# Relating overlap in time and space between larval northern anchovy and their zooplankton prey to annual recruitment

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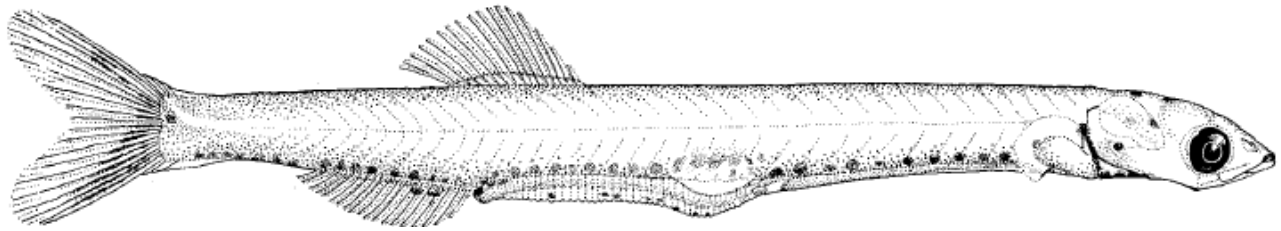
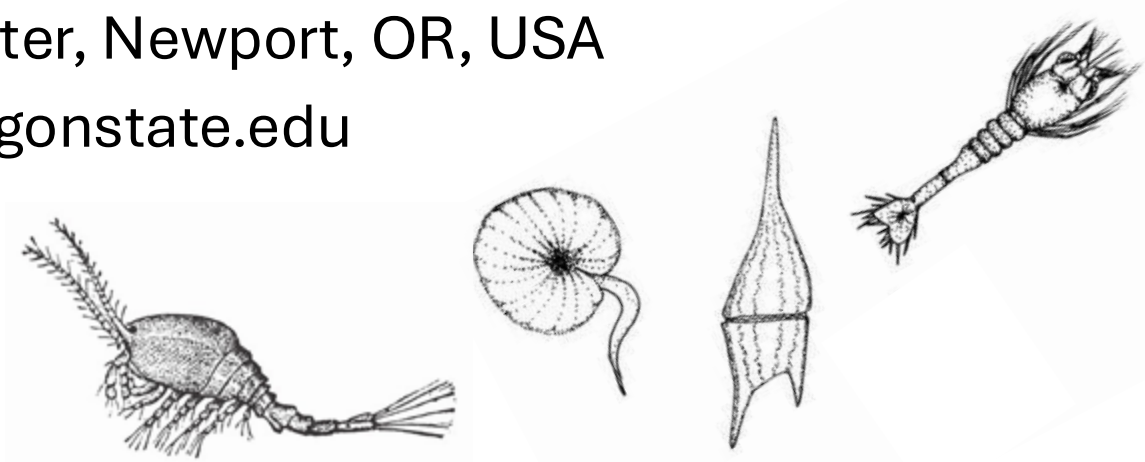
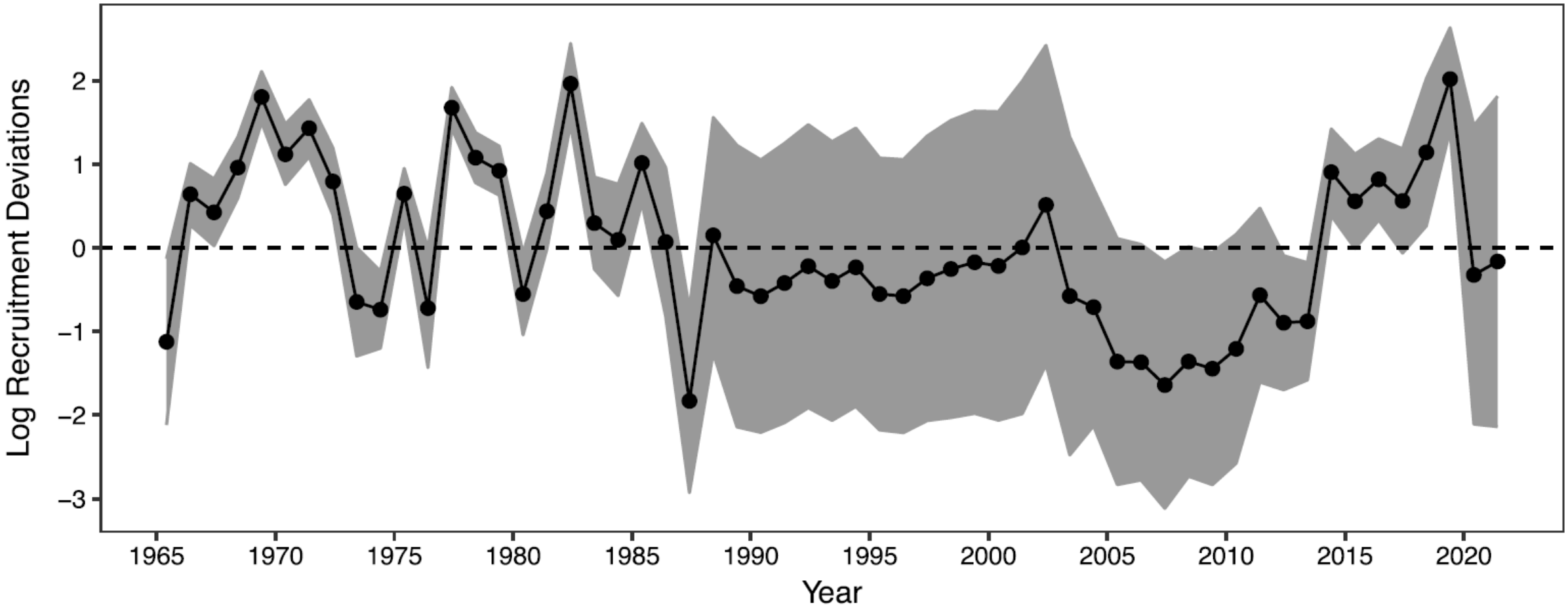
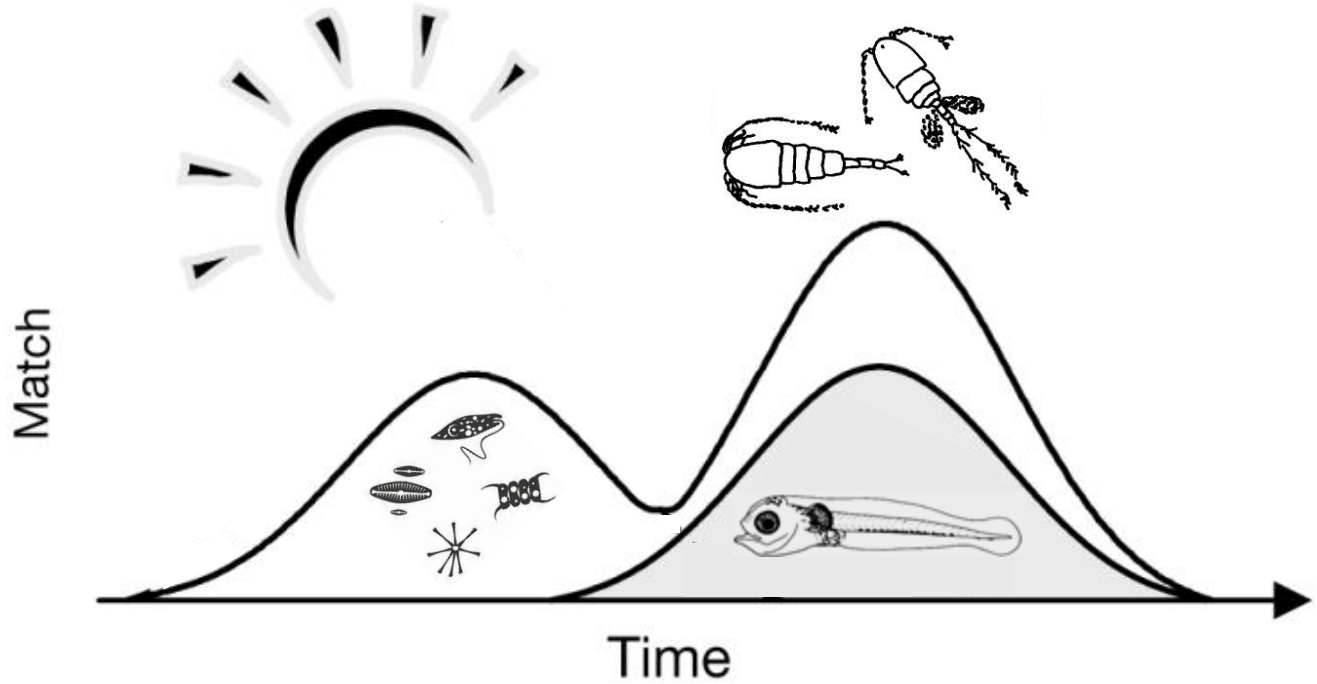




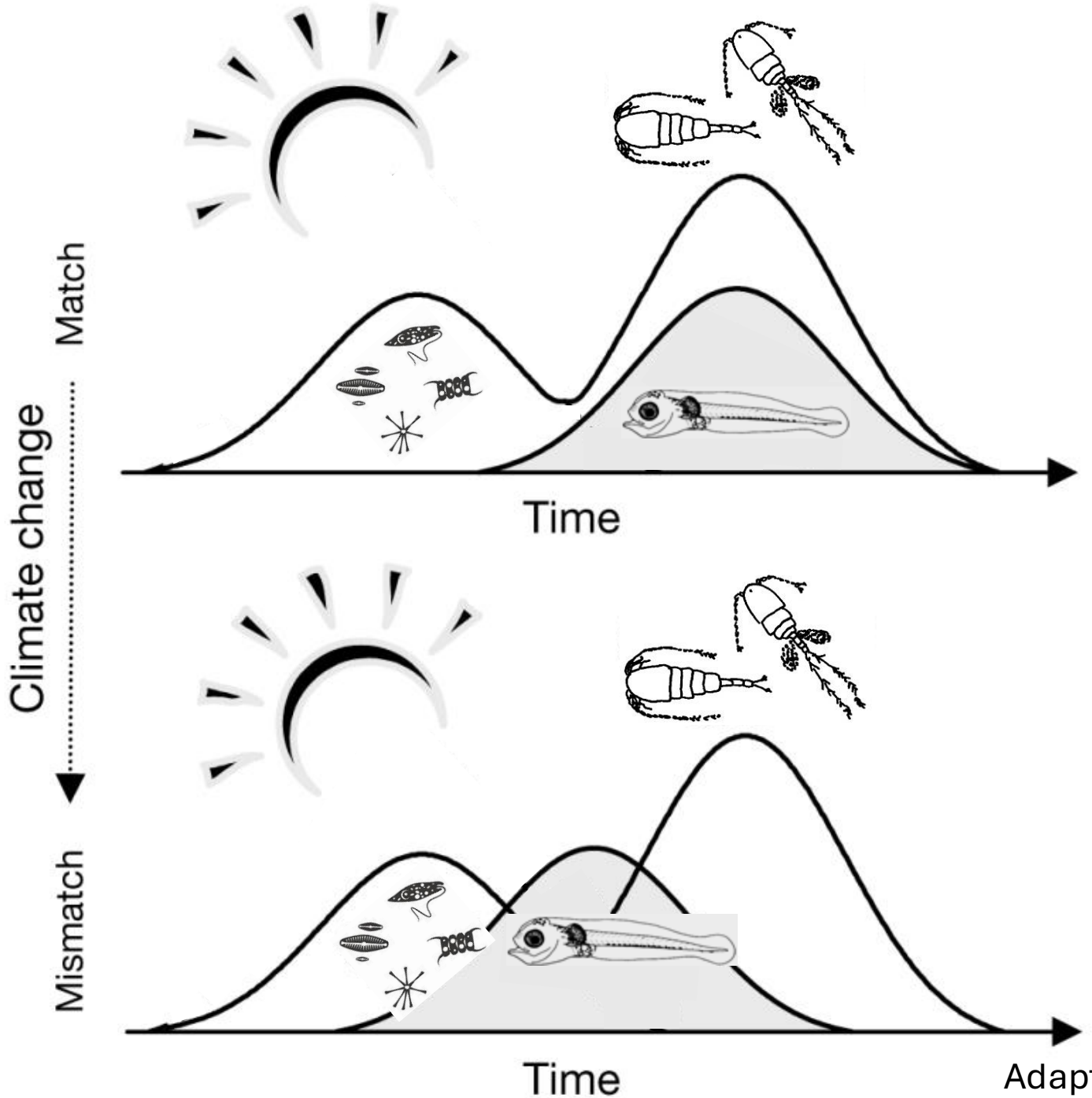
# Larval fish survival may explain recruitment variability




From Hinchliffe *et al.* 2024




Adapted from Durant *et al.* 2007

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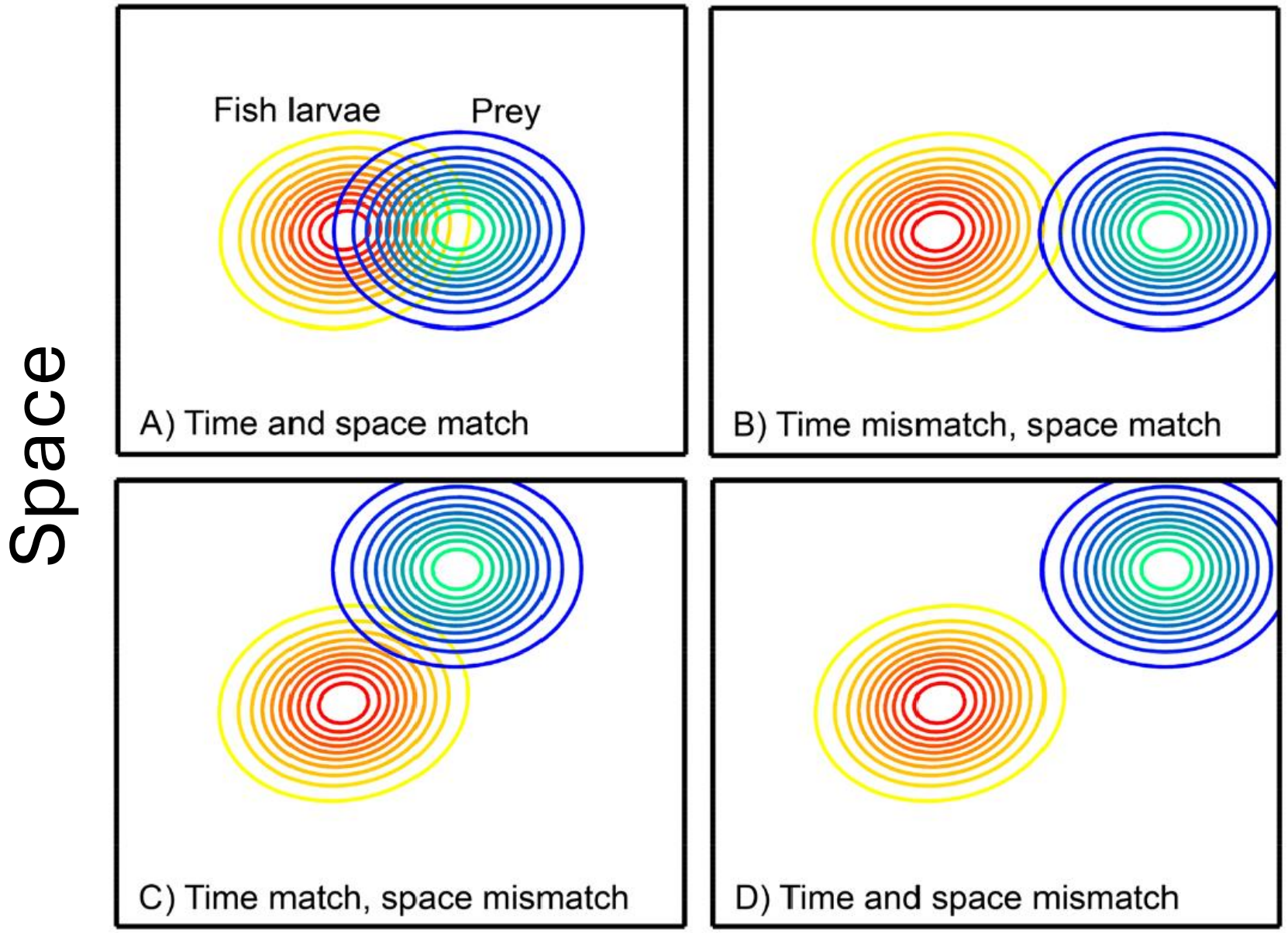
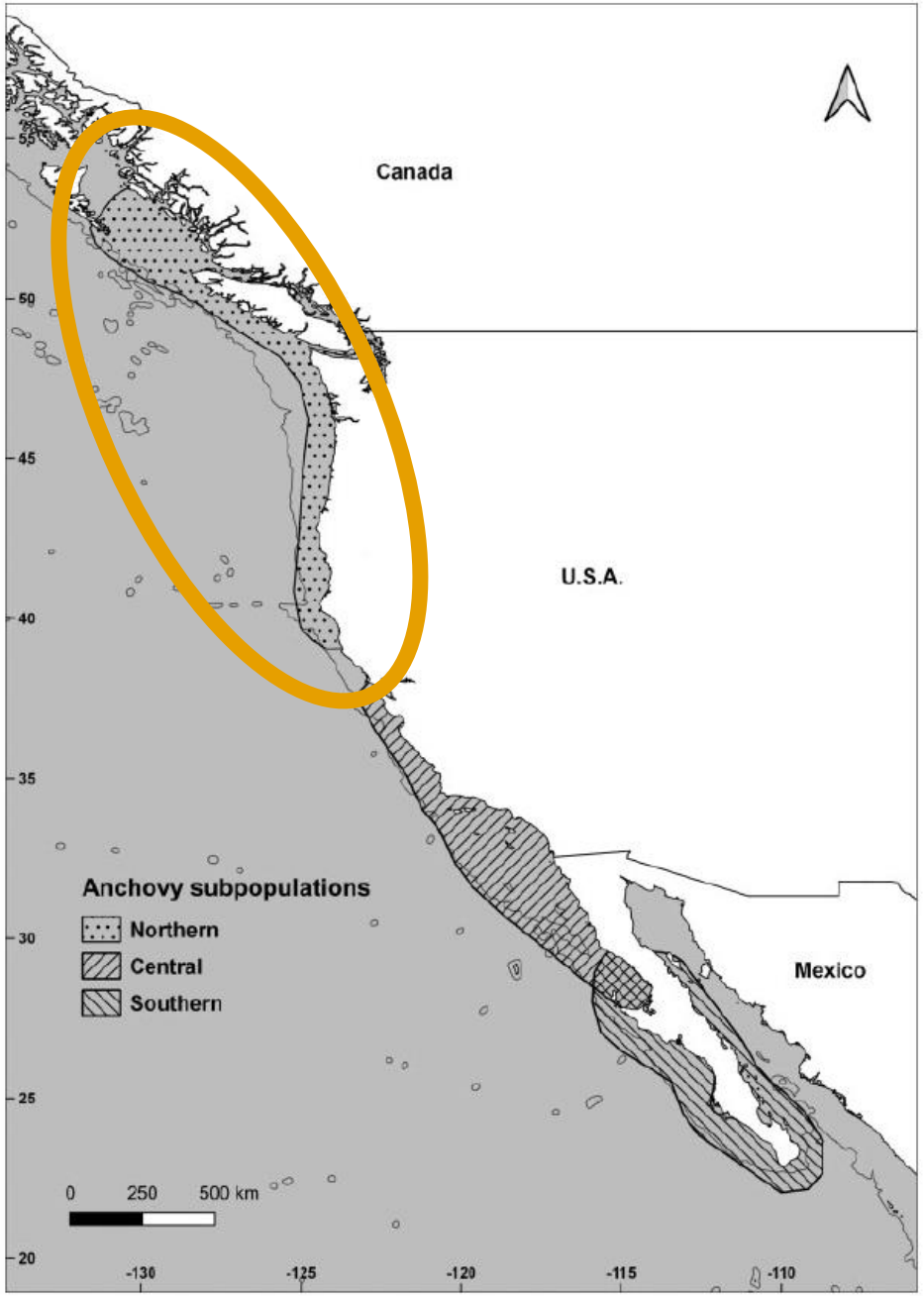



From Llopiz *et al.* 2014

# Northern anchovy may suffer from mismatch with prey

- Northern subpopulation spawns in coastal waters associated with the Columbia River plume
  - Usually May–June
  - Earlier (January!) in warm years
- Larvae eat zooplankton
  - Copepod eggs, nauplii, adults
  - Dinoflagellates
  - Ciliates
- Recruitment is highly variable
  - May be driven by overlap with prey



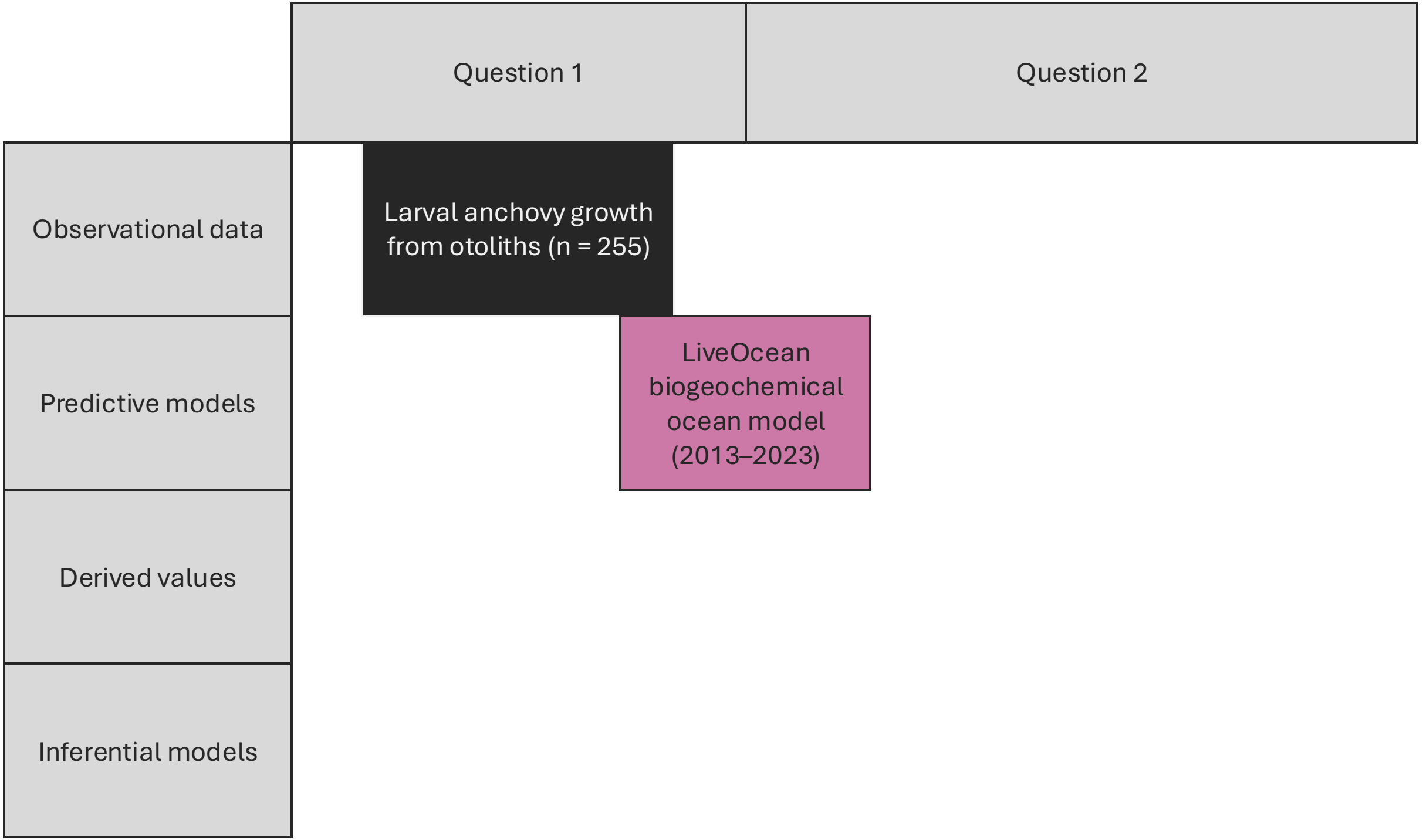

From Sydeman *et al.* 2020

# Research questions

1. Are spatial and temporal variation in zooplankton abundance related to performance of individual anchovy larvae?

2. Is the degree of spatial and temporal overlap between anchovy larvae and zooplankton in a year related to annual recruitment?

| | Question 1 | Question 2 |
| --- | --- | --- |
| Observational data | | |
| Predictive models | | |
| Derived values | | |
| Inferential models | | |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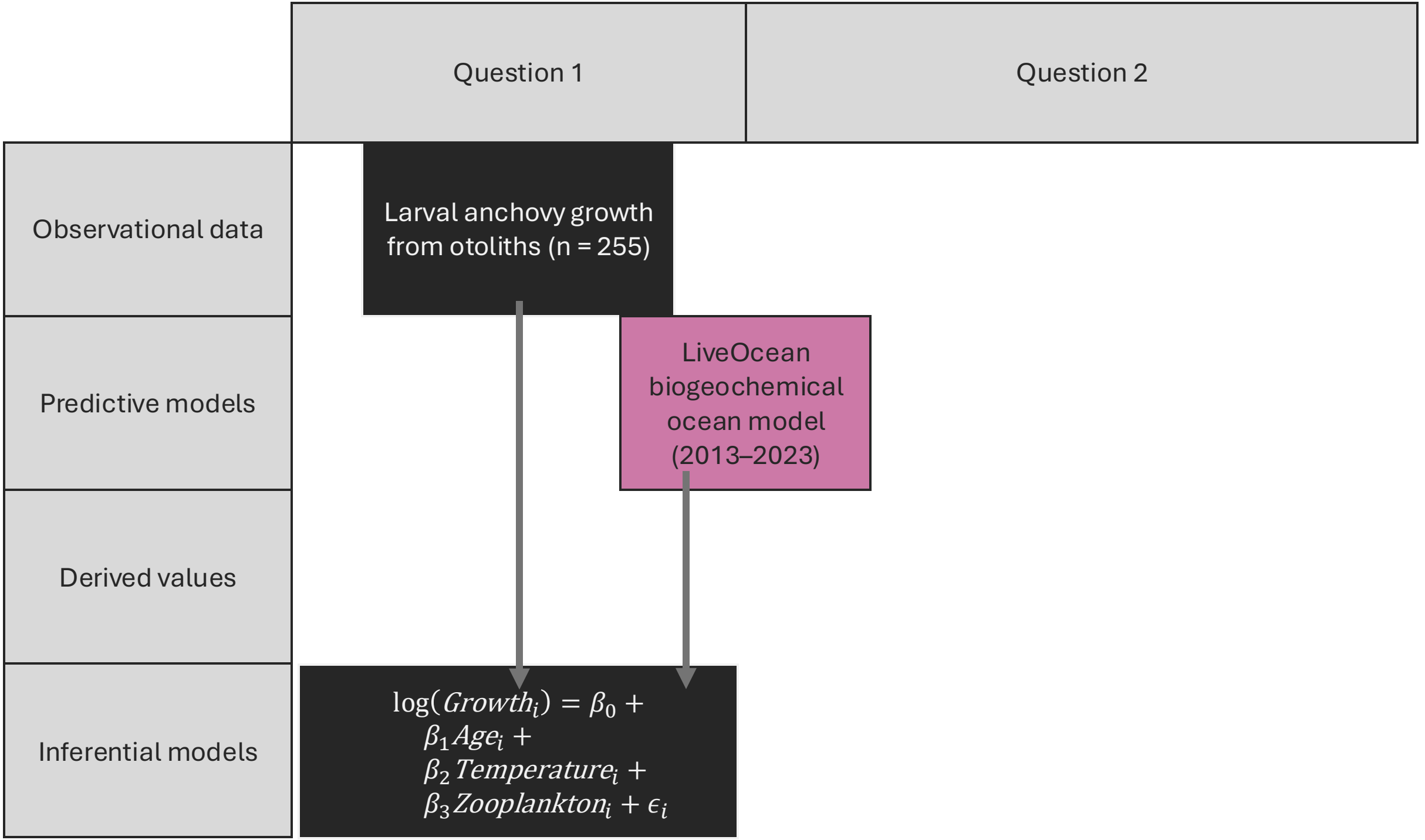
Larval anchovy growth from otoliths (n = 255)
LiveOcean biogeochemical ocean model (2013–2023)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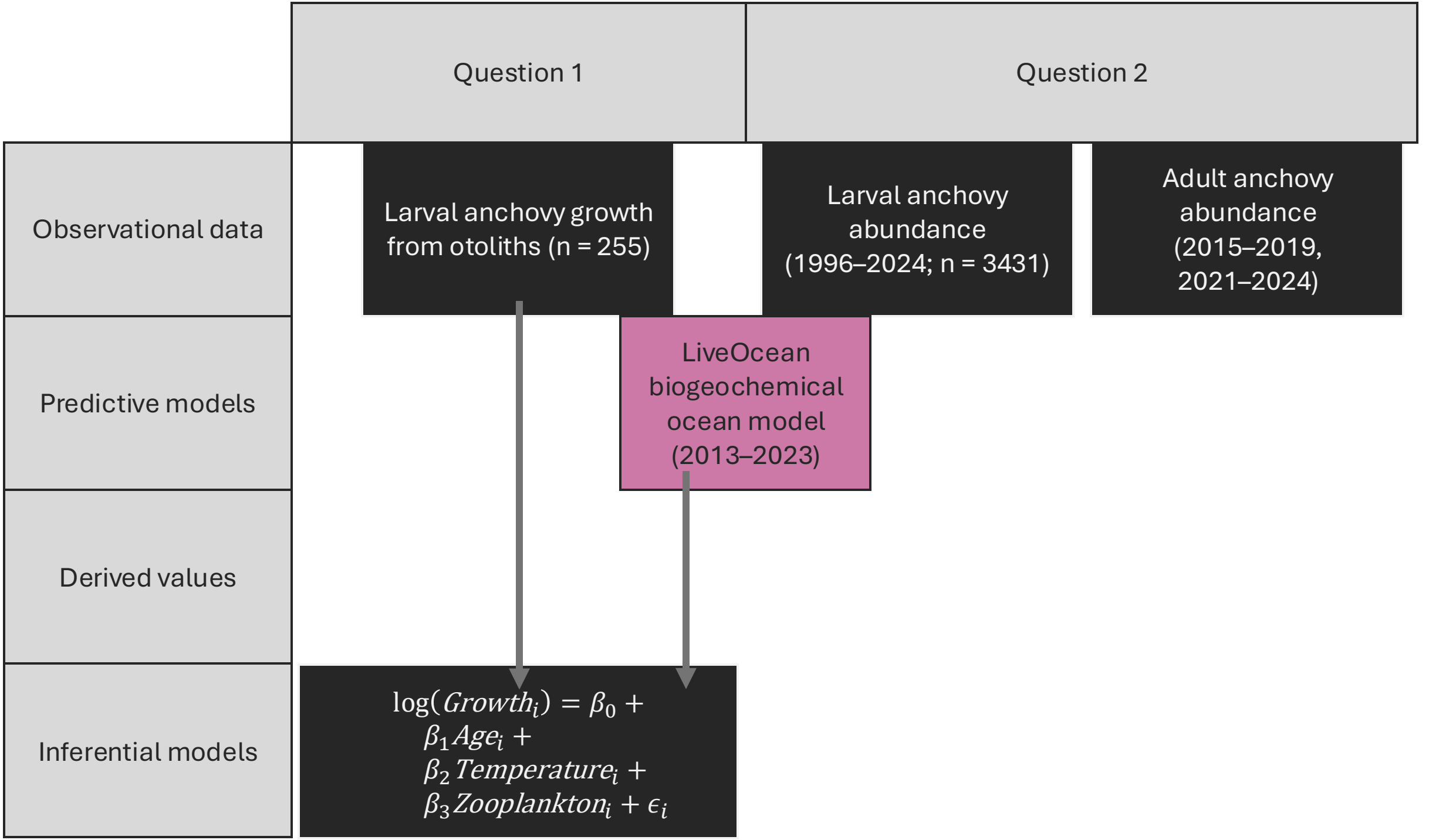
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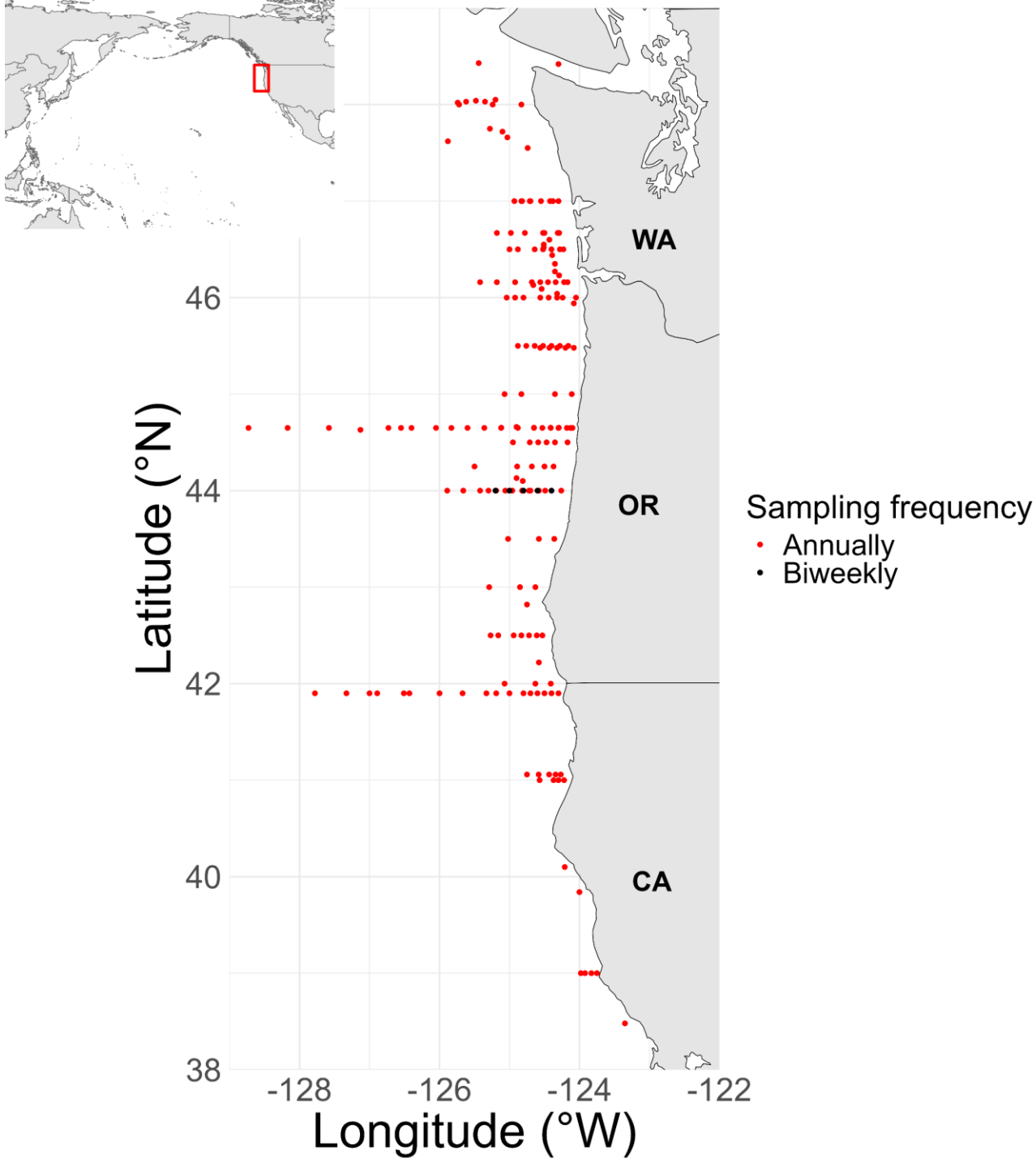


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Adult anchovy abundance (2015–2019, 2021–2024)

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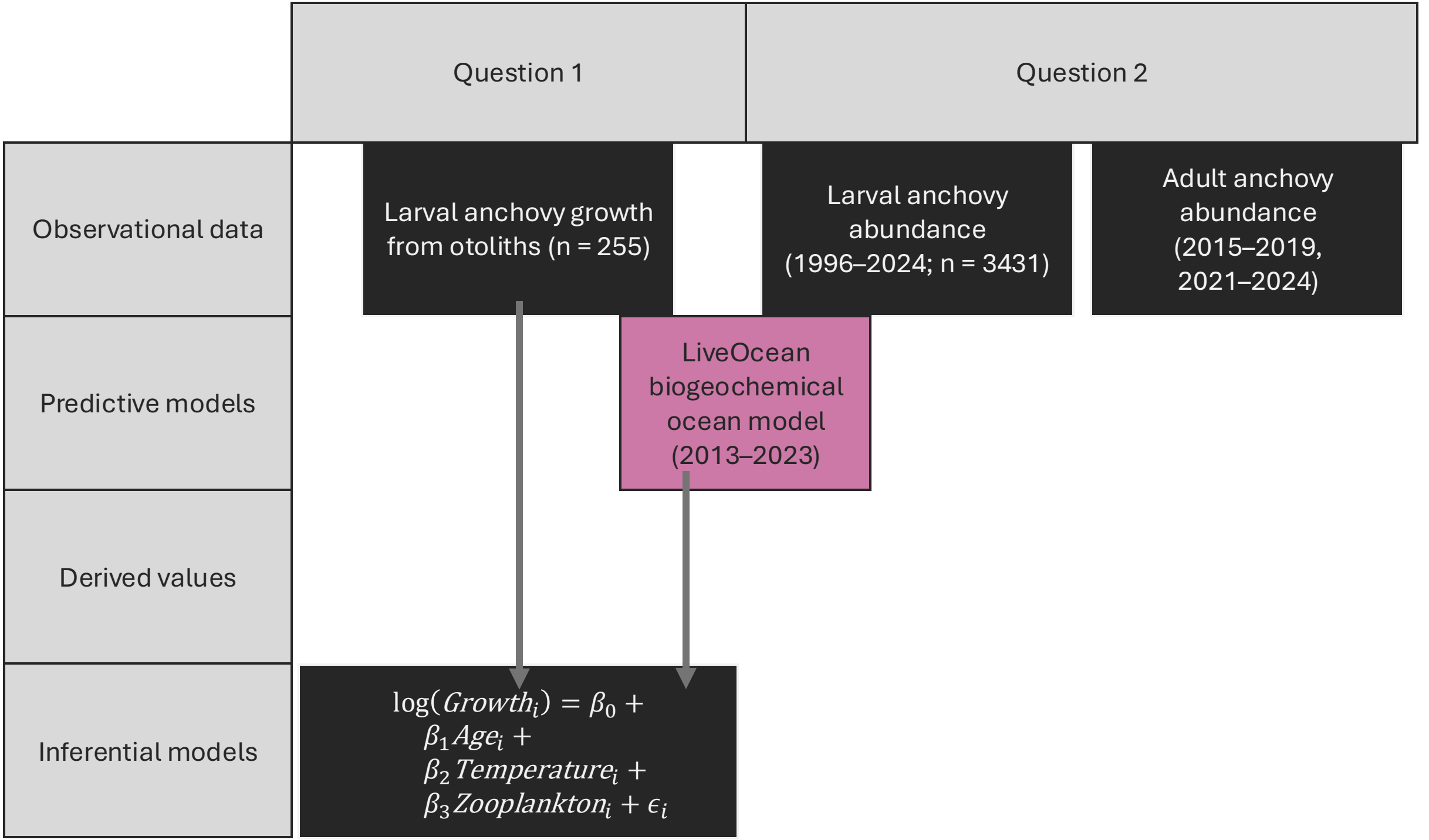
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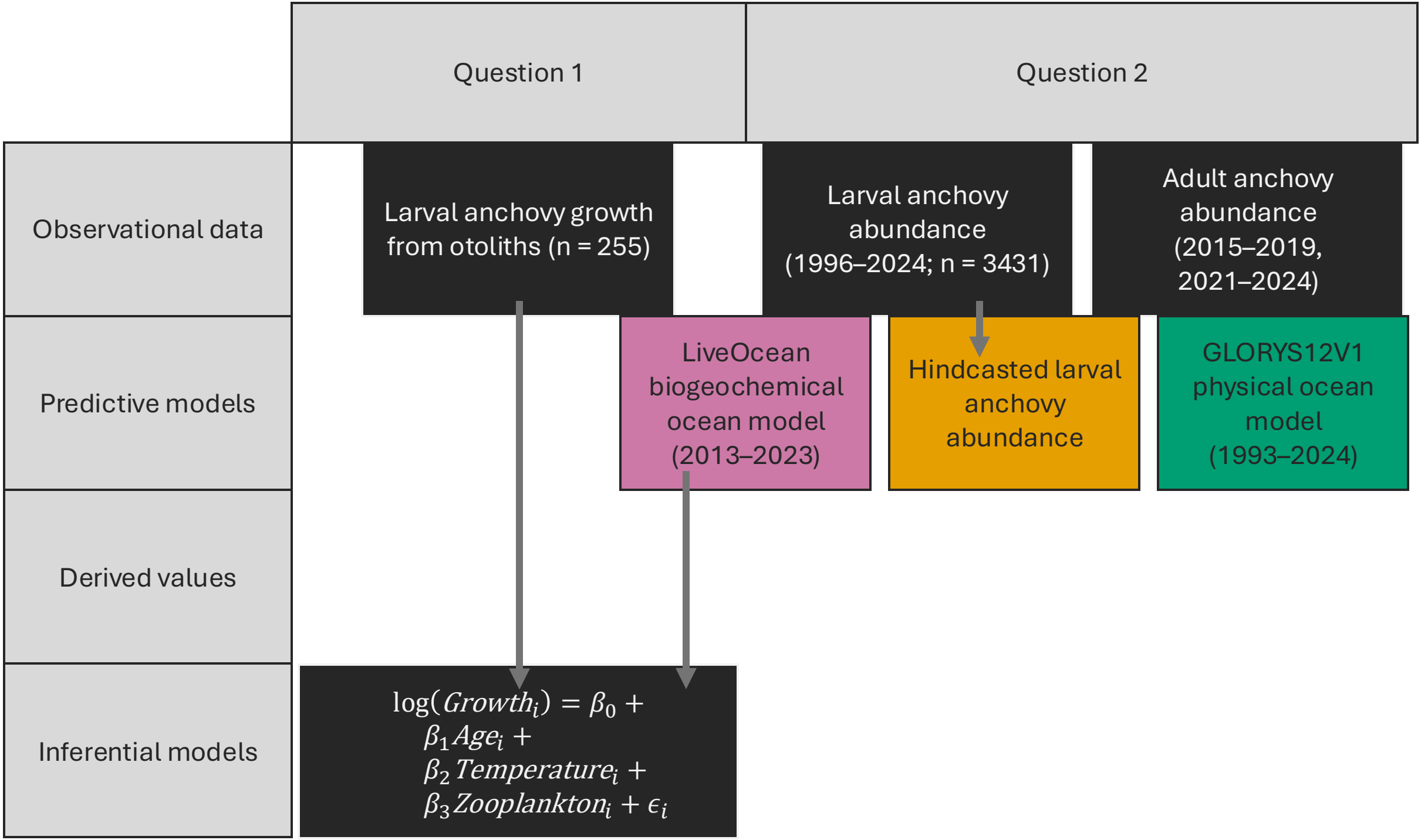
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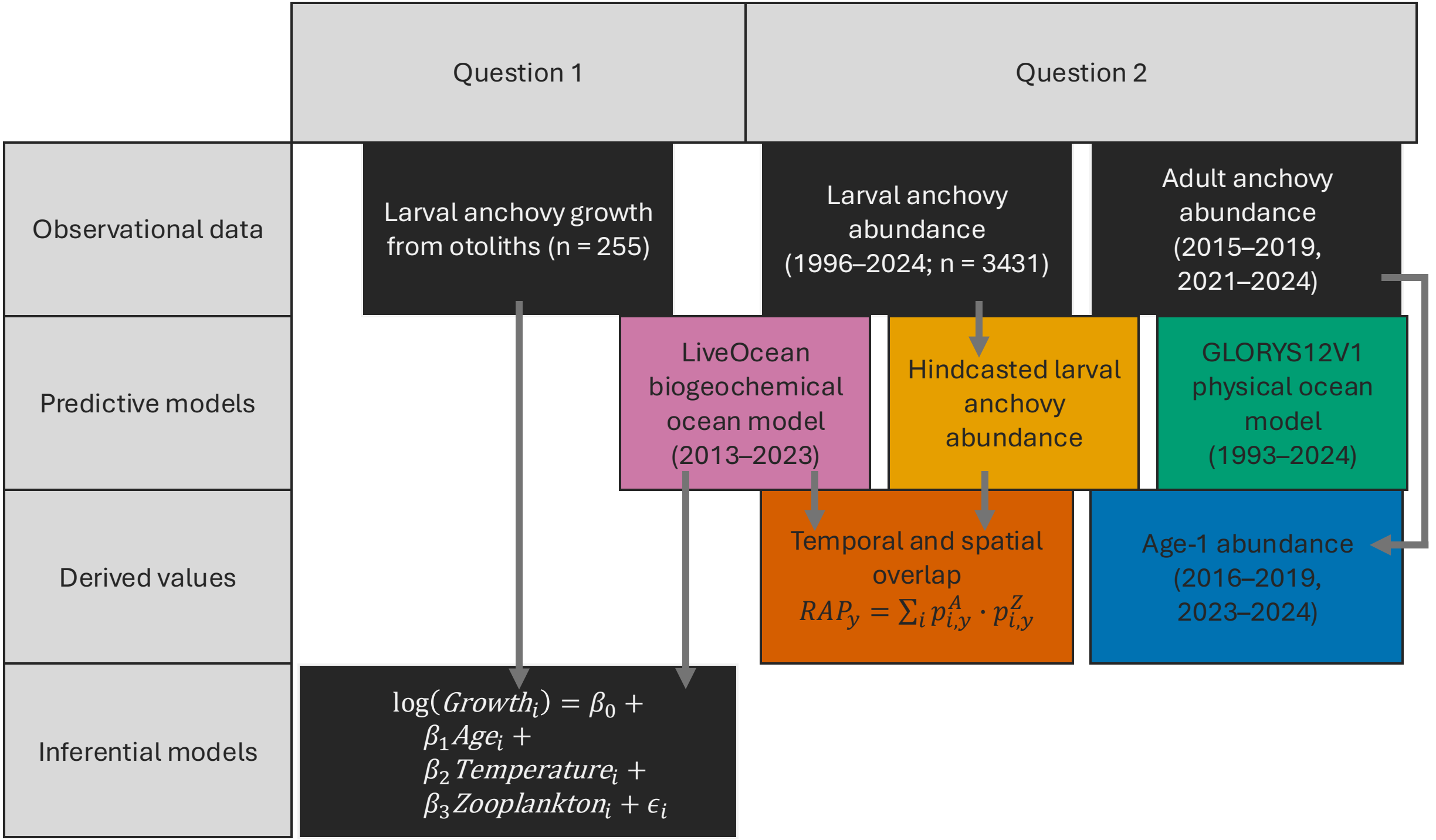
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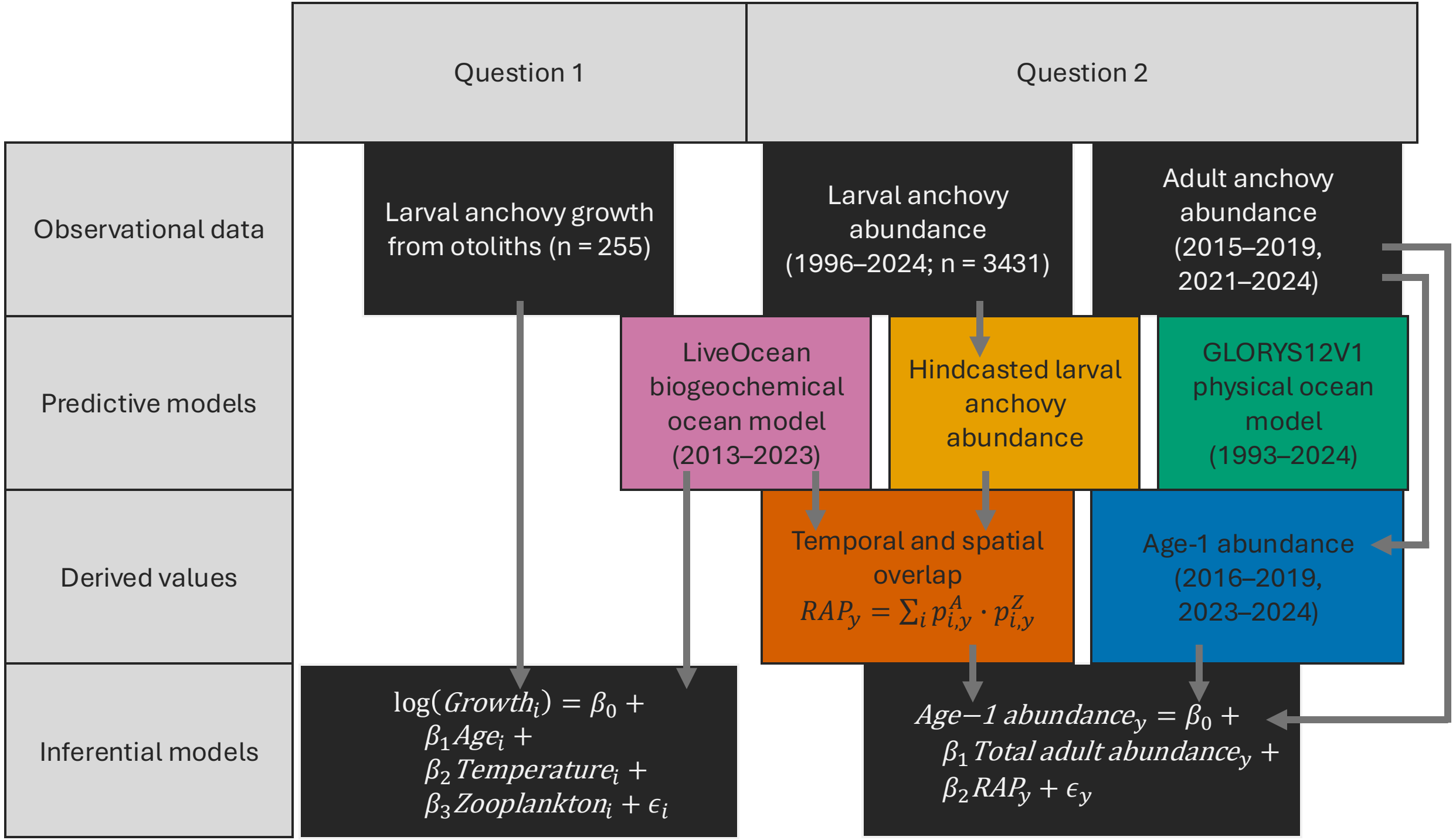
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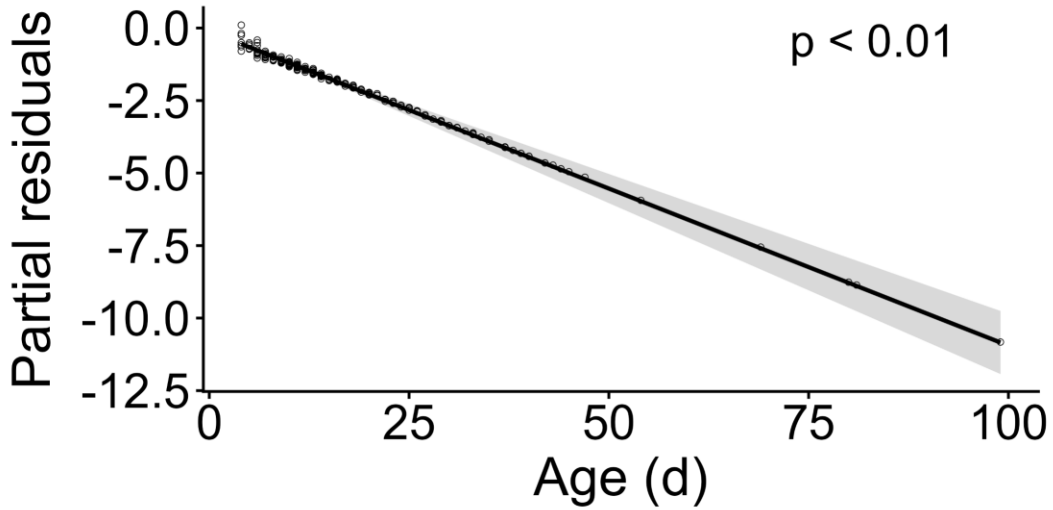
$Age{-}1\ abundance_y = \beta_0 + \beta_1 Total\ adult\ abundance_y + \beta_2 RAP_y + \epsilon_y$

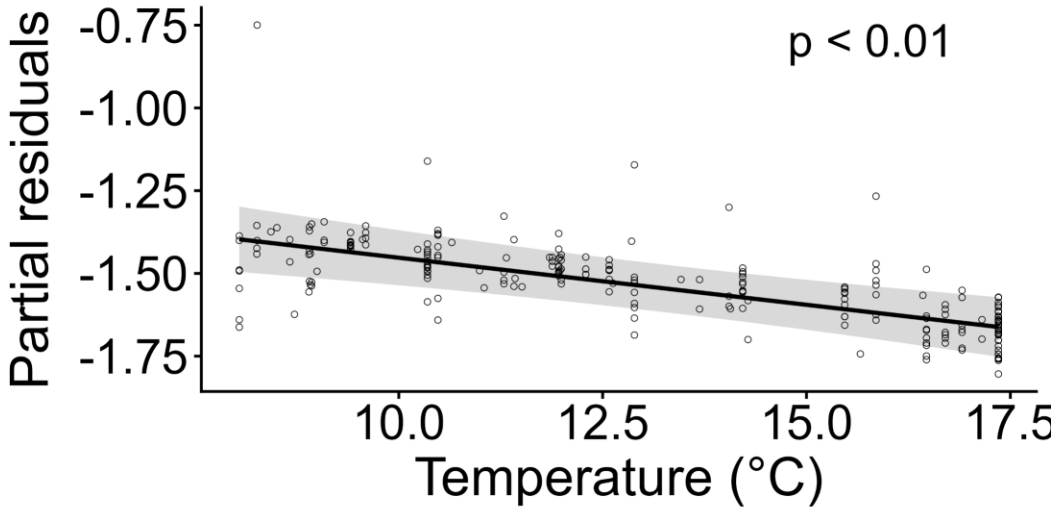
# Research questions

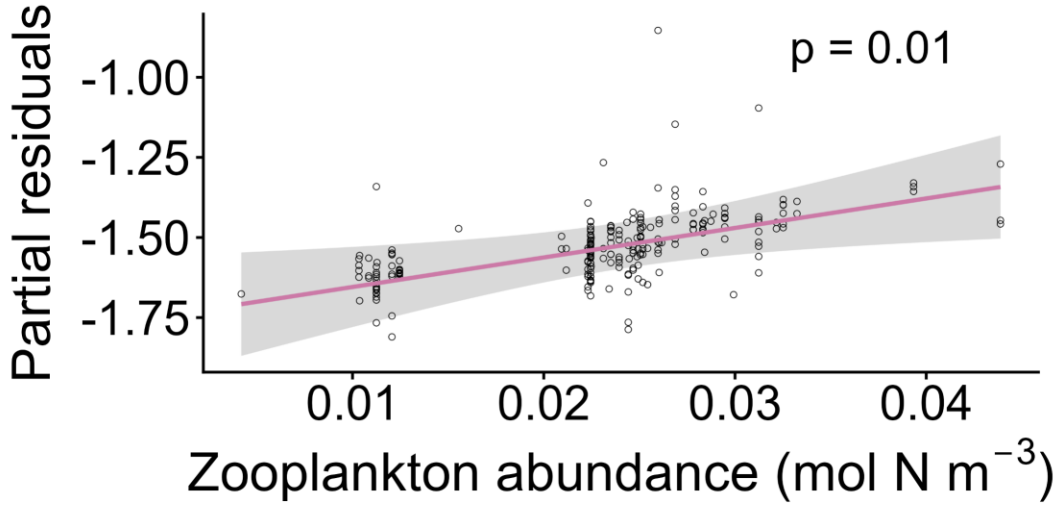
1. Are spatial and temporal variation in zooplankton abundance related to performance of individual anchovy larvae?

2. Is the degree of spatial and temporal overlap between anchovy larvae and zooplankton in a year related to annual recruitment?

# Zooplankton abundance has a positive effect on larval anchovy growth



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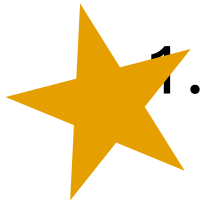
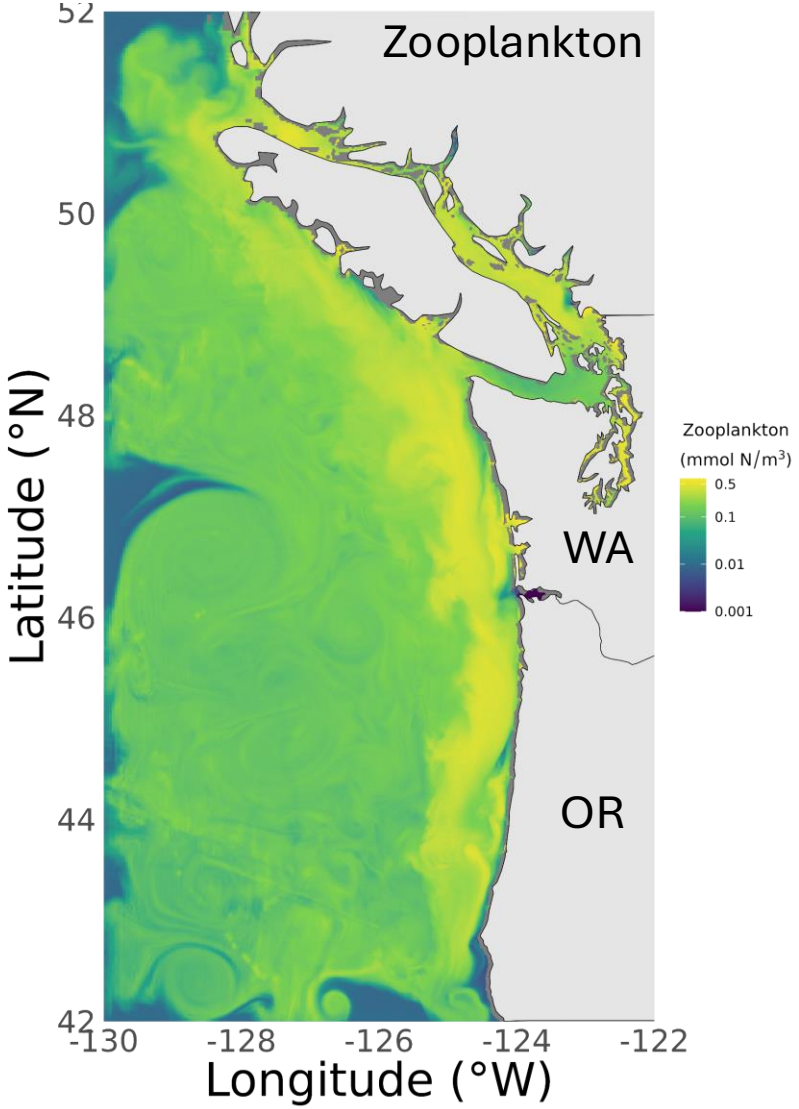


1. Are spatial and temporal variation in zooplankton abundance related to performance of individual anchovy larvae?
   - Positive effect of zooplankton abundance on larval anchovy growth
2. Is the degree of spatial and temporal overlap between anchovy larvae and zooplankton in a year related to annual recruitment?

# Larval anchovy and zooplankton abundance hindcasts replicated spatial abundance trends

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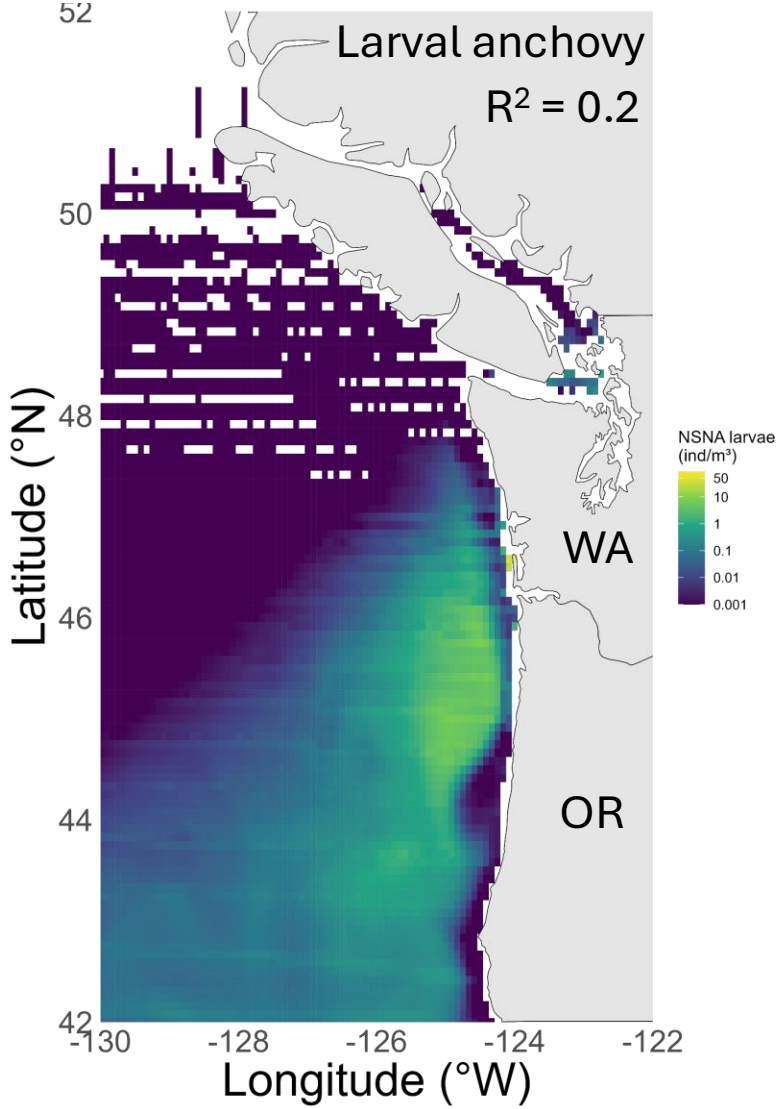
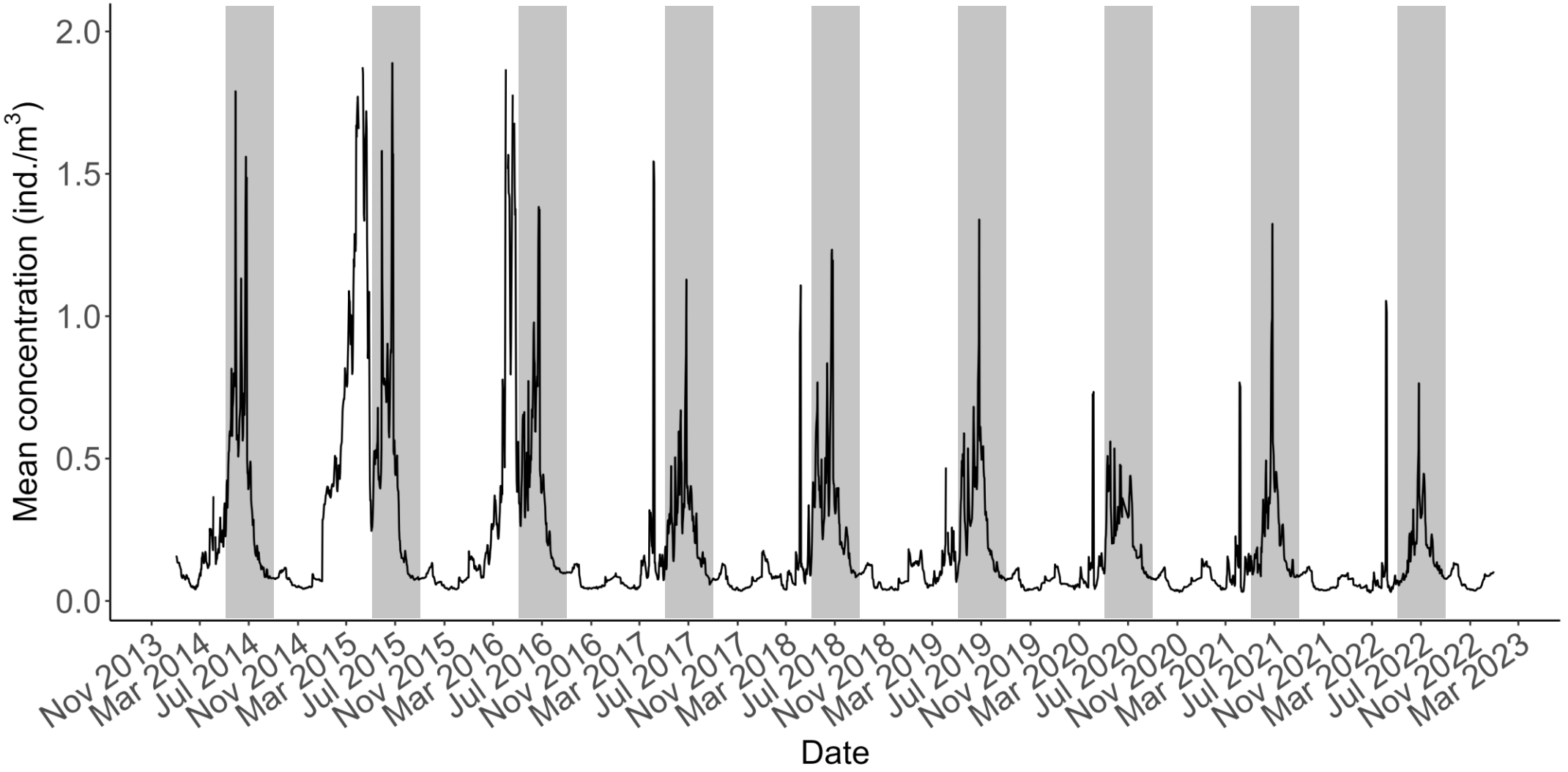
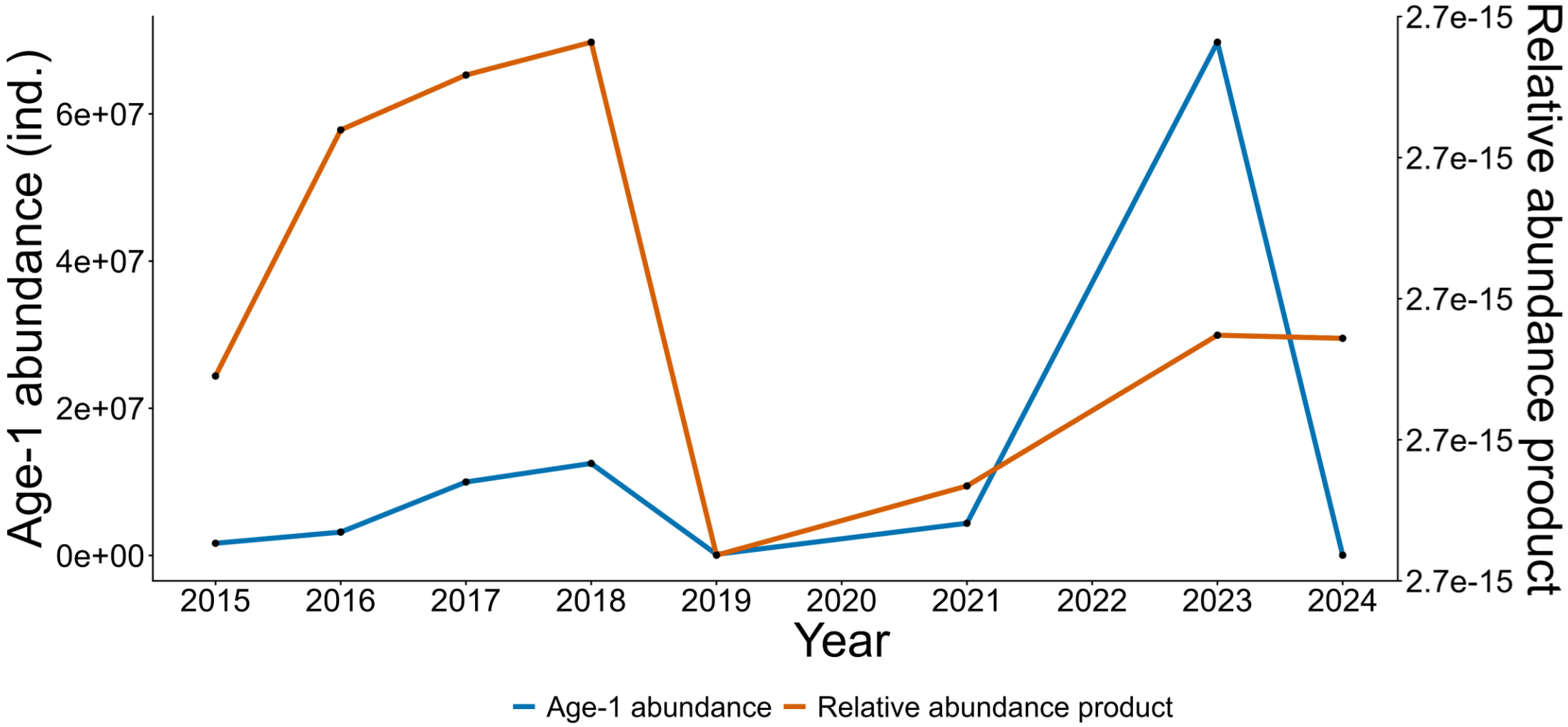


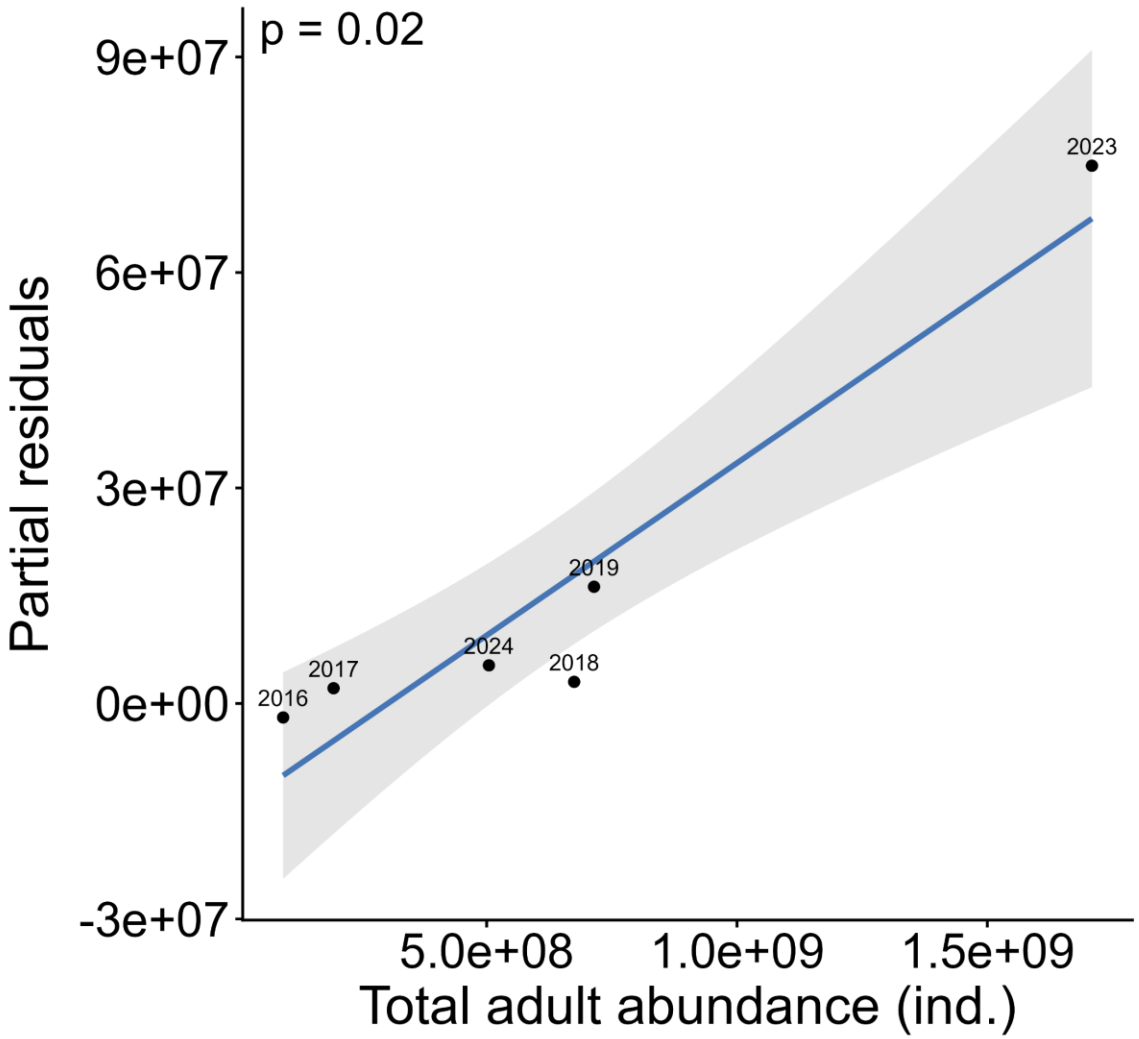
# Larval anchovy hindcasts replicated seasonal variation in larval anchovy abundance

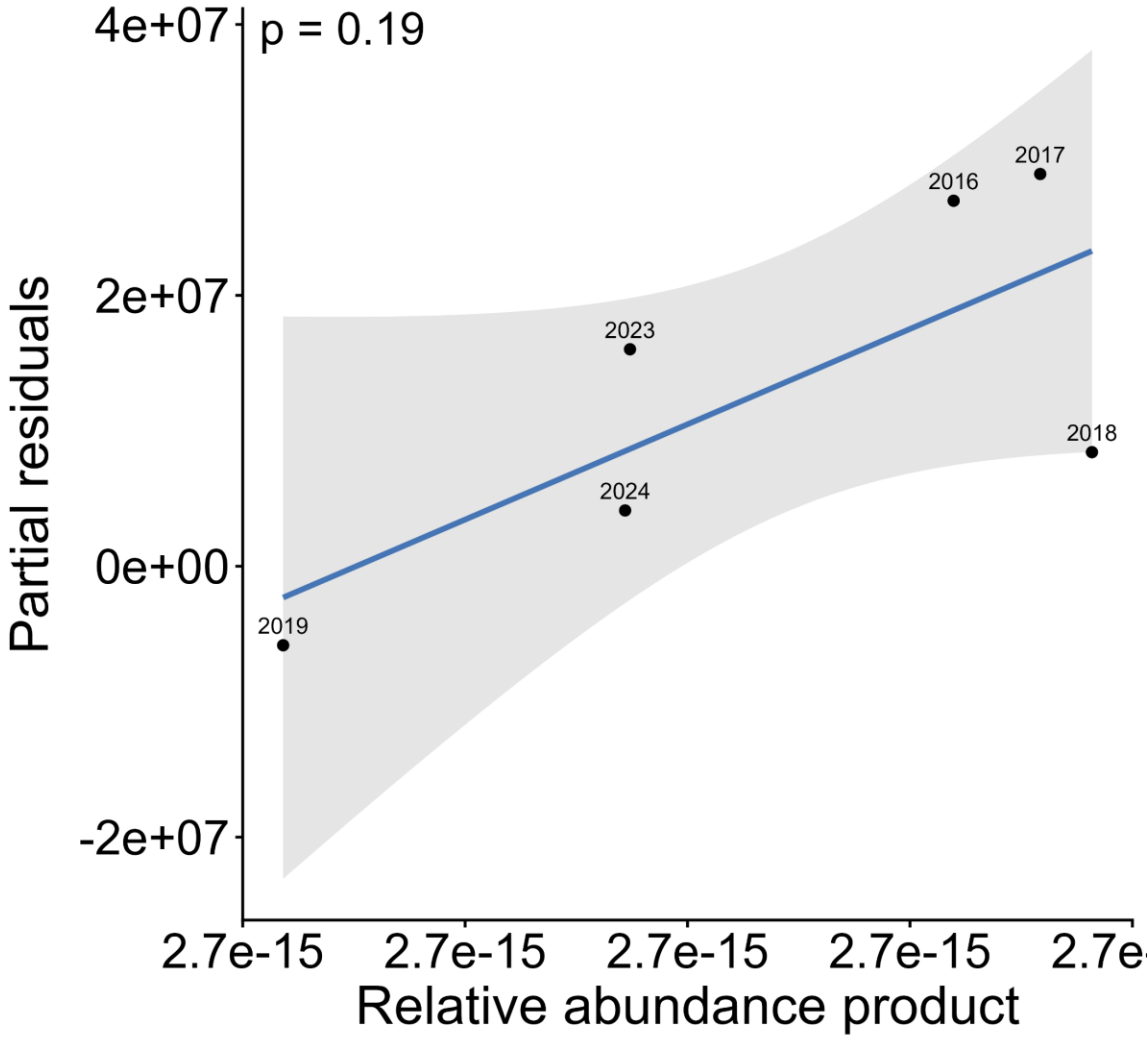


# Overlap between anchovy larvae and zooplankton mirrors annual recruitment



# Overlap has no significant effect on age-1 abundance



# Conclusions and future directions

1. Are spatial and temporal variation in zooplankton abundance related to performance of individual anchovy larvae?
   - Positive effect of zooplankton abundance on larval anchovy growth
2. Is the degree of spatial and temporal overlap between anchovy larvae and zooplankton in a year related to annual recruitment?
   - Non-significant, positive effect of overlap on age-1 anchovy abundance
   - Future directions:
     - Improve predictive performance of larval anchovy abundance model
       - Dissolved oxygen, position of Columbia River plume
     - Expand years of overlap analysis
       - NEP10k biogeochemical model outputs available for 1993–2024
       - Adult anchovy abundance potentially available for 1998–2019, 2021–2025

# Acknowledgements


- UW Coastal Modeling Group (LiveOcean)
- Mercator Ocean International (GLORYS12V1)
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