Future distributions of Atlantic Bluefin Tuna: seasonal, decadal and centennial scales

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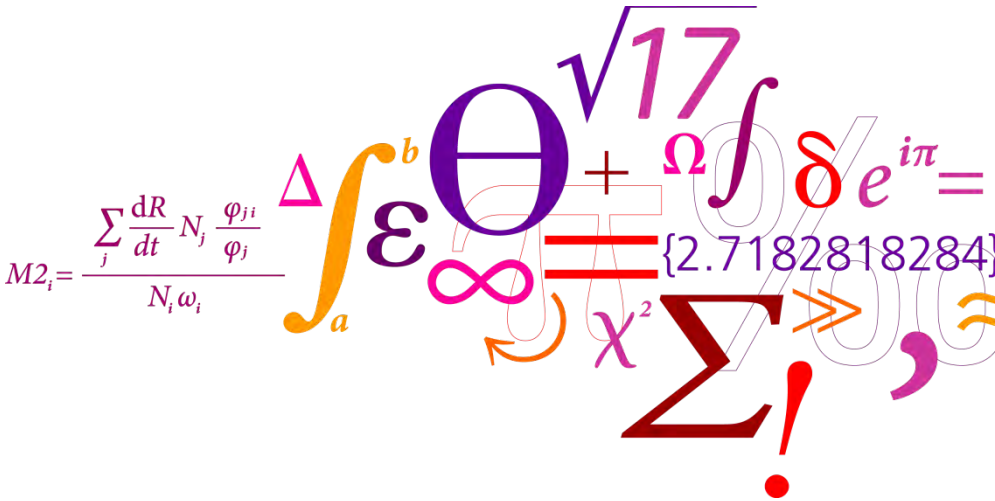

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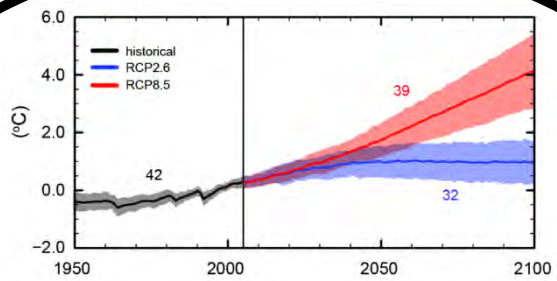
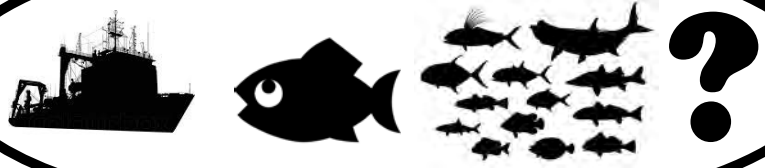
”Climate data is not climate information”

- Francisco Doblas-Reyes





Scientists

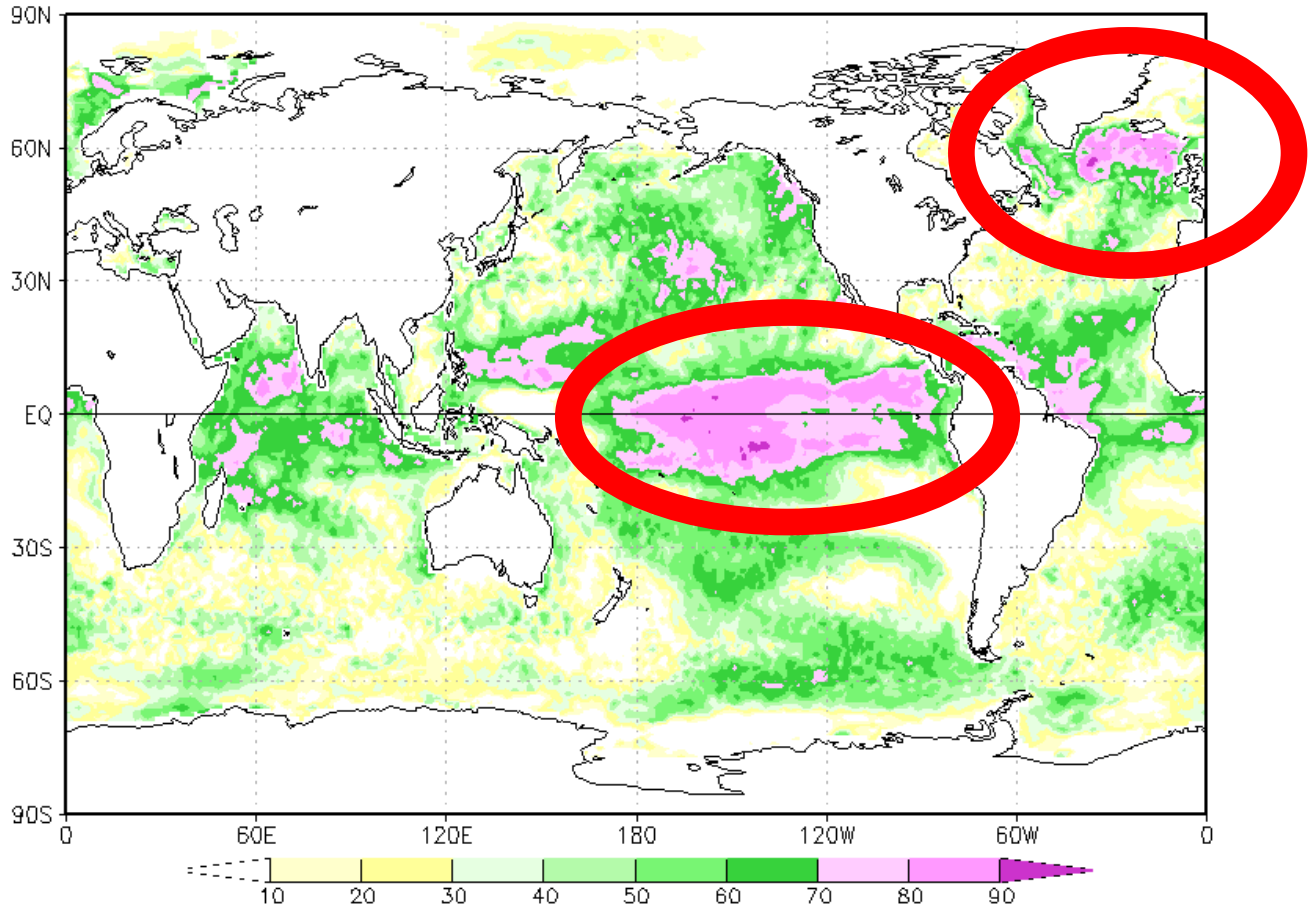
Stakeholders

Scientists

Days Weeks Months Seasons Years Decades Centuries

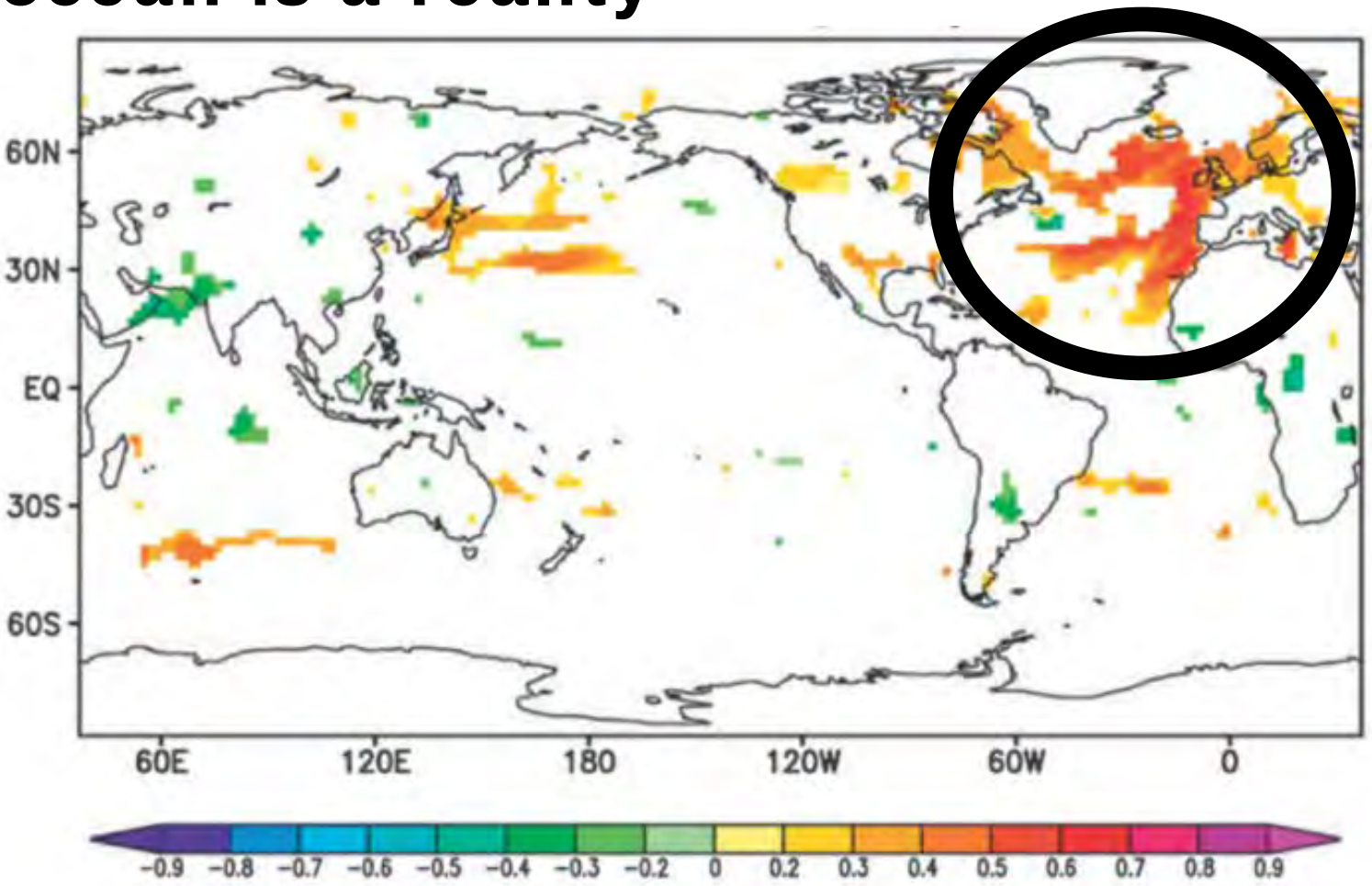
A revolution is taking place…

Seasonal-scale forecasting of the ocean is a reality



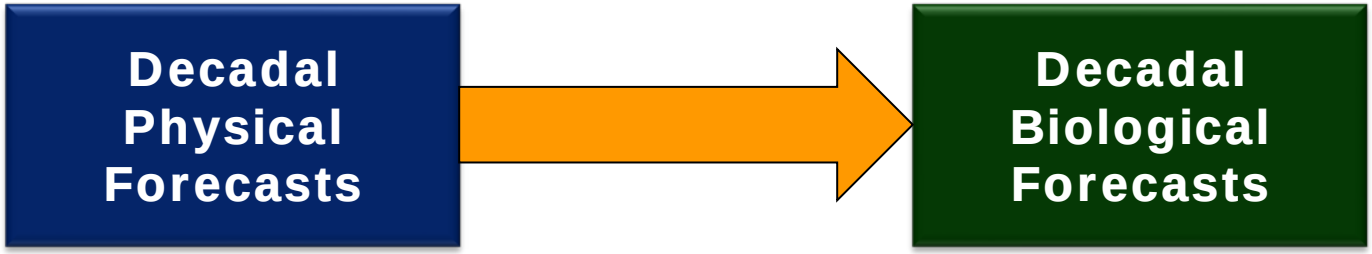
NMME Ensemble, SST Hindcast Correlation skill, 5 months lead

Decadal-scale forecasting of the ocean is a reality



MPI-ESM-LR Model, SST Hindcast Correlation skill, 2-5 years lead

Matei et al. J. Clim. 2012

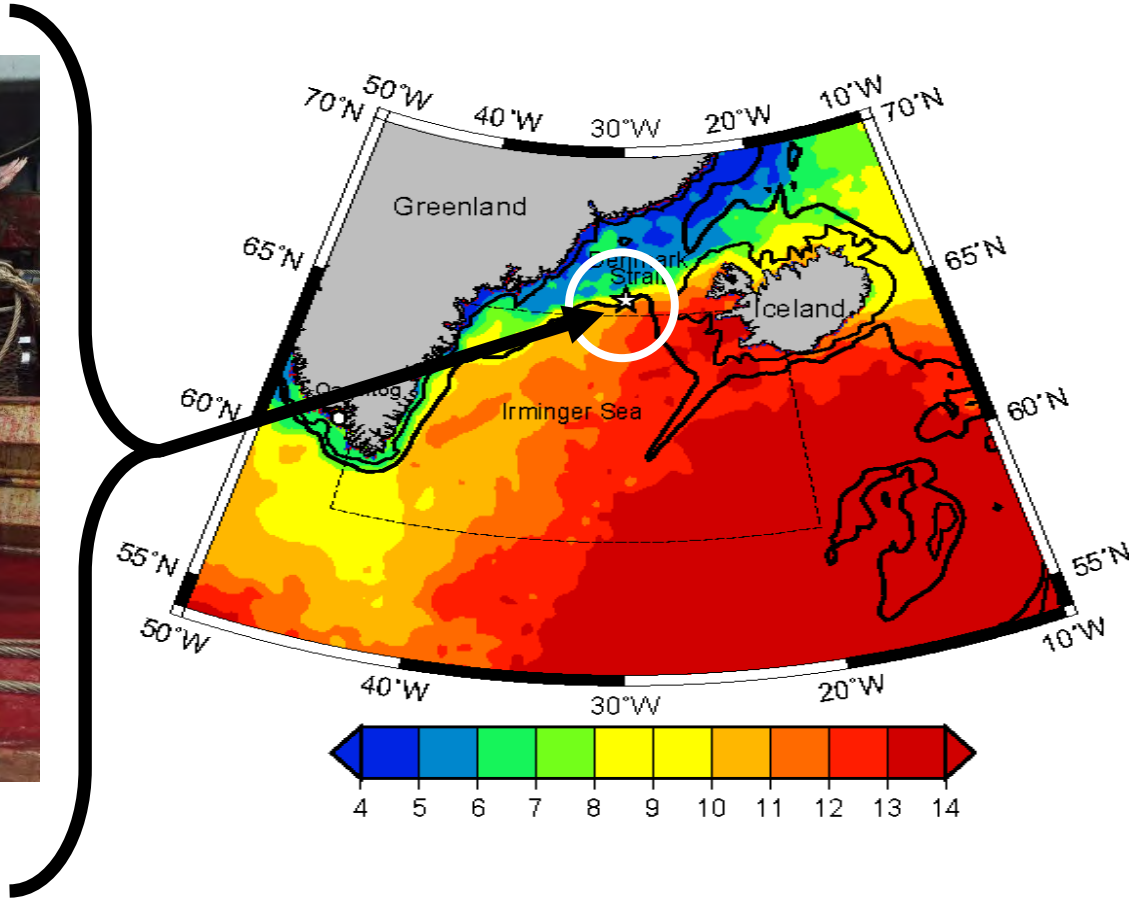


The Challenge
Can we make decadal forecasts of biology?

Catches of Bluefin Tuna in Greenland Waters

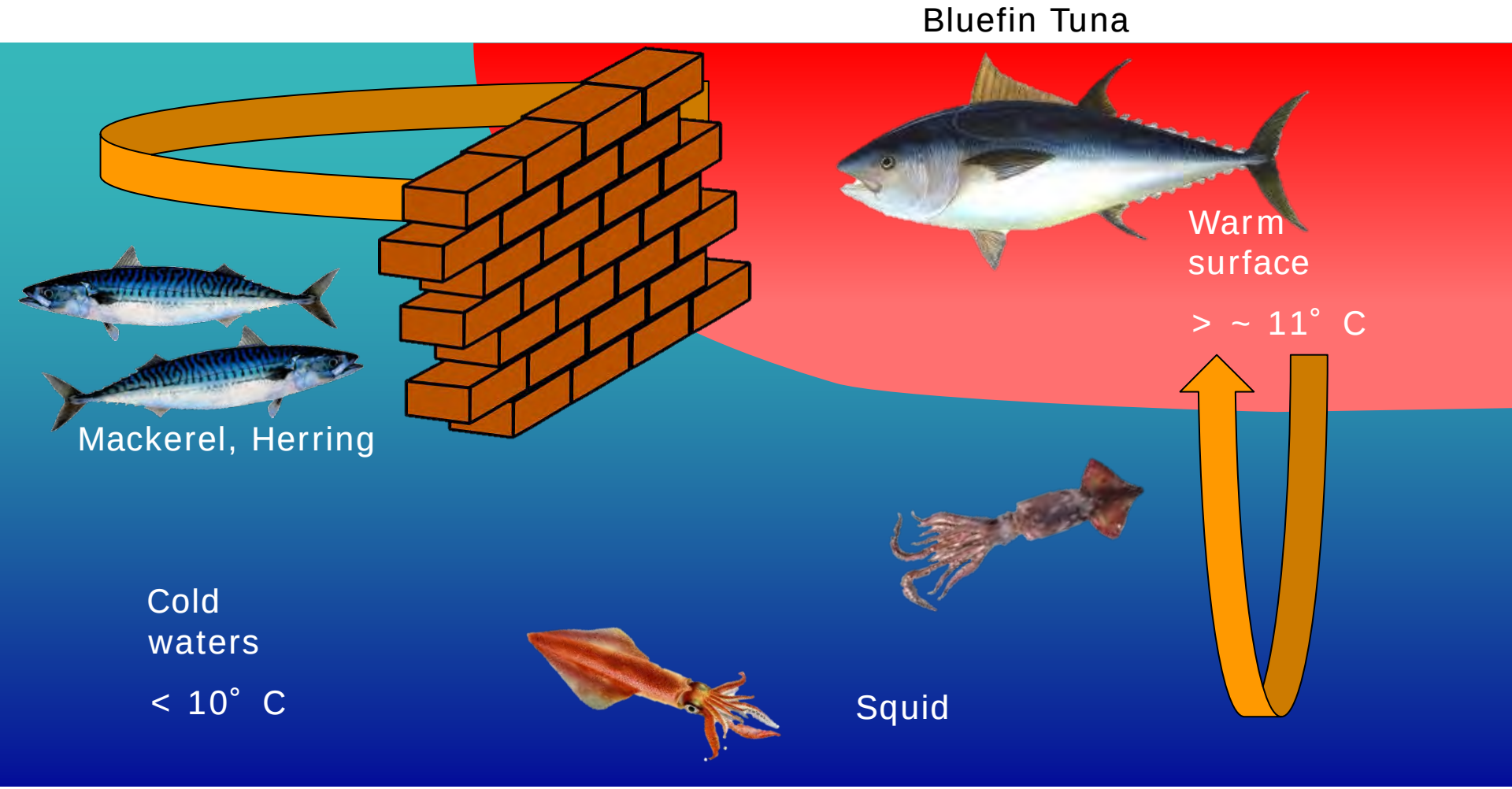
Aug 2012

Aug 2014

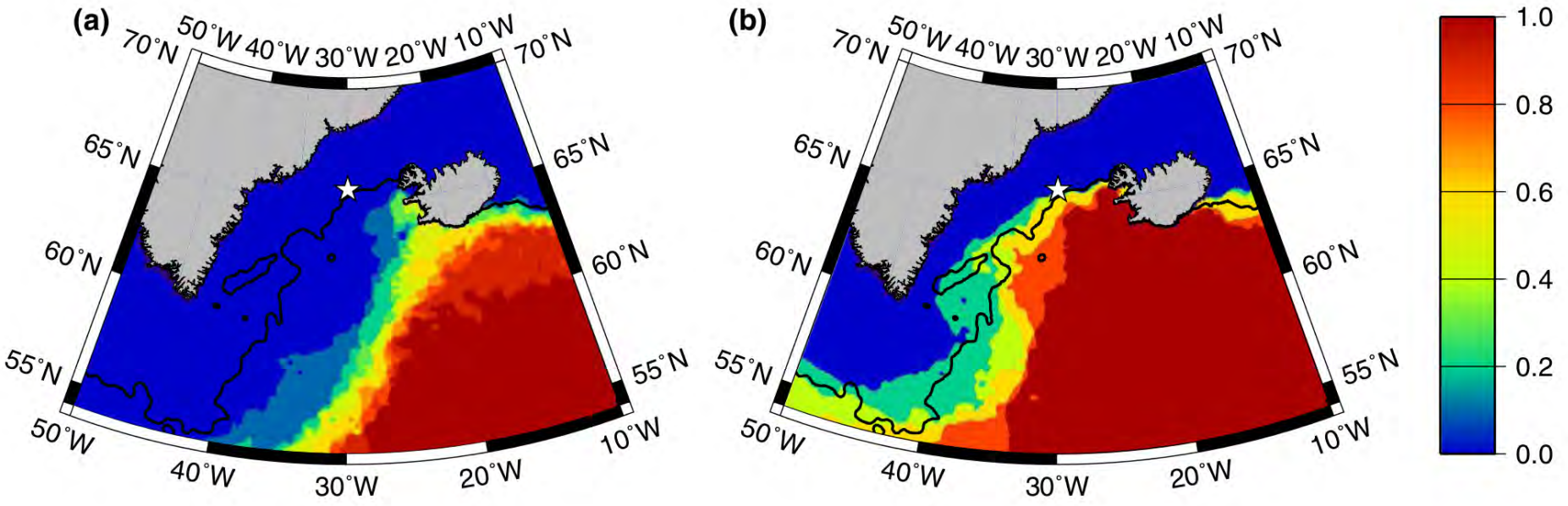


First report of tuna in this area in at least 370 years

Bluefin Tuna Habitat is thermally constrained



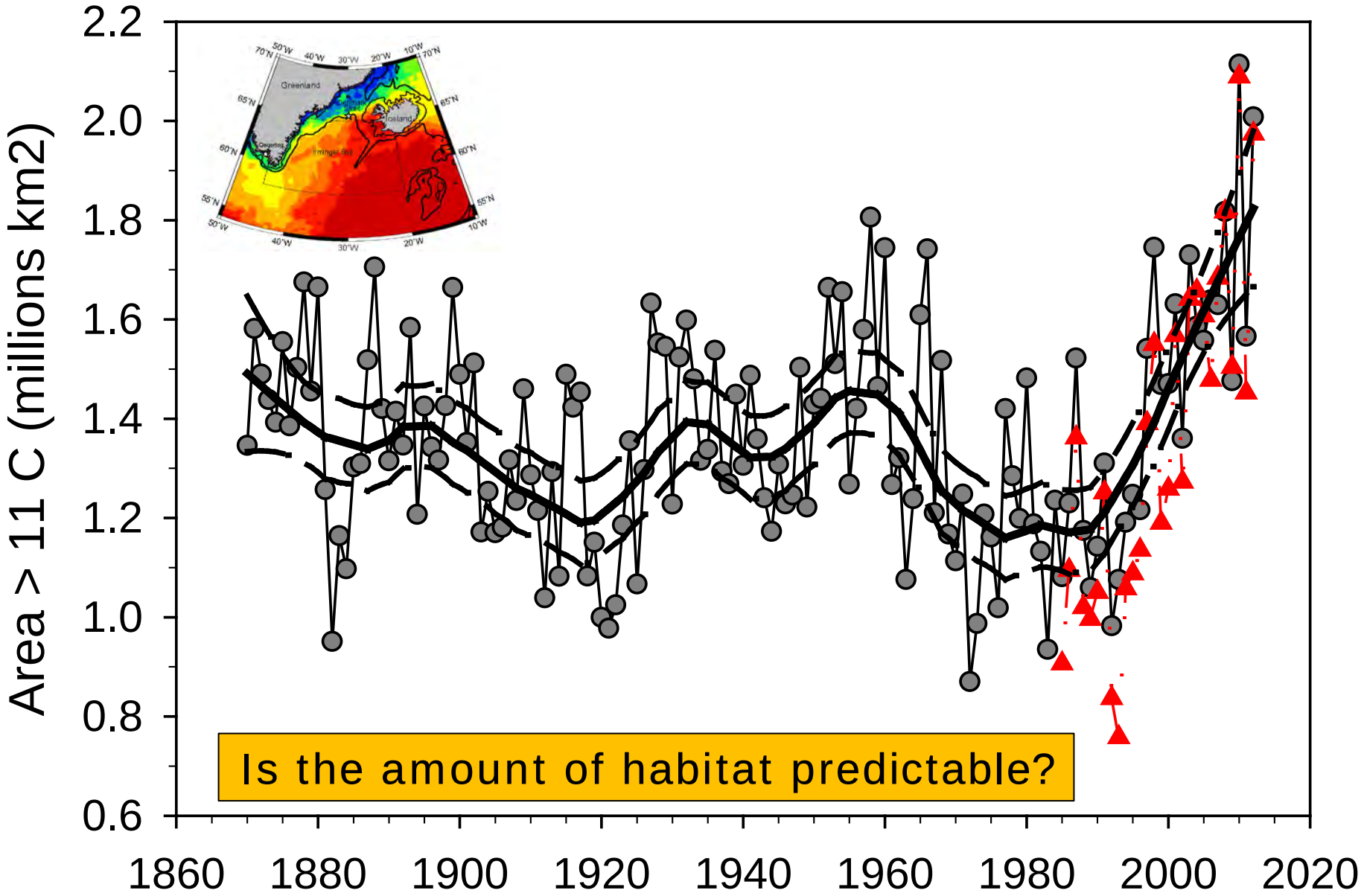
Proportion of years with suitable habitat



1985-1994

2007-2011

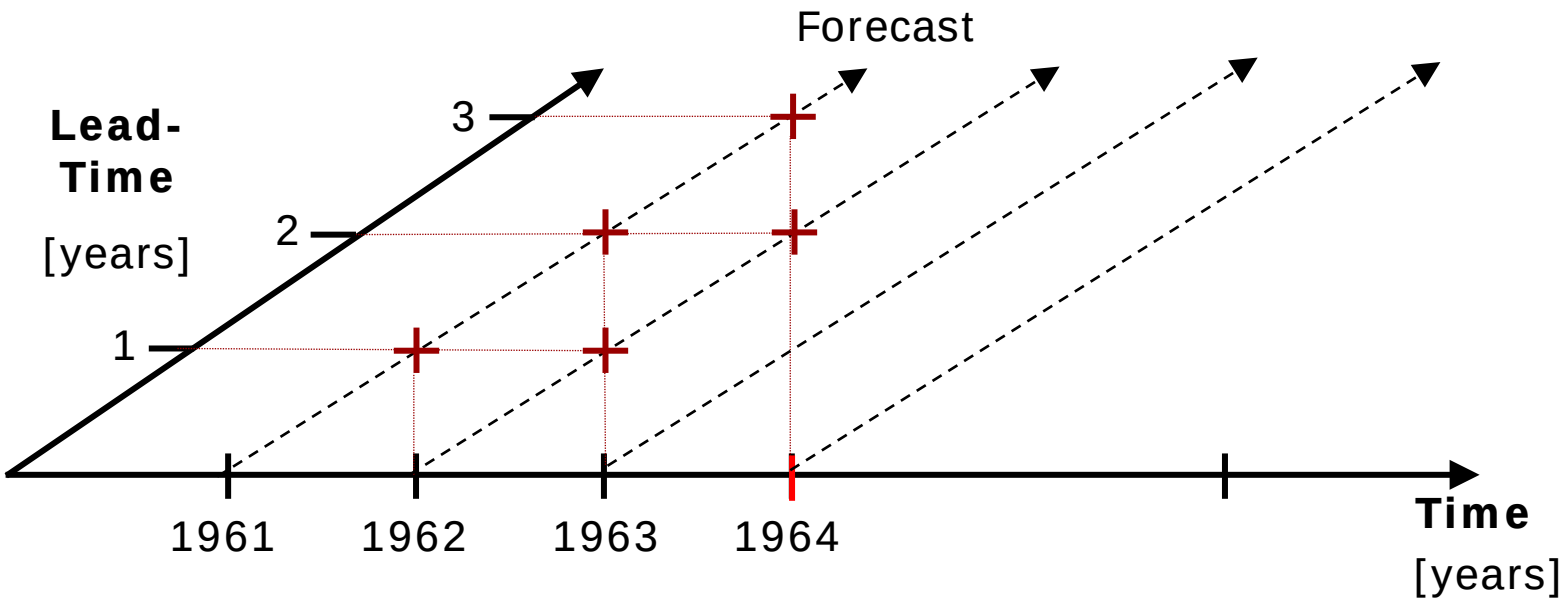
Thermally Suitable Habitat



Forecast / Climate Models

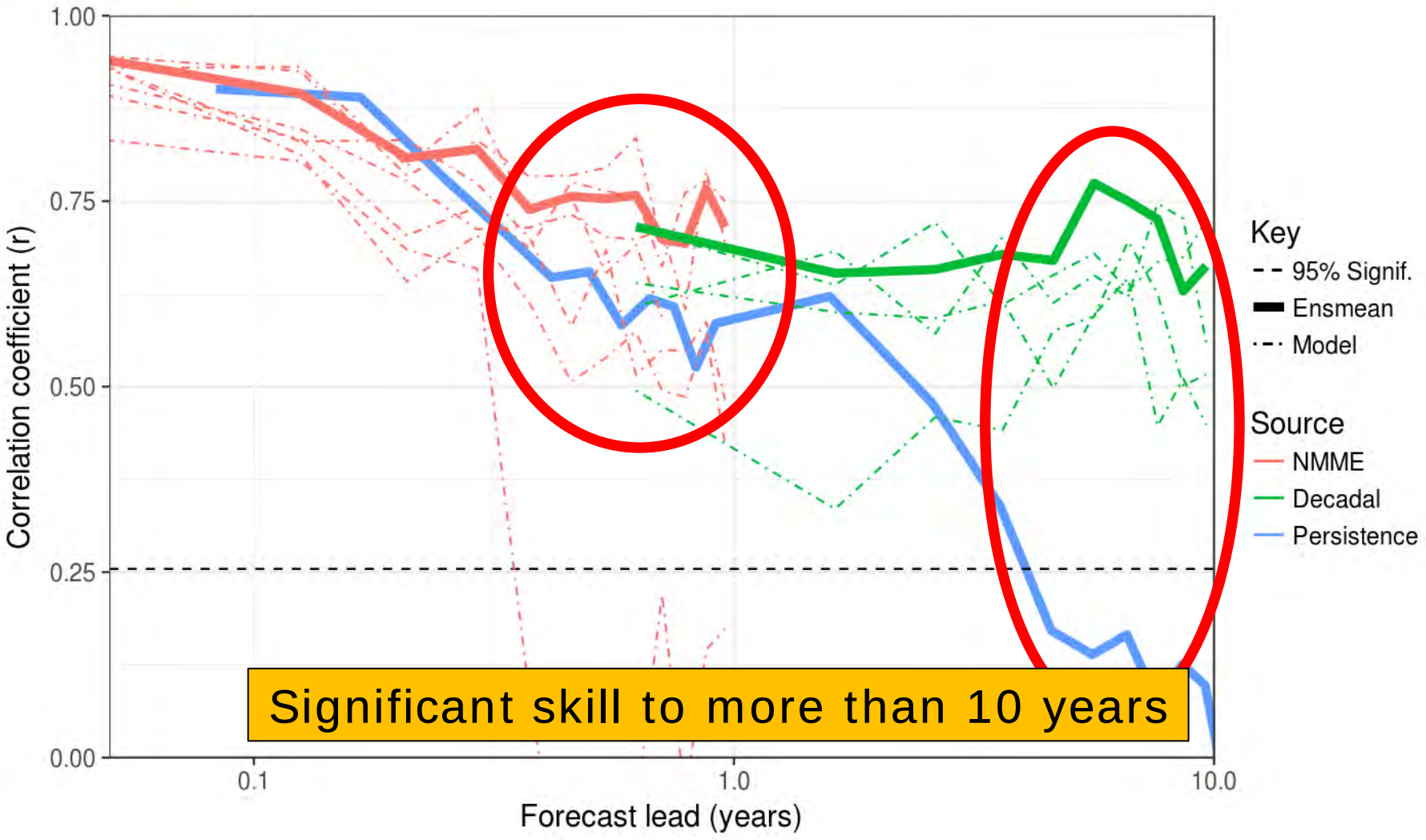
Type	Source	N. Models
Observations	HadISST	1
Seasonal forecasts (0-12 months)	North American Multi-model Ensemble (NMME)	7 + Ensmean
Decadal forecasts (1-10 years)	NOAA Geophysical Fluid Dynamics Lab Institute Pierre Simon Laplace Max Planck Institute for Meterology (2)	4 + Ensmean
Climate Models (2005-2100)	IPCC CMIP5 – RCP2.6, RCP8.5	46

Retrospective forecast (hindcast) skill



Skill is measured by correlation between forecast and observed

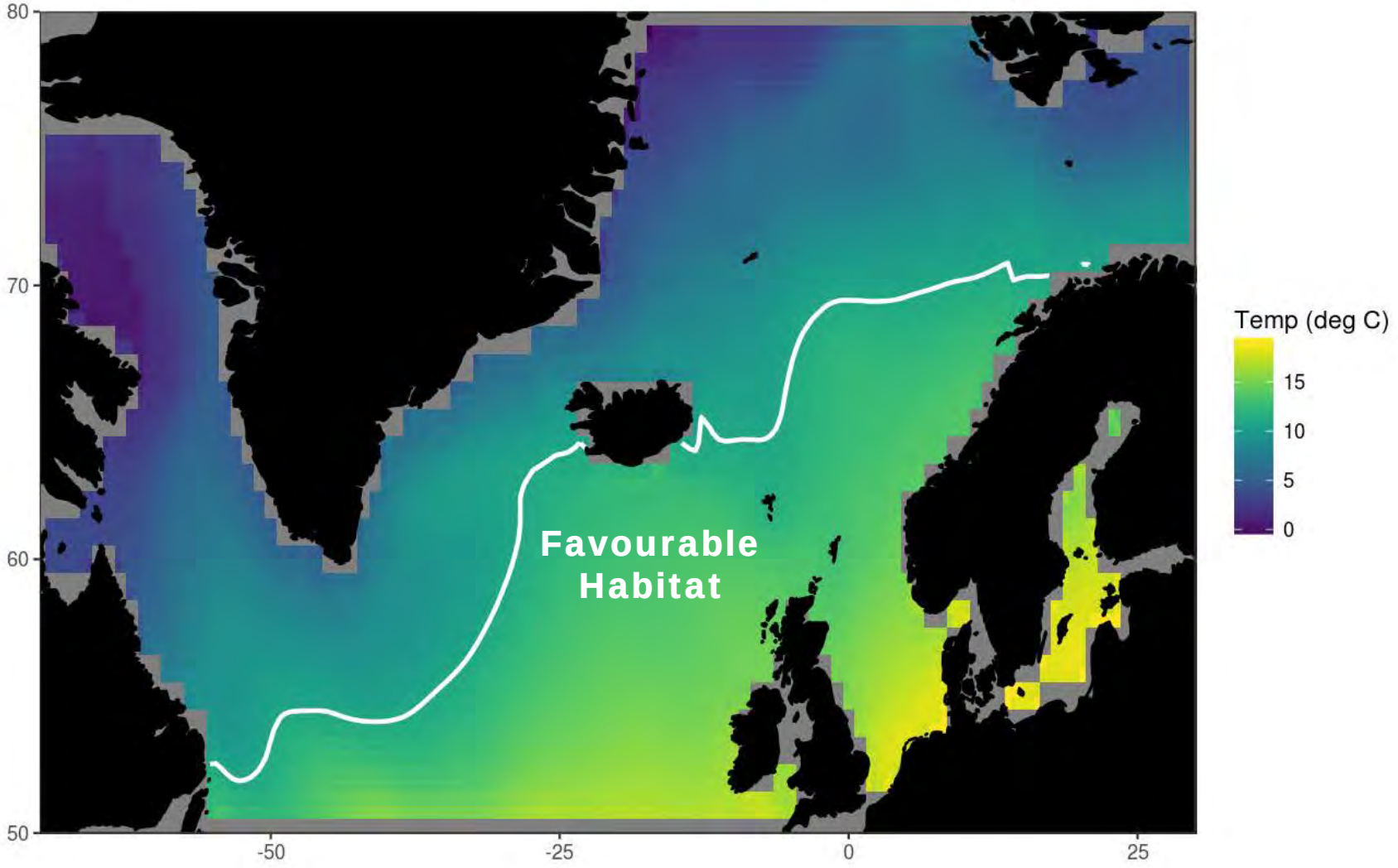
Retrospective Forecast (Hindcast) Skill - Area of Potential Bluefin Tuna Habitat



Decadal forecasts of Atlantic bluefin tuna habitat

Mark R Payne (@MarkPayneAtWork)

Forecast habitat – August 2018 (Ensemble forecast from NMME)



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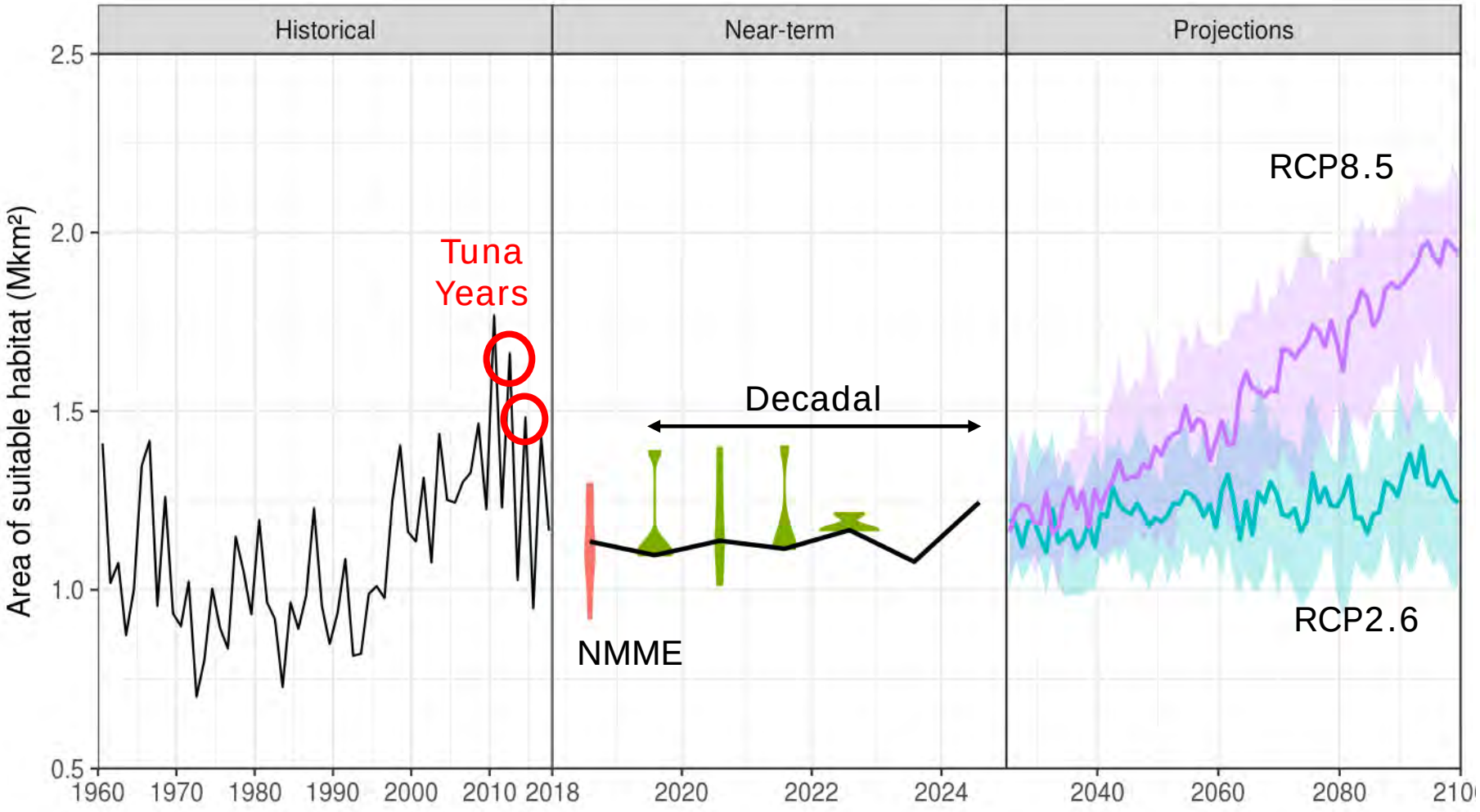
Bluefin Tuna Habitat Forecasts



Unlikely to see Tuna in Greenland Waters during the next decade

Decadal foreca ork)

How robust is this forecast?

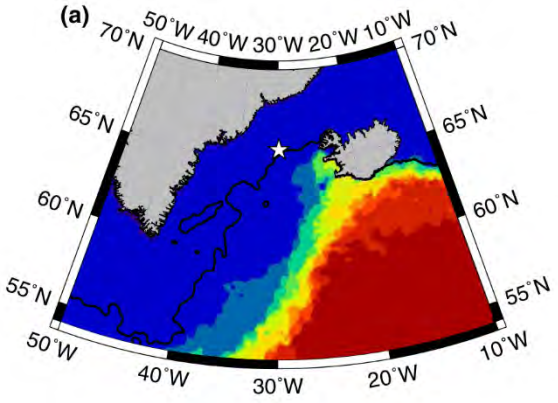
- Habitat is not distribution
  - –Presence of suitable habitat does not guarantee presence of fish
  - –Absence of habitat guarantees absence of fish

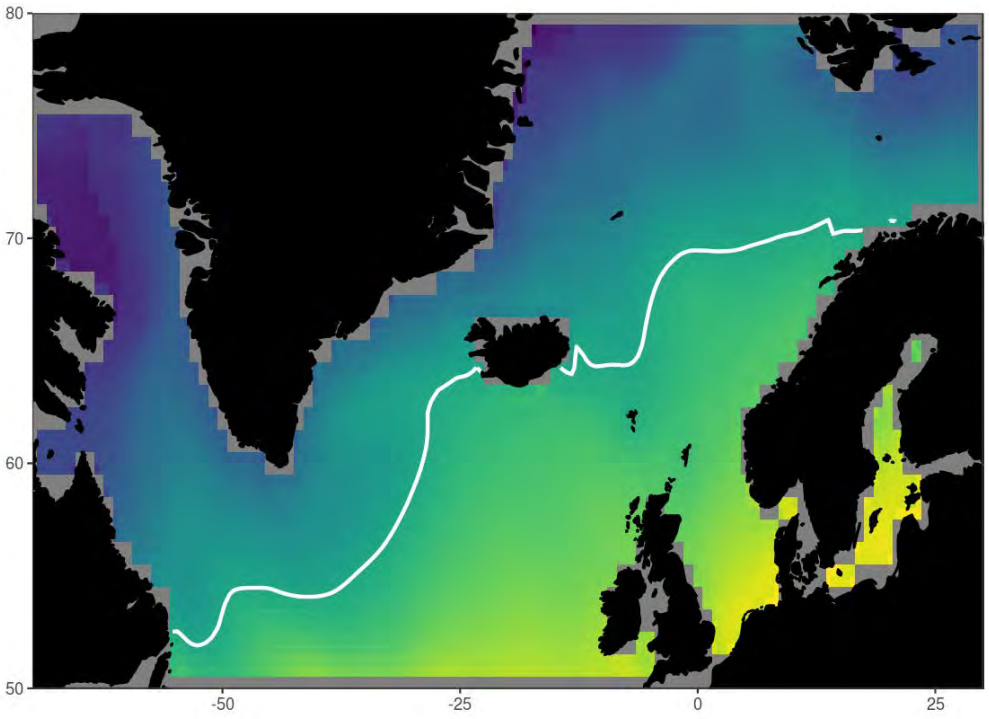
- Forecast skill is therefore asymmetric

- Forecast appears robust
  - –We forecast absence
  - –Agreement between models

How can this be used?

- Planning of fishing activities
- As a basis for choosing whether to seek quota
- In 2018 – 2025
  - –May see Tuna in Icelandic waters
  - –But not in Greenland waters





Decadal forecasts of Atlantic bluefin tuna habitat

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Decadal forecasts of Atlantic bluefin tuna habitat

Decadal prediction of
marine ecosystems is possible

Low probability of Tuna in
Greenland waters in next decade

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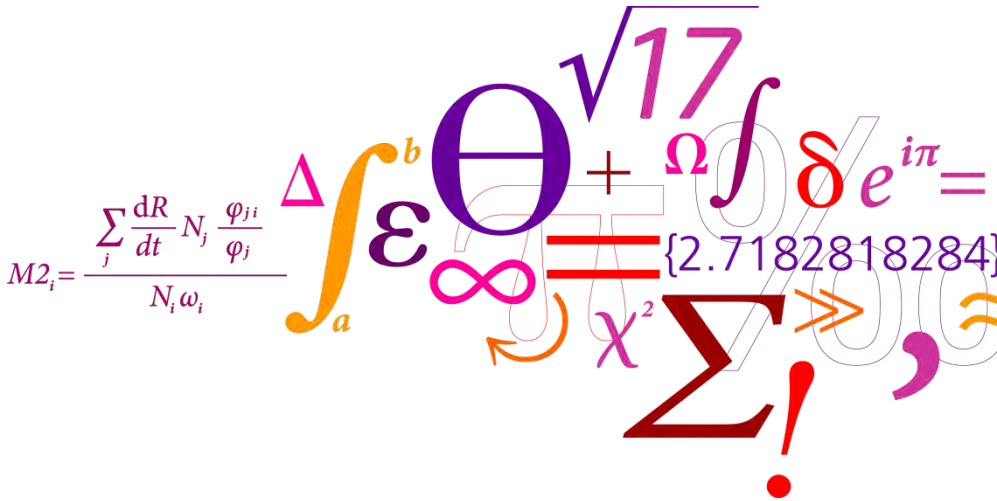

Acknowledgements

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