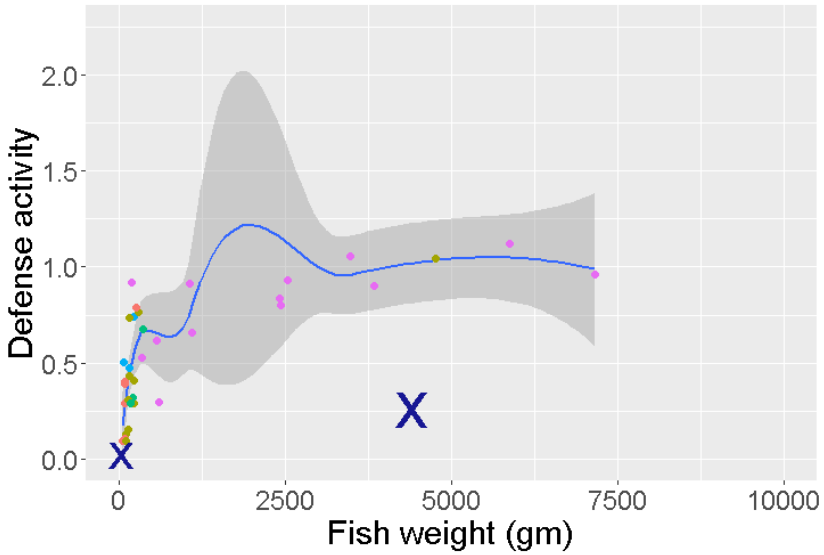
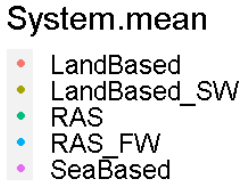
Forsvarsaktivitet i laksegjeller i kommersiell havbruk (n=1816, N=35)









Defence activity= (1000*Mucus density)/Mucus cell size (um2)

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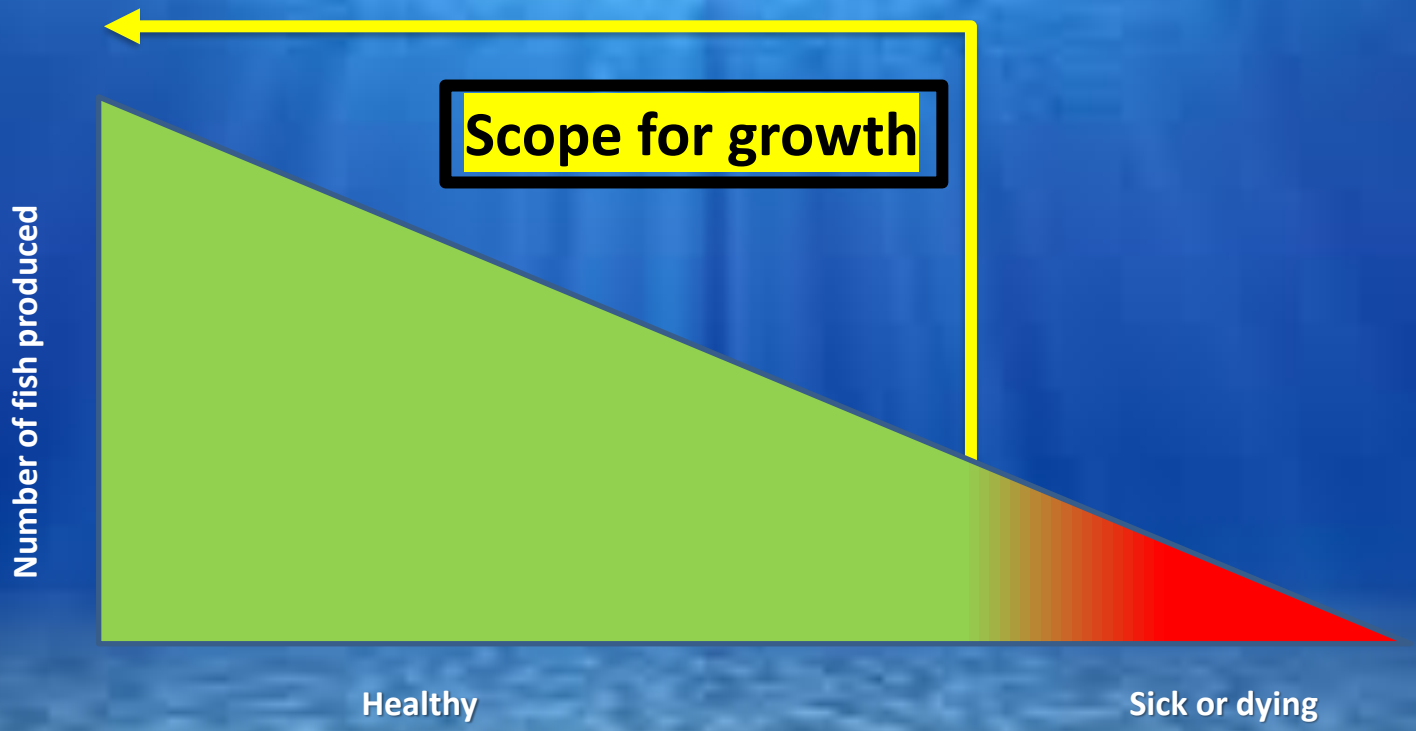
FISHMOM – lag en ny helse standard

-fiske immunitet, site helse, modellering og overvåking

-parallel MOM A,B,C miljøundersøkelser NS9410

-for sustainability, ecolabels and consumer confidence



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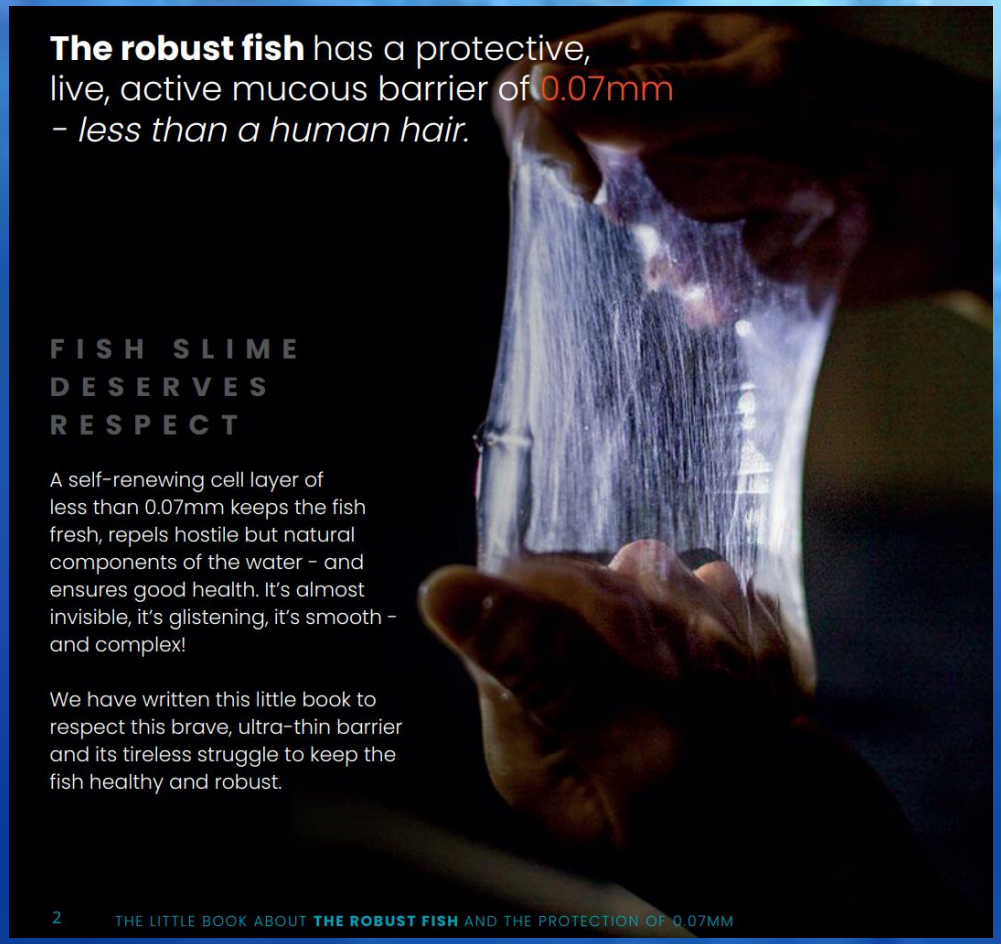

The Robust Fish

– gratis hefte

in English
www.Quantidoc.com

På norsk
Slimboken | Quantidoc – Quantidoc

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