Skill and uncertainty of environmentally driven forecasts of Pacific hake distribution

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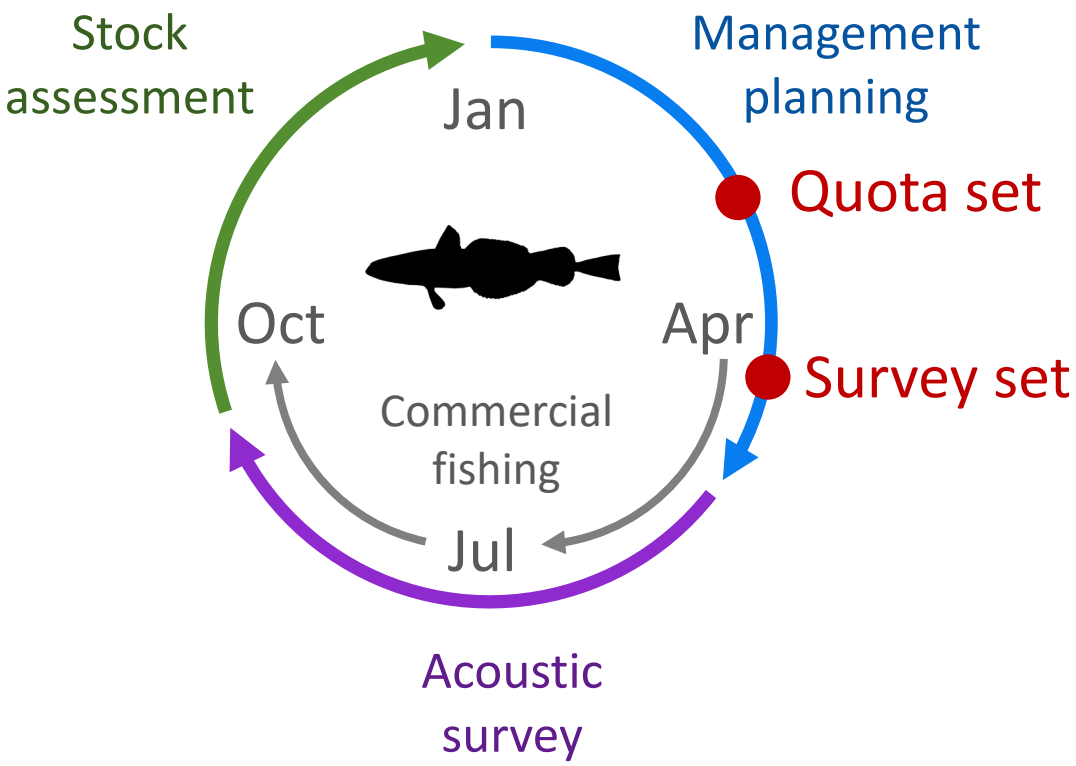
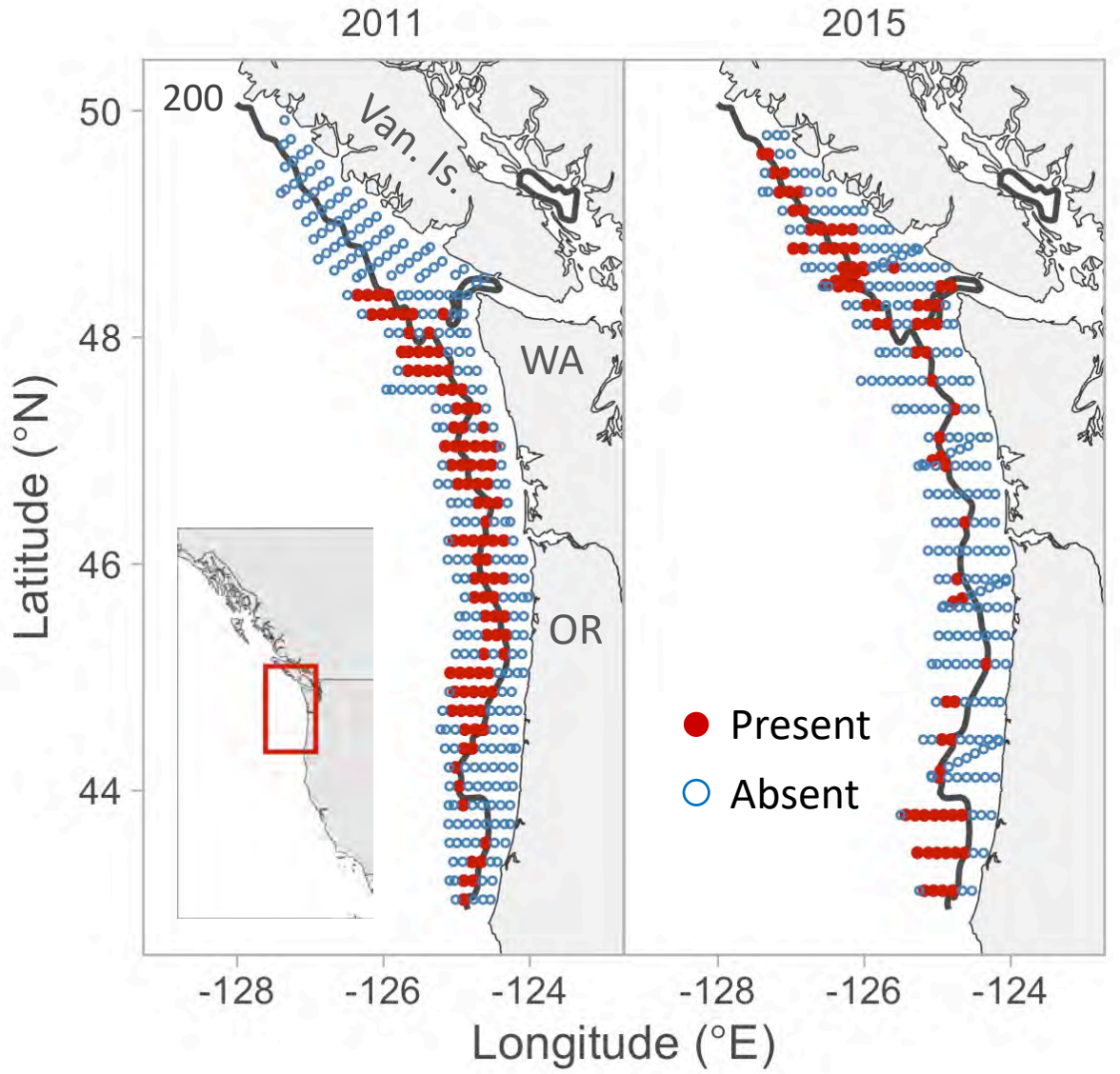
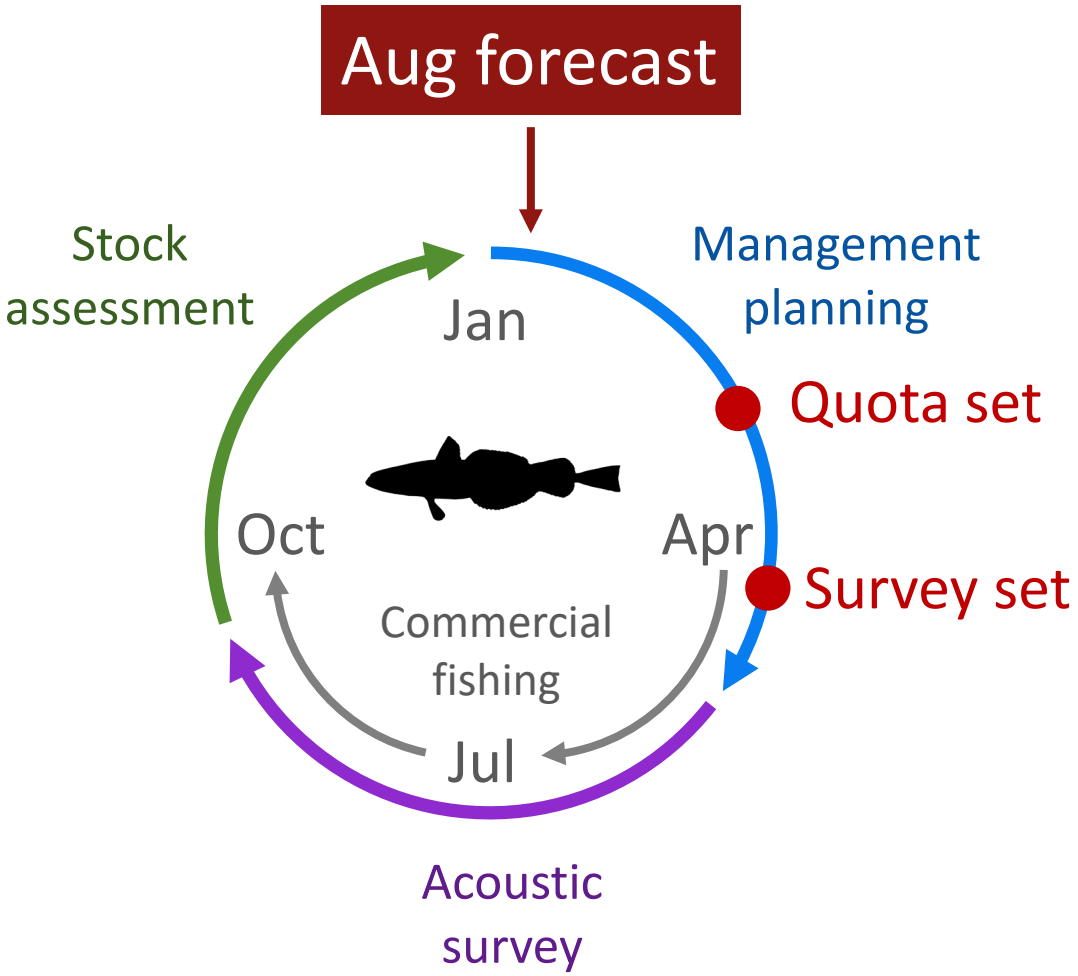
Hake management cycle

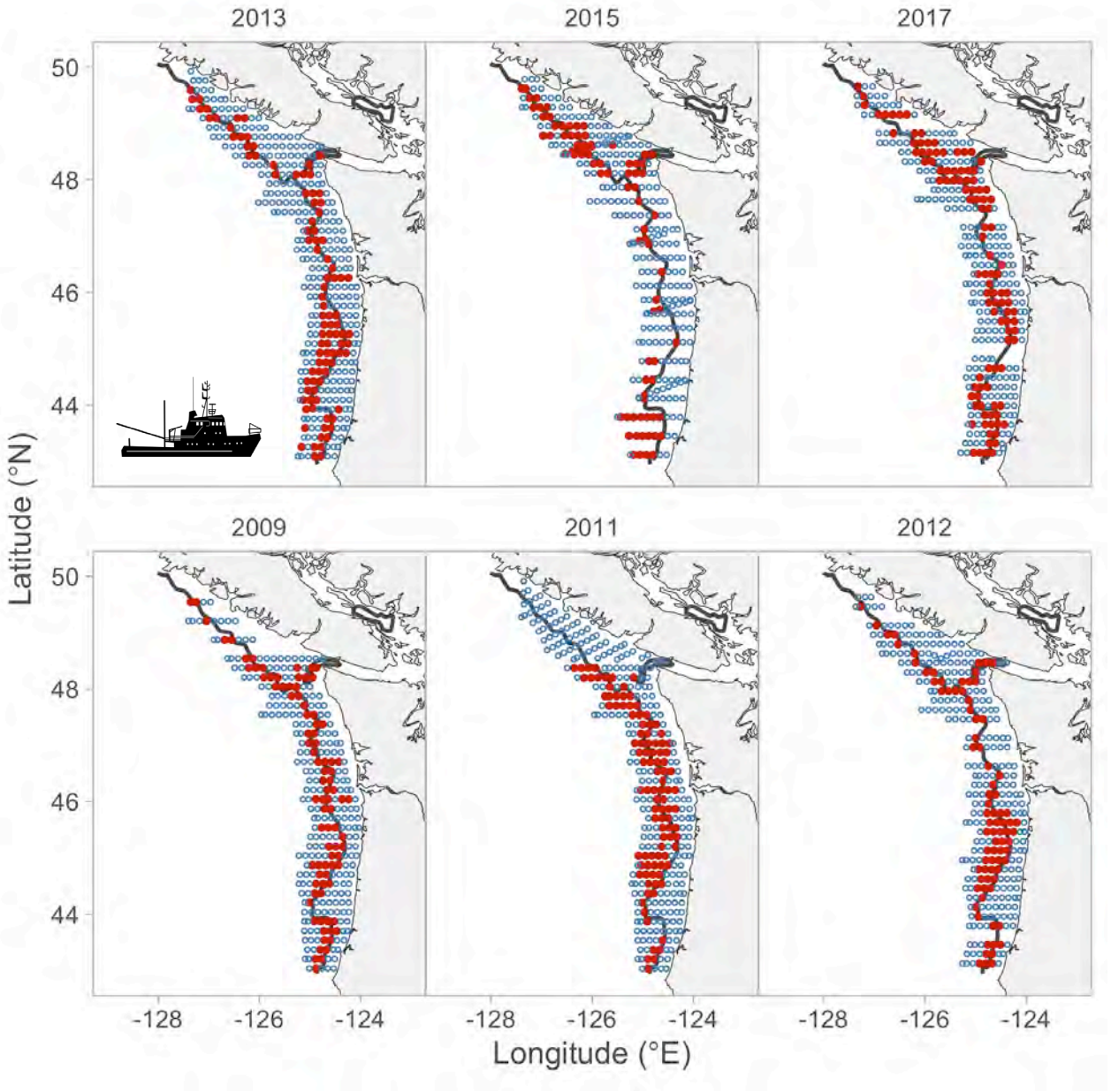




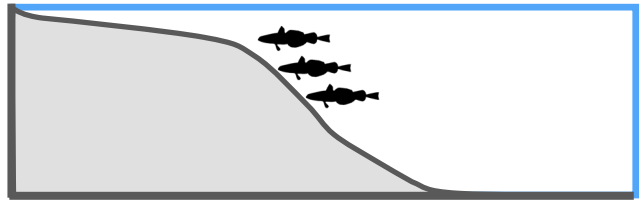


Evaluate skill and uncertainty of 8 month lead-time forecasts of Pacific hake summer distribution

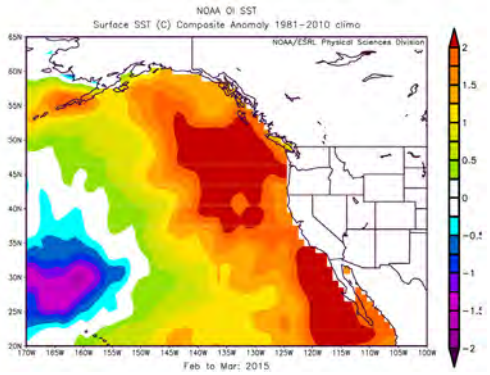
Hake data & distribution drivers



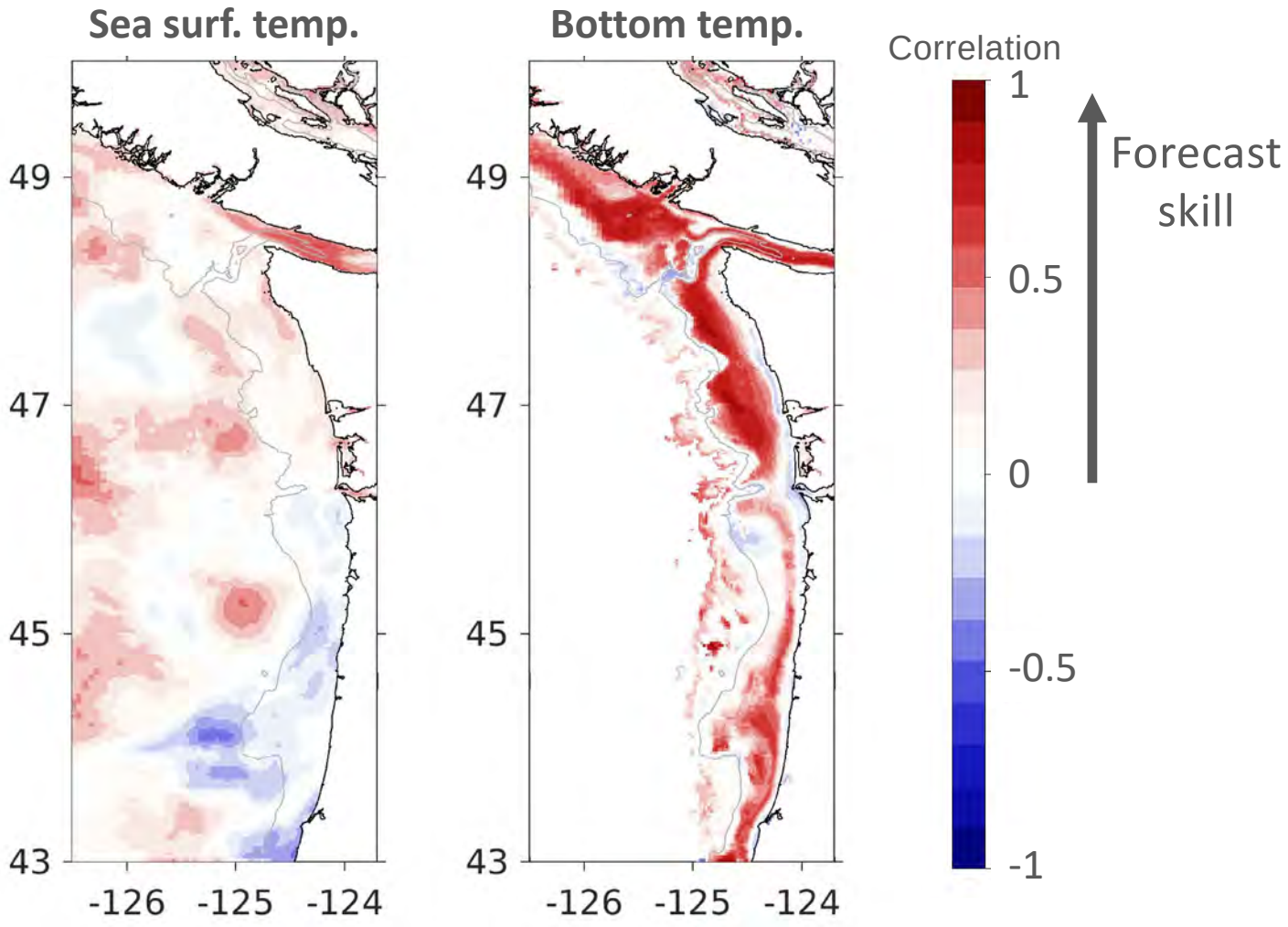
1. Shelf break hypothesis



2. Temperature hypothesis



J-SCOPE ocean forecasting model



- Temperature anomaly 250 m
- (Re)forecasts
- January initialized
- 3 member ensemble

Siedlecki et al. (2016) Scientific Reports

Base forecast model

$$Pr(H) = a + f_1(Lon,Lat) + \varepsilon$$

Shelf forecast model

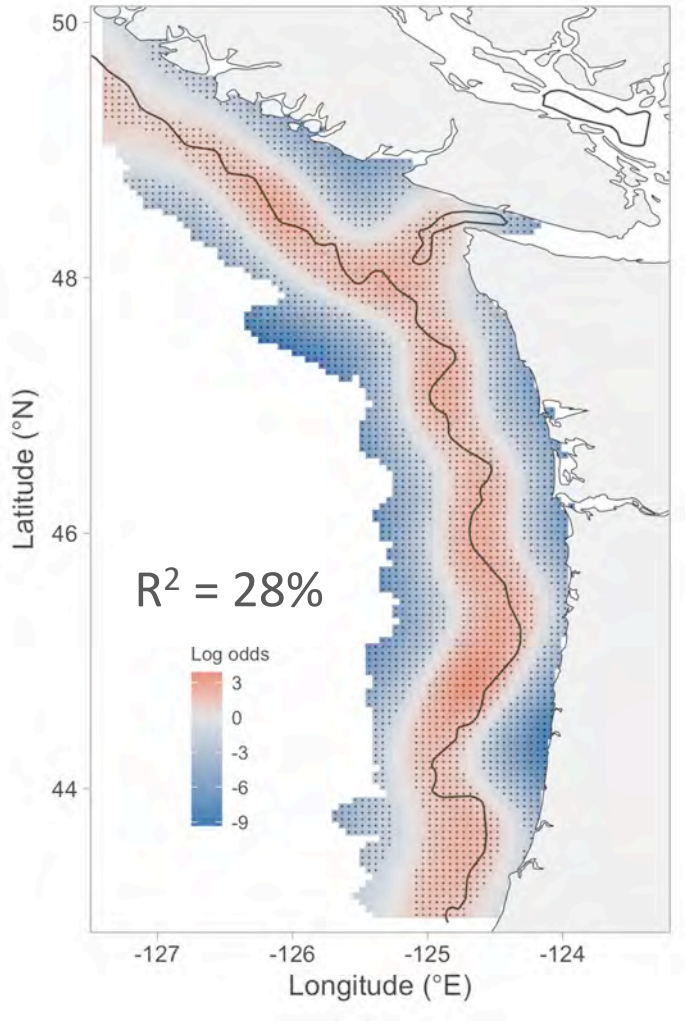
$$Pr(H) = a + f_1(\text{Shelf distance}) + \varepsilon$$

Shelf + temperature forecast model

$$Pr(H) = a + f_1(\text{Shelf distance}) + f_2(Lon,Lat)*Temp250 + \varepsilon$$

Base forecast model

$$Pr(H) = a + f_1(Lon,Lat) + \varepsilon$$



Shelf forecast model

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Shelf + temperature forecast model

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Base forecast model

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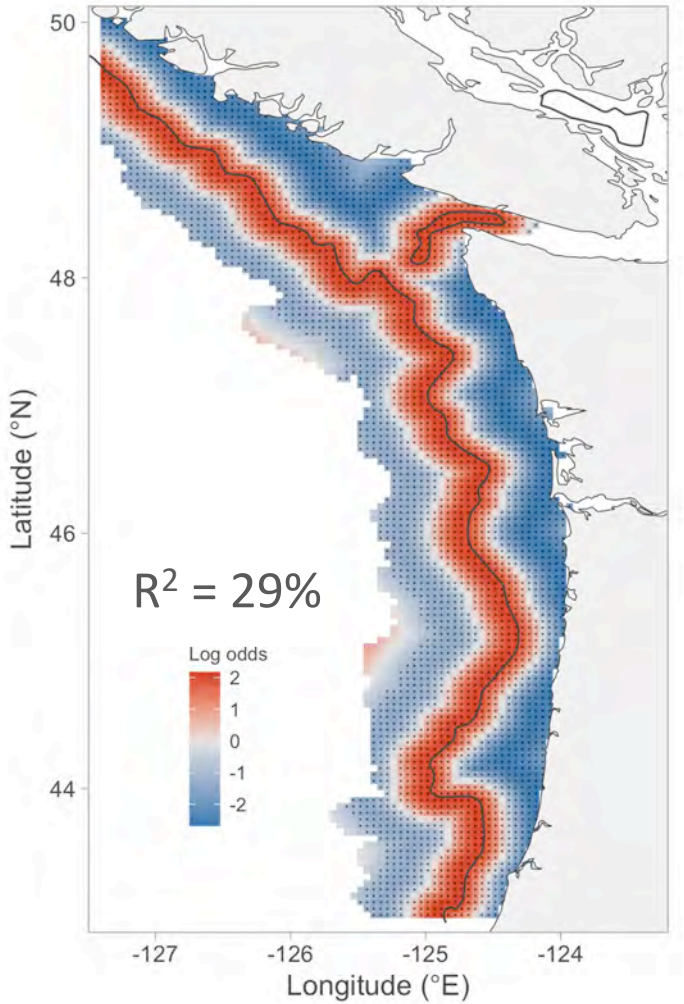
Shelf forecast model

$$Pr(H) = a + f_1(Shelf\ distance) + \varepsilon$$



Shelf + temperature forecast model

$$Pr(H) = a + f_1(Shelf\ distance) + f_2(Lon,Lat)*Temp250 + \varepsilon$$

Base forecast model

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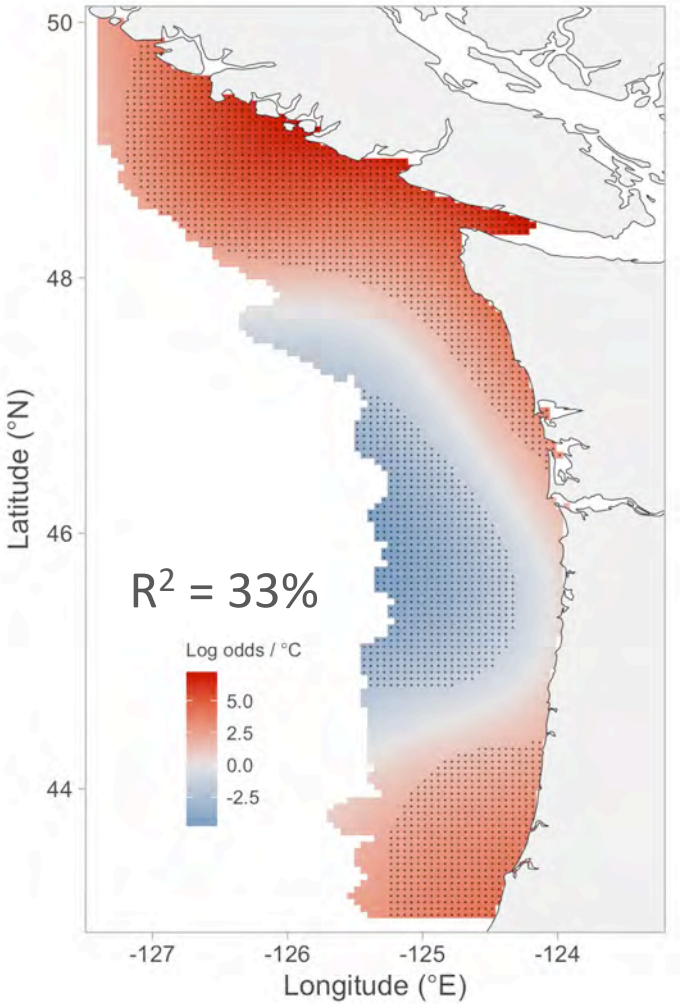
Shelf forecast model

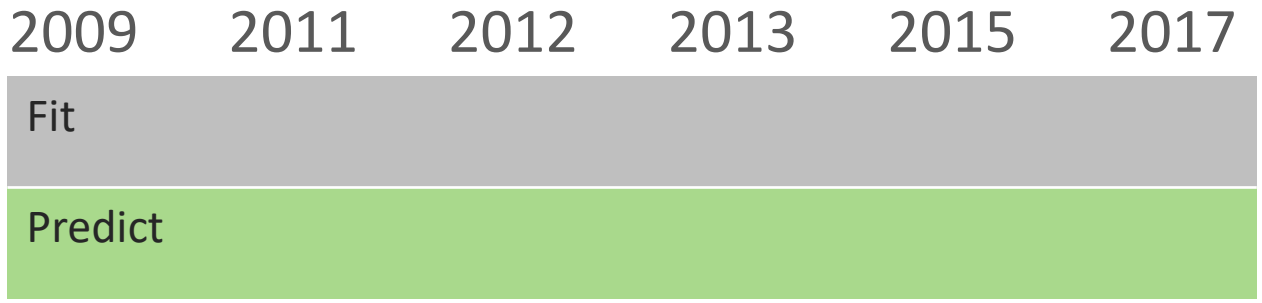
$$Pr(H) = a + f_1(Shelf\ distance) + \varepsilon$$



Shelf + temperature forecast model

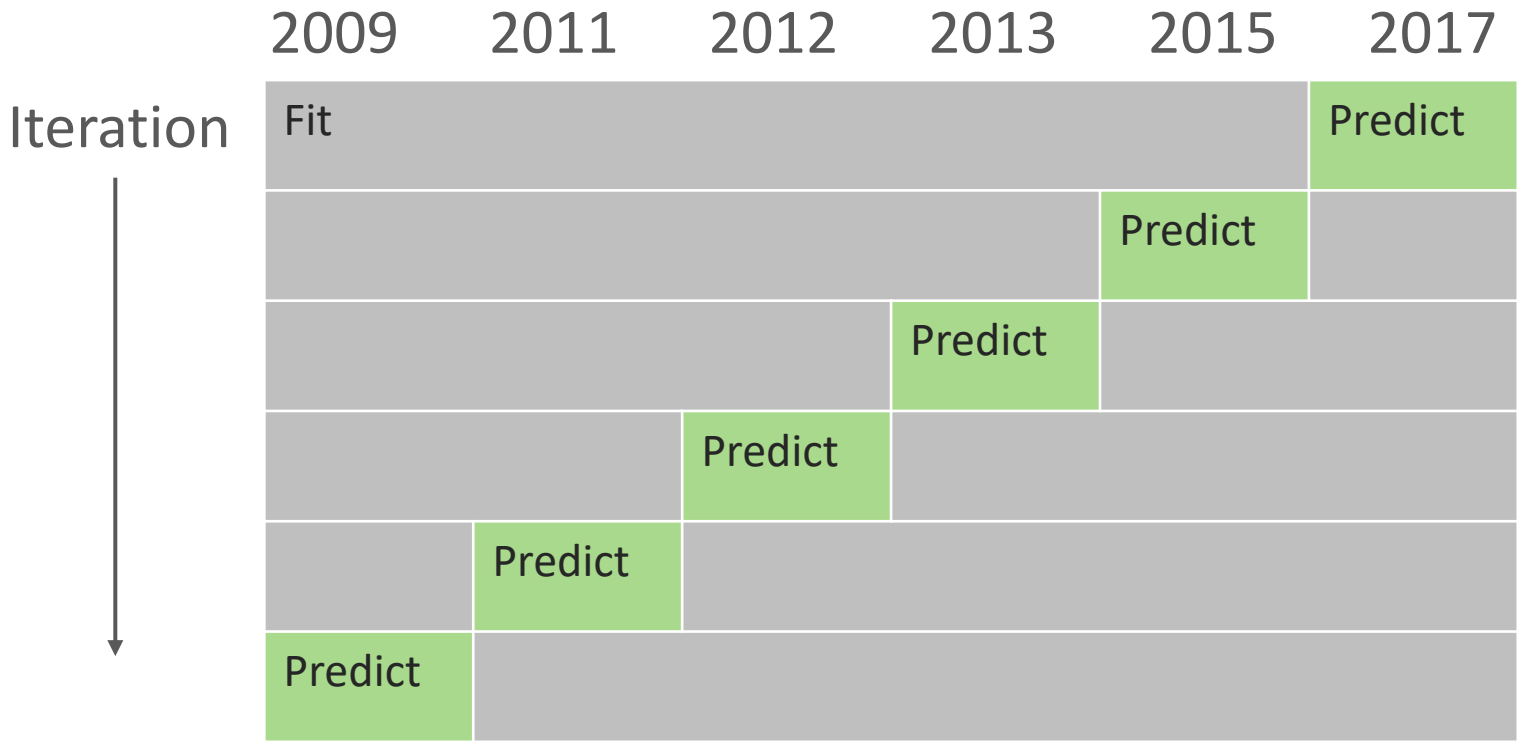
$$Pr(H) = a + f_1(Shelf\ distance) + f_2(Lon,Lat)*Temp250 + \varepsilon$$

In-sample predictive skill



How well the model fits the observed data

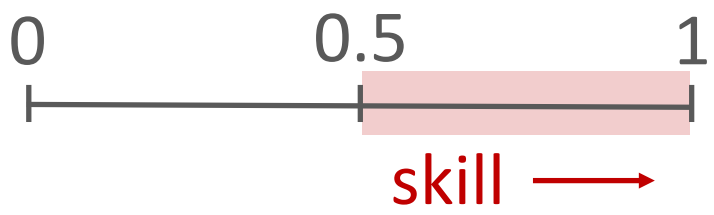
Out-of-sample predictive skill



How well the model forecasts unobserved years

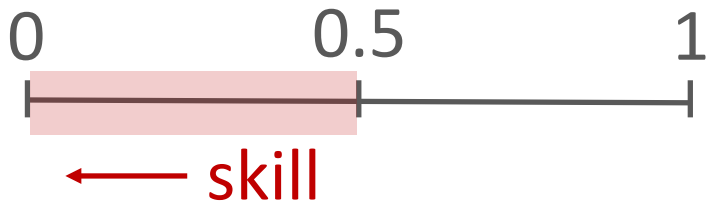
Forecast skill

AUC score



Higher = more skill

Brier score

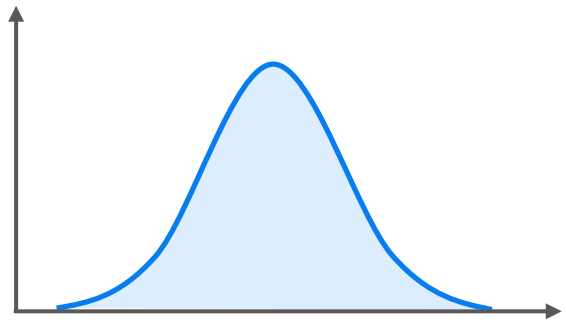


Lower = more skill

Posterior simulated forecasts

Draw 1	0.8	0.6	0.2	0.4	0.6
Draw 2	0.6	0.5	0.4	0.1	0.4
Draw 3	0.7	0.6	0.5	0.2	0.5
True values	1	1	0	0	1

AUC or Brier



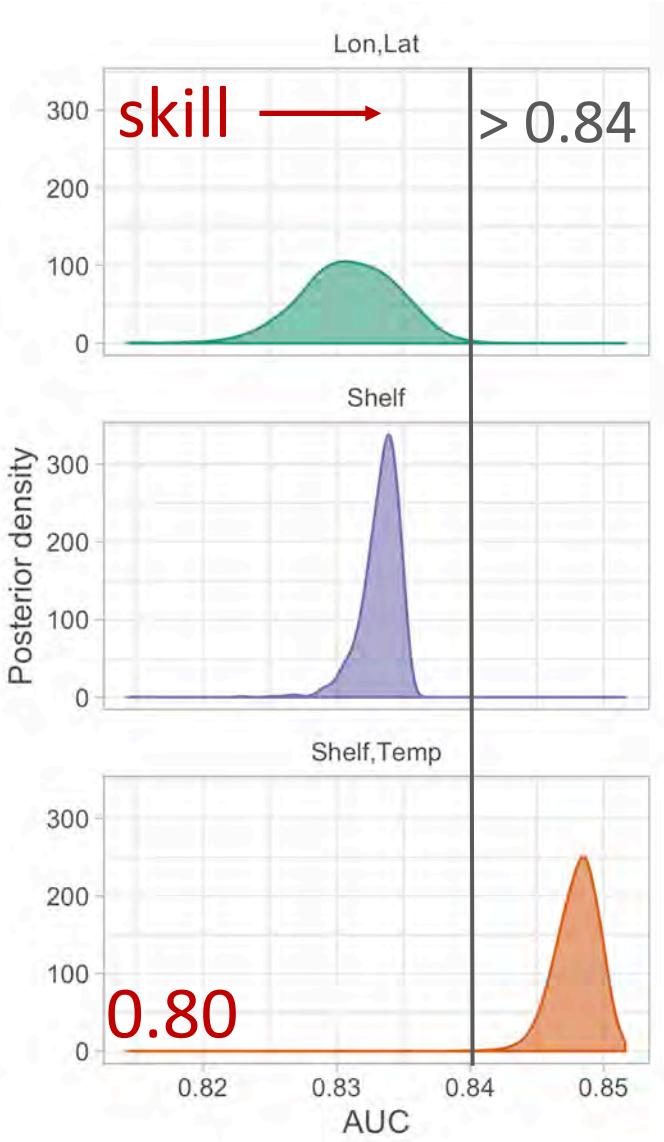
Skill: in-sample

Lon,Lat

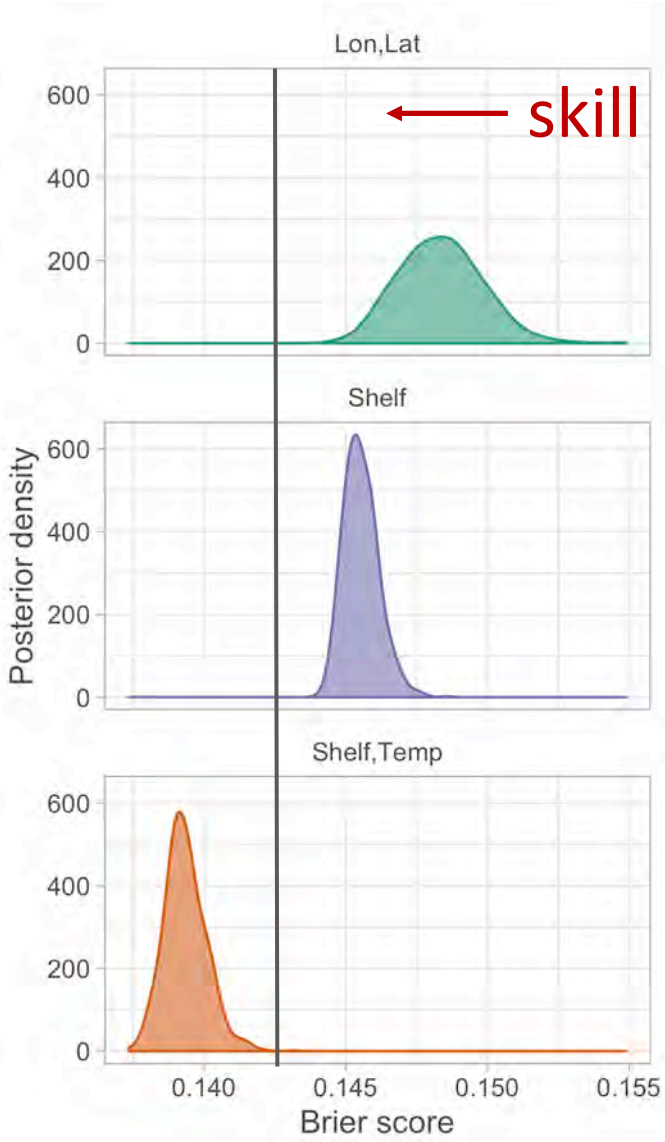
Shelf

Shelf,Temp

AUC score



Brier score



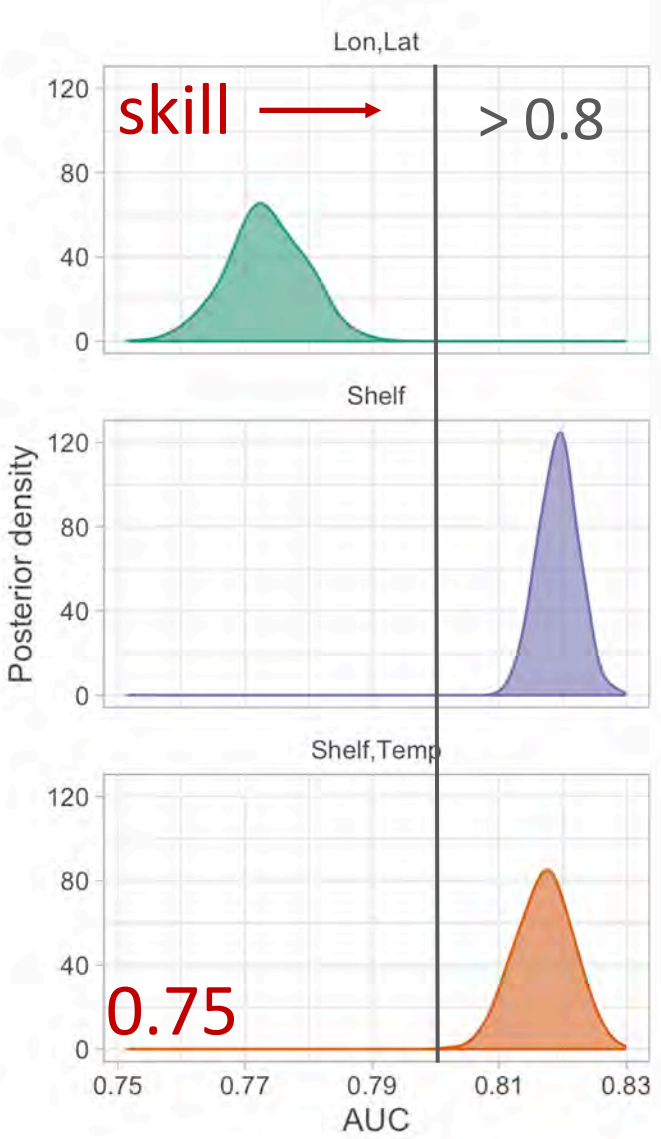
Skill: out-of-sample

Lon,Lat

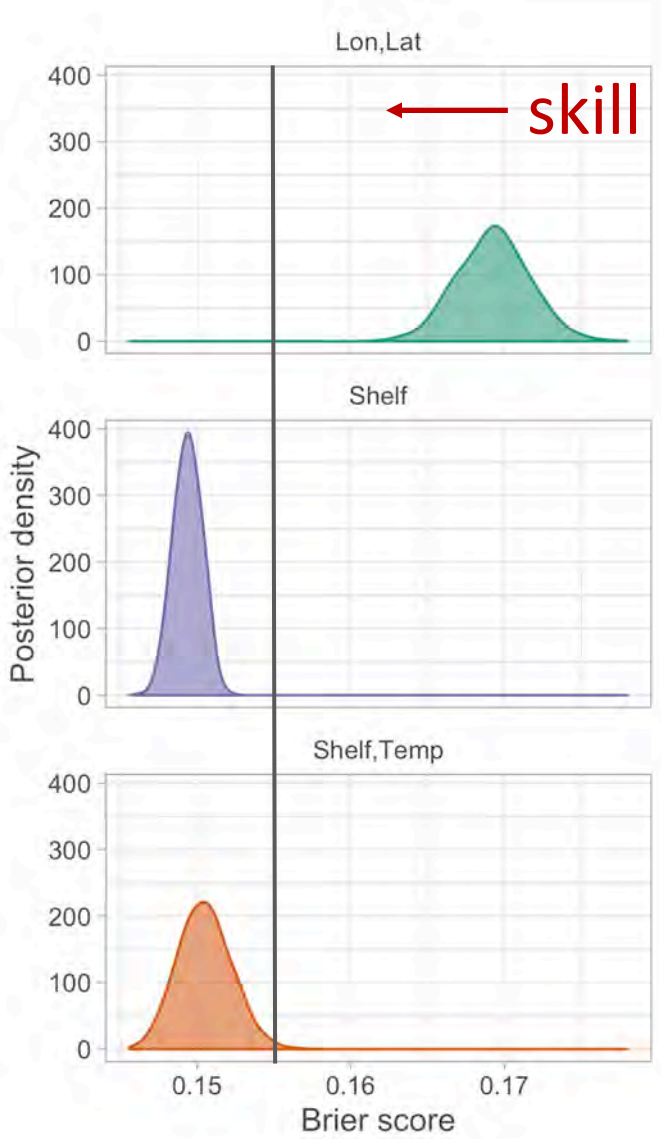
Shelf

Shelf,Temp

AUC score



Brier score



Skill: out-of-sample

AUC score

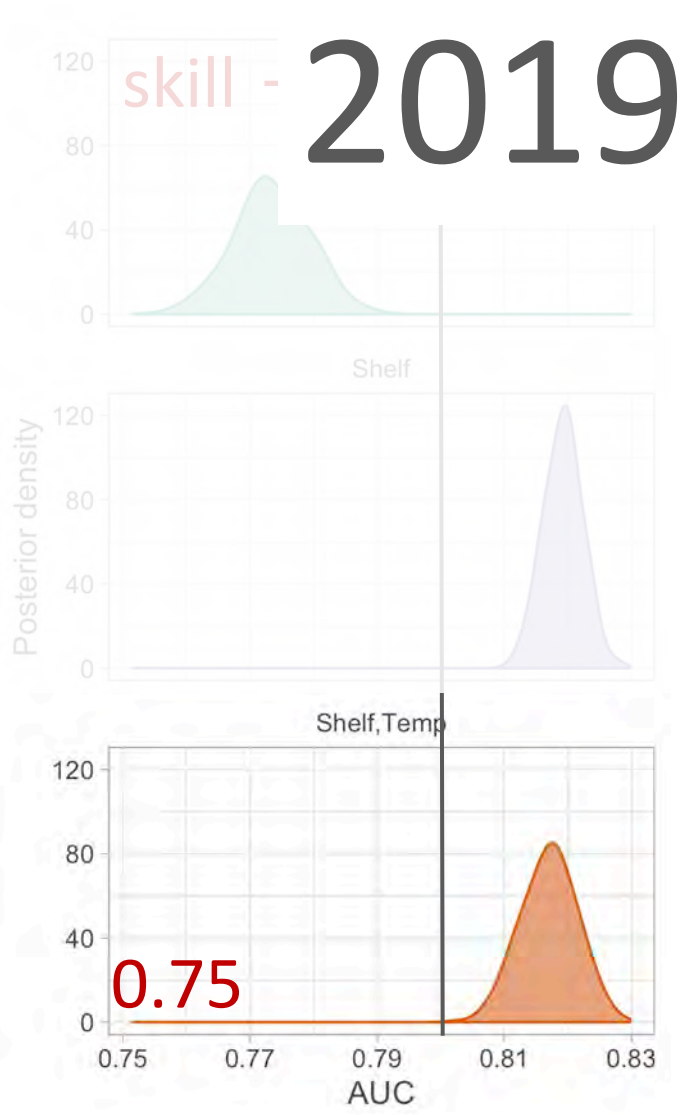
Brier score

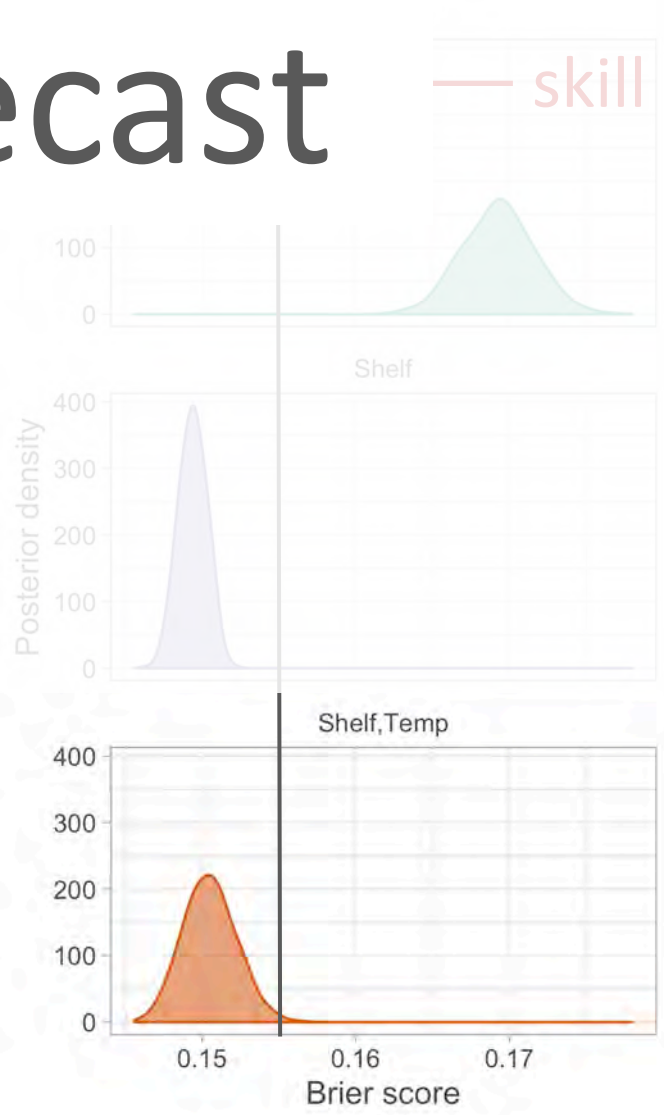
2019 Forecast

Lon,Lat

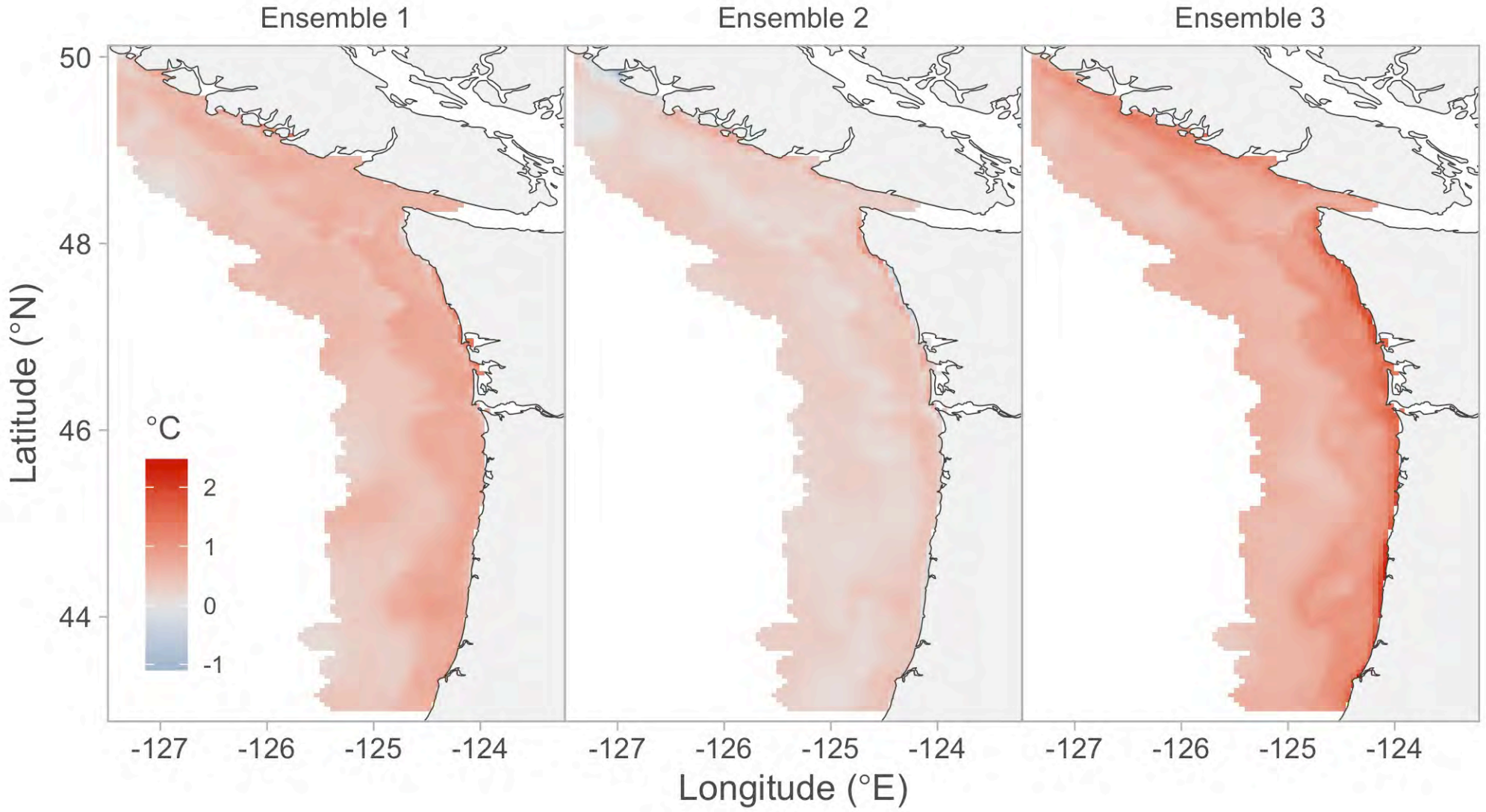
Shelf

Shelf,Temp



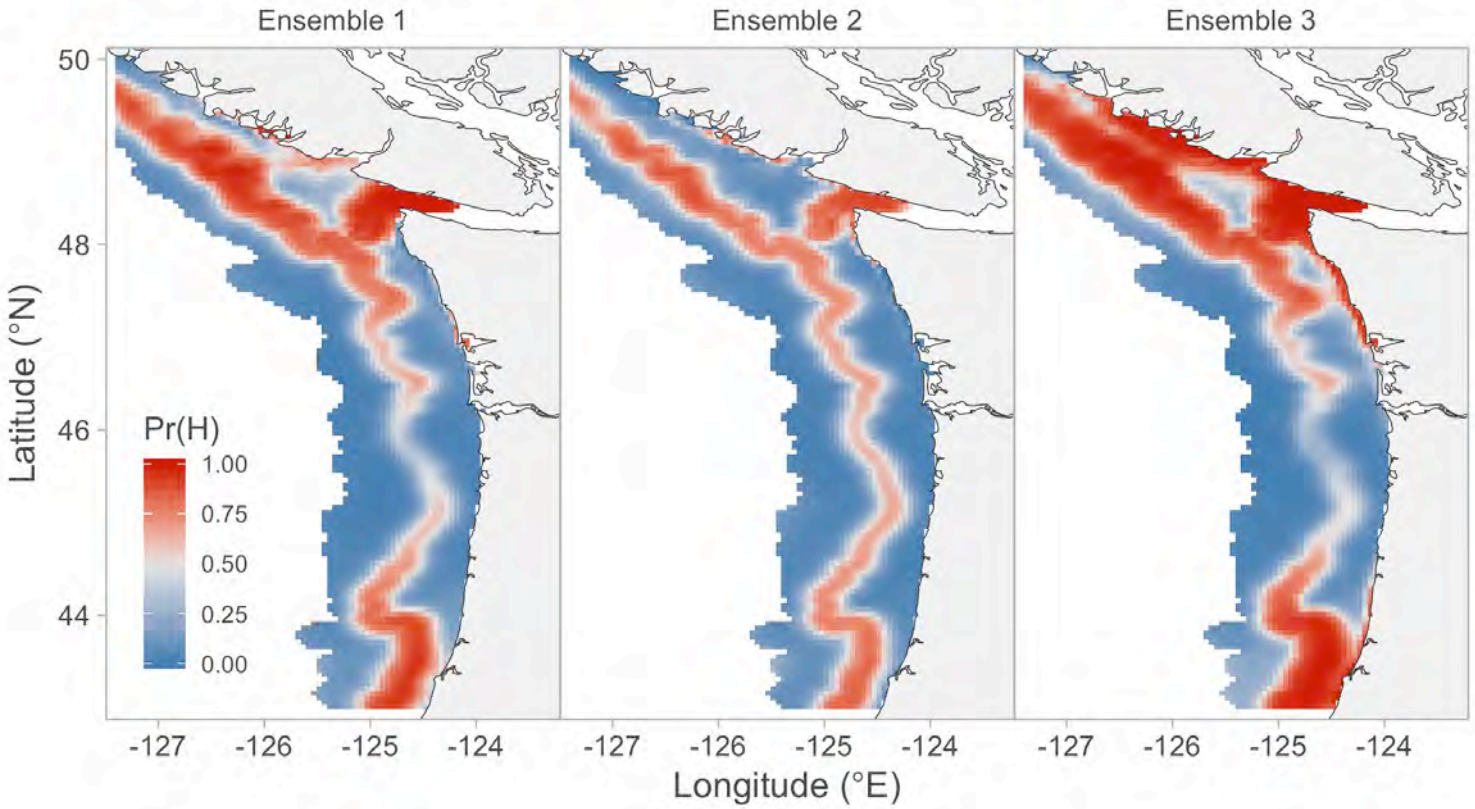


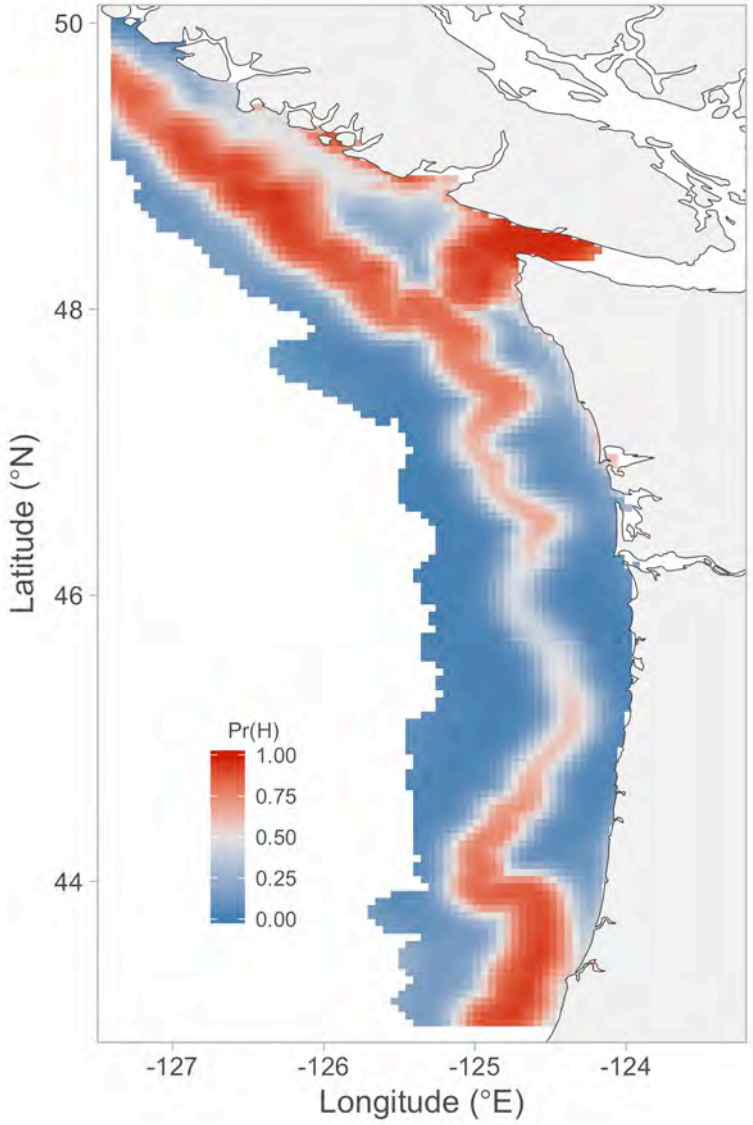
2019 forecast: temperature anomaly at 250 m



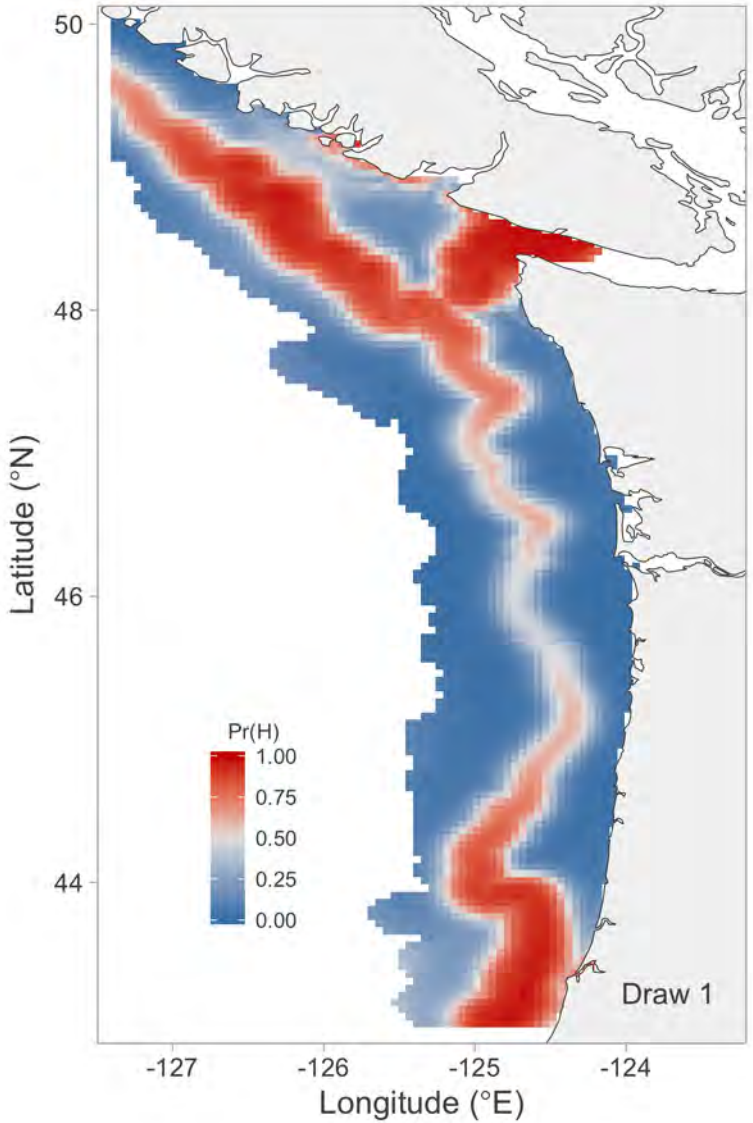
2019 forecast: hake distribution

$$Pr(H) = a + f_1(\text{Shelf distance}) + f_2(\text{Lon,Lat})*\text{Temp250}$$

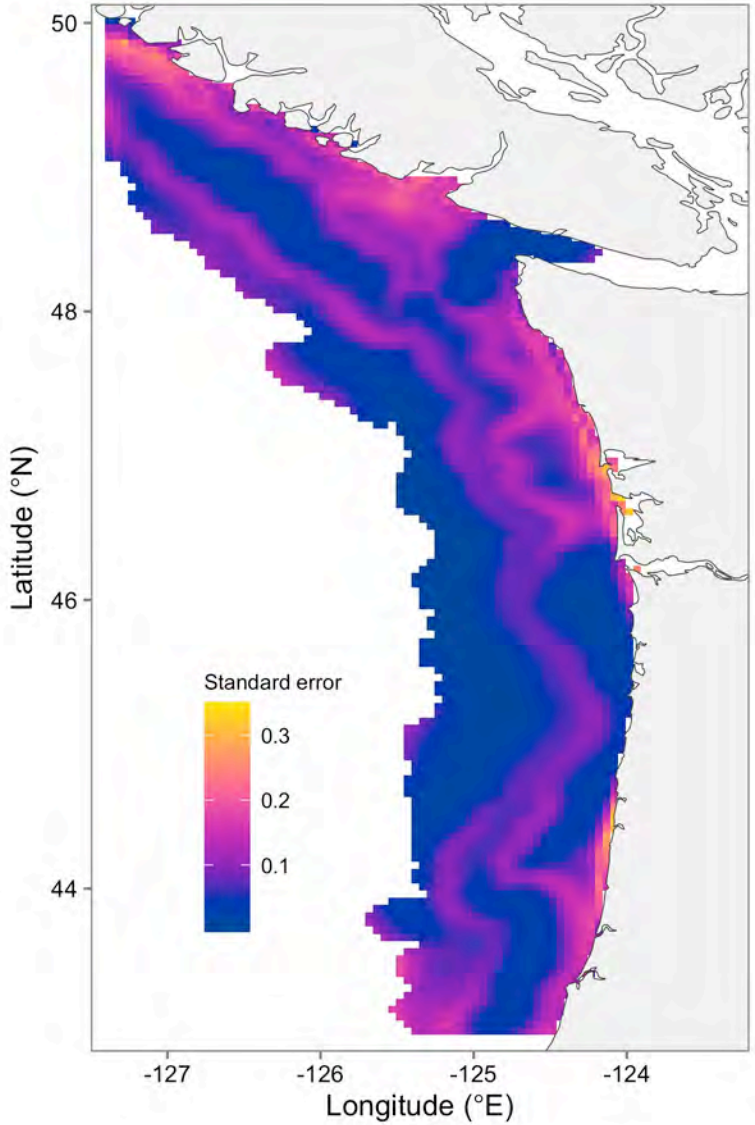




Posterior draws

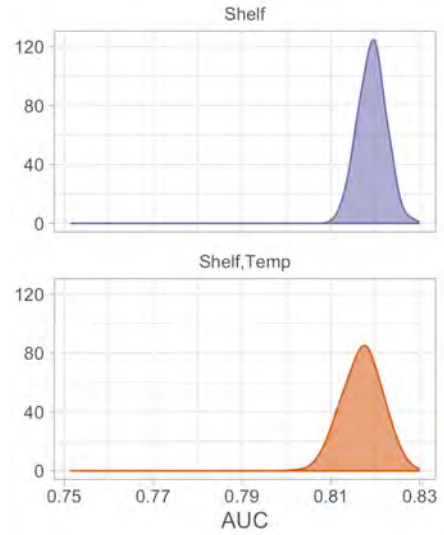


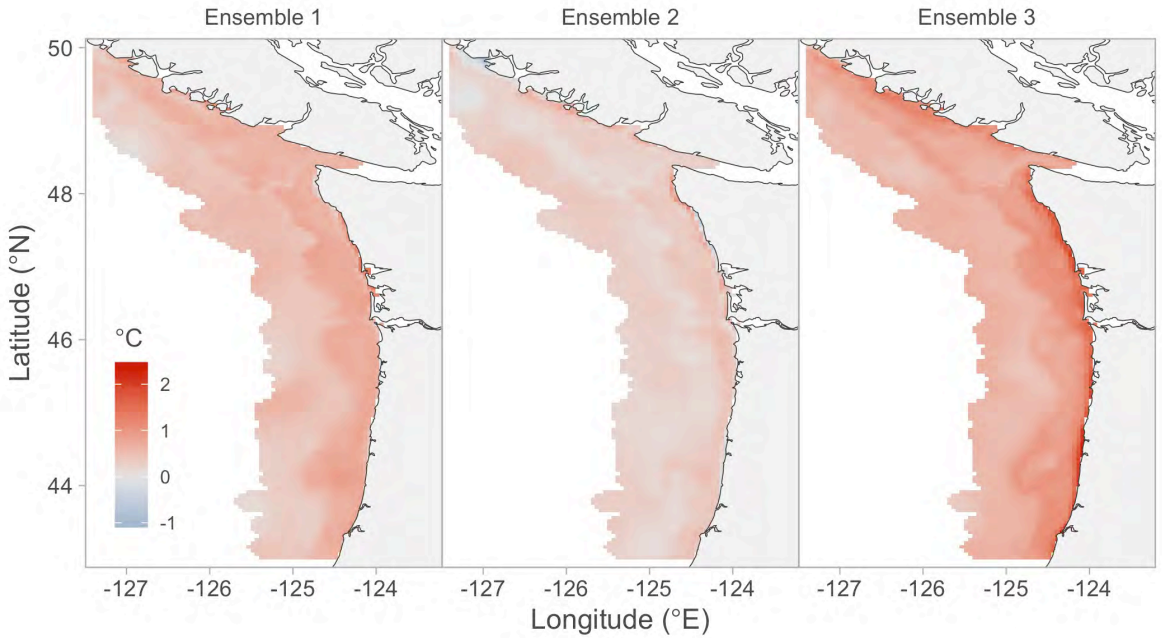
Standard error

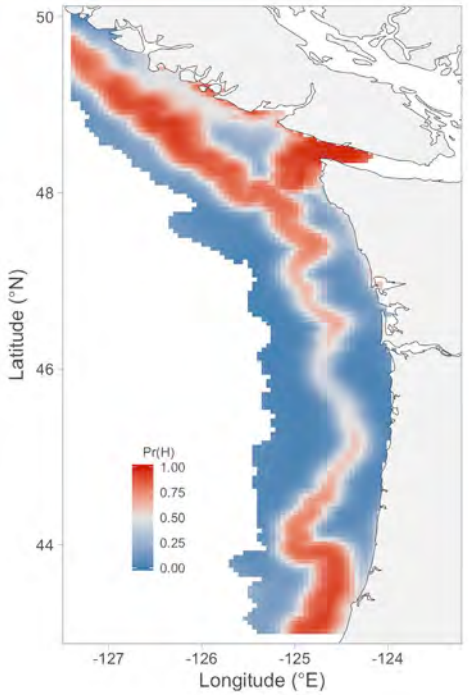


Conclusions

1. Pacific hake have a forecastable distribution
2. Distance to shelf break is a strong predictor
3. 2019 provides a good test for temperature effect







Acknowledgements

Advisors

Mary Hunsicker
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Collaborators

Sandy Parker-Stetter
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Aaron Berger
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Jan Newton
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