



**NOAA**  
**FISHERIES**

# Estimation of changes in growth

Using a state-space growth  
model

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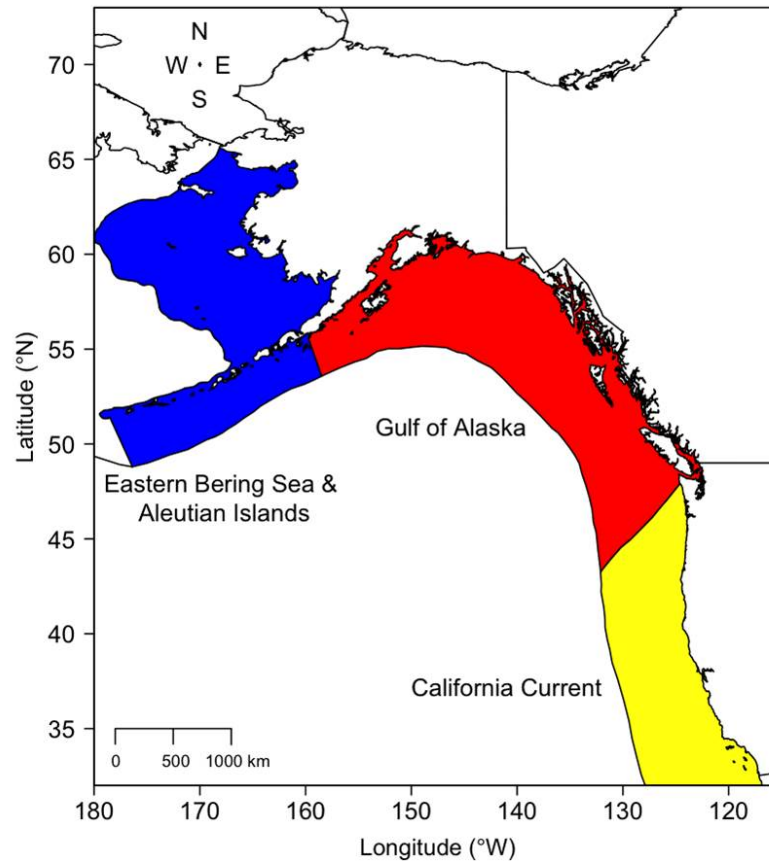
# ICES/PICES Working Group on Growth Change

- Co-chairs: Paul Spencer, C. Tara Marshall, Alan Baudron, John Morongiello, Shin-Ichi Ito
- California Current groundfish species modeled using multiple frameworks
- von Bertalanffy fit to each cohort (Alan Baudron et al 2014)
- von Bertalanffy state-space model (Tim Miller et al 2018)
- State-space autoregressive length-at-age model (Stawitz et al 2014)
- Other collaborators: Melissa Haltuch (NMFS), Sean Anderson (DFO)

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# The California Current



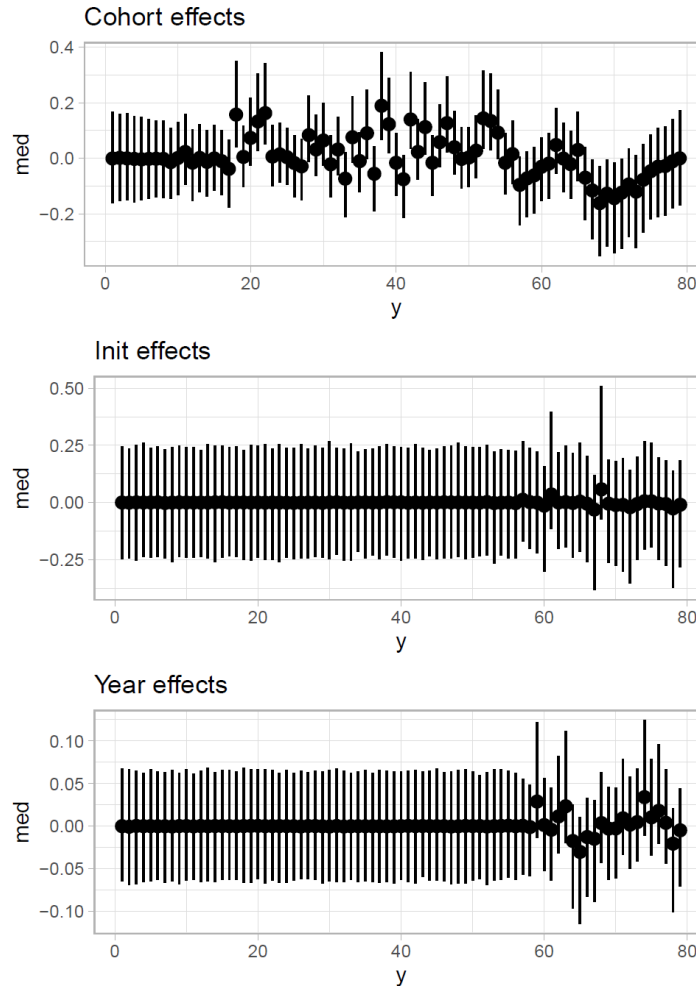
# State-space autoregressive length-at-age model (sarla)

- Based on Stawitz et al. 2014 model
- Adapted for the Stan software by Sean Anderson and Christine Stawitz
- Added ability to estimate different variation processes simultaneously

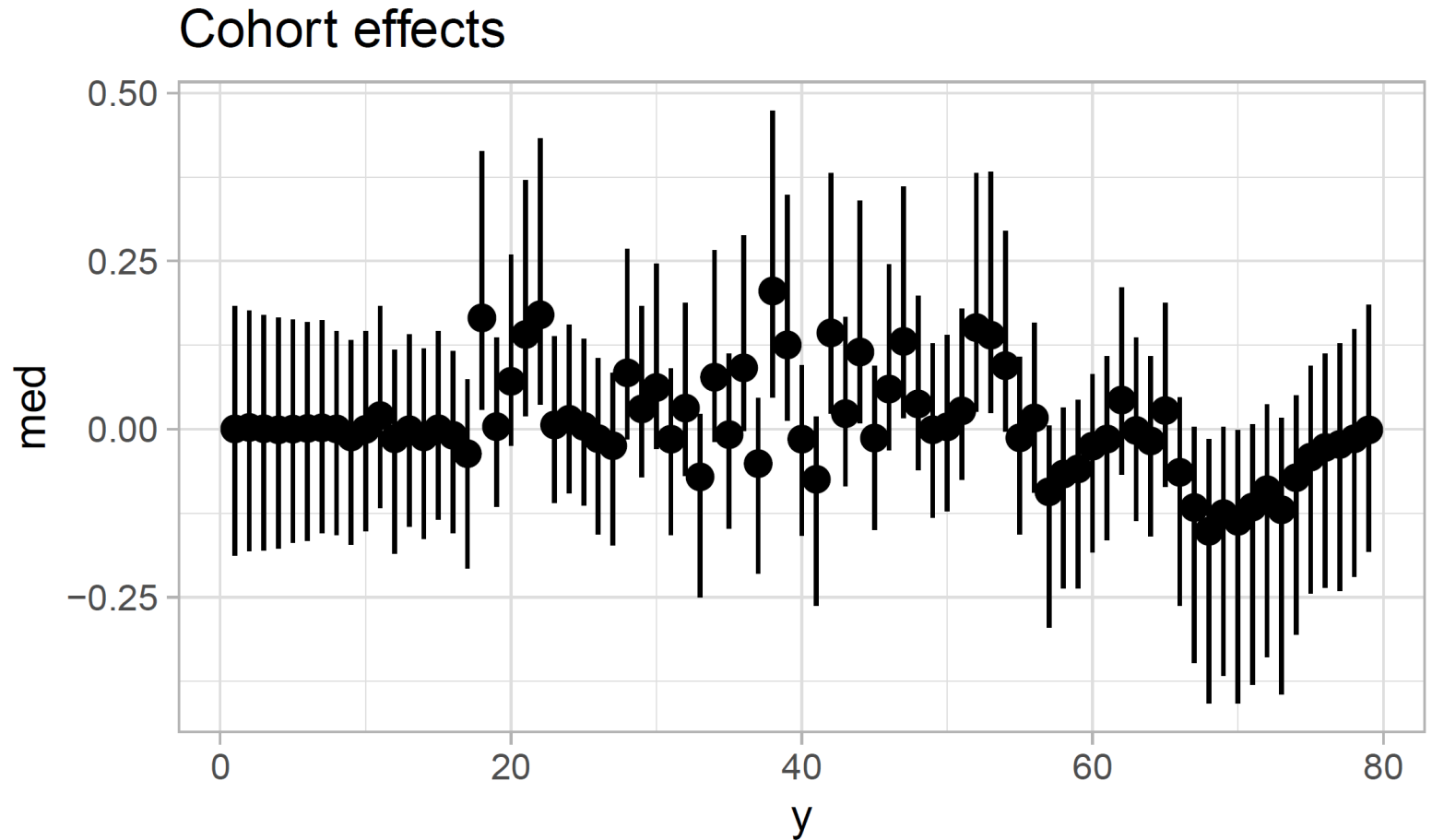
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# Preliminary Results - Sablefish



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# Takeaways

- Variation can be aliased by different processes
- No obvious synchrony or reaction to warming in these results

## Next steps

- Examining convergence in all effects models
- Adapting model selection criteria for time series
- Incorporating temperature time series applied by other WG members

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# References

- Baudron et al. 2013. Warming temperatures and smaller body sizes: synchronous changes in growth of North Sea Fishes. Global Change Biology. <https://doi.org/10.1111/gcb.12514>
- Miller, T.J. et al 2018. Temporal and environmental variation in growth and maturity and effects on management reference points of Georges Bank Atlantic cod. CJFAS. <https://doi.org/10.1139/cjfas-2017-0124>
- Stawitz et al 2014. A state-space approach for detecting growth variation and application to North Pacific groundfish. CJFAS. <https://doi.org/10.1139/cjfas-2014-0558>
- Denechaud et al. 2020. A century of fish growth in relation to climate change, population dynamics and exploitation. Global Change Biology. <https://doi.org/10.1111/gcb.15298>

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