Towards Decadal Predictions of Marine Ecosystems

The NACLIM Experience

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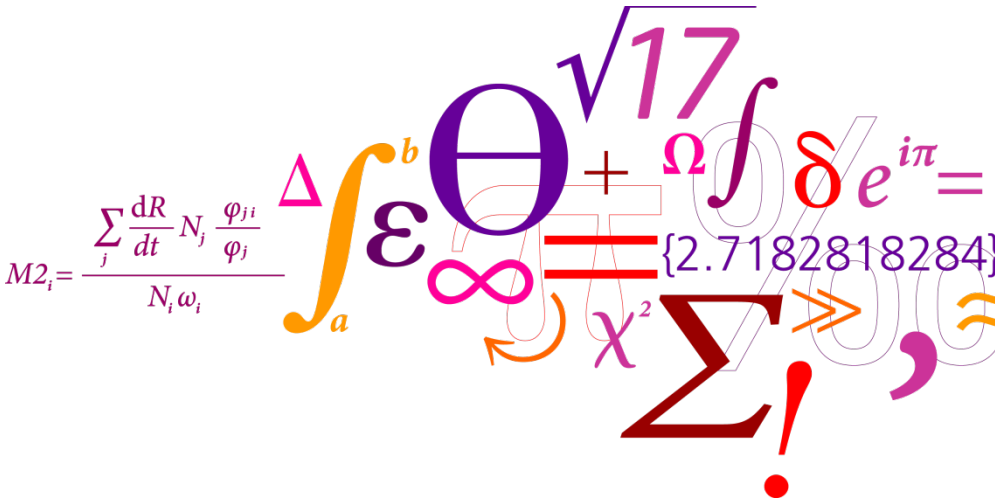

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Acknowledgements

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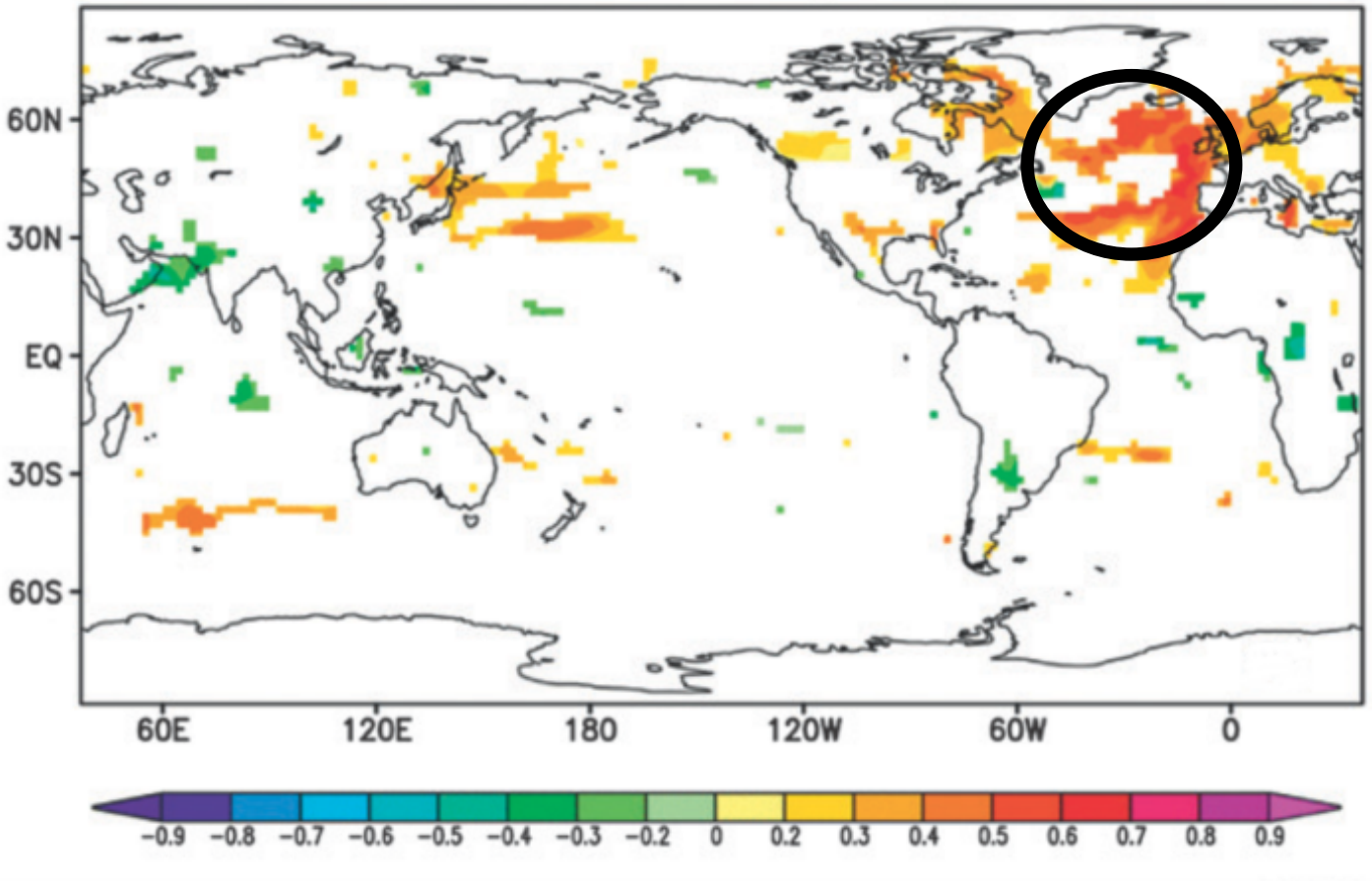
Predictability of the Physics…



Matei 2012 J. Clim

MPI-OM Model

SST

Correlation skill

2-5 years lead

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NACLIM – North Atlantic Climate

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Two fundamental principles

Working within our limitations

Low-hanging fruit

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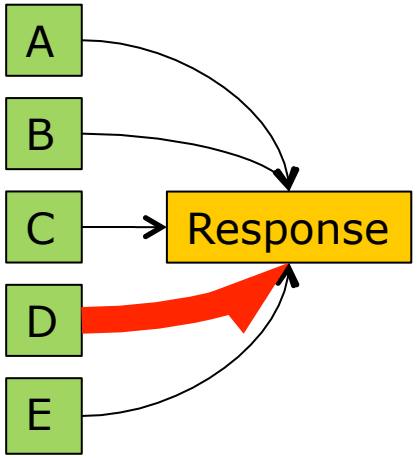
What would a predictable biological response look like?

- Drivers must be predictable e.g.
  - Response depends on SST
  - Response depends on prey abundance

- Tight coupling from physics -> biology
  - Coupling is unique and constant

- Good data
  - Fish Recruitment



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Species distributions might work..

- Particularly promising for pelagic fish
  - Ability to influence distribution
  - Sensitive to environment

- Lots of distributional data available
  - e.g. Fisheries surveys

- Environmental niche modelling (ENM)
  - Models coupling between distribution and environment

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Case Study : NE Atlantic Mackerel Surveys

(Scomber scombrus)

Mackerel Egg Survey (MEGS)

Tri-annual Egg Survey

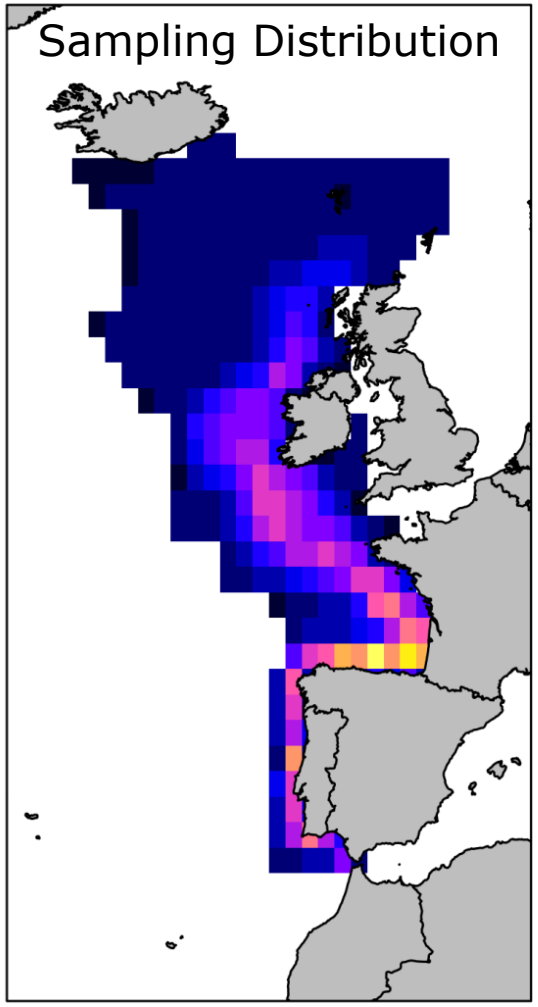
Jan-June, Gibraltar - Iceland

~ 2000 hauls, 250 Vessel days

Used in stock assessment

€3-5 million per survey

Can we forecast the distribution?



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So lets give it a go…

- Environmental correlates
  - SST
  - NPP
  - Daylength
  - Bathymetry
- Sampling parameters
  - Volume filtered
  - Gear type
- Response variables
  - Presence-Absence
  - Daily Egg Production
- Model types
  - Binomial GAM
  - Zero-inflated Poisson GAM
  - Random forest

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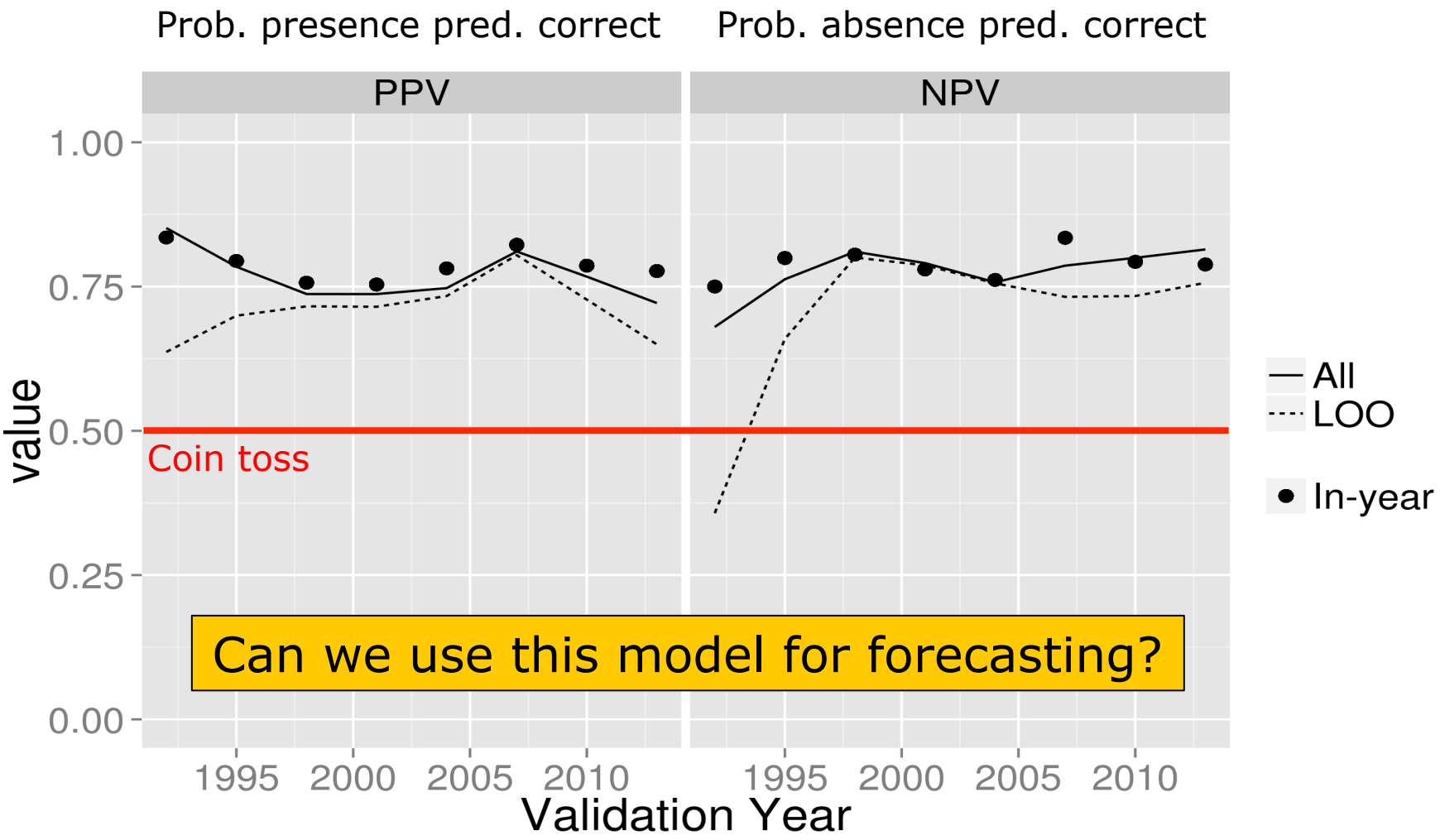
Predictive model skill



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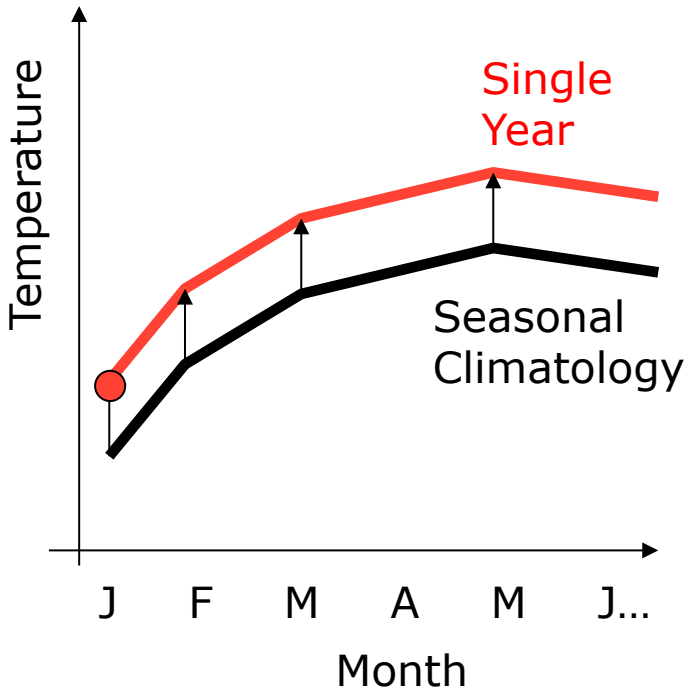
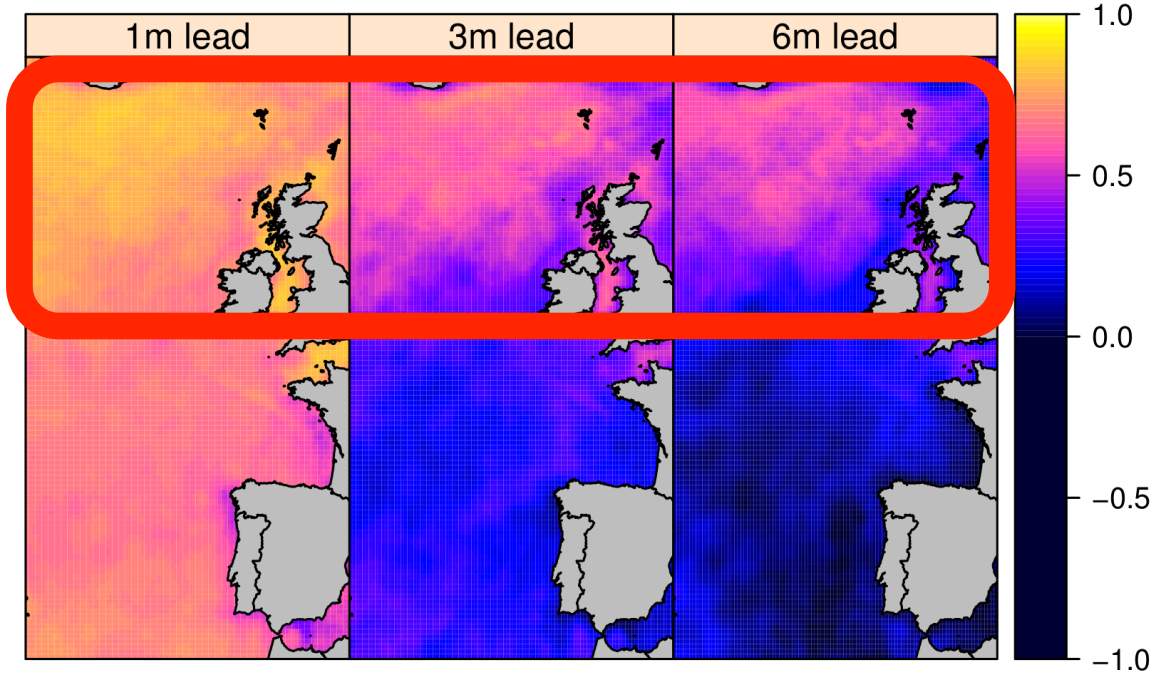
Anomaly Persistence Forecasts





Coefficient of correlation (*r*) of seasonal anomalies

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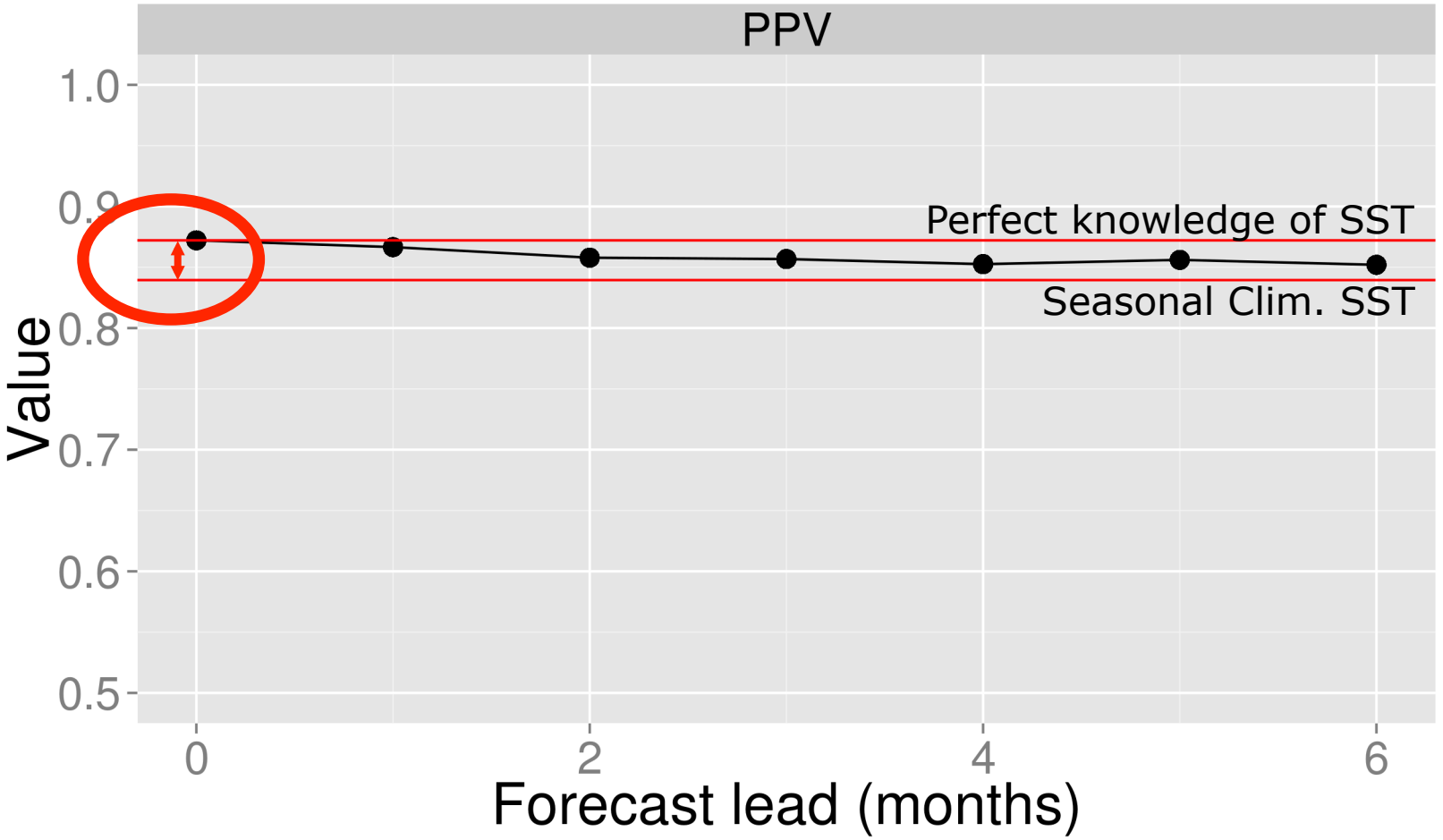
Forecast skill

(Probability of presence prediction being correct, Northern Region)



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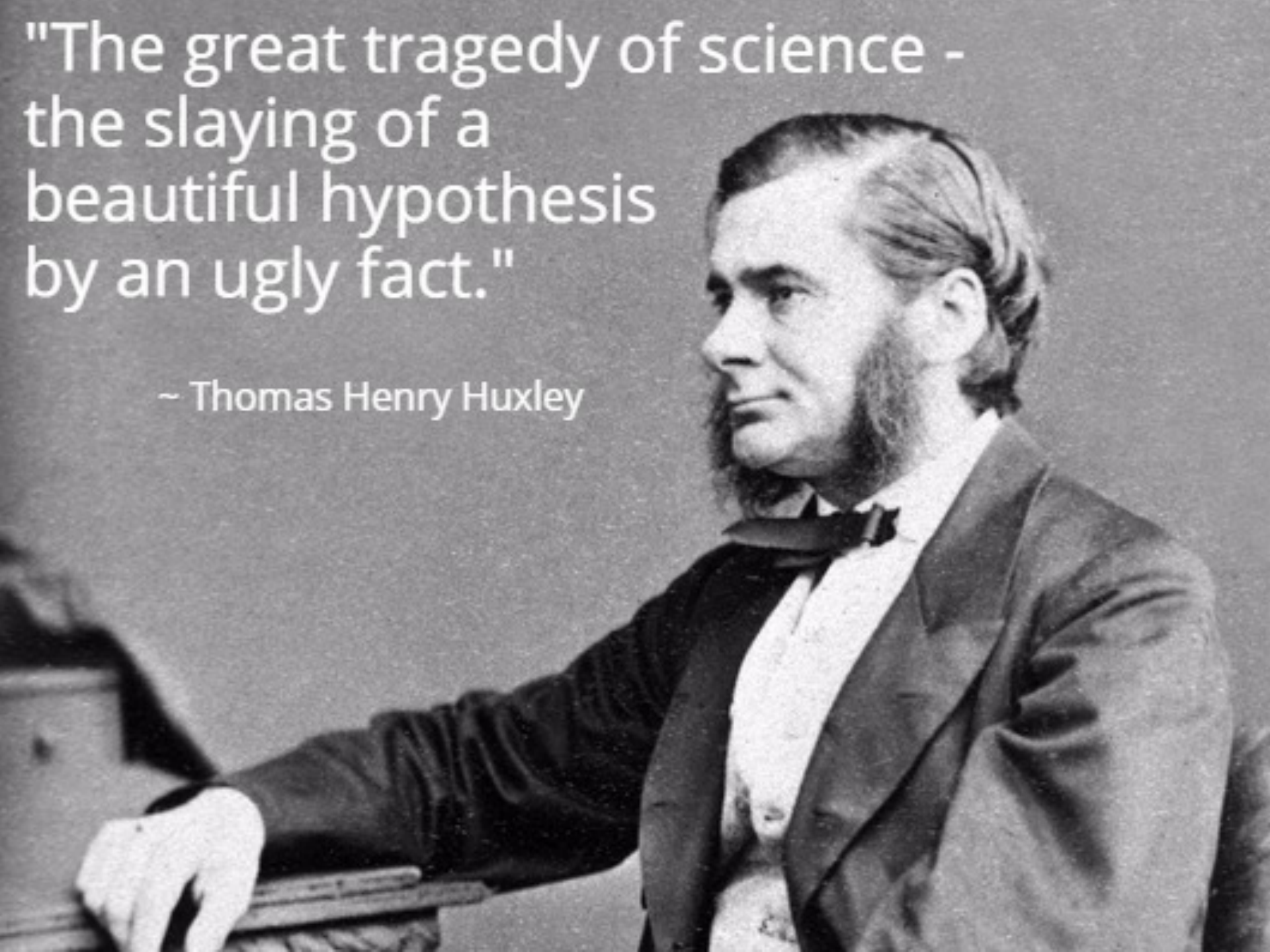
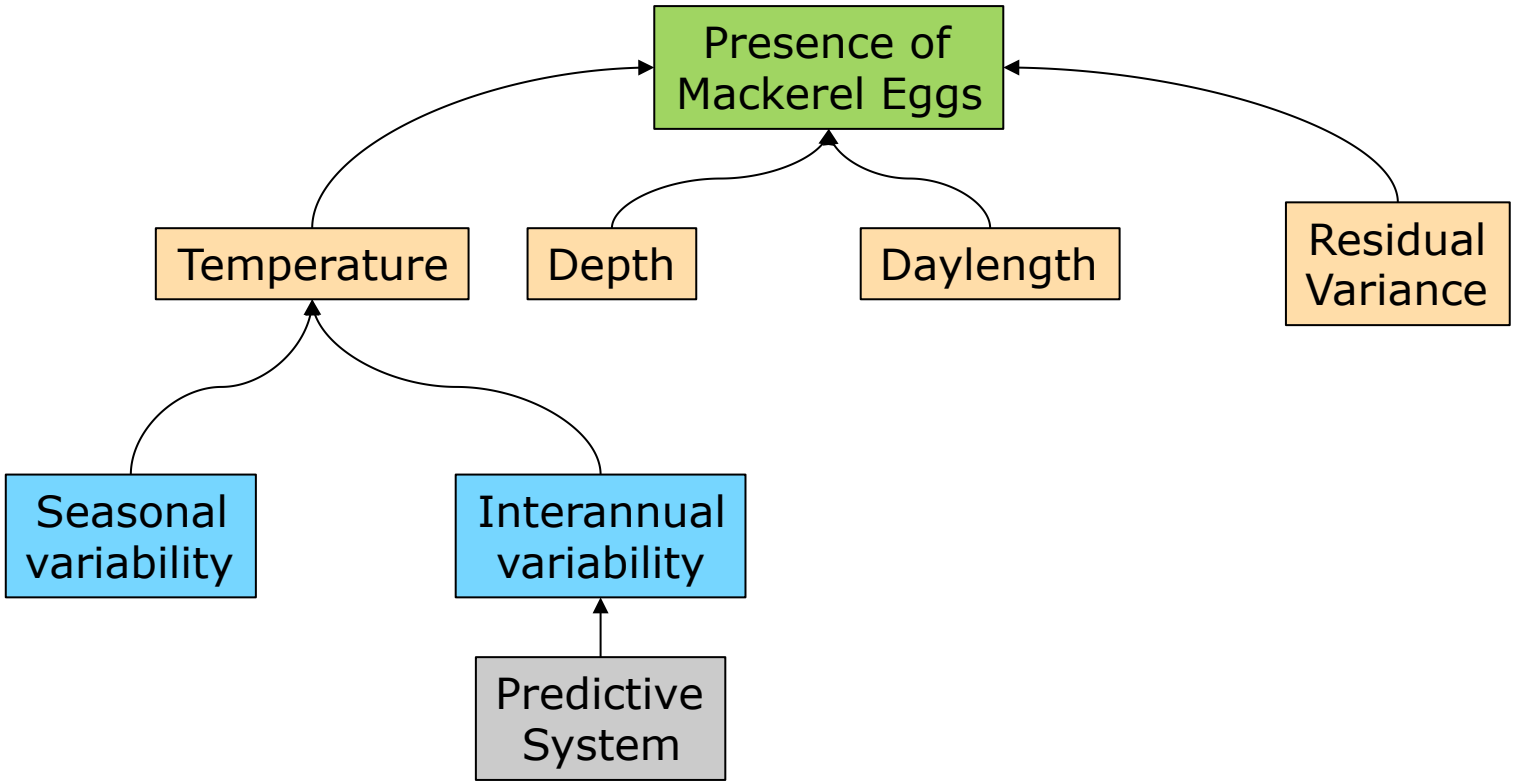

"The great tragedy of science -
the slaying of a
beautiful hypothesis
by an ugly fact."
~ Thomas Henry Huxley

So what goes wrong?



Inter-annual variability in SST
is simply not influential enough

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Ask not ”how do we predict something?” Ask ”what can we predict?”

Find systems and responses where the predictable variable DOMINATES.

Don’t forget a reference forecast

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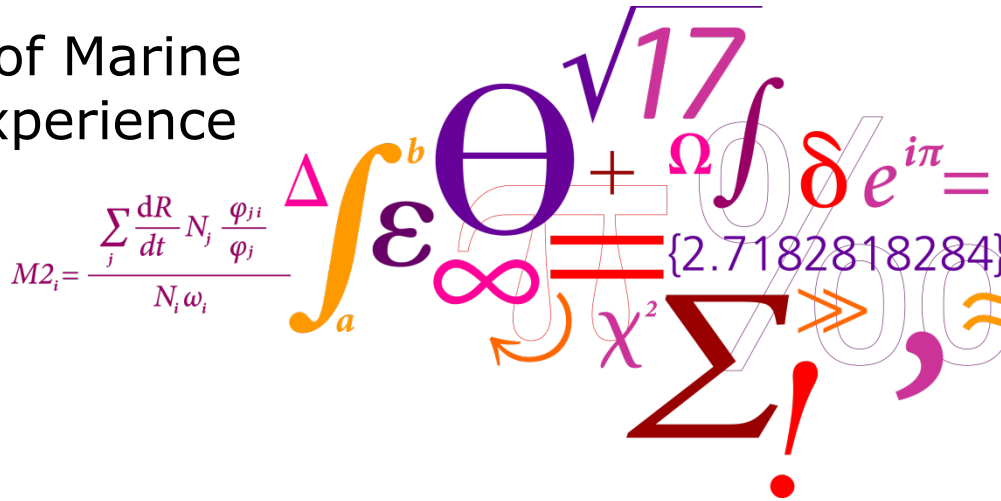

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