



UNIVERSITY OF BERGEN

Quantidoc

SKIN, GILLS AND GUTS OF FISH:
slimy barriers protect against lice
and other pathogens or irritants



Mucosal Mapping

Karin Pittman
Universitetet i Bergen

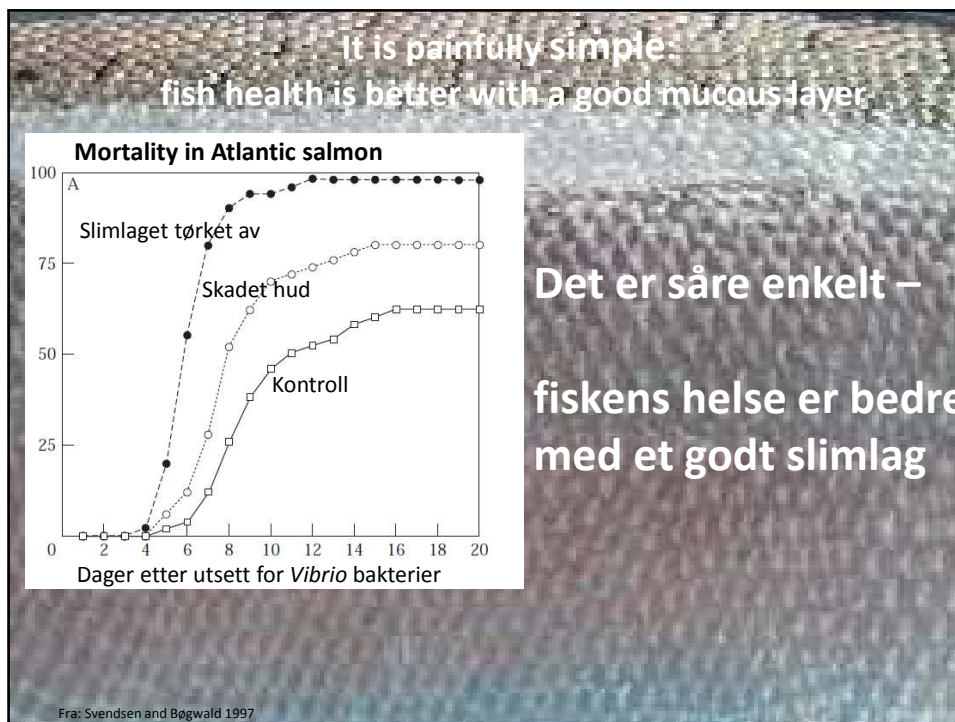
Based on talk first given at EAS Rotterdam 2015







Co-conspirators

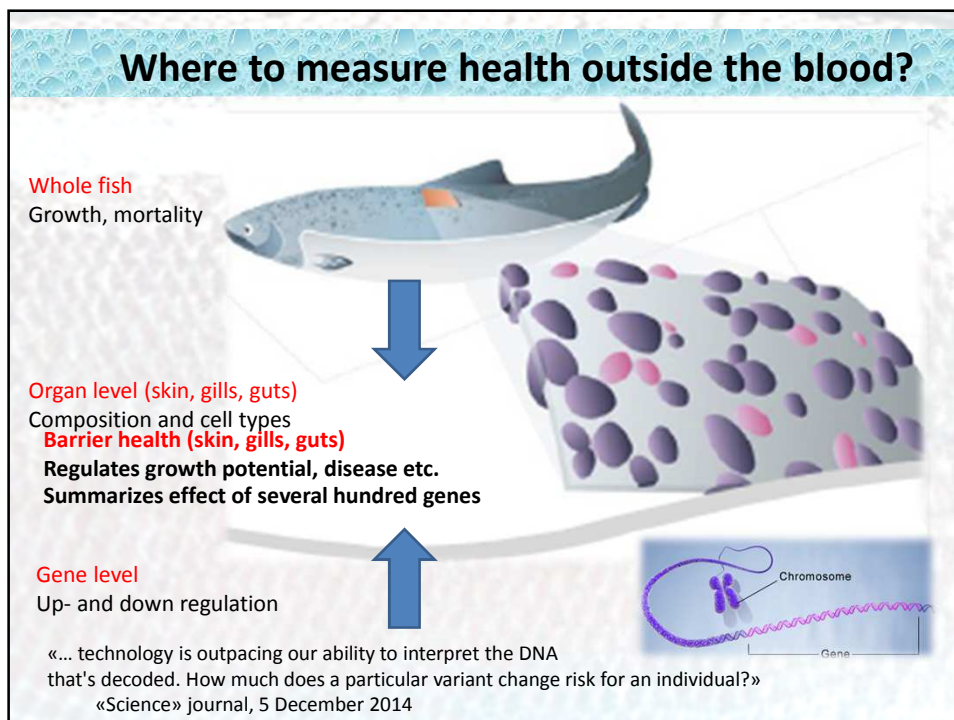
- Bjarne Ravnøy, Produx AS
- Johan Johansen, Gildeskål forskningsstasjon
- John Sweetman, Alltech Aqua
- Sulefisk A/S
- Ingrid Uglenes, IMR
- Tine Oen, BIO UIB/Fiskeridirektoratet
- Amanda Pittman, UIB/U Copenhagen
- Kirsten Redmond, BIO UIB/UiStavanger
- Stine Karlson, BIO, UIB/IMR
- Aurora Campo, Quantidoc, Bergen
- Stanko Skugor, Nofima Averøy
- Elizabeth Sweetman, Ecomarine
- Marco Custodio, U Algarve, Portugal
- Imelda Rantti, BIO UIB
- Hugo Maxwell, BIO UIB
- Kåre Thorsen, BIO UIB
- Silvia Torrecillas, Univ of Gran Canaria, Spain
- Marisol Izquierdo, Las Palmas de Gran Canaria University
- Phillippe Sourde, Vet'eau/Aquatv, France
- Katerina Koutsoulakis, Nofima, Norway
- Arne Skorping, BIO UIB
- Mathias Ugelvik, BIO UiB
- Mark Powell, NIVA/BIO UIB
- Salmon Group
- Salmobreed
- ILAB, Bergen
- Alltech Japan
- Cooke Aquaculture, Canada

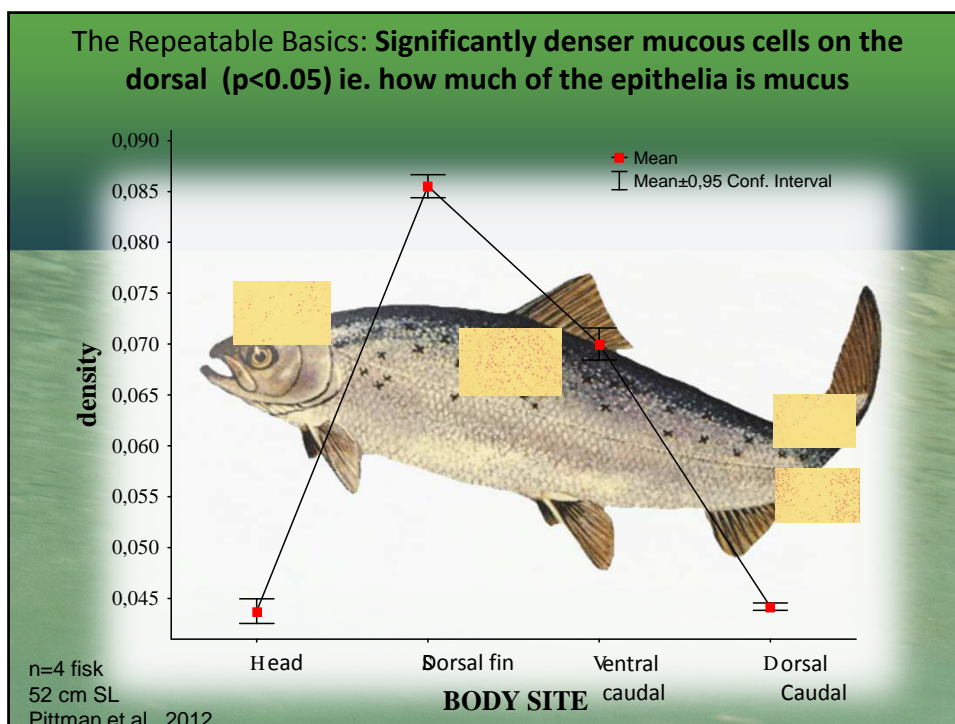
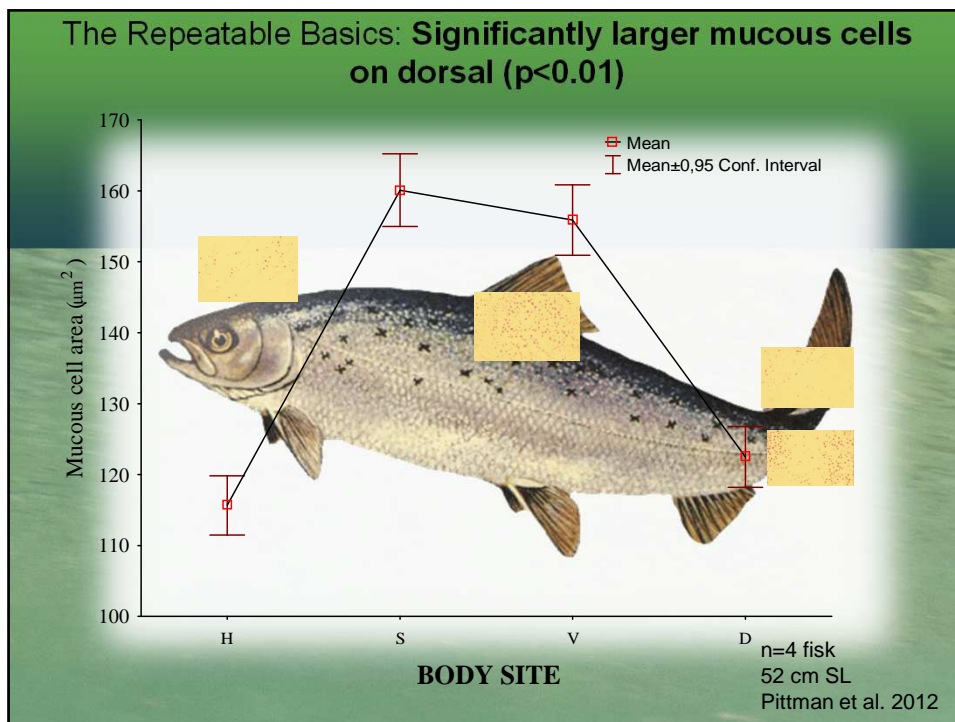
Funding sources:
Industry
Regional Research Fund
Innovation Norway
Norwegian Research Council



Mucous Cells

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			√	






International On-farm Trials

1. Sulefisk - field trial on commercial farm, 4 cages with 2 control 2 Aquate-fed groups
- 280 000 salmon (about 50 m tons), 4 sampling dates, 7 months duration
2. Gifas1 - field trial on research station, 60 000 salmon, 12 cages with 3 cages for each of 4 diets (control, plus three other diets), 5 sampling dates over 4 months
3. Gifas2 - field trial on research station, 60 000 salmon, 12 cages dose-response to 2 levels of trial diet plus control diet, 3 sampling dates over 2 months
4. Averøy - controlled trial at Salmobreed, two specially bred families
- 1 sampling date
5. Gill test - gills from GIFAS2 first date control fish
6. Seabass (Spain) – guts, skin and gills at research station Las Palmas; 720 fish, 4 diets in triplicate, 8 weeks
7. Delousing salmon (Norway) – 1 day before, then 2,8 and 15 days after, samples of skin, gills, esophagus following exposure to hydrogen peroxide
8. Yellowtail (Japan) – diet and parasite control, (Kochi Univ and Alltech)
9. Salmon (Canada) – diet and parasite control, (Coblesqua)

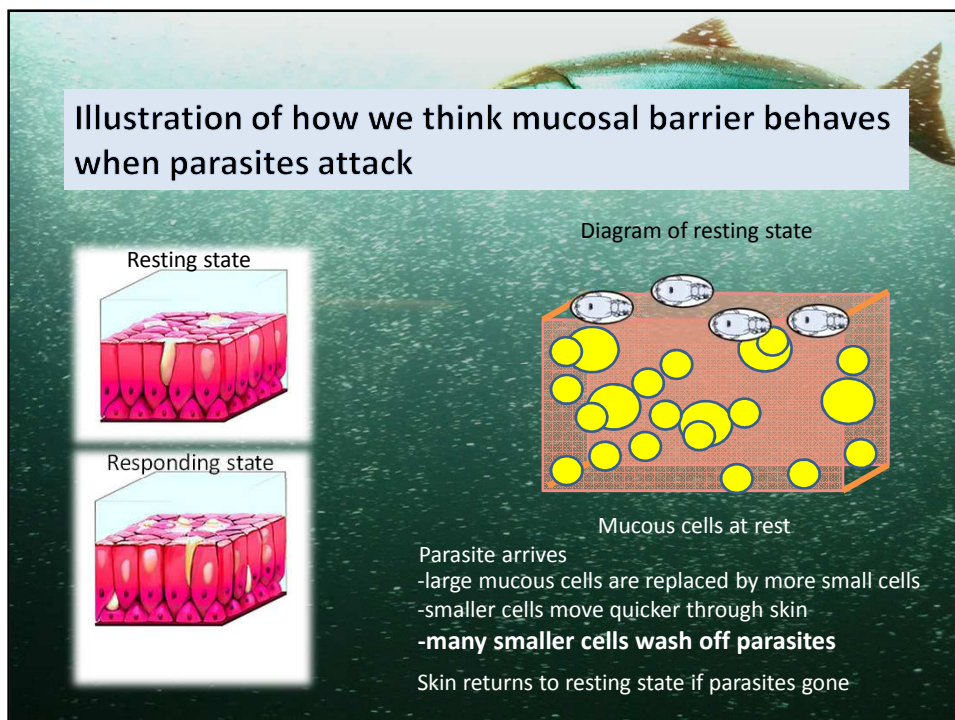
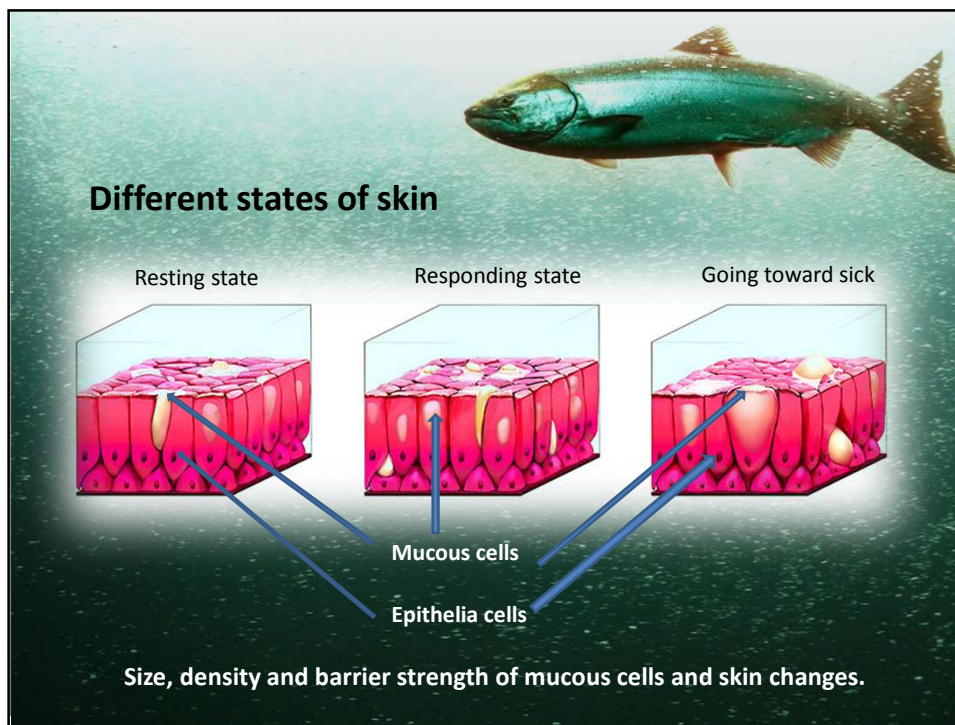
More than 6000 samples

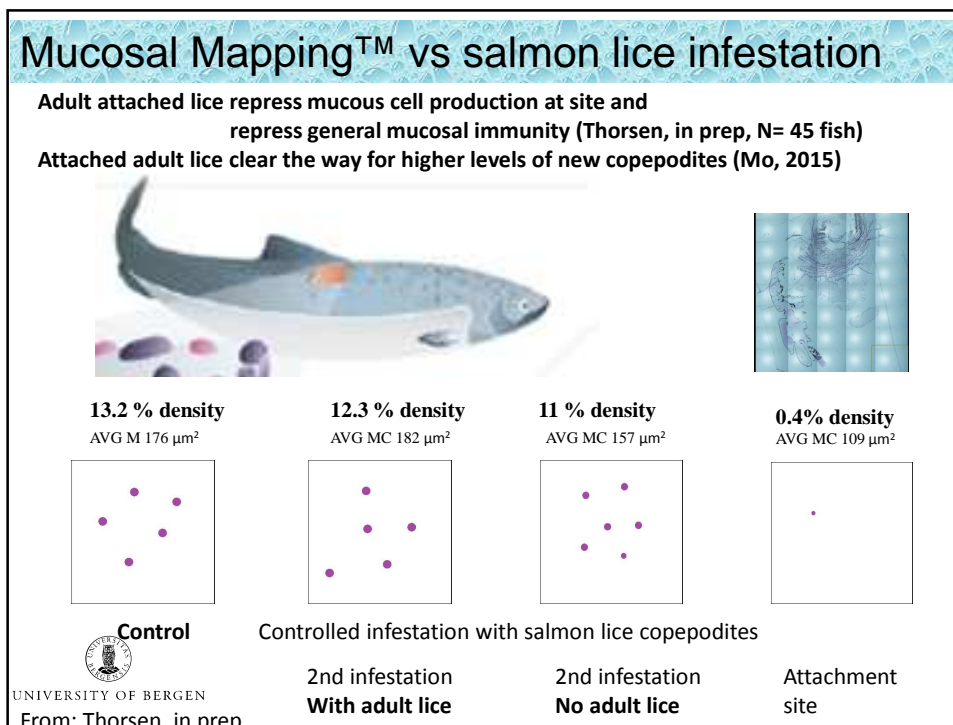


MUCOSAL MAPPING™ IN SALMONIDS



Parasites go where mucosal cells are small and few

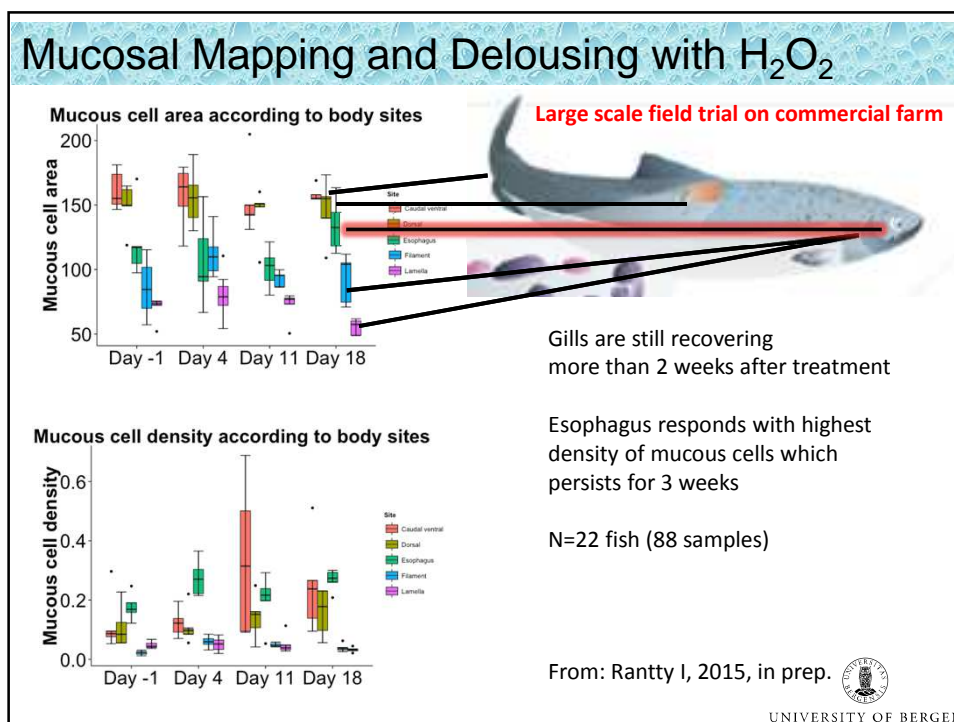




Mucosal Mapping™ on salmon and lice problem

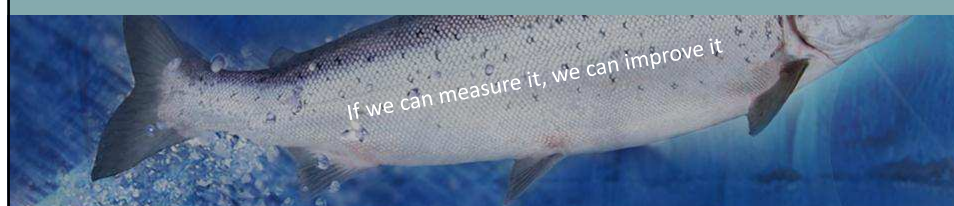
- [proper animation first draft by Egil Paulsen](#)

Skin response to salmon lice is stage specific



Example of result-based «decision-making tool»

- **Skin** : some diets influence skin mucous production and reduce pathogens
- **Gills** : it takes about 2 weeks to recover from a delousing
- **Guts** : plant or fish based diets influence mucous cell production and barrier strength and therefore growth potential



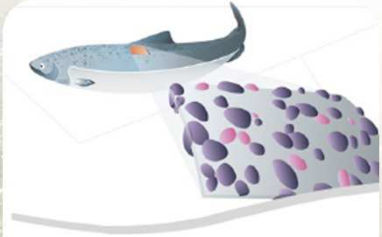
The big picture summary

1. Slimhinnene (fiskehud, gjeller) har en konsekvent reaksjon til parasitter
2. Hudens reaksjon til lakselus er spesifikk til lusens livsstadie,
små lus gir huden en sjans å «vaske av» parasittene
3. Voksne lus se ut til å slå av slimcelleproduksjon under festestedet
4. Det kan ta opp til flere uker før slimhinnene «kommer seg»
etter en avlusing med hydrogenperoksid (vondt verre?)



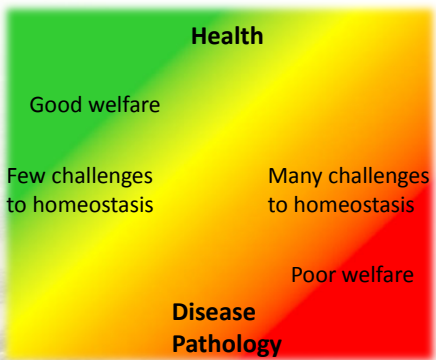
Forsterk barrierene!

Healthy barriers = healthy fish



Mucosal
Mapping

wabbit
Quantidoc



Health

Good welfare

Few challenges to homeostasis Many challenges to homeostasis

Disease Pathology

Poor welfare

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MUCOSAL MAPPING™ (MUCOMAP)

Quantidoc owns the IP for this diagnostic method of quantitatively assessing mucous cells and is commercializing the product for industrial application

- Diagnostic – health status (skin, gills and guts)
- Quantitative, objective & comparable
- Statistically robust
- Links diet & immunity
- Summarises the effects of >200 genes
- Important tool for monitoring and improving fish health and welfare



Quantidoc
Contact: quantidoc@gmail.com