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Towards spatial-explicit daily egg production estimates

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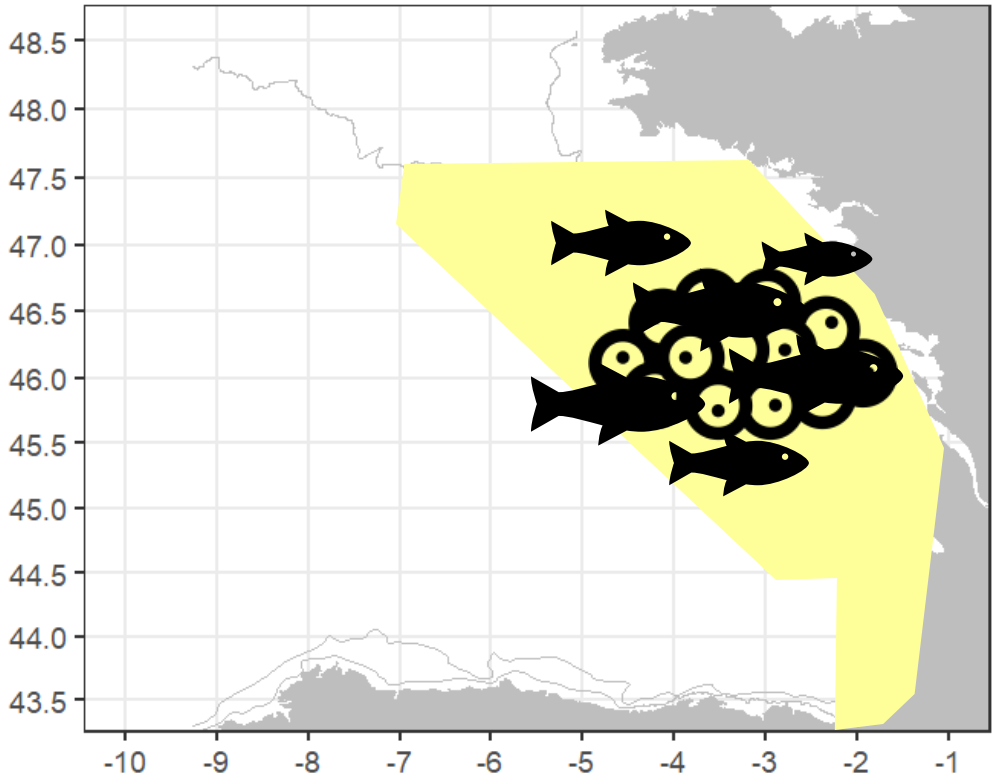
DAILY EGG PRODUCTION METHOD

In the DEPM, we cover the spawning area at the spawning peak



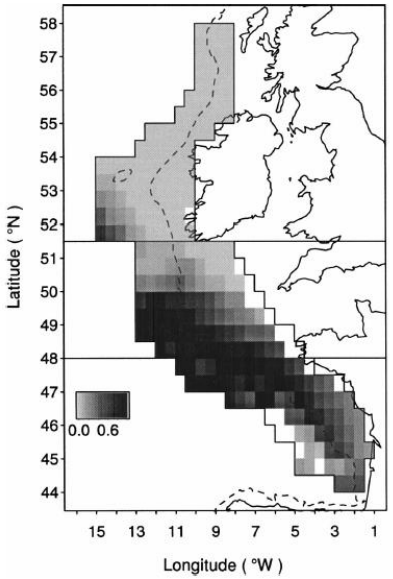
Daily Egg Production
(P_{tot})

Daily Fecundity
(DF)

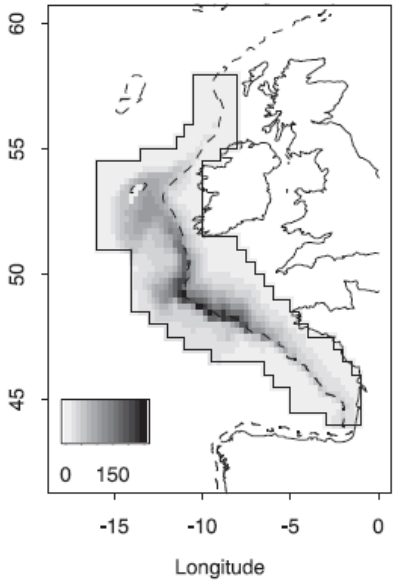
$$SSB = \frac{P_{tot}}{DF}$$

CAN WE OBTAIN SPATIALLY-EXPLICIT ESTIMATES??

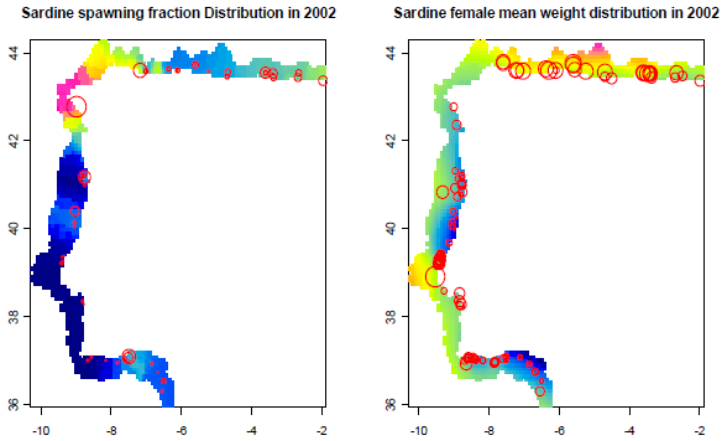
THIS IDEA IS NOT NEW…



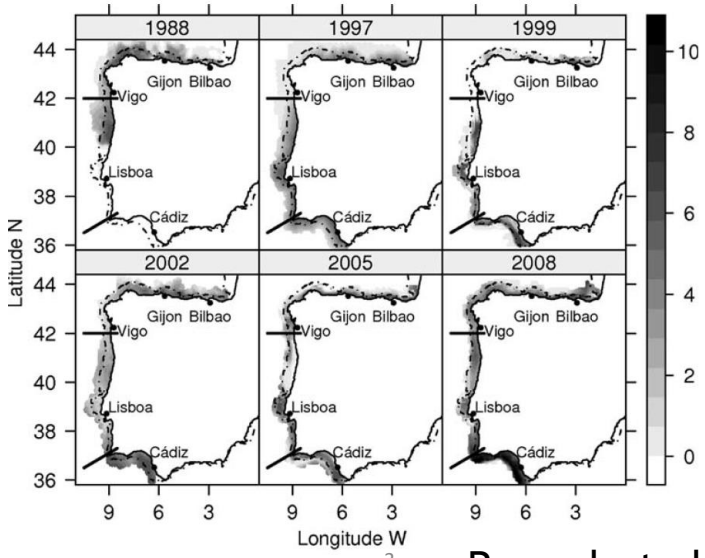
Borchers et al. (1997)



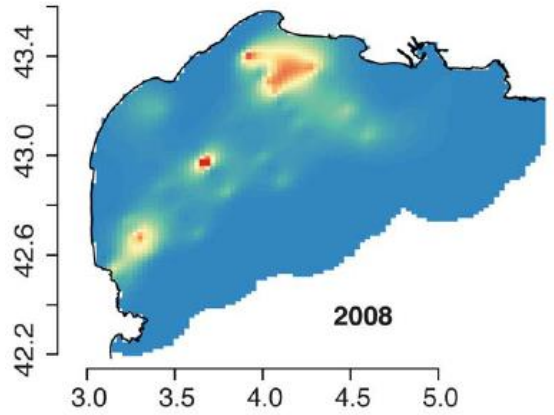
Augustin et al. (1998)



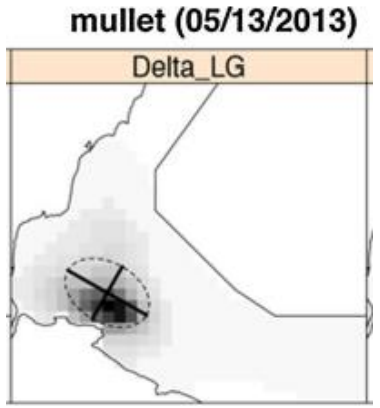
ICES (2004)



Bernal et al. (2011)



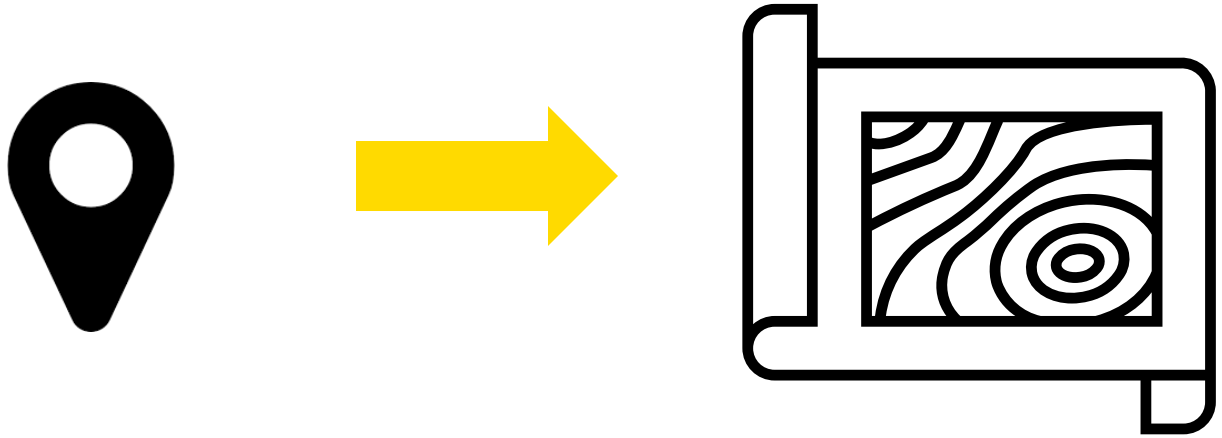
Ospina-Alvarez et al. (2013)



Li et al. (2017)

OBJECTIVE OF THIS WORK

Extend the approach by Citores et al. to obtain spatially-explicit P_{tot} estimates



CURRENT METHOD FOR ESTIMATING P_0 AND z

MODEL REFORMULATION

After the egg ageing process we have:

$Y_{i,j}$: number of eggs in cohort *j* in station *i*
$a_{i,j}$: mean age of eggs in cohort *j* in station *i*
R_i: effective area sampled in station *i*

And we fit the egg mortality curve model as a GLM:

$$Y_{i,j} \sim Negative\ binomial(\mu_{i,j}, \theta)$$

$$\log(\mu_{i,j}) = \log(R_i) + \log(P_0) + \varepsilon_i - Z\ a_{i,j}$$

$$\varepsilon_i \sim Normal\ (0, \sigma_\varepsilon^2)$$

PARAMETERS

RANDOM EFFECTS

MODEL REFORMULATION

In a Bayesian setting, we need to specify the prior distributions:

$$z \sim \text{Gamma}\,(2.15,\ 112.56)$$

BASED ON THE LITERATURE

$$\log(P_0) \sim Student\ t\ (3, location, scale)$$

$$\sigma_\varepsilon \sim Student\ t\ (3{,}0{,}10)$$

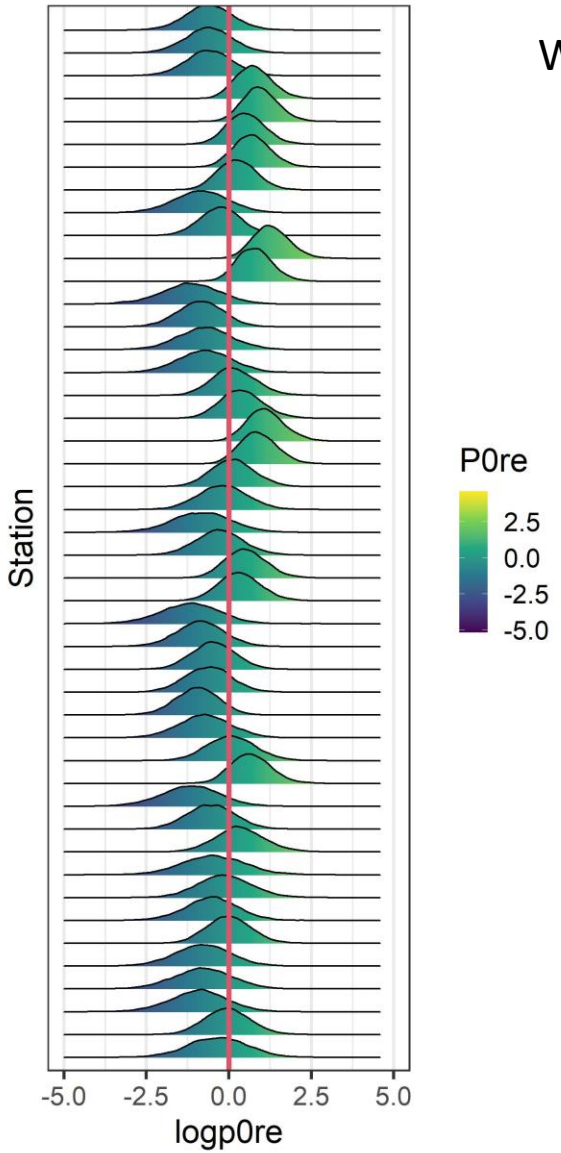
$$\theta \sim \text{Gamma}(0.01, 0.01)$$

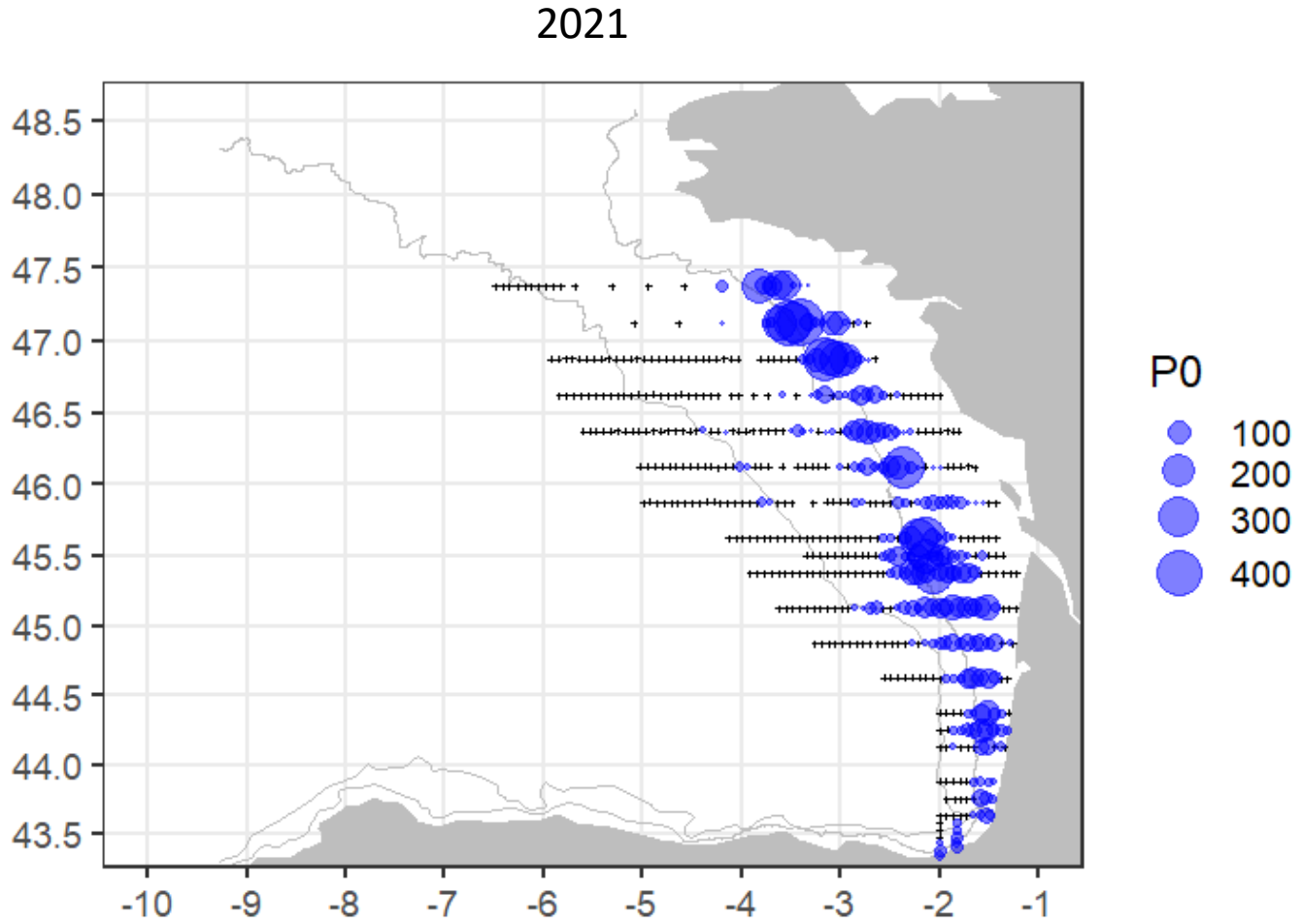
DEFAULT PRIORS

MODEL FITTED USING R PACKAGE brms (Bürkner 2017, 2018, 2021)

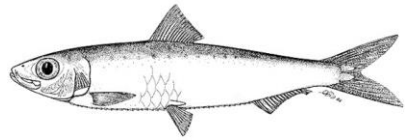
SARDINE IN THE BAY OF BISCAY

We applied the method to sardine in 8abd covered by the BIOMAN surveys 2005-2021

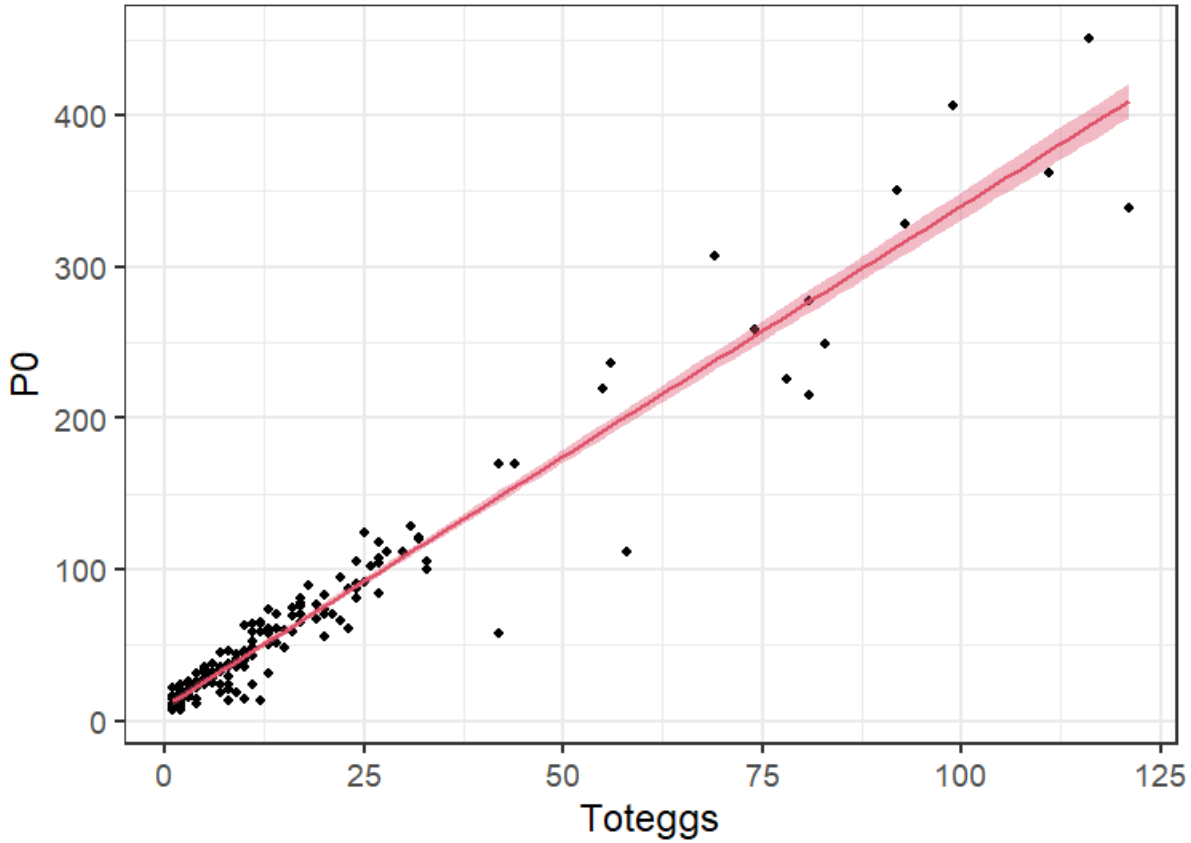




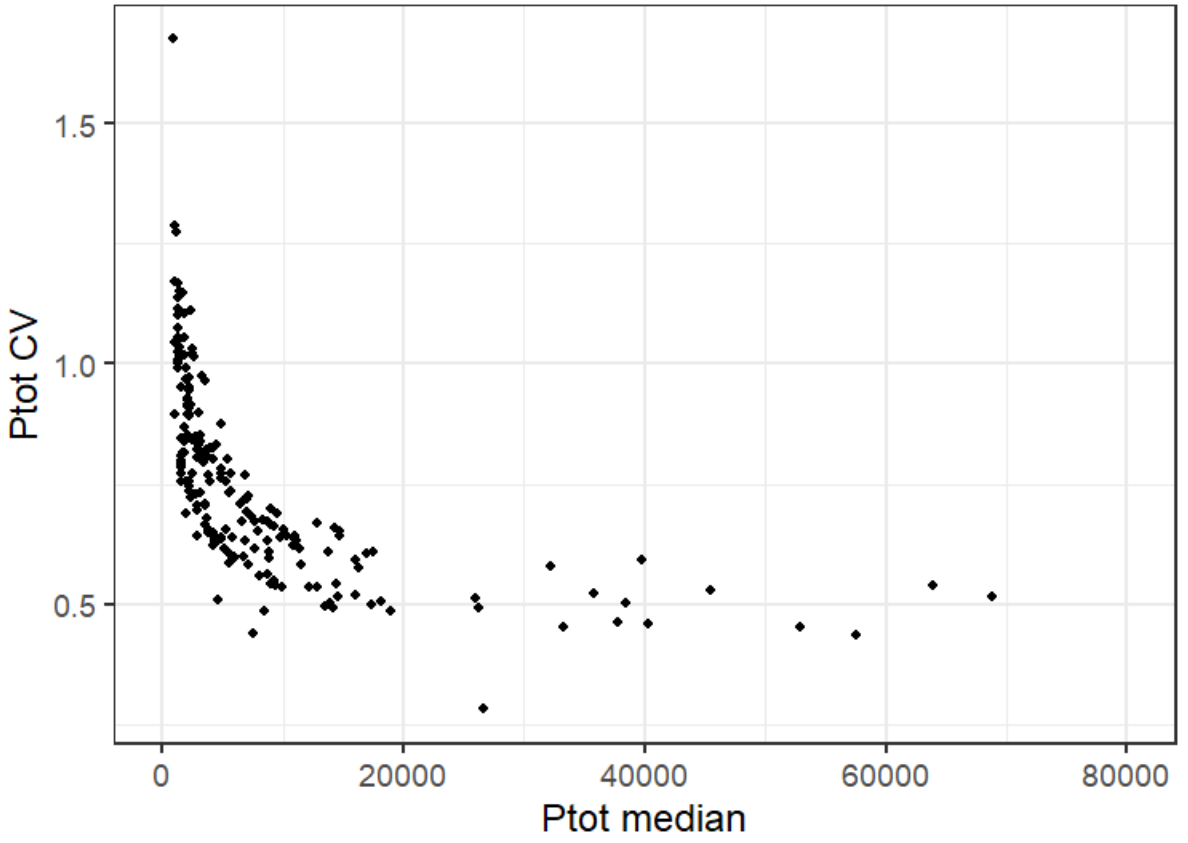
SARDINE IN THE BAY OF BISCAY



2021

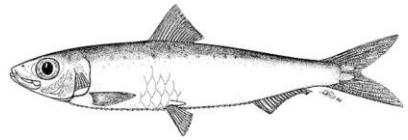


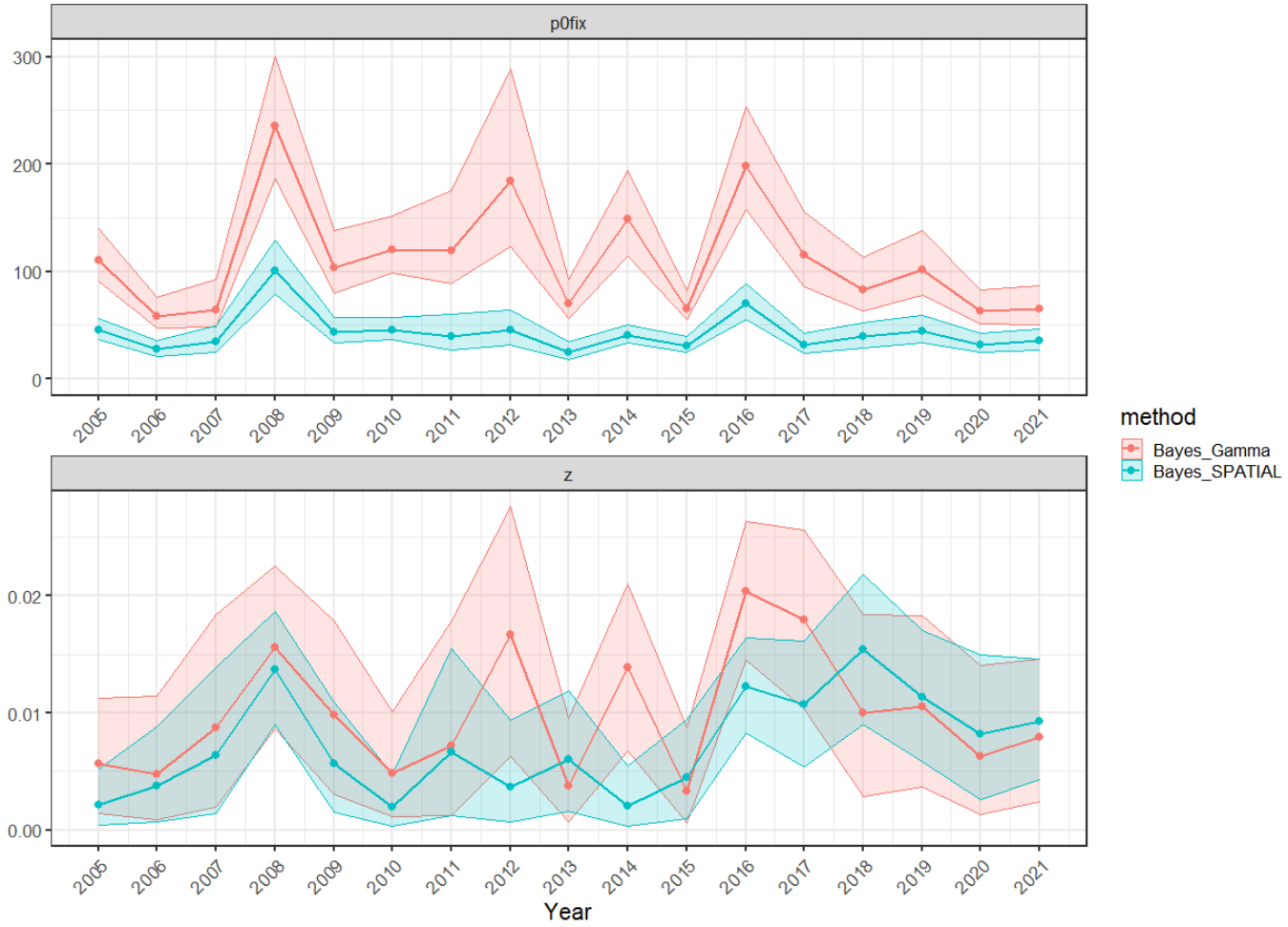
Larger production in stations with more eggs

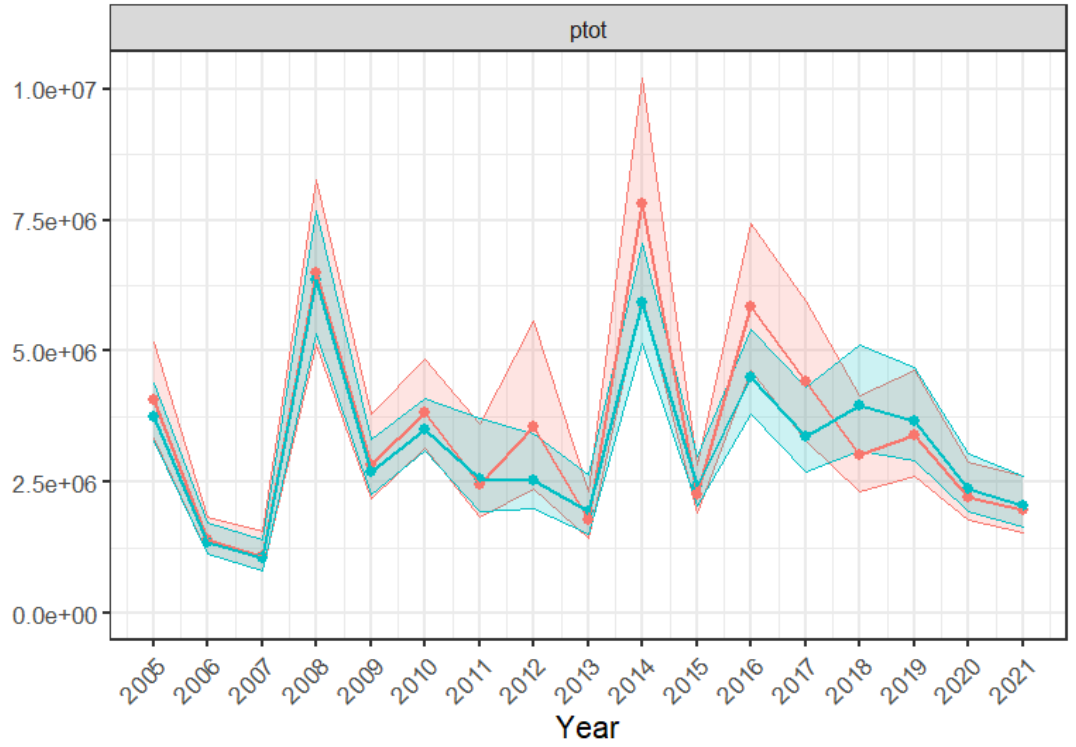


Larger uncertainty in low production areas

SARDINE IN THE BAY OF BISCAY







Need to understand better the differences in Z for 2012, 2014, 2016, 2018

CONCLUSIONS AND FURTHER WORK

- Recent statistical advances allow us to incorporate new elements into the egg mortality curve model fit.
- Results look promising so far, but work is still in progress.
- Further work:
  - Understand the differences between spatial-explicit and overall estimates in some years
  - Explore having Z estimates per big spatial strata
  - Test the method for anchovy

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