C14A: Scottish shellfish aquaculture

Reference case

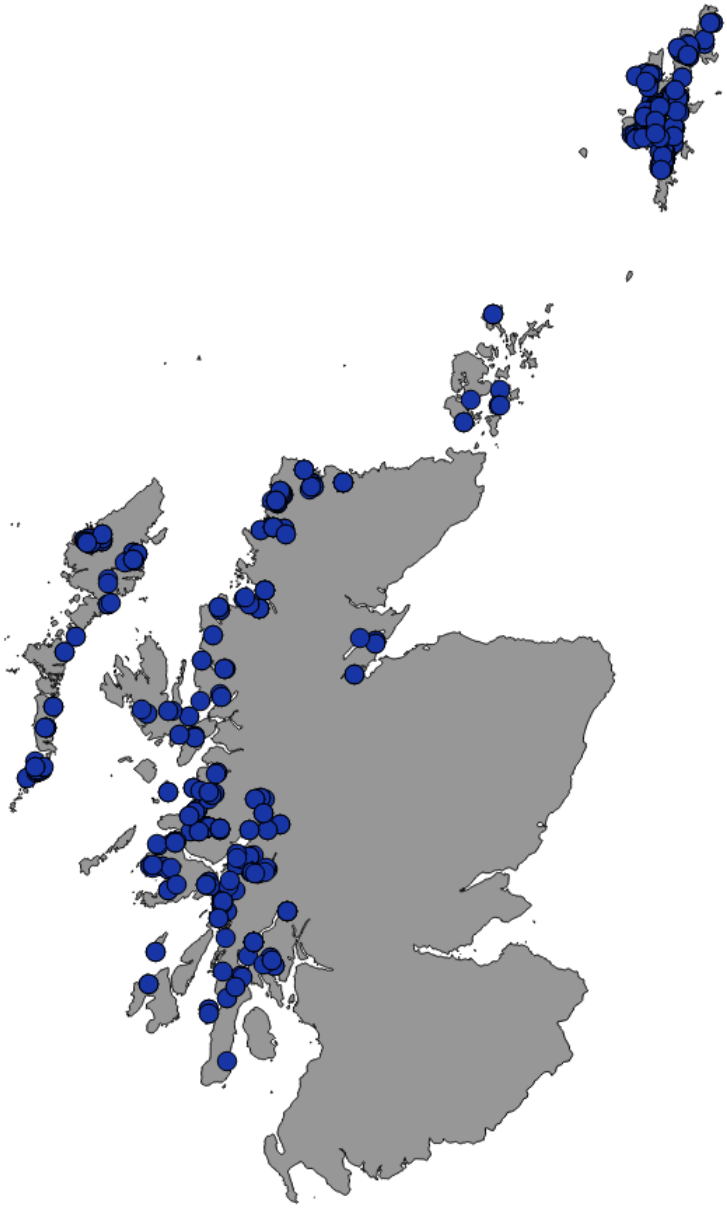
2020 International Forum on the Effects of Climate Change on Fisheries & Aquaculture
25-26 February 2020, Rome

ClimeFish

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

Case study description

- 2018 there were 7212 tonnes of shellfish produced in Scotland
  - Blue mussel (95%)
  - Pacific oyster (4.5%)
  - Native oyster, Scallop, Queen scallop (<1%)
- In 2018, the total value at first sale approximately £9.5 million
- 130 active businesses



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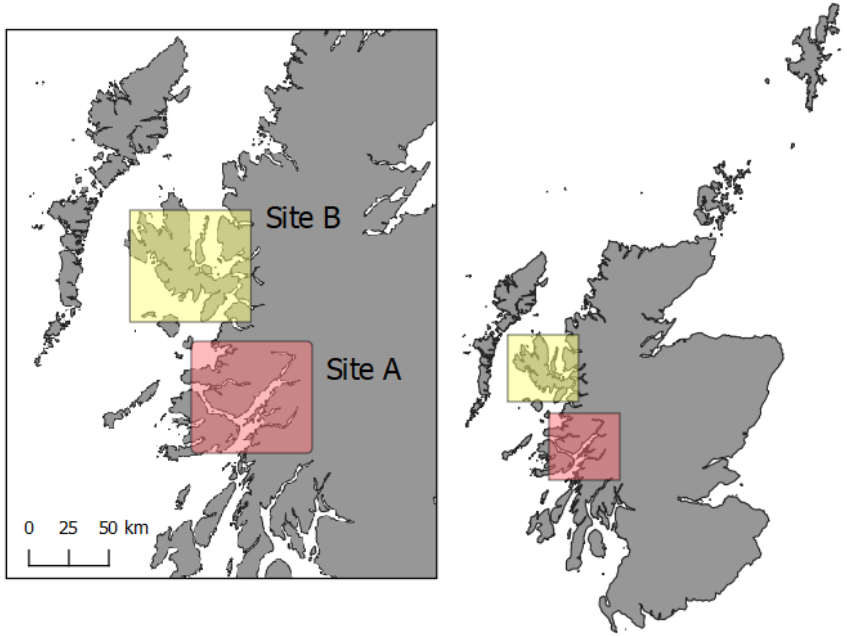
C14A Scottish shellfish production

- Mussels
  (*Mytilus edulis*)

- Pacific oysters
  (*Crassostrea gigas*)

- West coast of Scotland



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Biological forecasting

- Modelled growth using Dynamic Energy Budget (DEB) model
  - Future climate projections for RCP4.5 and RCP8.5
    - Temperature
    - Chl-a (proxy for food)
  - Two individual shellfish in two different areas on the west coast

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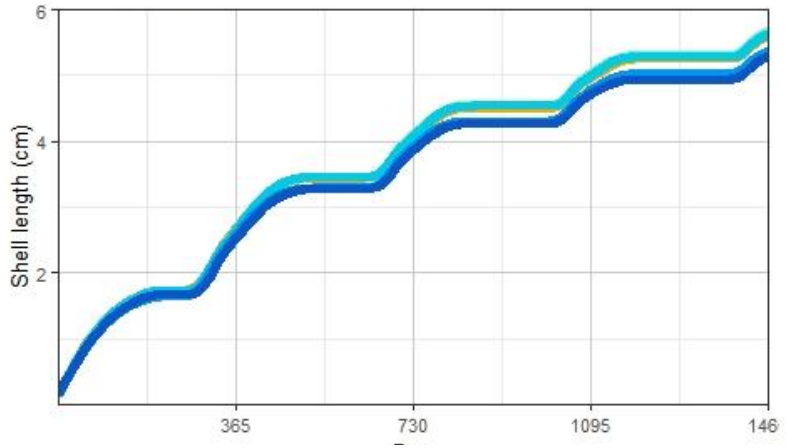
Biological forecasting: Mussels

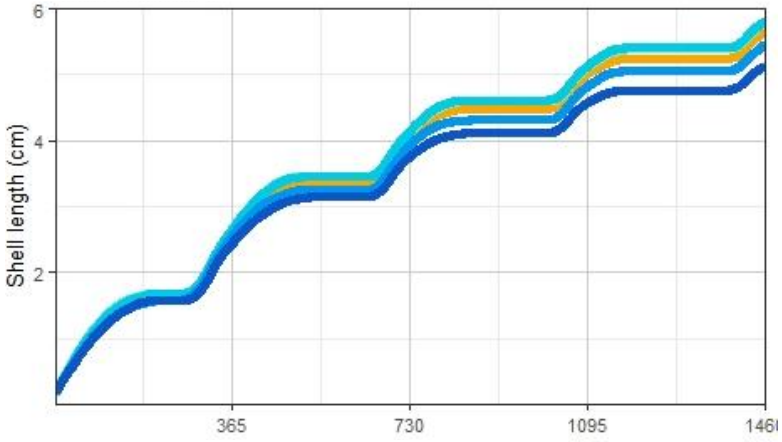
Site A (RCP 4.5)



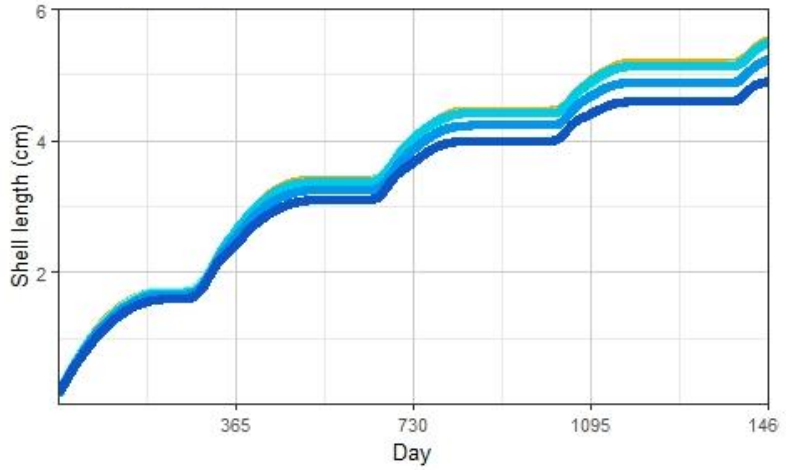
Time period

- 2006 – 2015
- 2016 – 2025
- 2026 – 2035
- 2046 – 2055
- 2061 – 2070

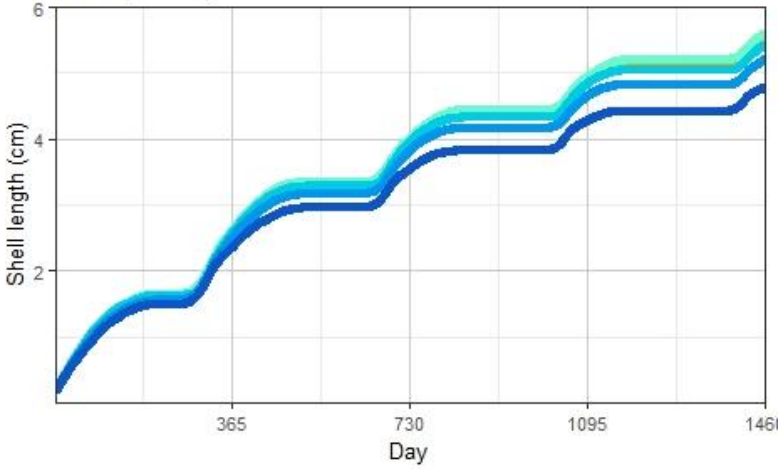
Site B (RCP4.5)



Site A (RCP 8.5)



Site B (RCP8.5)



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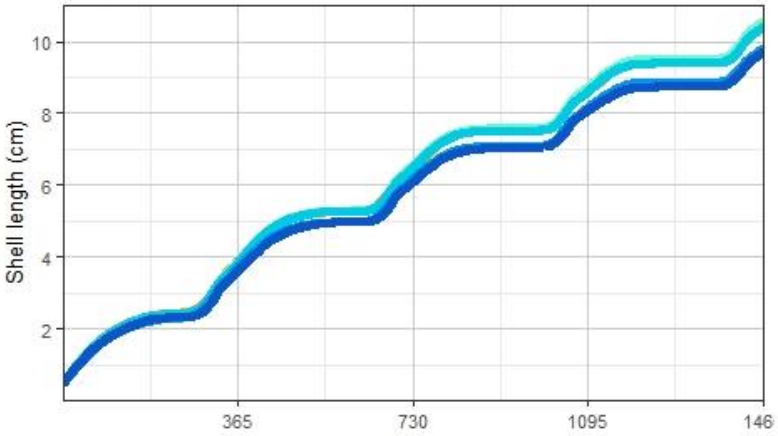
Biological forecasting: Oysters

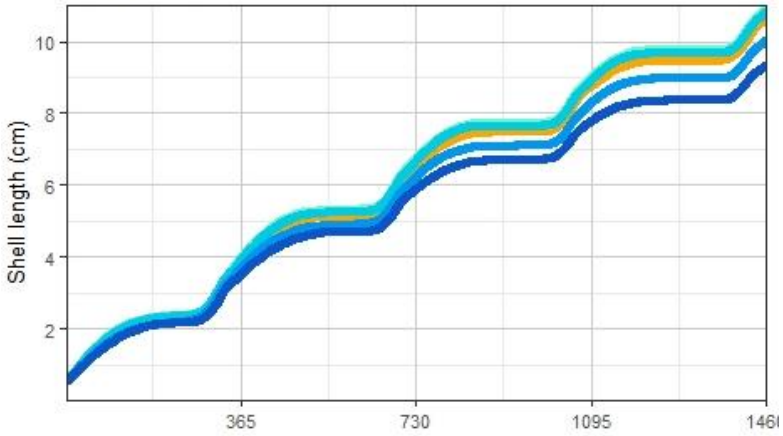
Site A (RCP 4.5)



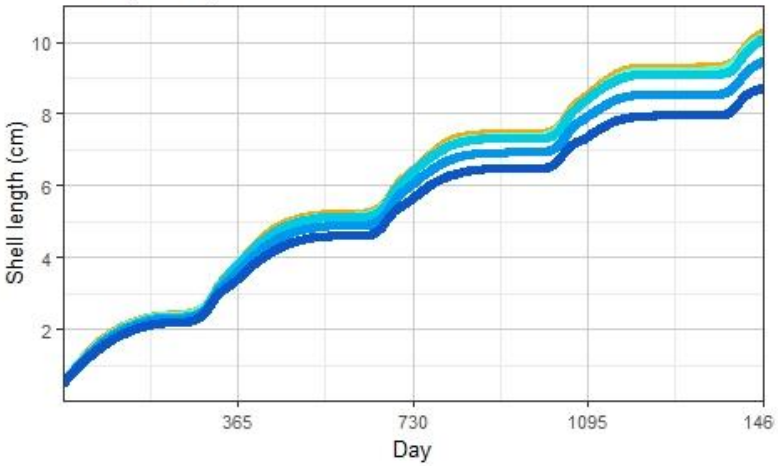
Time period

- 2006 – 2015
- 2016 – 2025
- 2026 – 2035
- 2046 – 2055
- 2061 – 2070

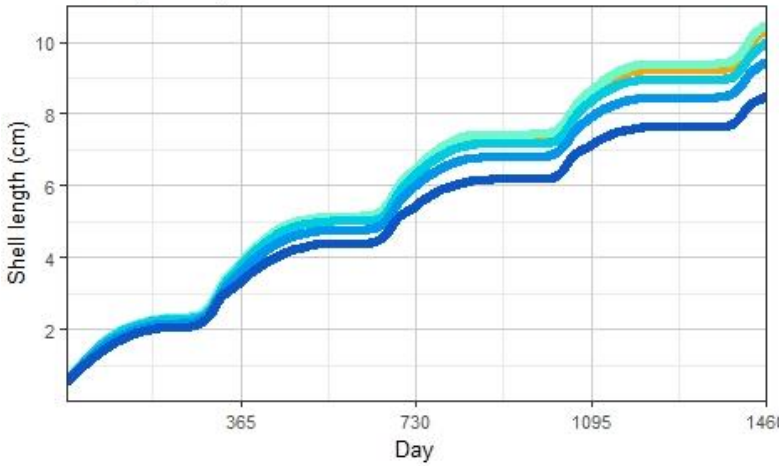
Site B (RCP4.5)



Site A (RCP 8.5)



Site B (RCP8.5)



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Biological forecasting

- Under RCP4.5 and RCP8.5, mussels and oysters at the two sites both show reduction in potential growth in future decades
- Longer time to market size
- Reduction in potential growth is due to reduced food availability (Chlorophyll as proxy)

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Biological forecasting

- Other factors that would affect growth and production that were not modelled include:
  - Disease outbreaks
  - Storminess
  - Spat availability
  - Changes in salinity
  - Heatwaves

- Major constraint for biological forecasting is data availability

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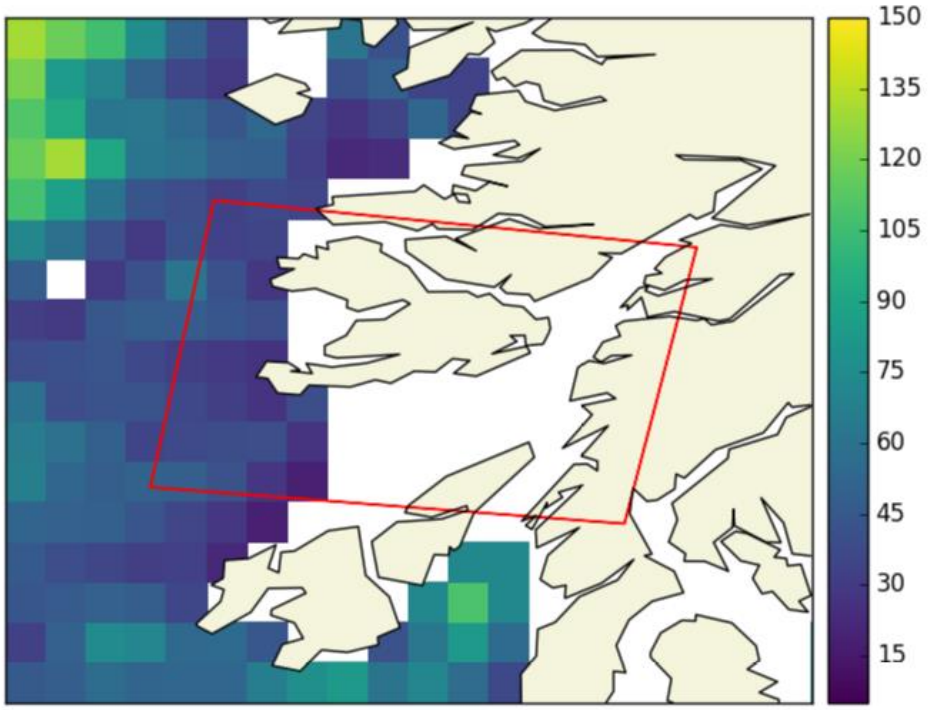
Biological forecasting



Downscaled climate model projections do not cover the coastal and intertidal areas where shellfish are produced

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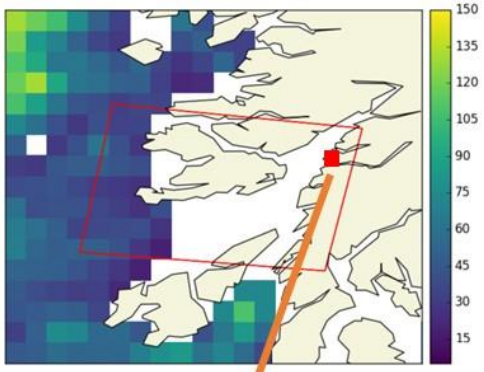
Impact on local level



Climate model
West coast

Climate model
Coastal bay

Need better resolution climate models and more *in-situ* data

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Impact on local level

- Regional downscaled climate model projections are more suitable for open ocean.
- Lack of data for coastal and intertidal areas where Scottish shellfish production takes place.
- Production potential highly variable between sites.

We need more long-term monitoring of environmental conditions and physiological response of shellfish is Scottish waters

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Summary

- Many uncertainties and knowledge gaps
  - More data required, long-term monitoring studies, impact of short vs long term stressors and combination of stressors
- Need higher resolution climate models
  - Offshore conditions do not represent inshore/intertidal
- Need to consider spatial heterogeneity
  - Spatially explicit approach - but this requires more data
- Other factors should be considered in addition to growth
  - Spat availability, mortality, algae blooms, water quality

- **Difficult to generalise potential impact on other areas or Scottish industry overall – more research needed.**

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