

Case study 7F – Northern Norwegian Lakes

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Reference case

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This project has received funding from the European Union's Horizon 2020 research and innovation action under grant agreement no. 677039



Case study description

- Target species are cold water salmonids exposed to sustenance and recreational fishery

Trout



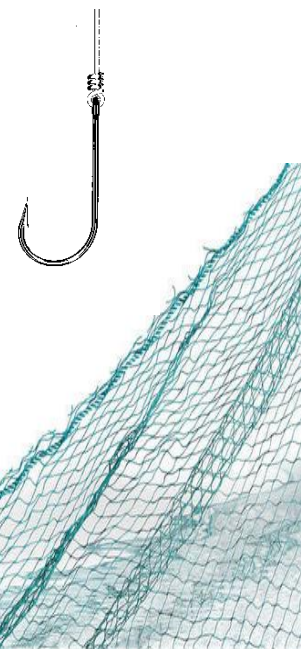
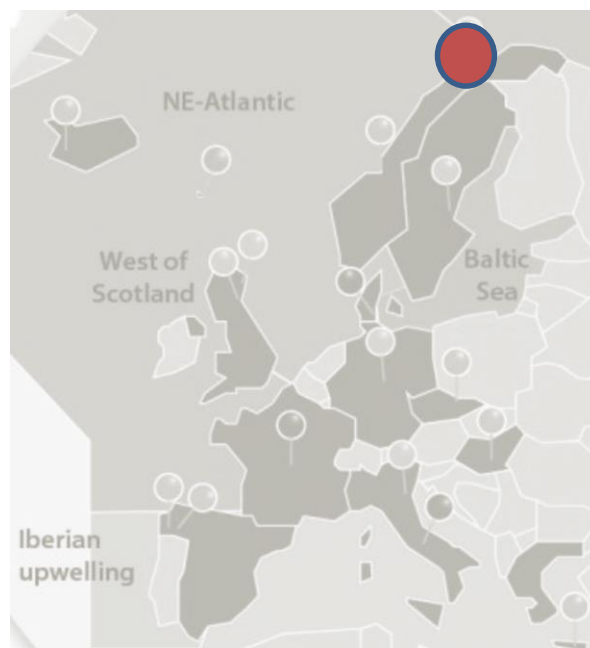
Charr



Whitefish



Vendace



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Biological forecasting and modelling

- Temperature affinity and distributions

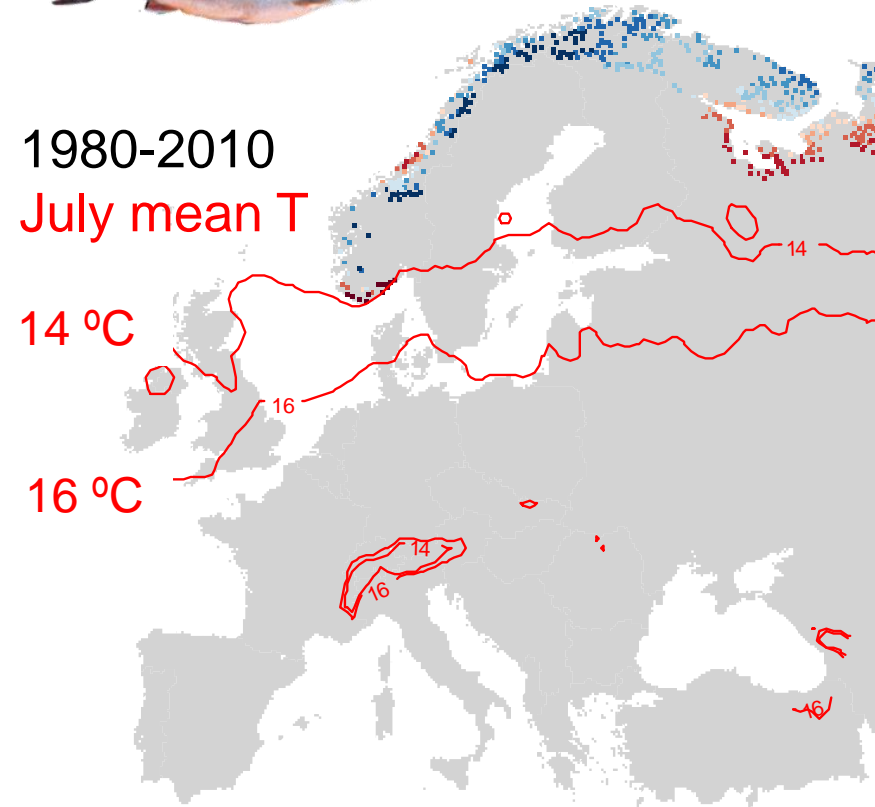


1980-2010

July mean T

14 °C

16 °C



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Biological forecasting and modelling

- Temperature affinity and distributions

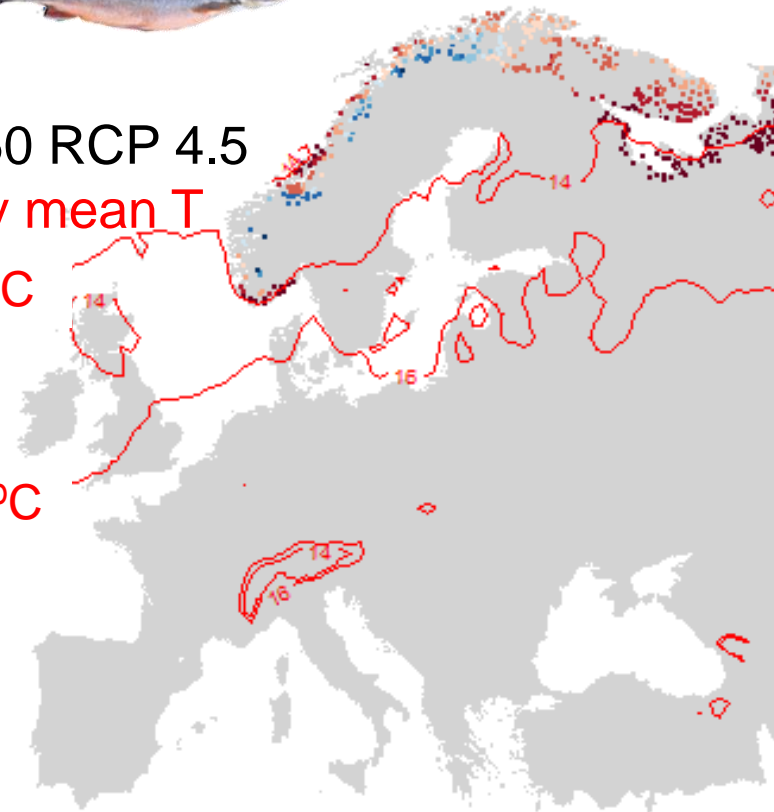


2050 RCP 4.5

July mean T

14 °C

16 °C



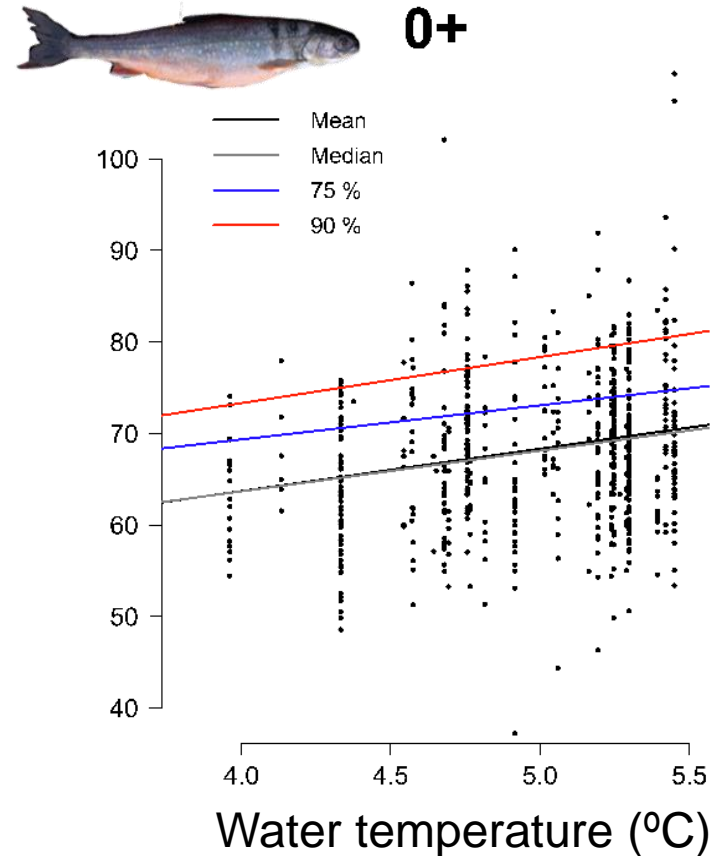
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Biological forecasting and modelling

- Temperature dependent growth
- Increase in **growth rates** with warming since 1980s documented for Arctic charr, whitefish and vendace



Smalås et al. In prep.

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Biological forecasting and modelling

- IBM forecasts

- climate scenarios rcp-4.5-8.5, climate models regionally downscaled (25x25 km - CORDEX)



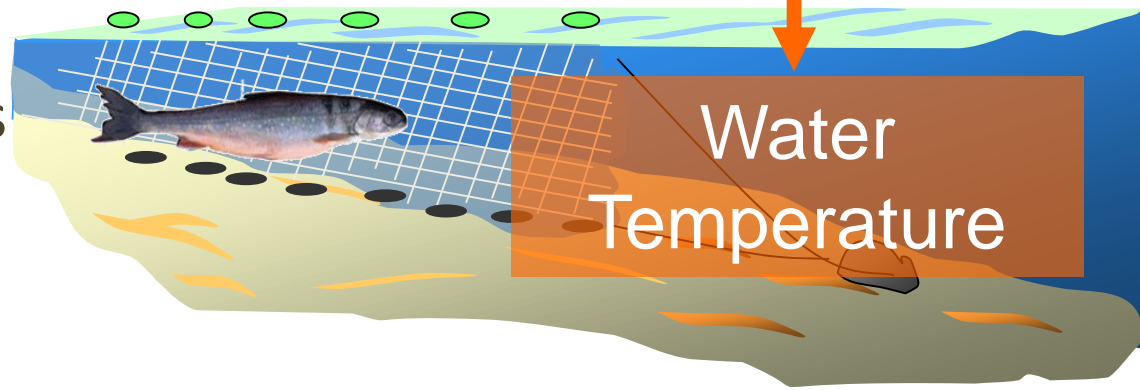
- air-water temperature process models (1D - GLMr)

RCP 4.5, 8.5

Climate
change

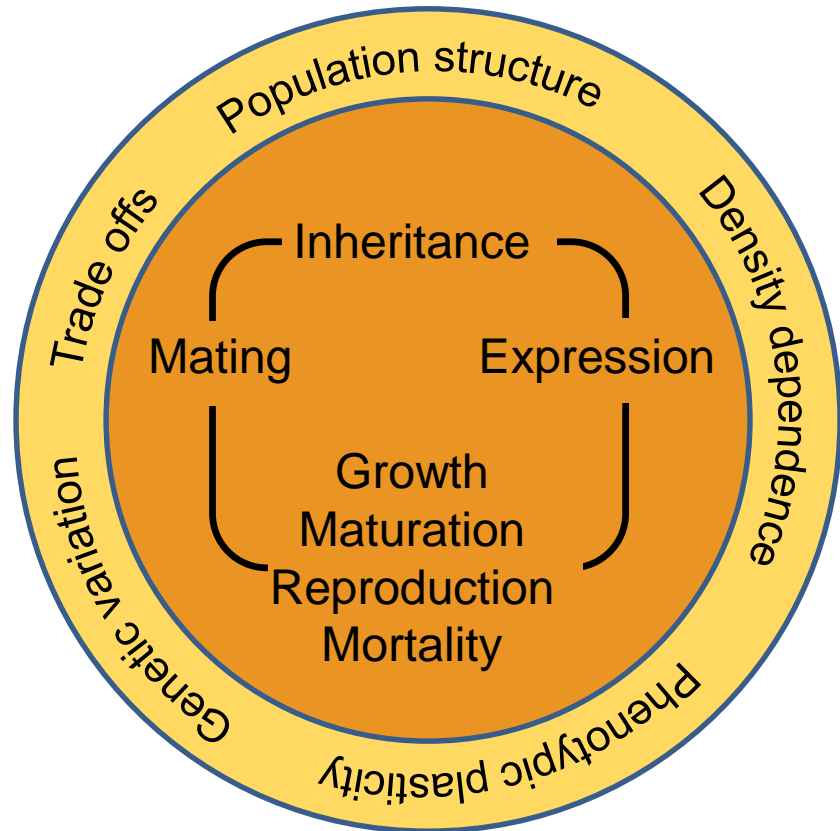
Air Temperature

Water
Temperature



Biological forecasting and modelling

- IBM forecasts



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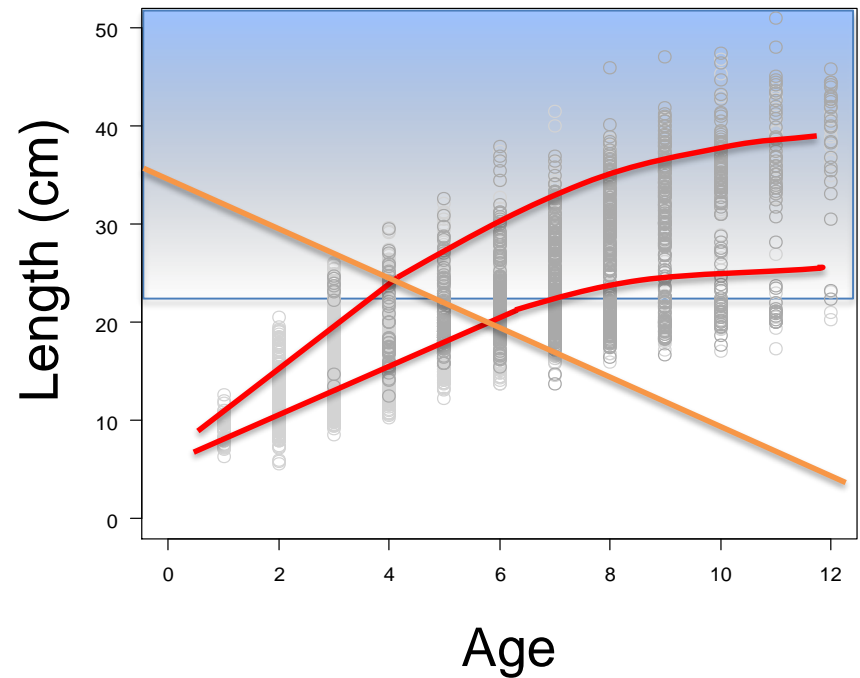
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Biological forecasting and modelling

- IBM forecasts



Biological forecasting and modelling

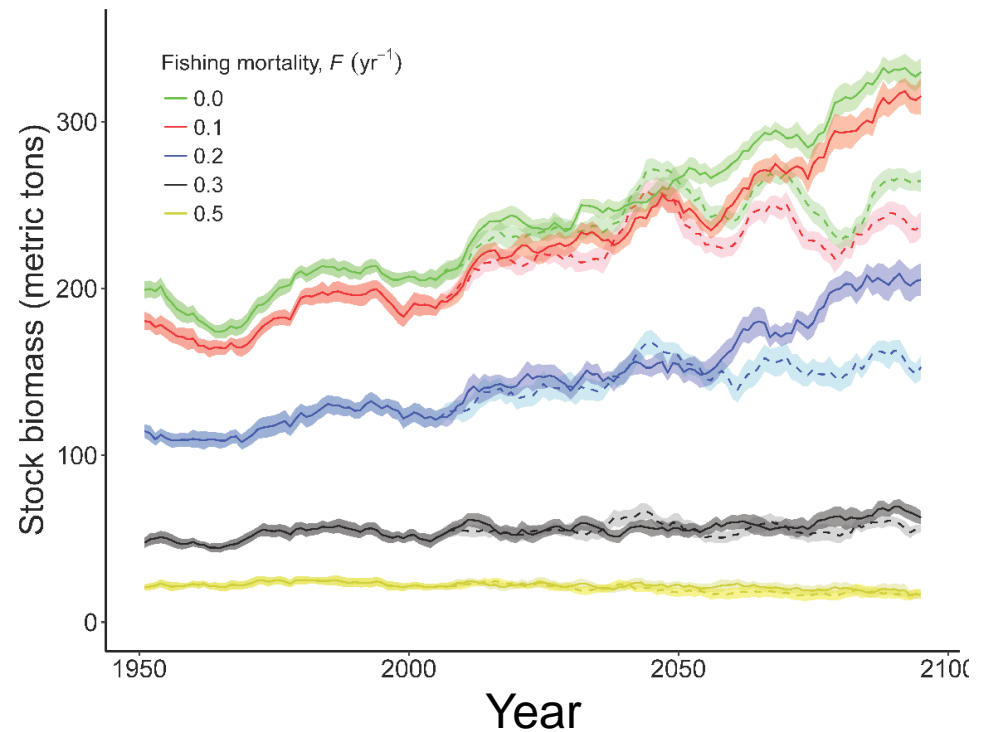
- IBM forecasts



F:
0.0
0.1
0.2
0.3
0.5



Biomass



Smalås et al. 2019 *J App Ecol*

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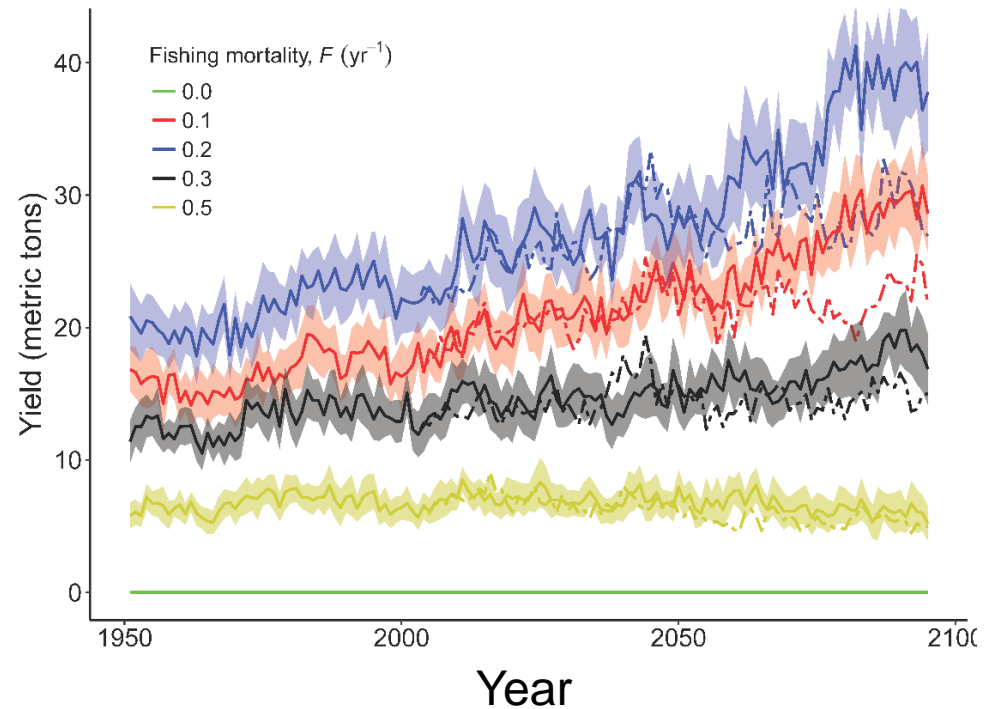
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Biological forecasting and modelling

- IBM forecasts



F:
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0.5



Smalås et al. 2019 *J App Ecol*

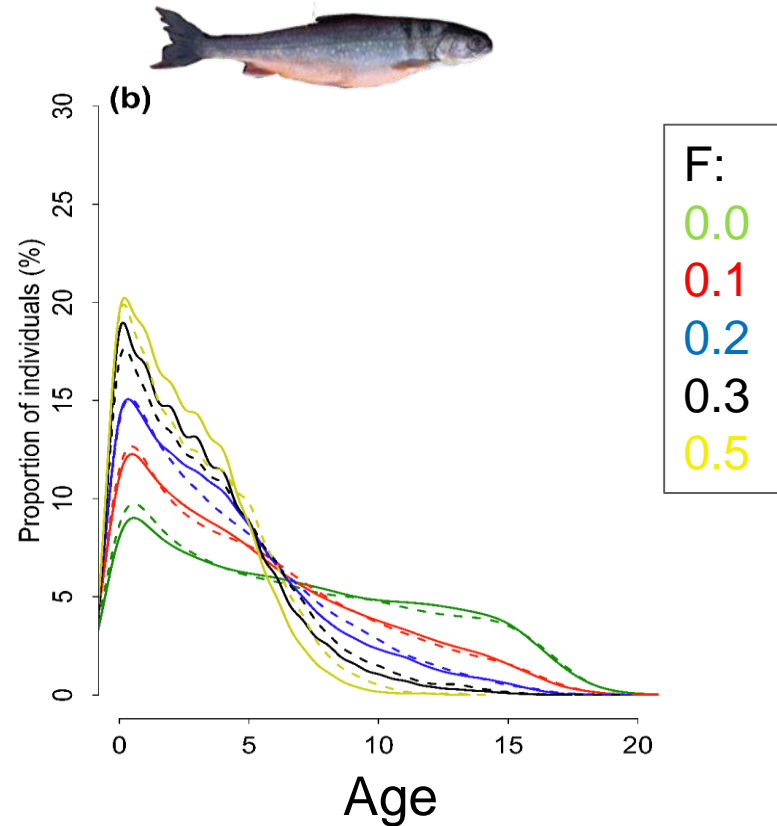
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Biological forecasting and modelling

- IBM forecasts



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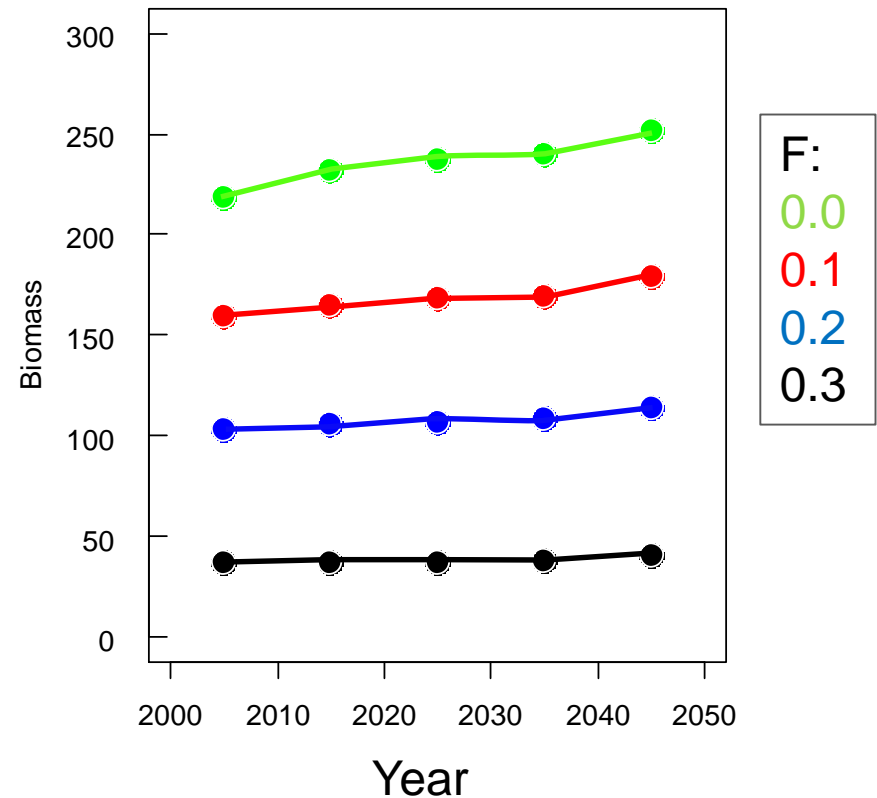
Biological forecasting and modelling

- IBM forecasts



RCP 4.5

Biomass



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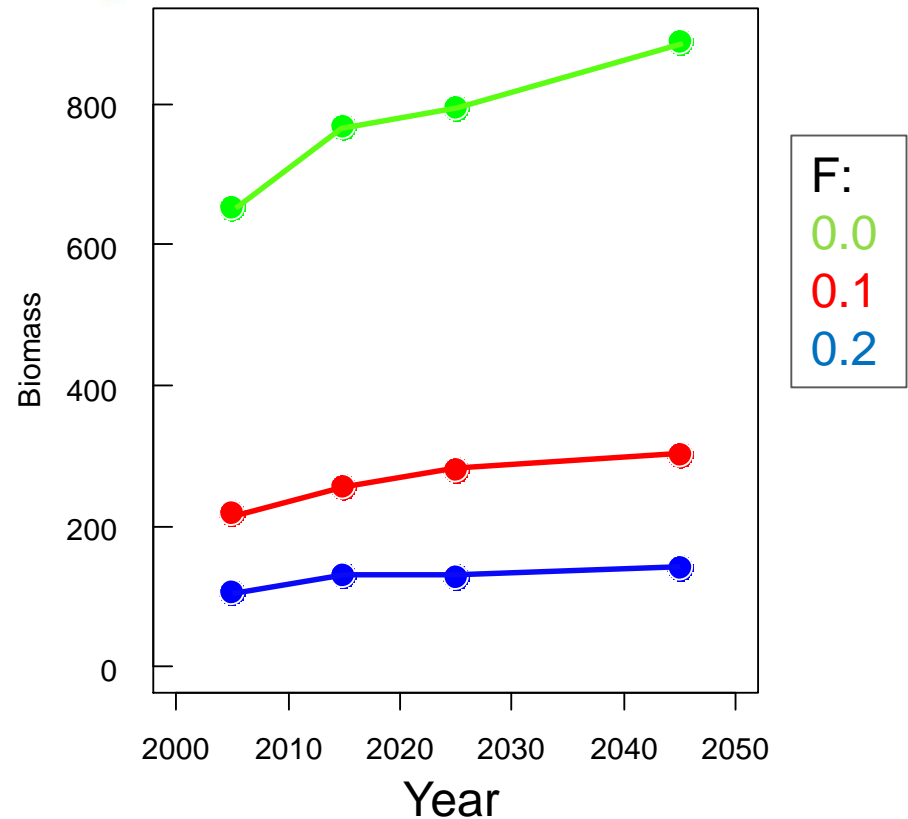


Biological forecasting and modelling

- IBM forecasts



RCP 4.5
Biomass



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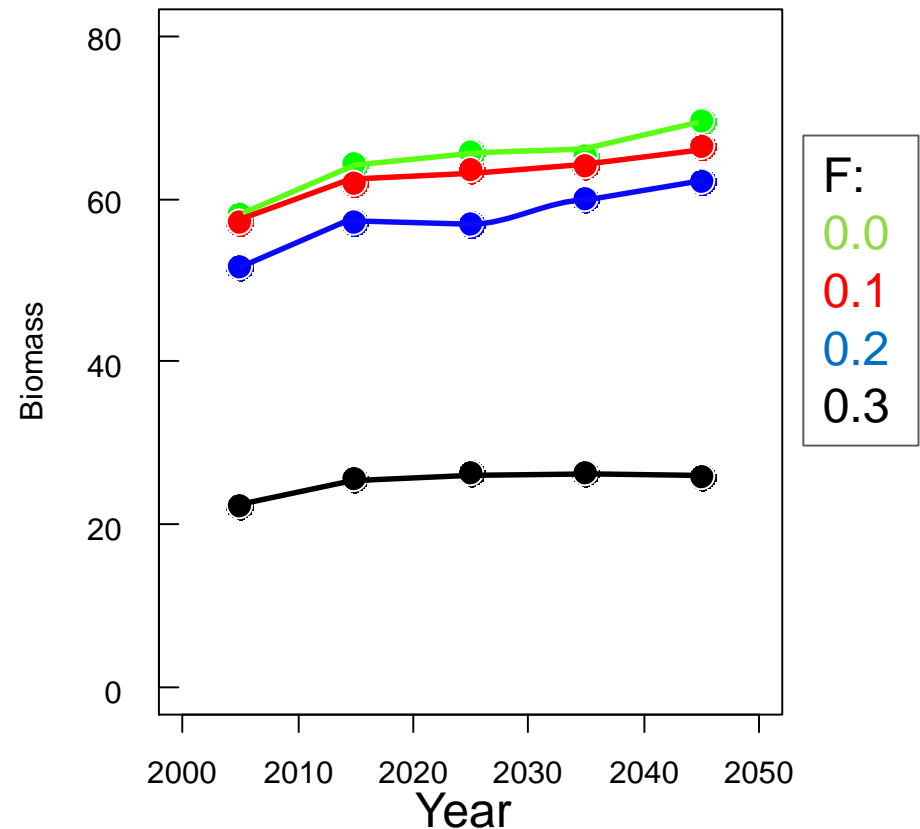


Biological forecasting and modelling

- IBM forecasts



 **RCP 4.5**
Biomass



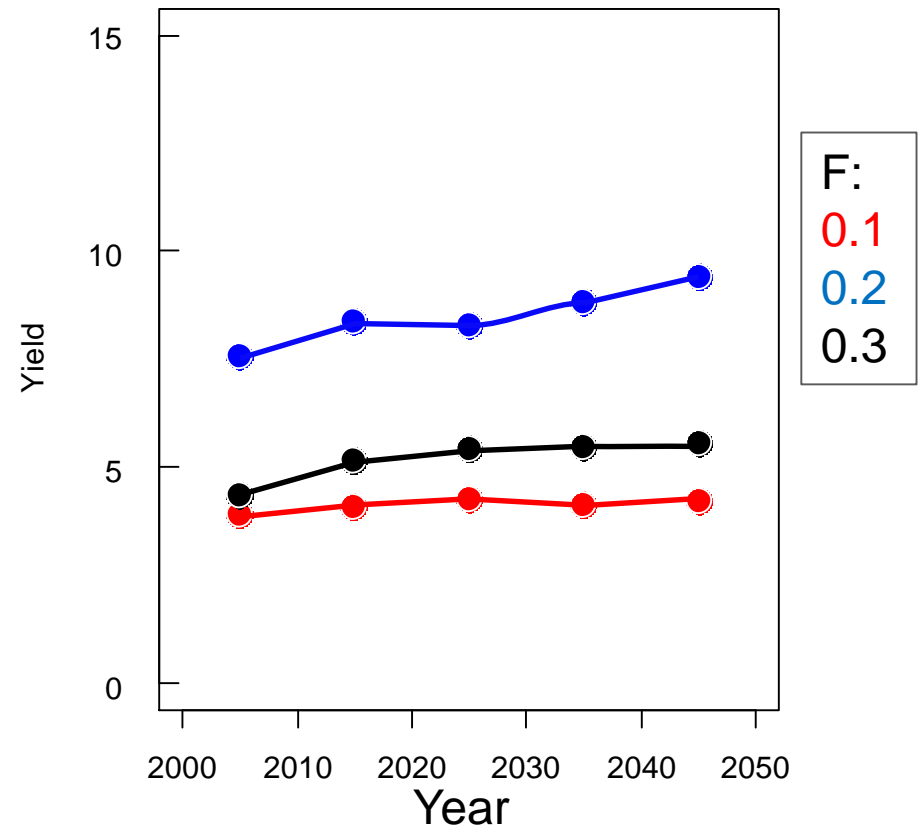
Biological forecasting and modelling

- IBM forecasts



RCP 4.5

Yield



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Major risks and opportunities

- Risks
 - Local loss of cold-water species like Arctic charr
 - Increased vulnerability of exploited species to environmental perturbations
 - Northward expansion of southerly species
- Opportunities
 - Increased growth and production



Adaptation measures

- Protection of cold-water fish
 - Adaptive monitoring of sentinel lakes
 - Strict fishery management
 - Revision gillnets mesh-size minimum and range
 - Containment of invasive species and avoidance of introductions
- Fishery regulations
 - Fishermen's utilisation of emerging species



Impact on local level

- Increased monitoring and regulation of growing recreational fisheries driven by tourism expansion
- Need for stronger gillnets limitations where inland fishery is loosely regulated





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