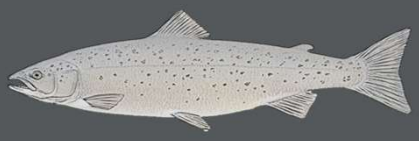
Effects of climate change on fishing

Cumulative impacts and systemic solution seeking



Päivi Abernethy, PhD, MRes, MSc
Senior (Social) Scientist, Luke
ACAF Meeting, Rovaniemi, November 15, 2021

1

What about climate change & fish(ing)

- Climate change is predicted to affect the hydrology of Finland considerably. By 2080, expected increase of
  - average annual temperature by 3–7◦C
  - average precipitation by 13–26%, mostly during winter
- The hydrology of Finland characterised by temperature-sensitive snow-dominated seasonality, with snow accumulating during winter and snowmelt during spring.
  - relatively modest increases in temperature can result in substantial changes in runoff patterns

Veijalainen, N., Dubrovin, T., Marttunen, M., & Vehviläinen, B. (2010). Climate change impacts on water resources and lake regulation in the Vuoksi watershed in Finland. *Water Resources Management*, 24(13), 3437-3459.

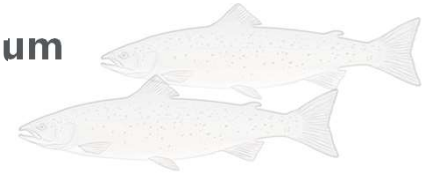
2

Effects of climate change on fish and fishing

- Open water fishing **seasons** longer;
  reduced ice cover will interfere with traditional winter fishing
- Increasing frequency and intensity of storms will reduce the **number of fishing days**
- **Different fish species react differently** to climate change, e.g.
  - ✓ Warm water species will benefit from the temperature changes (Cyprinids, perch and pikeperch)
  - ✓ Cold water fish will suffer (Arctic char, Atlantic salmon, brown trout, burbot and grayling)
- Alien species and numerous diseases will become more common, food competition might increase, changes in acidity may affect various factors
- **Cumulative social-ecological effects complicate the situation**

3

Climate does not take place in a vacuum to pristine environments



Salmon as an example

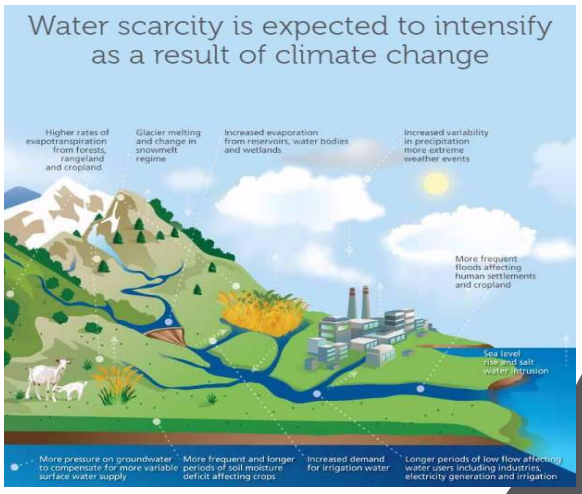
The struggling salmon stocks & cumulative impacts in complex social-ecological systems

- Salmon stock collapses
- Increasing temperatures & acidification
- Pollution, fishing pressures & other human activities
- **Opportunities in the need for new ways of thinking**

4

Direct and indirect climate impacts

- Spawning season
- Warmer waters
- Acidification
- Toxic blooms/ pathogens
- Contaminant release
  - ✓ Temperature
  - ✓ Flooding
- Ice cover reduction
- Water eutrophication
- Near-bottom oxygen levels
- Less fresh water
- Increased ocean levels



A tweet by the Food and Agriculture Organization (FAO) of the United Nation, Jan.31, 2017 https://twitter.com/FAOclimate/status/826467671625580546

Luke NATURAL RESOURCES INSTITUTE FINLAND

5

Examples of complex developments: Acidification

- **Impacts of acidification in pink salmon**: Early exposure to high levels of CO2 during the larval stage of development had significant negative effects on the fish's size, metabolism and sense of smell - ability to sense threats in their environment (Weight loss and impaired navigation)
- **Different conclusions in Nova Scotia & Norway:** Acid deposition/increased atmospheric CO_2 and increased precipitation
  - ✓ Challenges in predicting outcomes for complex issues

Ou et al. (2015). *Nature Climate Change*, 5(10), 950-955; Farmer (2000). Fisheries and Oceans Canada; Wright et al. (2017).. *Science of The Total Environment*, *574*, 128-138.

Luke

6

Unexpected effects of climate change

Science of The Total Environment
Volumes 476–477, 1 April 2014, Pages 165-180

Flood-related contamination in catchments affected by historical metal mining: An unexpected and emerging hazard of climate change

S.A. Foulds [a] A, P.A. Brewer [a], M.G. Macklin [a], W. Haresign [b], R.E. Betson [a], S.M.E. Rassner [a]

Show more

+ Add to Mendeley Share Cite

https://doi.org/10.1016/j.scitotenv.2013.12.079 Get rights

Highlights

- Pb concentrations in flood sediments exceed threshold values, in some samples by a factor of 82.
- Contamination of animal feed caused blood Pb poisoning and mortality in cattle.

Different ways of knowing:

Different roles of

- science (incl. modeling & monitoring) &
- local/ Indigenous knowledge

7

Invitation to rethink fishing & the governance of fishing in the changing climate

- Bringing together different ways of knowing to address complex problems
  - ✓ Natural sciences
  - ✓ Social sciences
  - ✓ Local & regional practitioners
  - ✓ Local knowledge
  - ✓ Indigenous knowledge
  - ✓ Decision-makers
- Reframing the problems and ways in which we think about fish monitoring, fish(ing) governance & regulations

8

The power of phone apps, GIS mapping, citizen science, & local/Indigenous knowledge

https://globalnews.ca/news/8365724/indigenous-guardians-front-lines-climate-change/

9

Alternative/complementary monitoring mechanisms

- The Heiltsuk Nation's traditional-style fish weir in the Koeye River in BC
- Allow fishers to target specific salmon runs and enable in-season monitoring
- Fishers can assess a run's health in real time, while releasing non-target species unharmed

Credit: B.Deroy, https://phys.org/news/2020-12-indigenous-revitalize-pacific-salmon-fisheries.html

Atlas et al. (2017). Ancient fish weir technology for modern stewardship: Lessons from community-based salmon monitoring. *Ecosystem Health and Sustainability*, 3(6), 1341284.

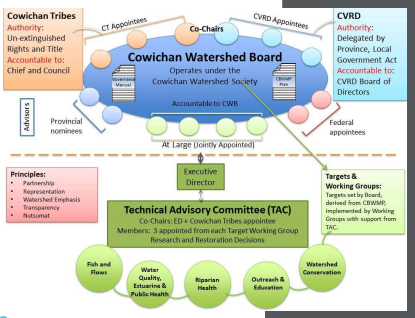
Luke NATURAL RESOURCES INSTITUTE FINLAND

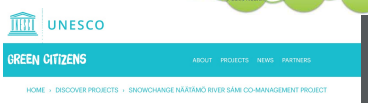
10

Value of working together locally

The CWB's mandate is to provide leadership for sustainable water management to protect and enhance ecosystem health in the Cowichan Watershed guided by the Cowichan teaching:

Muks 'uw'slhilhukw'tul –
We are all inter-connected.





Snowchange Näätämö River Sámi Co-Management Project

"We do this because it's the right thing to do. It's not because we're mandated by the Province – that's not what drives reconciliation. It's local relationships." (Brian Carruthers, CVRD Chief Administrative Officer)

"You guys are just as important to us as we are to you." (Chief William Seymour, Chief of Cowichan Tribes First Nation)

Luke
NATURAL RESOURCES INSTITUTE FINLAND

11

Thank you

Päivi Abernethy
paivi.abernethy@luke.fi

12