



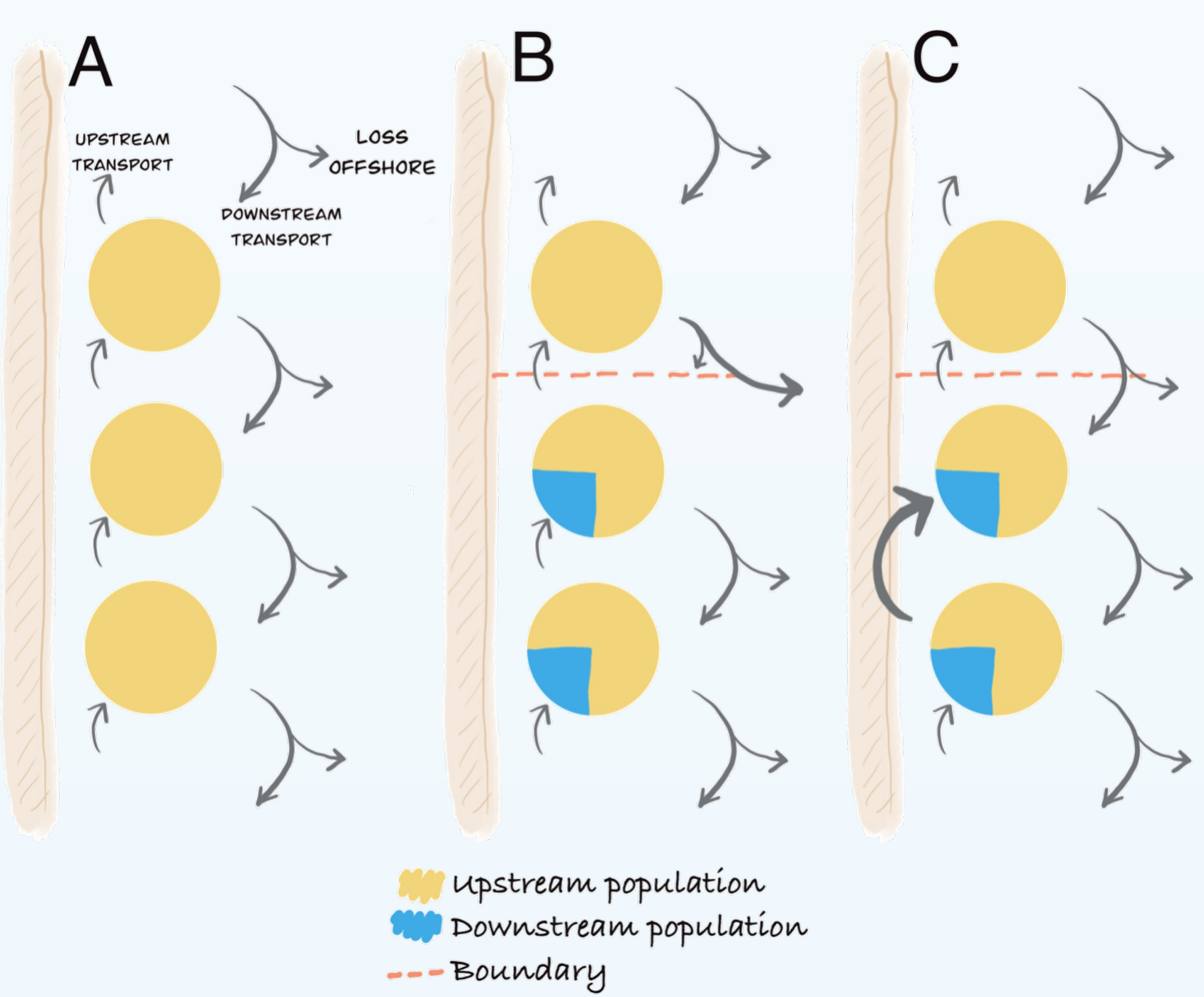
Drifting Along: circulation-driven larval dispersal patterns set the location of many coastal biogeographic boundaries

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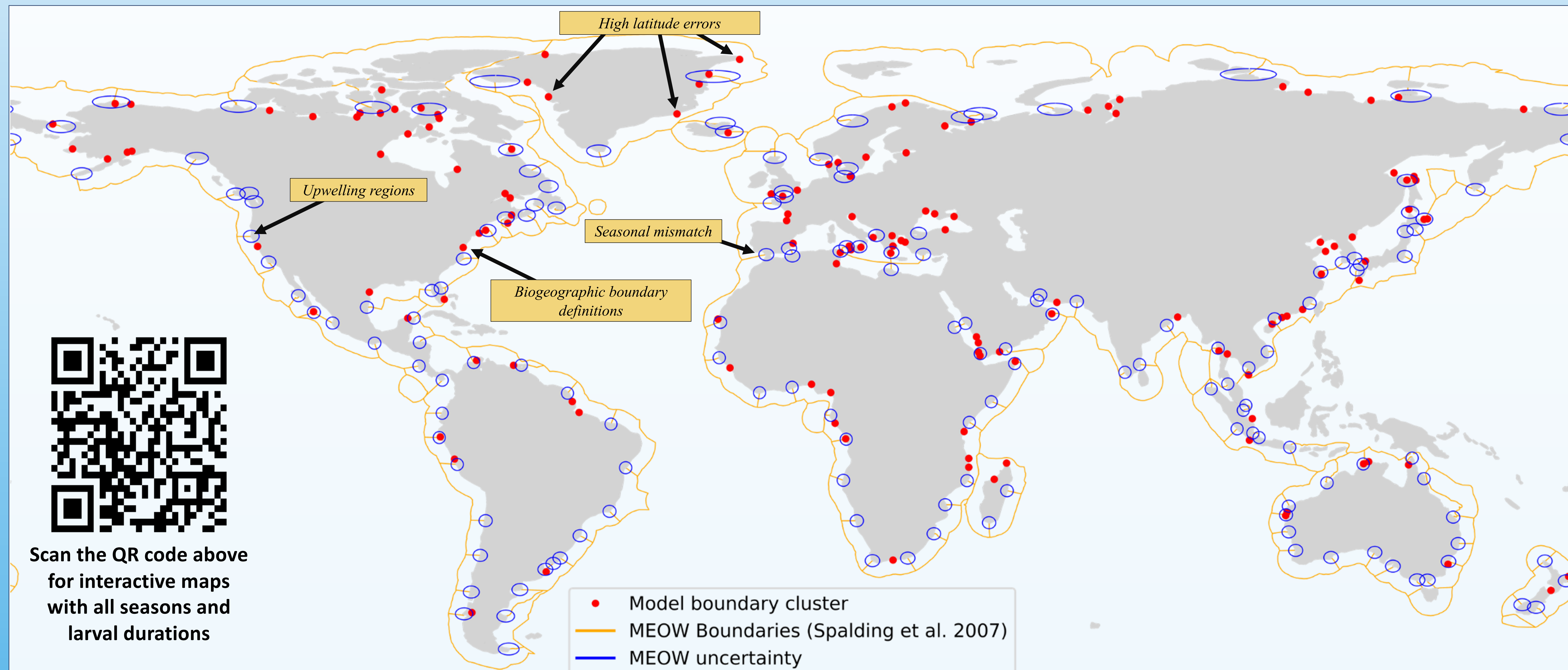
Species range boundaries cluster in many locations along the global coastline – where does circulation set the location of these clusters?



Alongshore variation in larval transport and range boundary formation for two species. **A)** constant flow, resulting in only the upstream species (orange) remaining in the domain. Causes no boundary clustering **B)** interruption in alongshore circulation, allowing the downstream species to gain a foothold due to a lack of upstream larval input **C)** enhanced retention of downstream species, allowing the downstream species to persist despite larval input from upstream

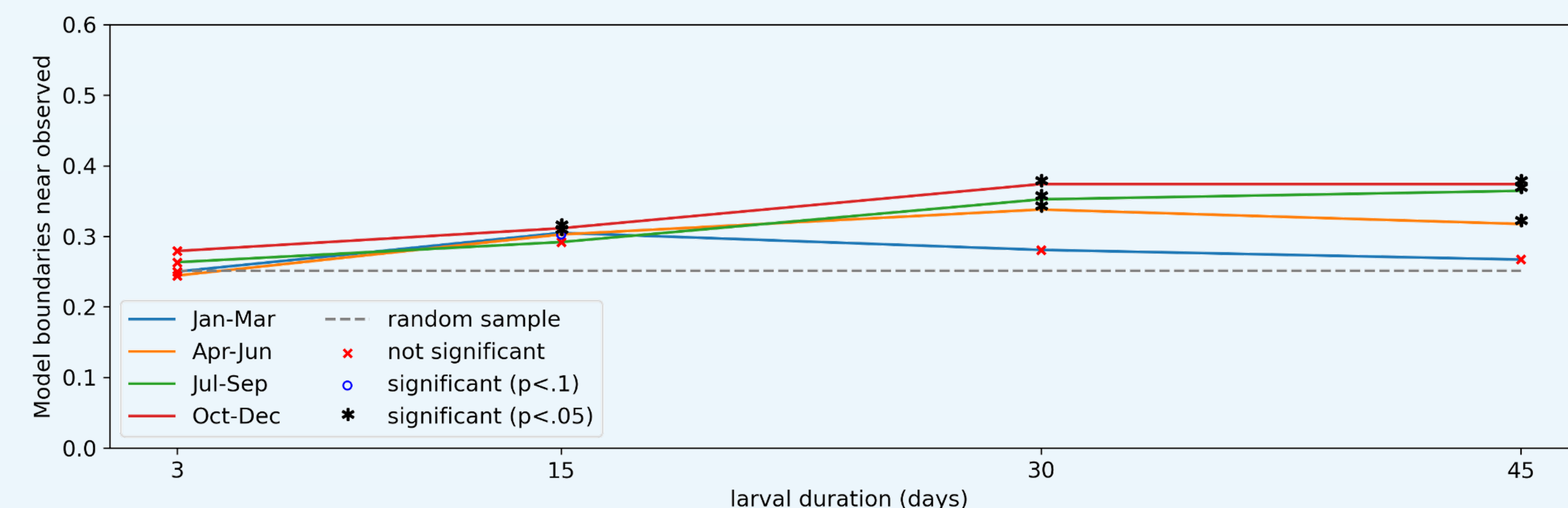
Modeling biogeographic boundaries

- Global coastal connectivity from Mercator Ocean 1/12° global model and TRACMASS Lagrangian particle tracking software
- Individual ‘species’ range boundaries generated using a neutral population model with each model species initialized at a single location along the coastline
- Boundaries are clusters of individual species range boundaries that form after many generations of the population model
- Model boundaries compared to ecoregion boundaries from Marine Ecoregions of the World (MEOW)^[1]

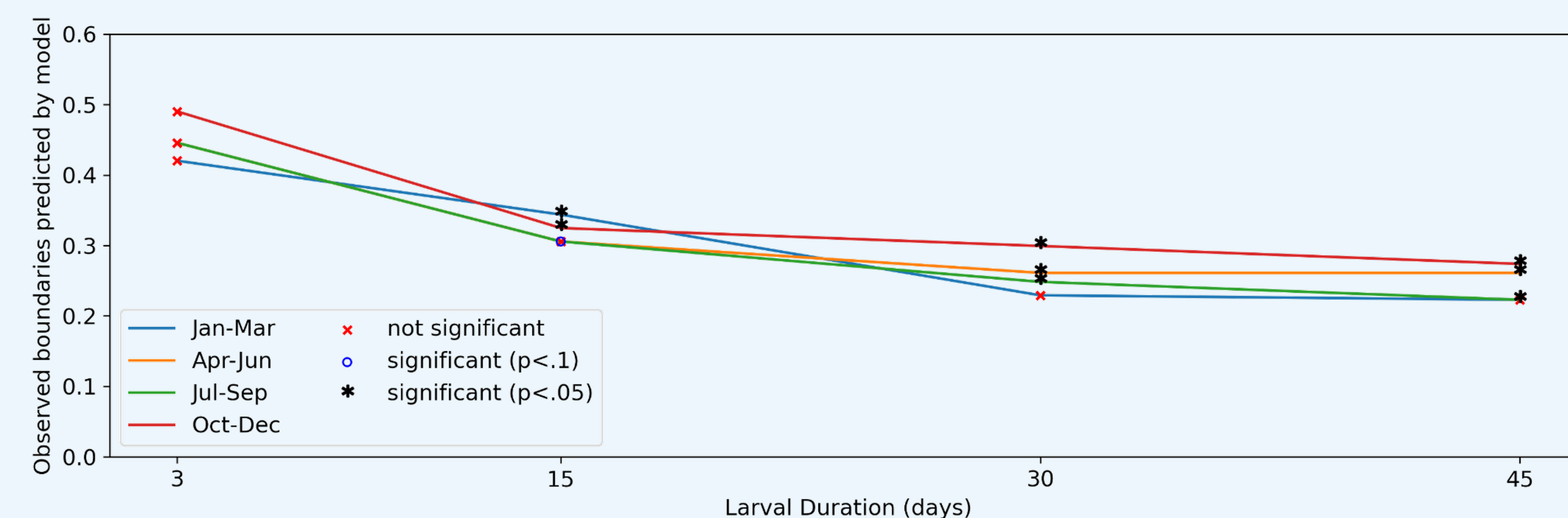


Model boundary cluster locations for April-June larval releases with 30-day larval durations (in red) compared against boundaries from MEOW^[1]

- Do model boundaries cluster near MEOW ecoregion boundaries more than random chance?



- How many observed biogeographic boundaries does a circulation-based model predict?



Coastal circulation is sufficient to predict the location of many observed biogeographic boundaries for larval durations of 15 days and longer

Learning from model failures:

- Problem 1: observed biogeographic boundaries not replicated by the model
 - Lack of planktonic dispersal at high latitudes^[2]
 - Seasonality
- Problem 2: model boundaries that don't match observed biogeographic boundaries
 - Life history mismatch (e.g. surface larvae in upwelling zones)
- Definition of ‘biogeographic boundary’

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Cited works:
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[2] Marshall DJ, Krug PJ, Kupriyanova EK, Byrne M, Emler RB (2012) The Biogeography of Marine Invertebrate Life Histories. *Annu Rev Ecol Syst* 43:97-114.
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