Aquaculture and climate change

Antti Kause, Jari Niukko, Markus Kankainen

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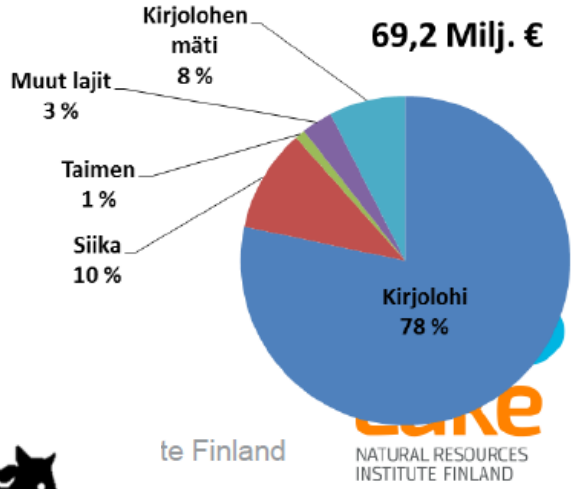
Aquaculture

- Farming of aquatic organisms
- Efficient way to produce animal protein for human consumption



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Protein Retention	31 %	21 %	18 %	15 %
Energy Retention	23 %	10 %	14 %	27 %
Edible Yield	68 %	46 %	52 %	41 %

Brändö Lax, Kustavi
Kuva: Markus Kankainen

Savo Lax, Rautalampi
Kuva: YLE

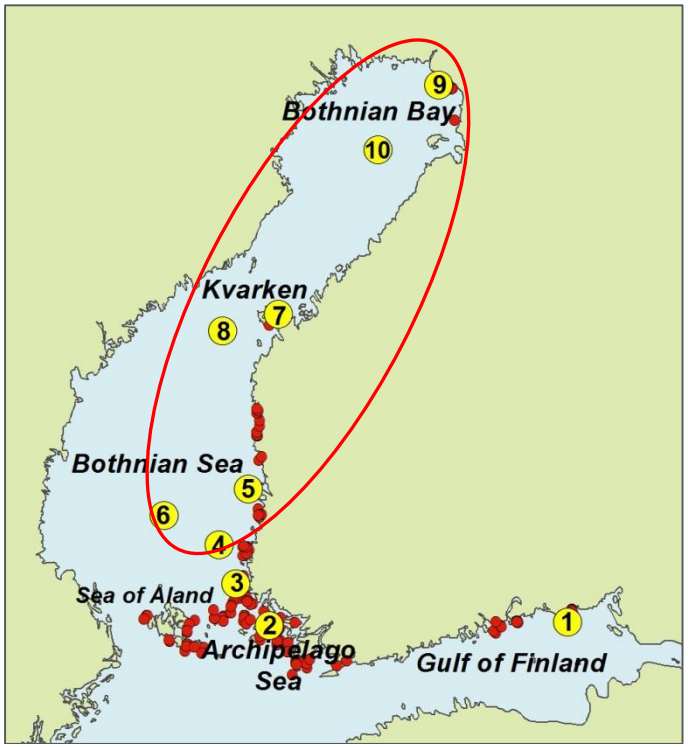
Temperature – rainbow trout

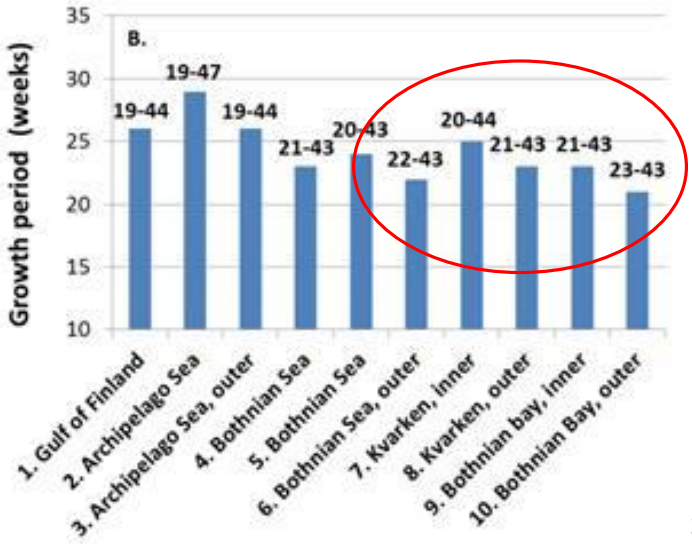
- Low temperatures are limiting growth of rainbow trout at Gulf of Bothnia
- Increased water temperature will:

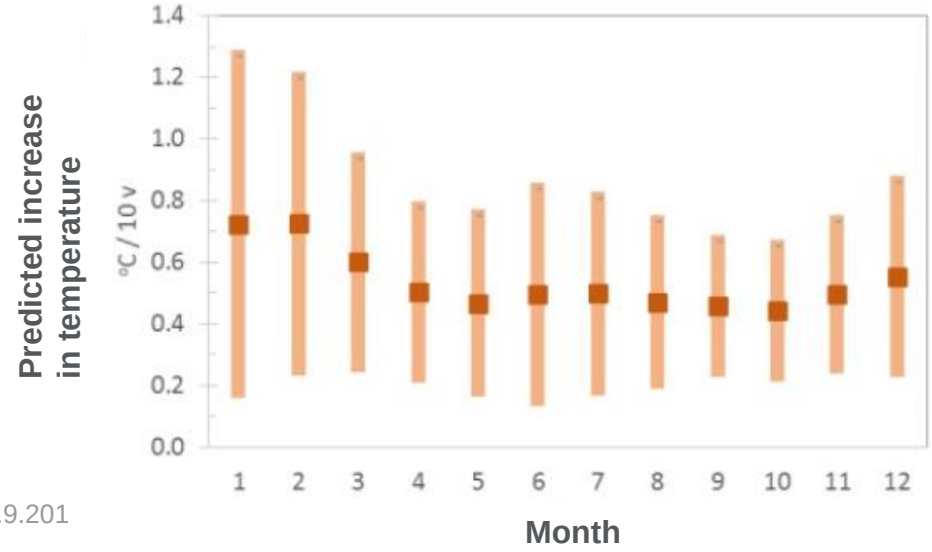
A) prolong growth season

B) provide more optimum temperature for rainbow trout growth,

especially at open areas (not in summer and in south)

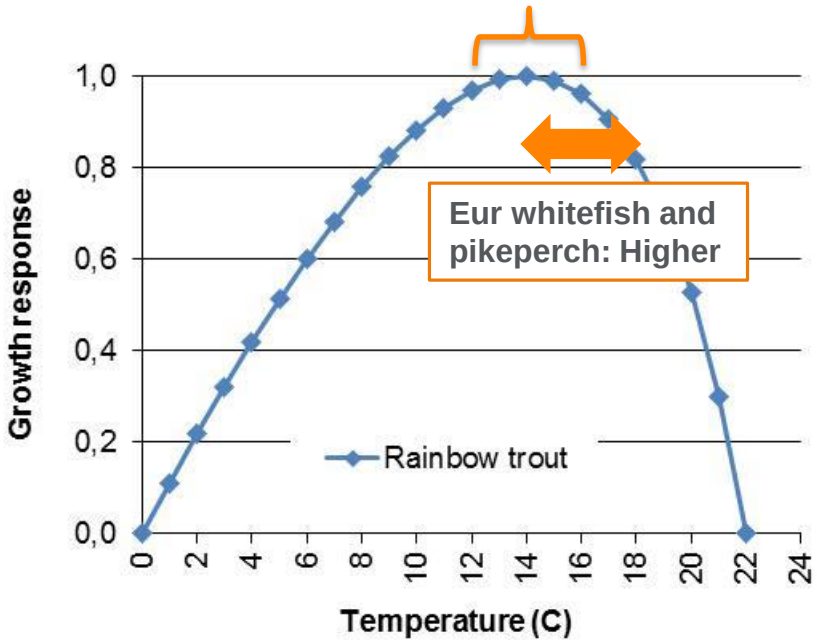






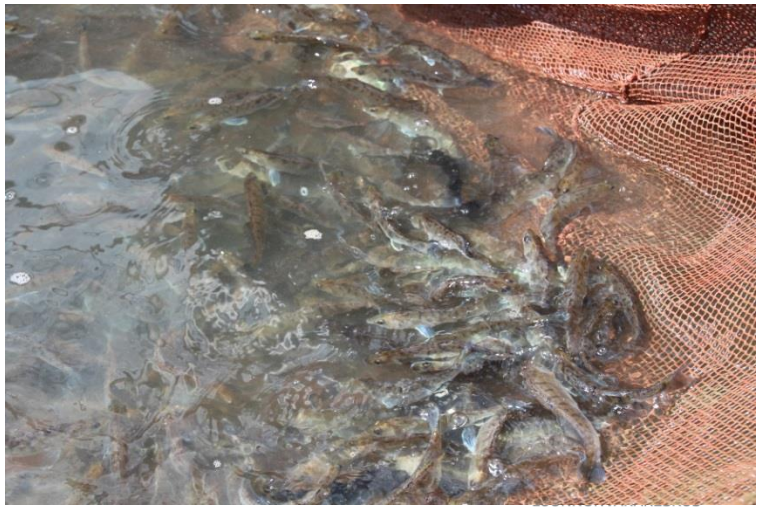
Temperature – other species

- Farming of more warm-adapted species, European whitefish and pikeperch, benefit from warm water



European whitefish (siika)

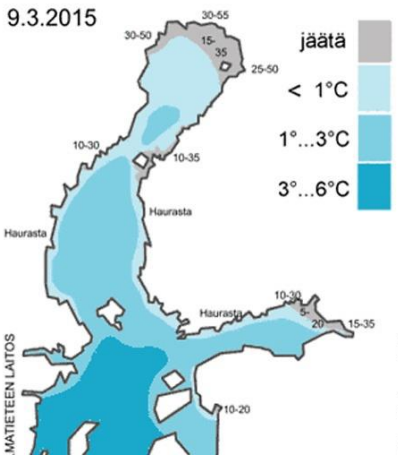
Pikeperch (kuha)



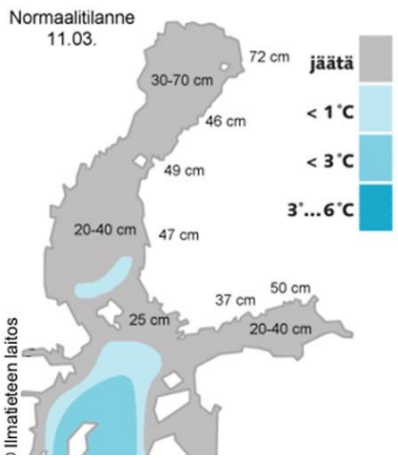
Ice cover

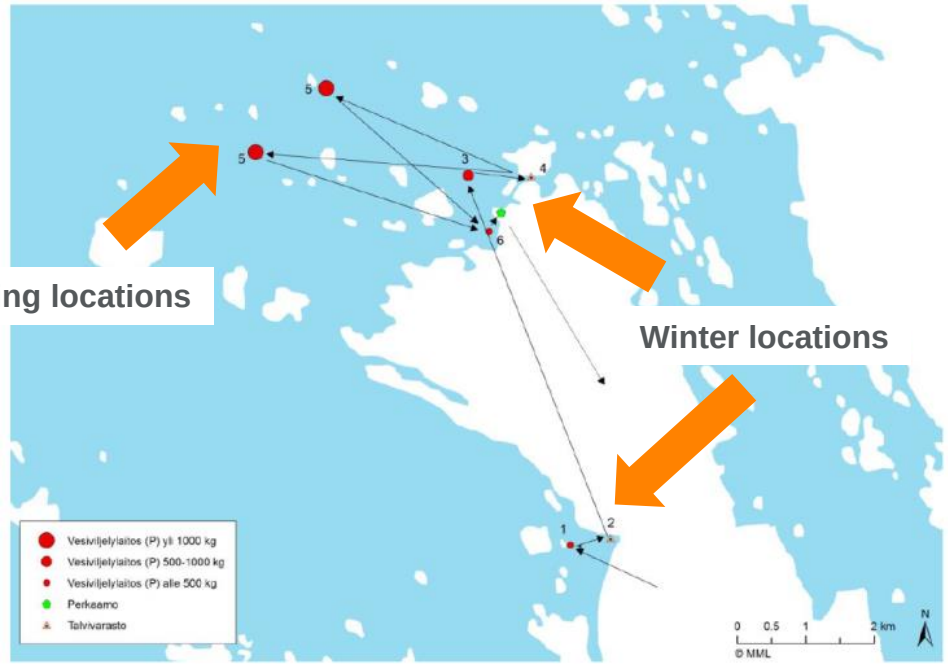
- Ice thickness and duration of ice cover has reduced and is predicted to be reduced even more
- Winters with limited ice cover at Gulf of Bothnia
- **Potential for a major change in the aquaculture logistics**
- Reduced need for holding farms near coast (e.g. during winter)

Ice cover (grey) in 2015

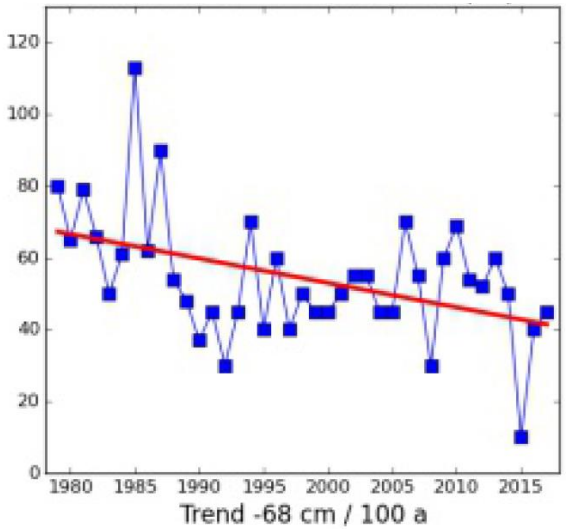


Average ice cover





Ice thickness in Raahe from 1979 to 2017



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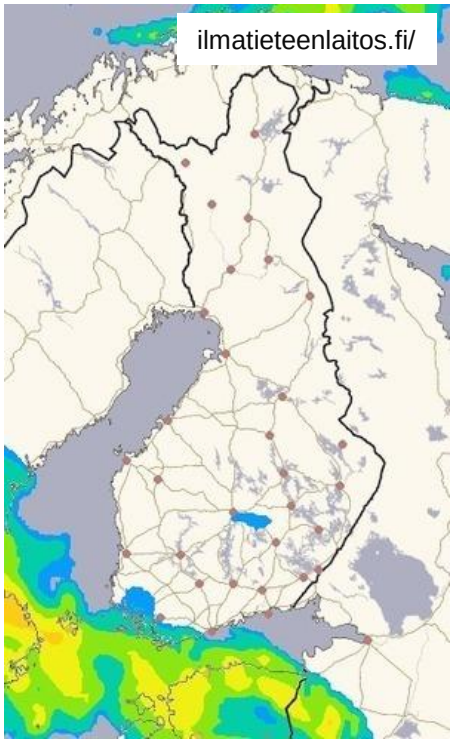
Surface run-off and nutrients

- Surface run-off of water likely to increase during winter, reduce during summer
- May lead to increased nutrient flow from the mainland, need for management activities at land
- Fish farming quotas and licenses impacted by environmental legislation
- Need for a holistic approach to control and survey total nutrient loads



Hydrology	Season	Predicted change	Notes
Surface run-off	Winter Summer	+ -	In winter, 30-60% increase by 2050 In summer, 20% reduction by 2050
Nutrient load from land	Winter Summer	+ -	

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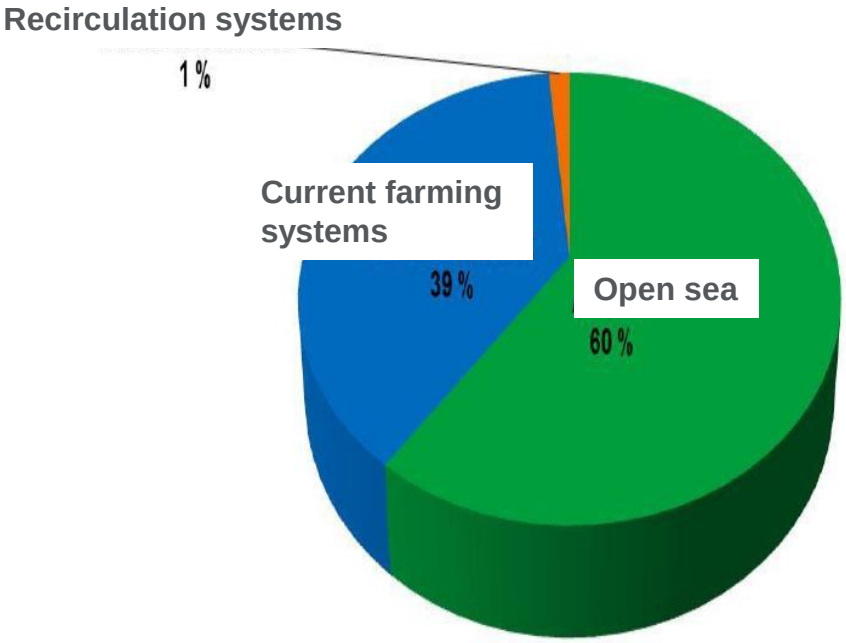
Conclusions

- Climate change has mostly positive effects on aquaculture at Gulf of Bothnia
- Globally, pressure to produce farmed fish at open sea, in a sustainable way

- Need for sustainable development
- Location of farms one key (maritime spatial planning), well-planned with other stakeholders



FAO: Where is fish farmed in 2030

Brändö Lax, Kustavi
Kuva: Markus Kankainen

Savo Lax, Rautalampi
Kuva: YLE

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