

Local-scale versus basin-scale drivers of copepod community dynamics in the northeast Pacific

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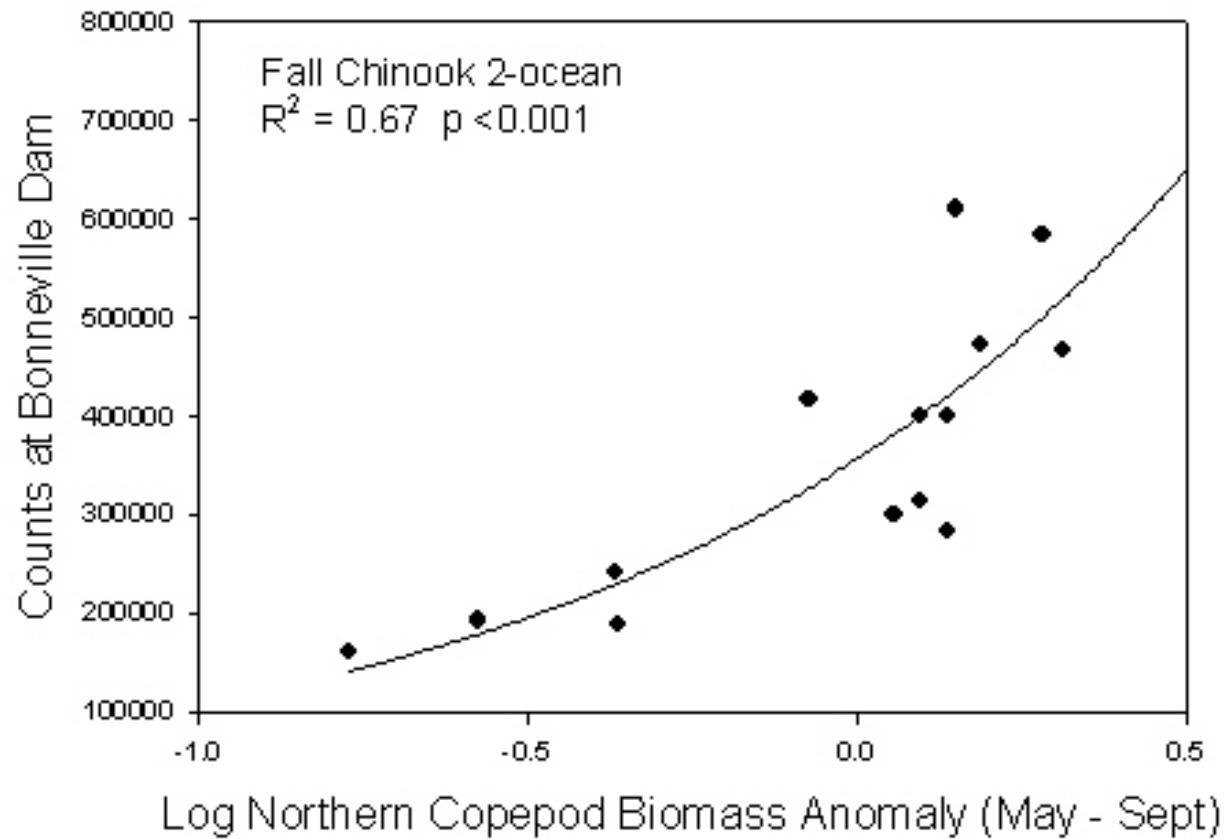
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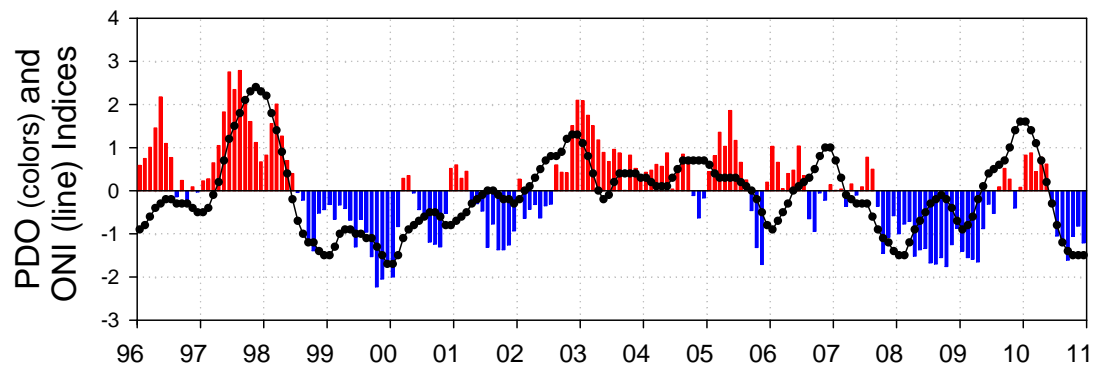
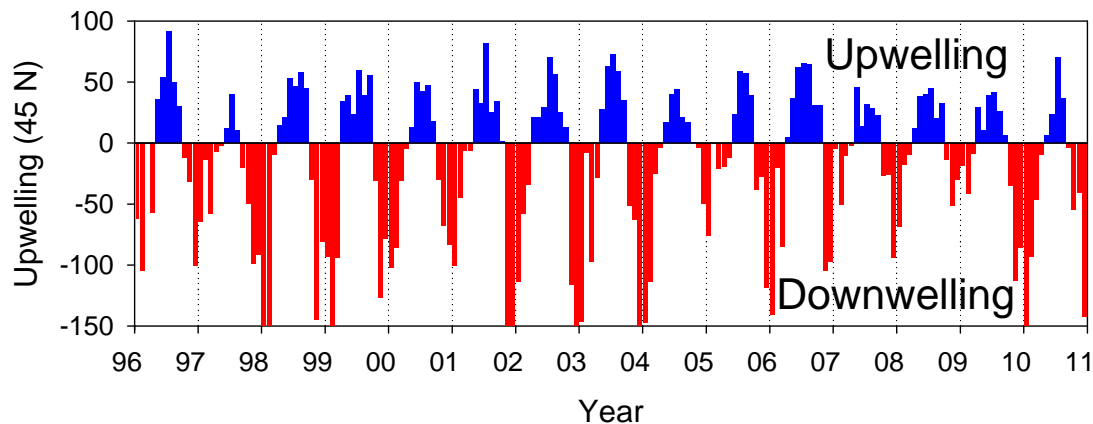


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“Coastal upwelling is the best known type of upwelling, and the most closely related to human activities as it supports some of the most productive fisheries in the world”- *Wikipedia*



Two main sources of physical variability forcing copepod communities



Seasonal structure of coastal upwelling

- Spring/summer- Upwelling
 - Boreal/northern spp.
 - ‘cold water’ copepods
- Winter- Downwelling
 - Sub-tropical/southern spp.
 - ‘warm water’ copepods

Basin-scale forcing- Advection

- Keister et al. 2011
- Bi et al. 2011

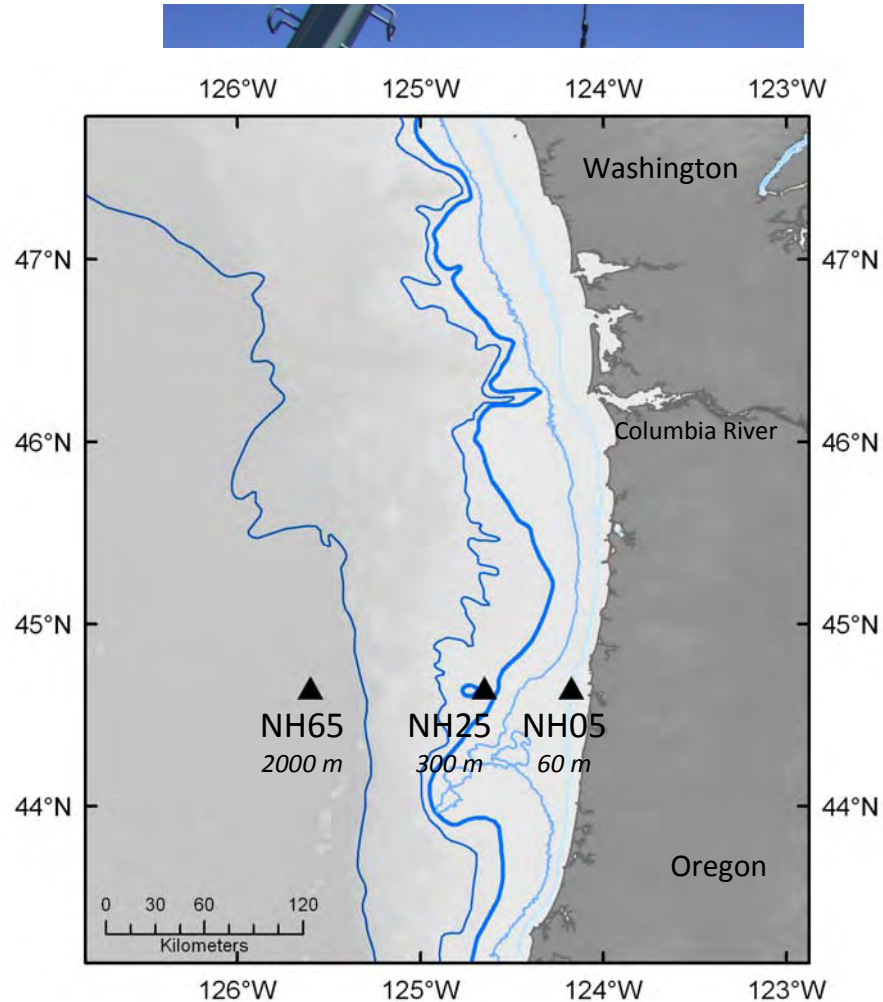
Questions

1. Does upwelling play a role in structuring the copepod community?

- Copepod community differences out to 65 nm
- Seasonal cycles
- Timing of the biological transition

2. How quickly do different copepod communities respond to changes in upwelling, the PDO, ONI, NPGO?

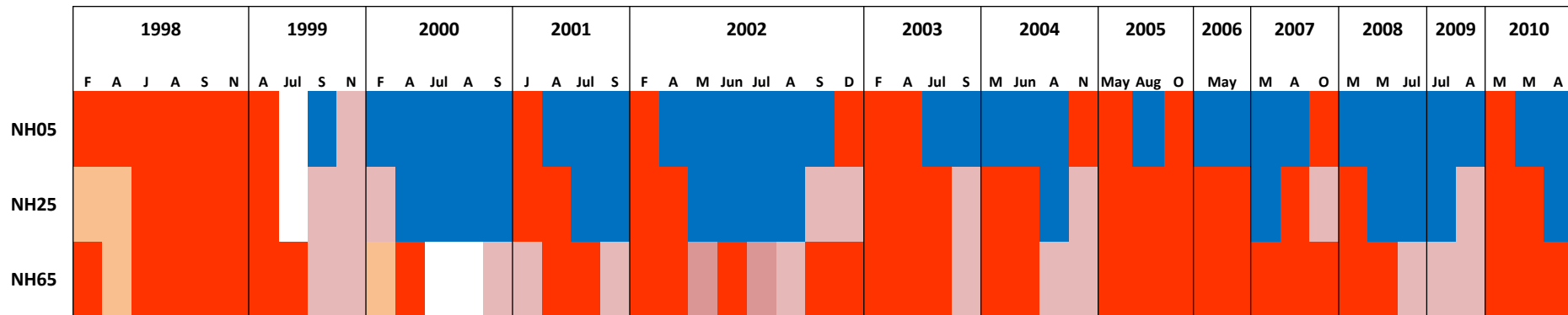
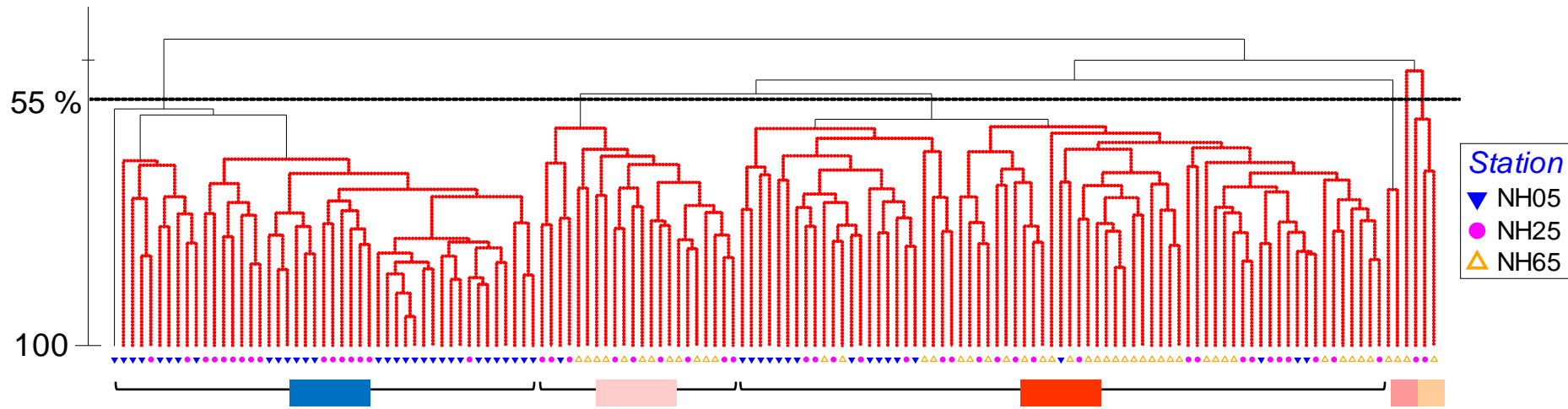
Newport Hydrographic Line



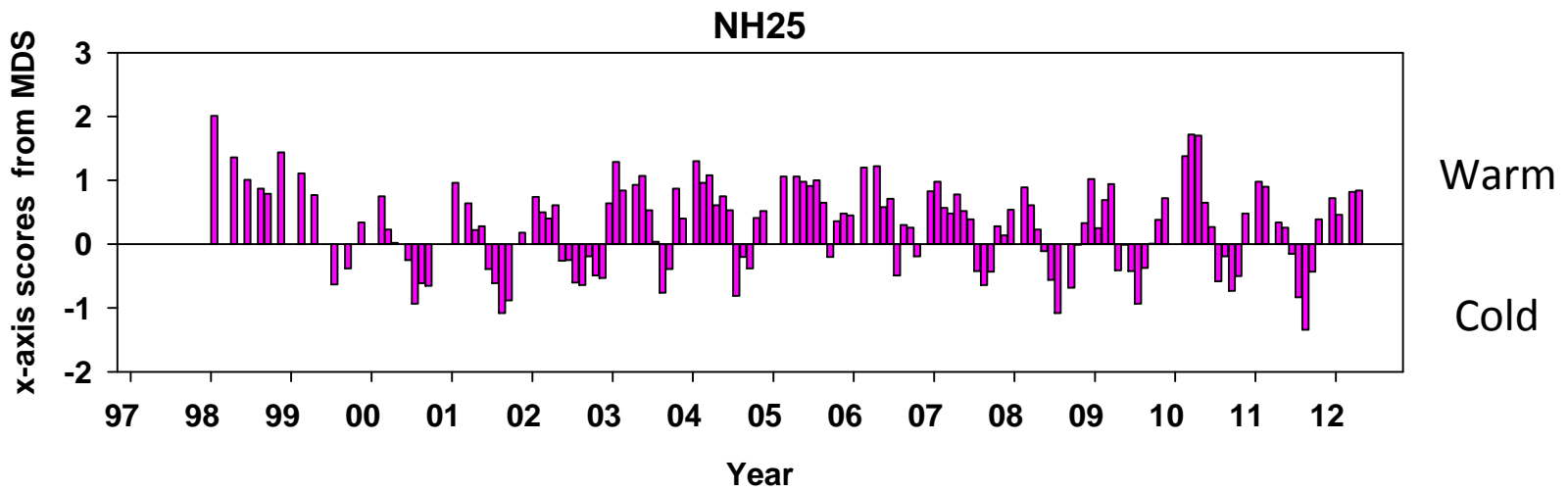
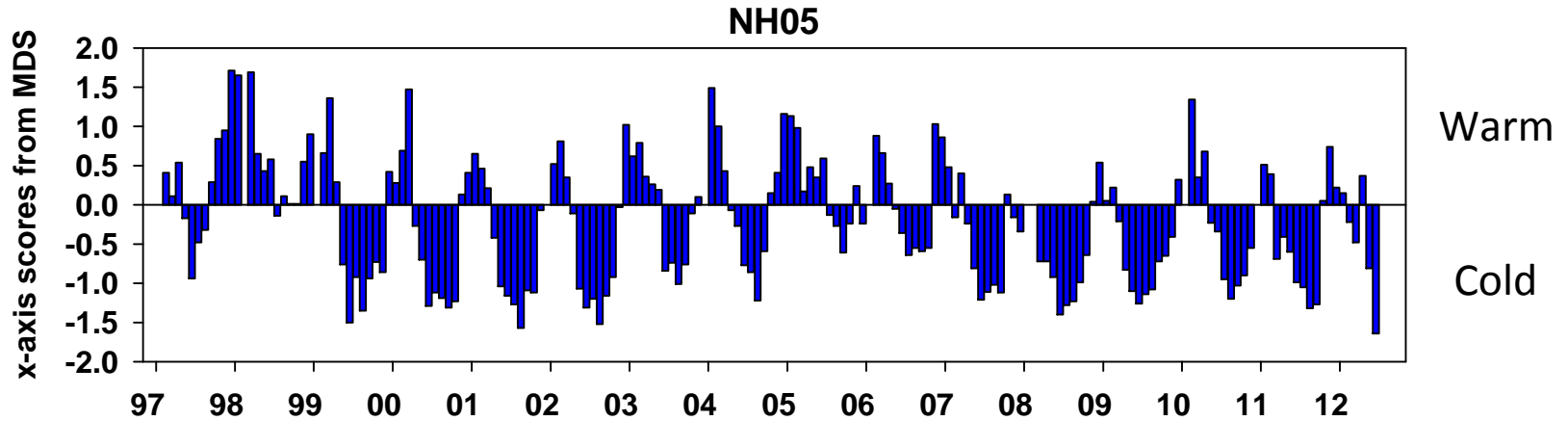
- Sampled biweekly for 21 years
 - 1969-1973, 1983, **1996-present**
 - 7 stations (1 – 25 nm)
- Ichthyo-zooplankton, CTD, nutrients, chl-*a*
- Sample out to 65 nm and 150 nm as often as possible
- **Today:**
 - **NH05, NH25, and NH65**

Seasonally different copepod communities at NH05 and NH25 compared to NH65

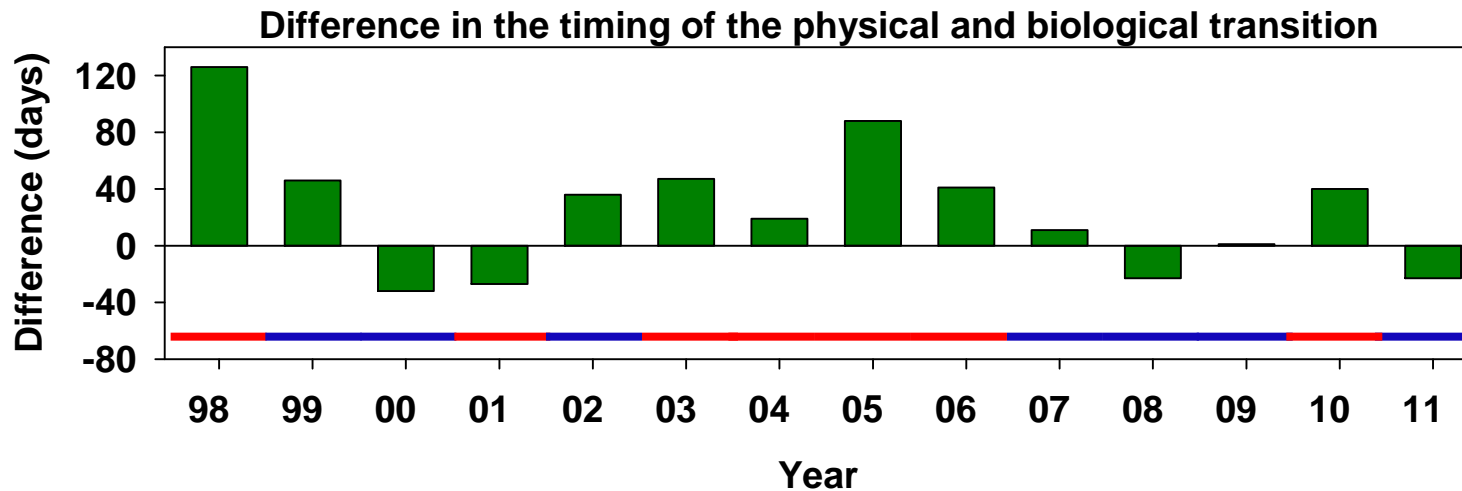
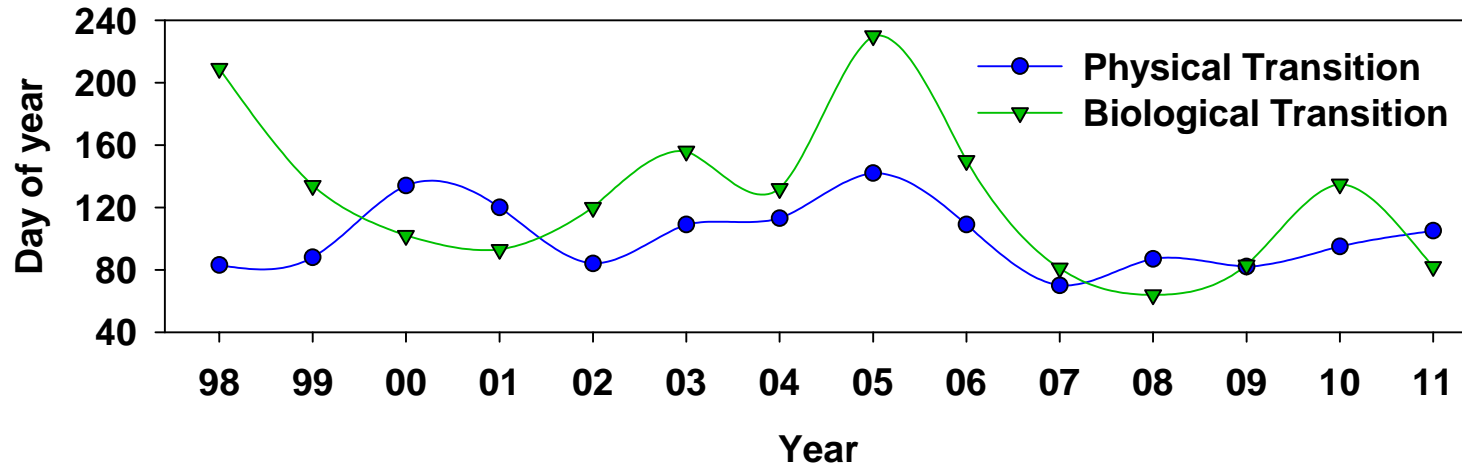
(n = 50 dates when all 3 stations were sampled; 1998 – 2010)



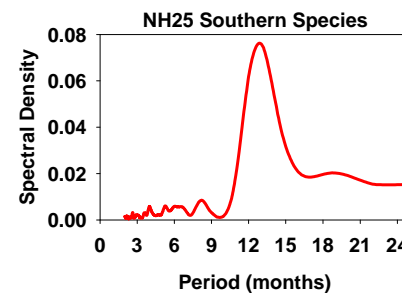
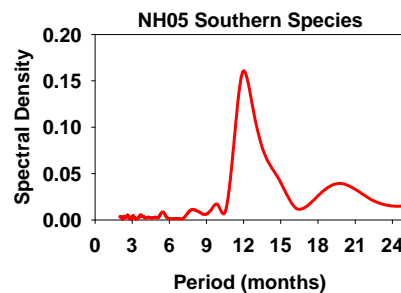
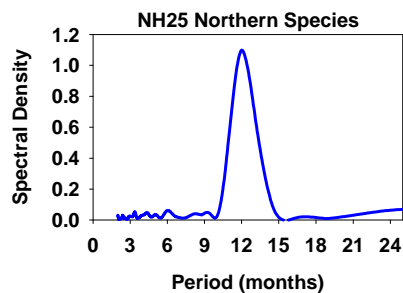
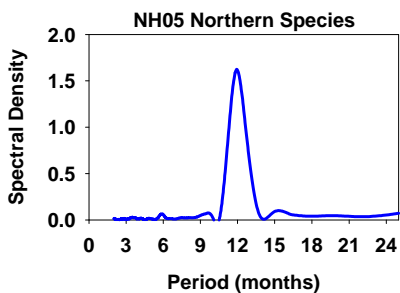
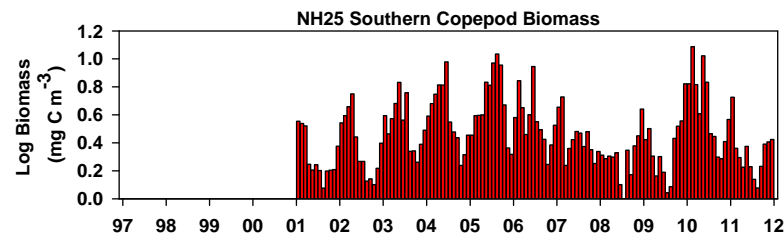
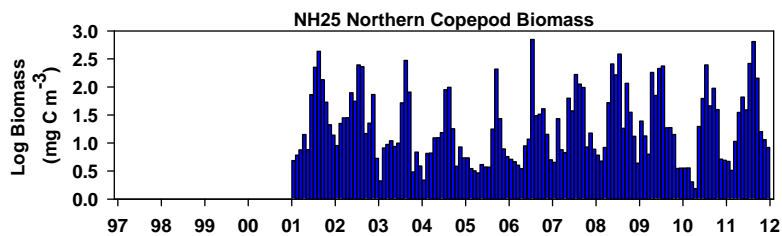
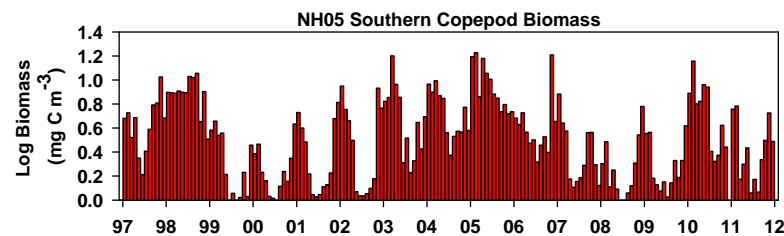
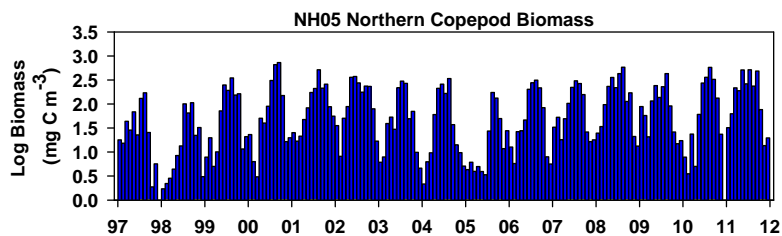
Copepod Community Seasonality at NH05 and NH25



The timing of the biological spring transition is not always in synch with the physical spring transition



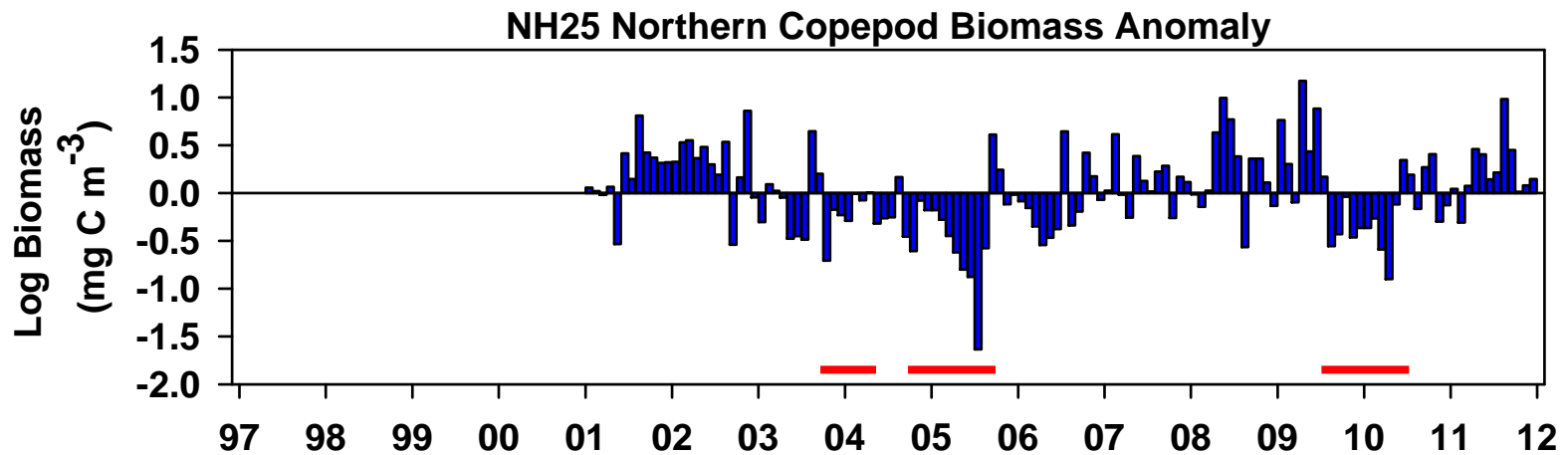
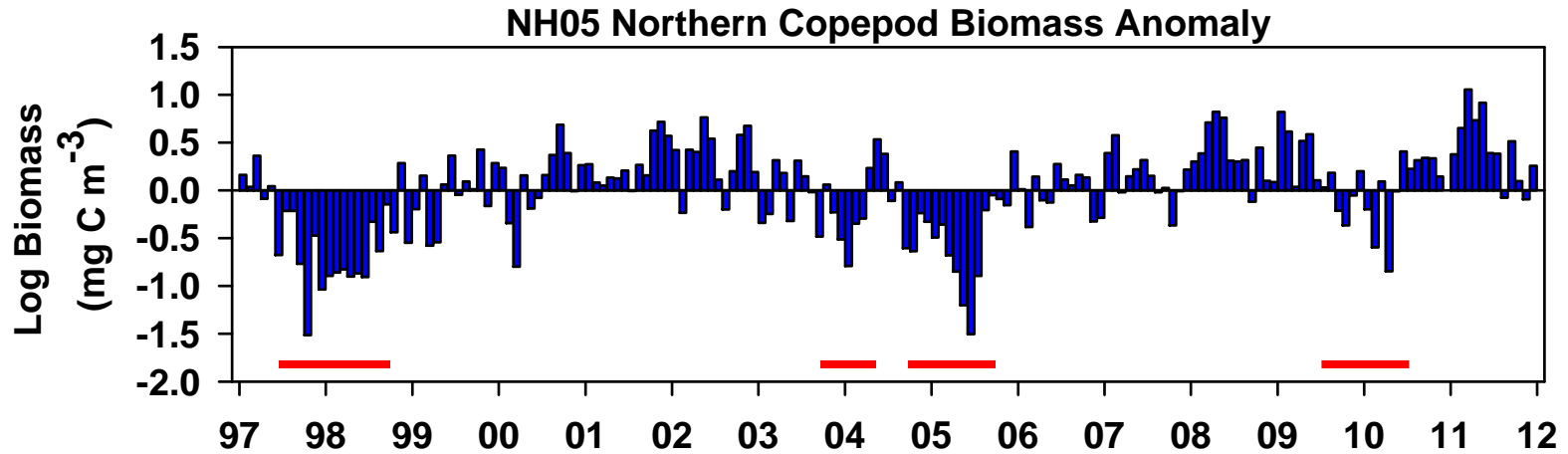
Strong seasonality of Northern and Southern copepods at NH05 and NH25



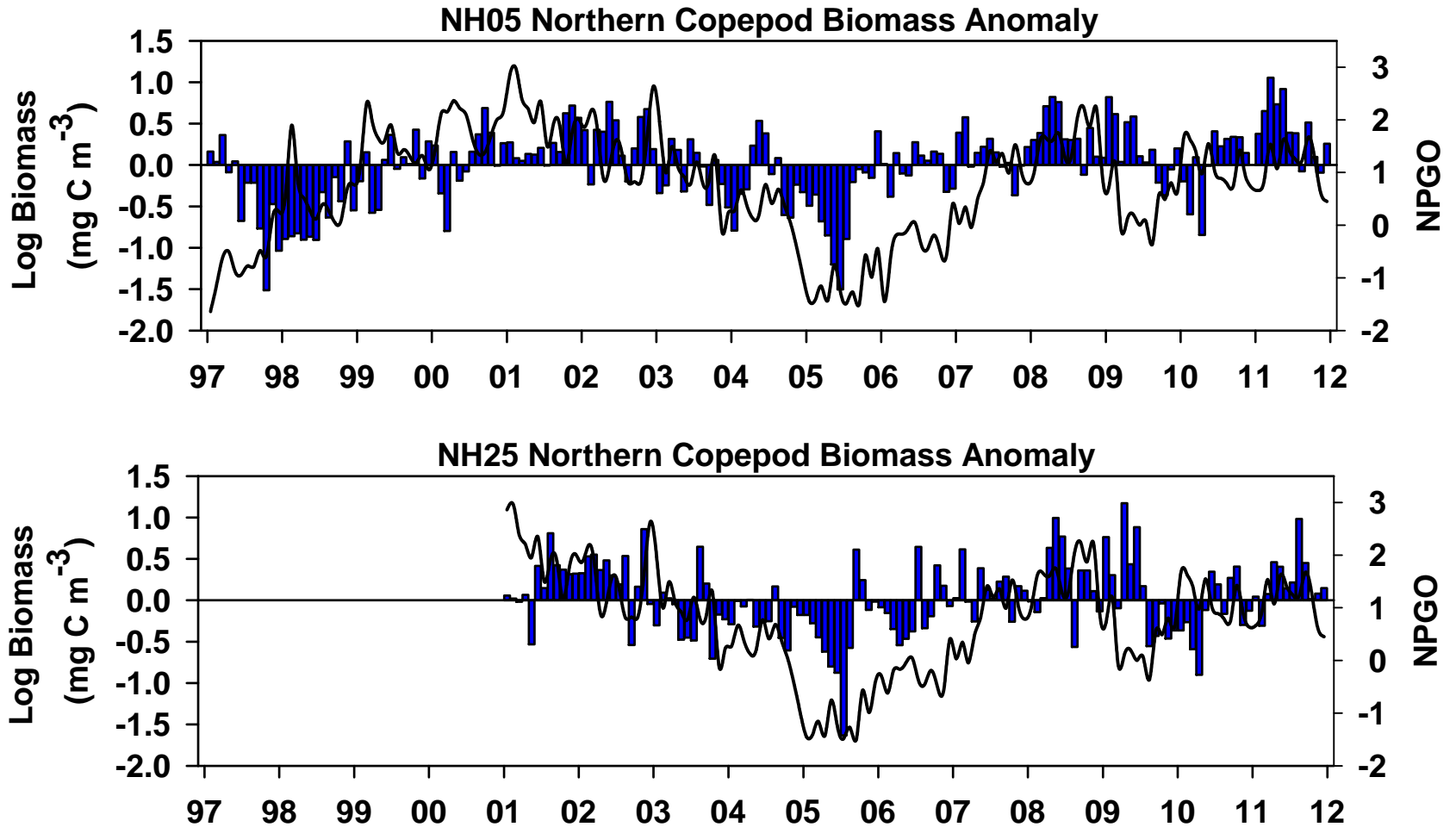
Peak in Jul - Aug

Peak in Jan - Feb

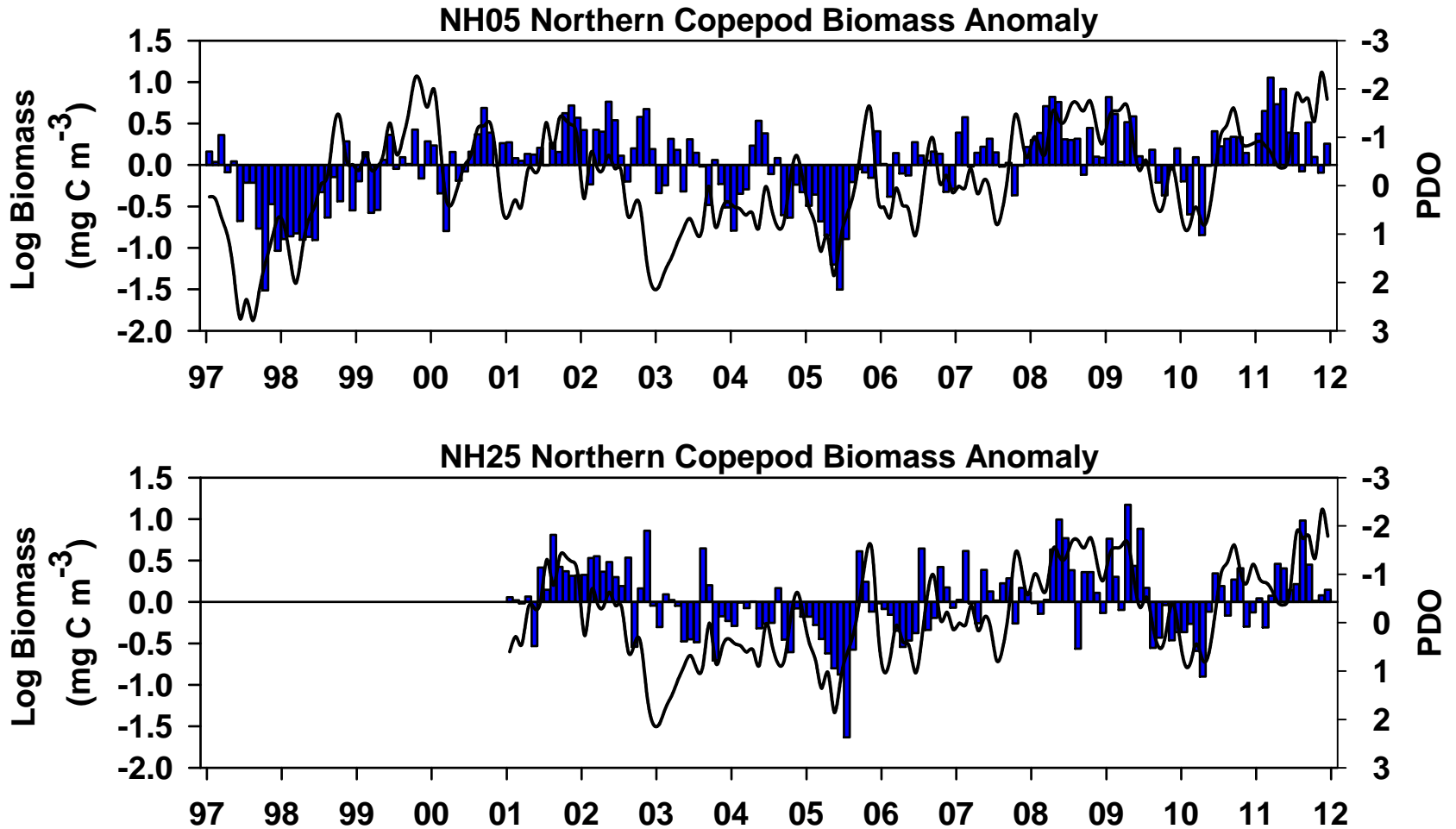
Inter-annual variability of the northern biomass anomalies at the two stations are similar



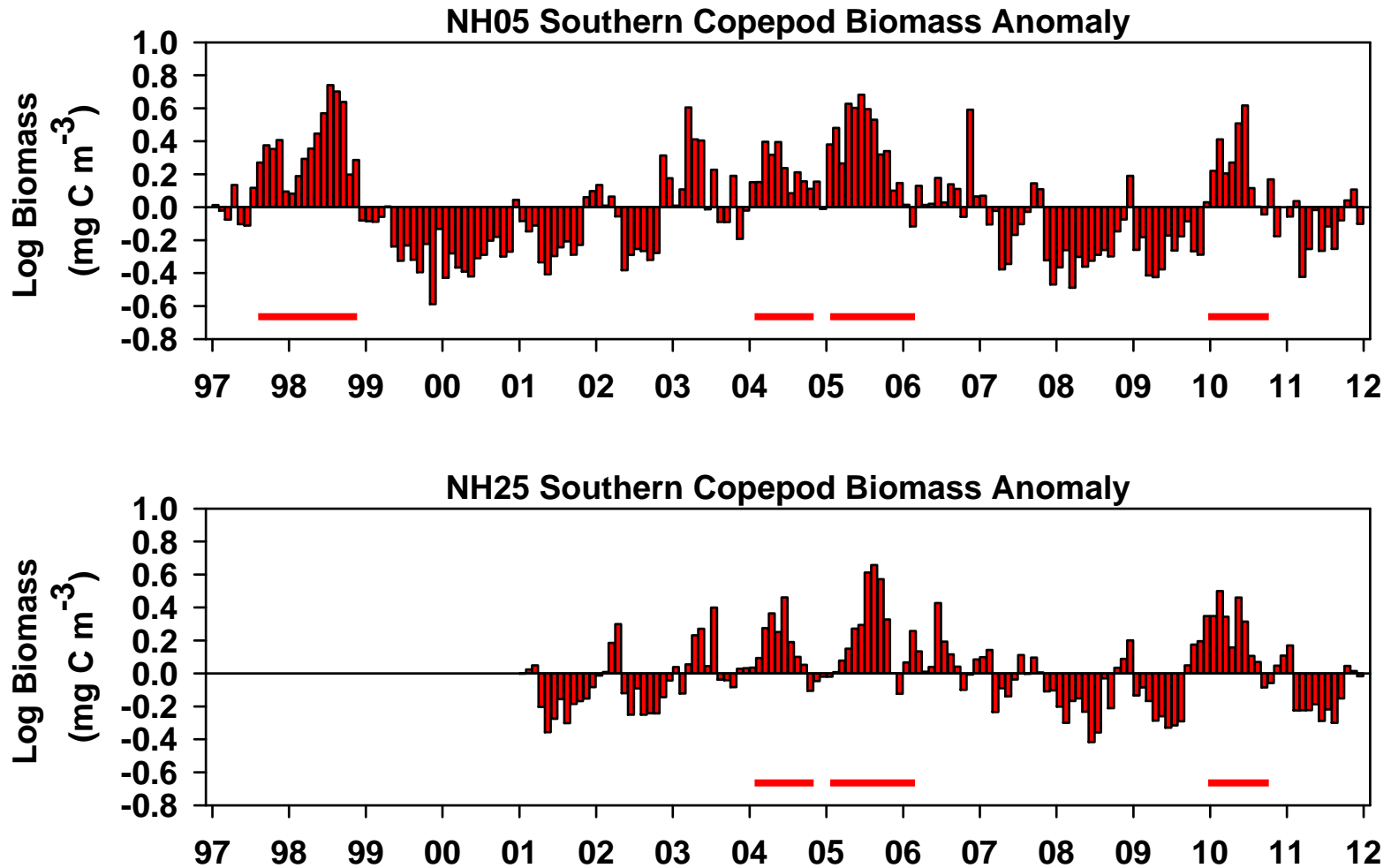
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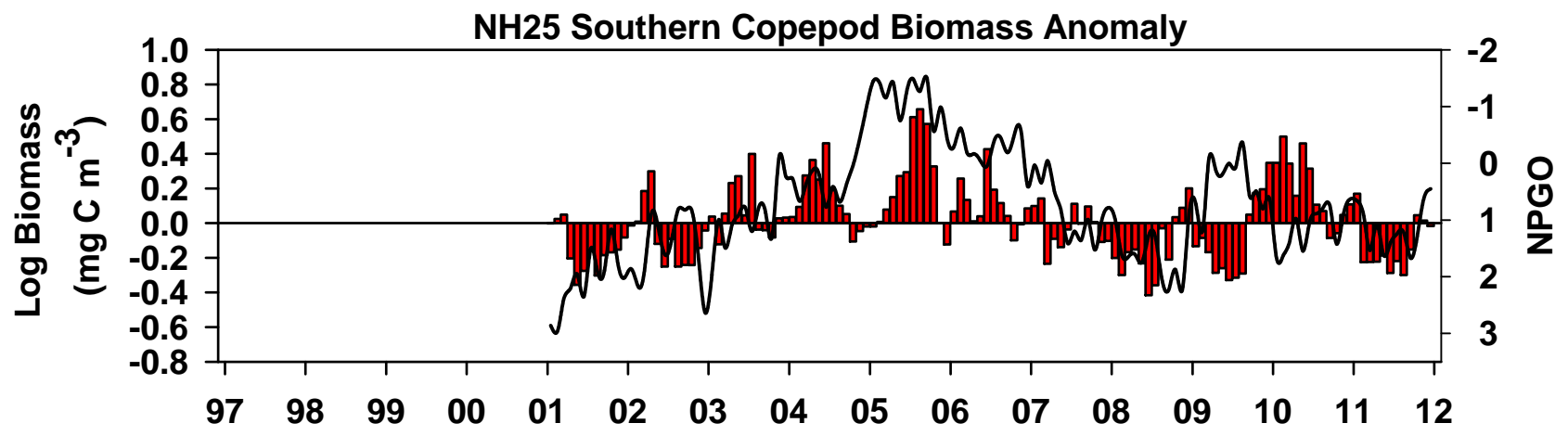
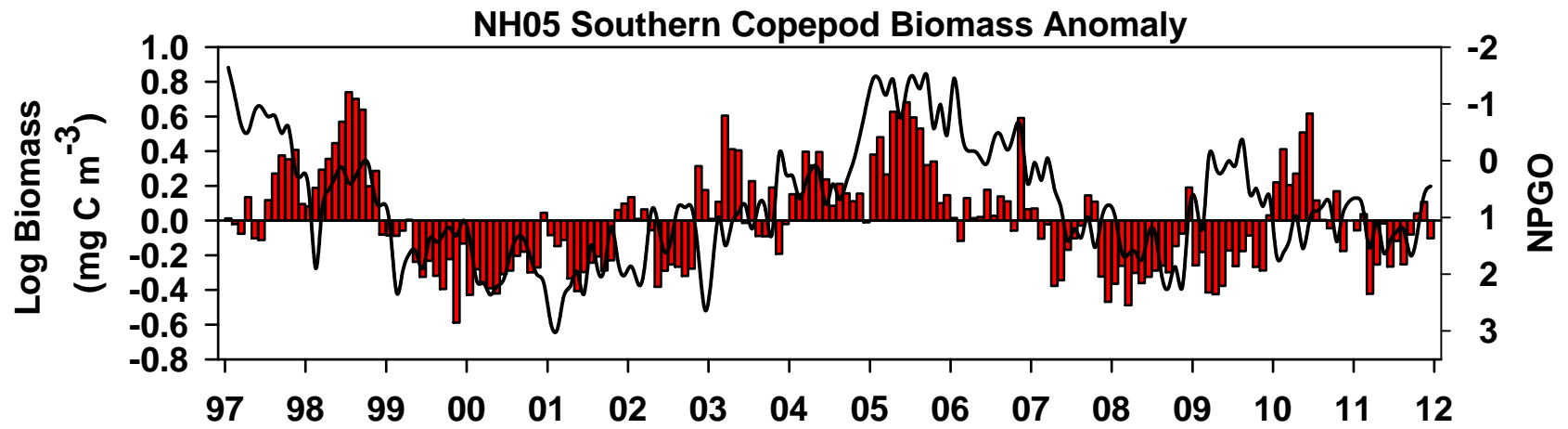
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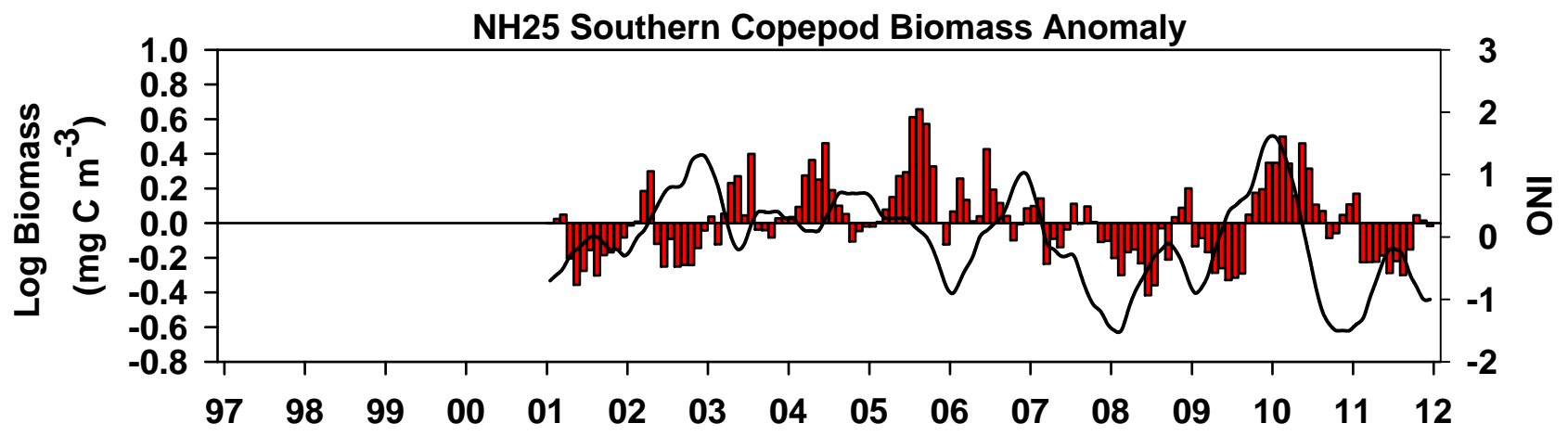
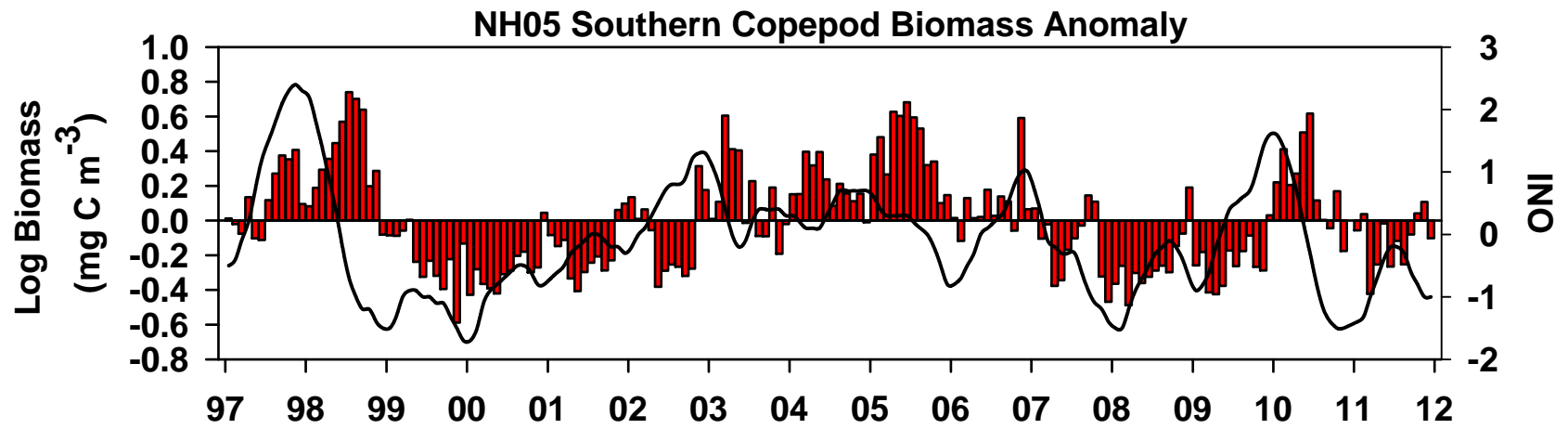
Inter-annual variability of the southern biomass anomalies at the two stations are similar



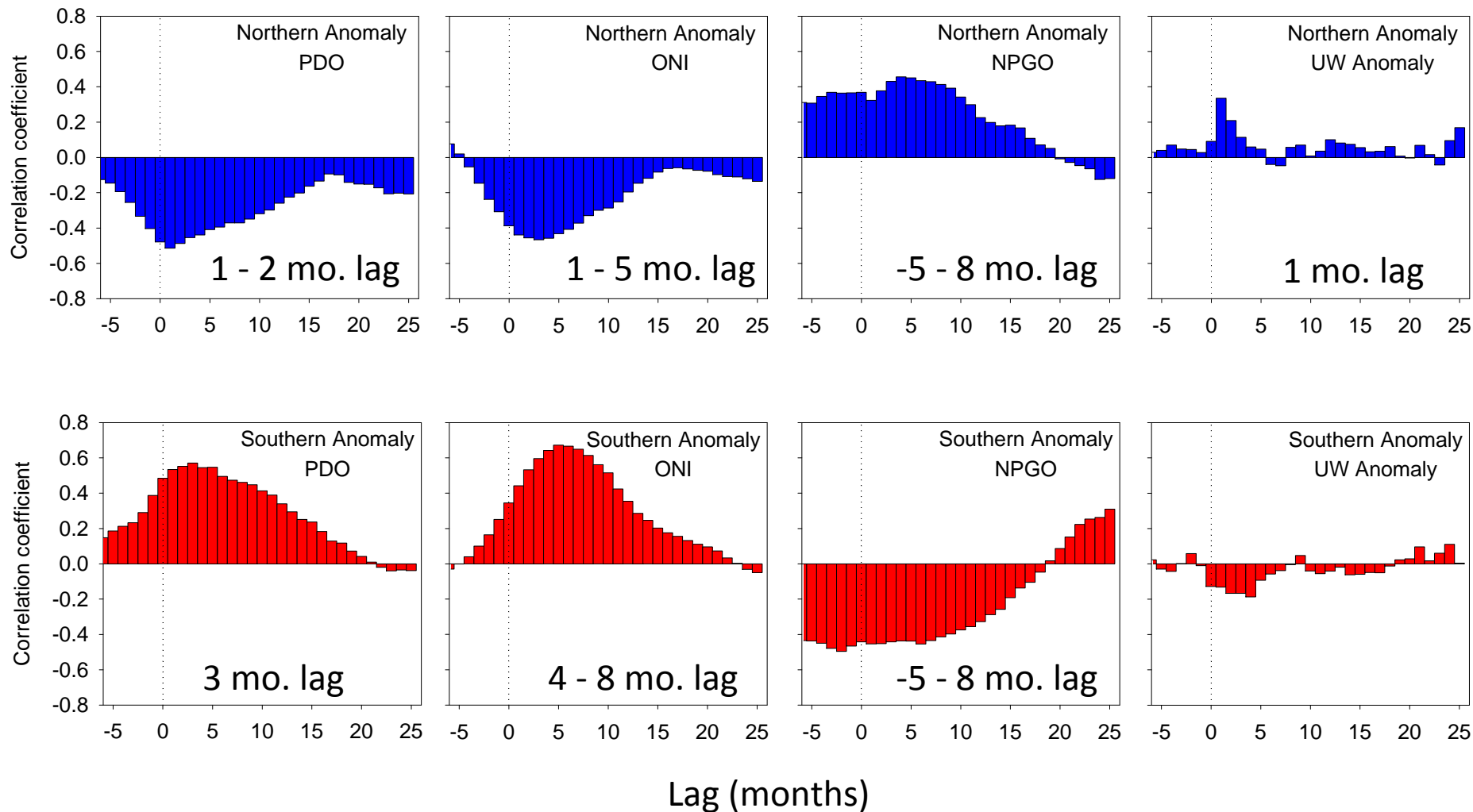
Inter-annual variability of the southern biomass anomalies at the two stations are similar



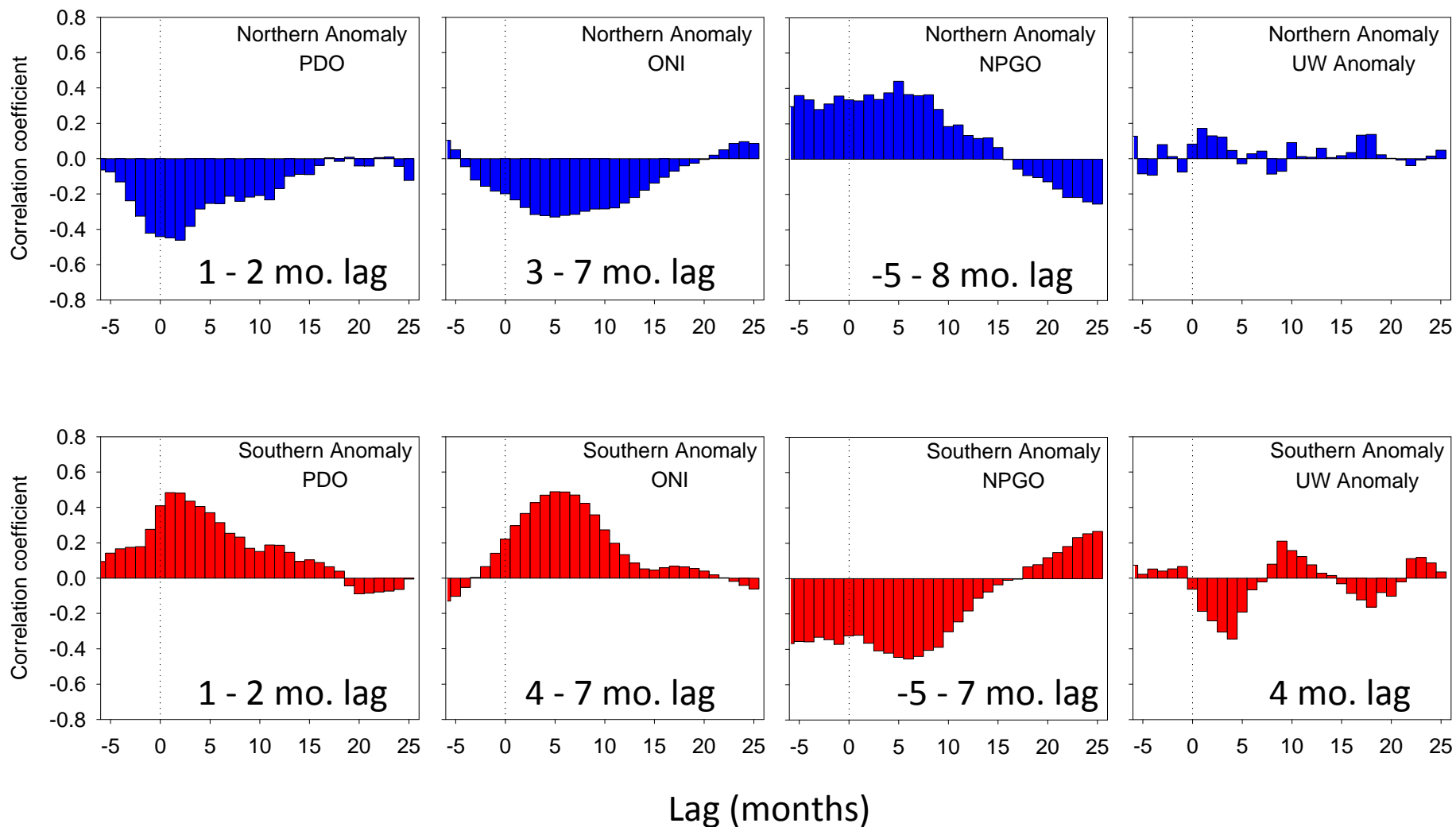
Inter-annual variability of the southern biomass anomalies at the two stations are similar



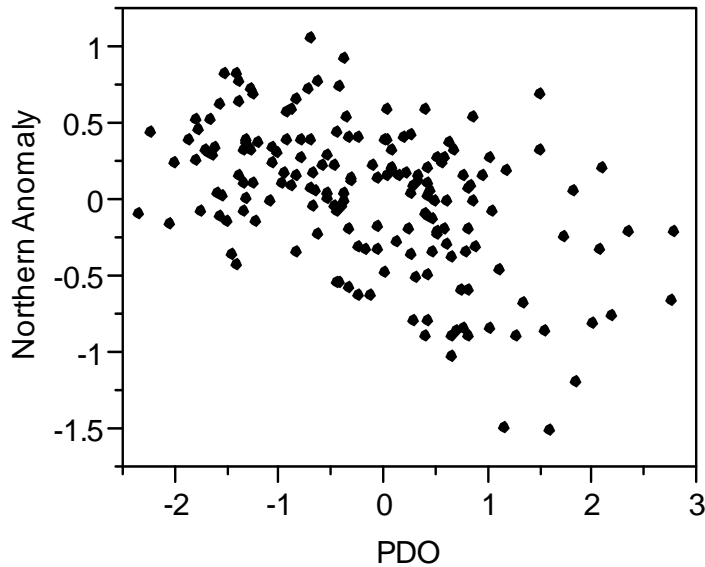
Inter-annual variability of the copepod anomalies largely driven by basin-scale processes at NH05



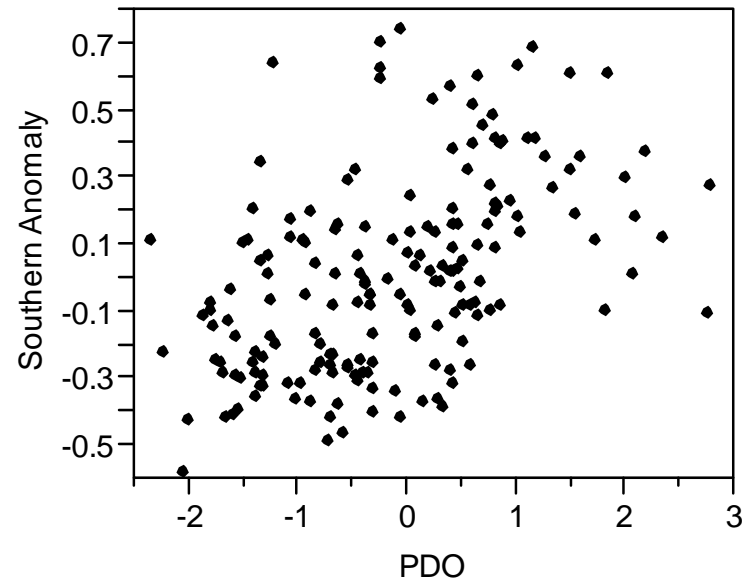
Inter-annual variability of the copepod anomalies largely driven by basin-scale processes at NH25



It is important to incorporate the lagged biological response into models



Multiple regression w/
PDO, ONI, NPGO, UWIa



Northerns $R^2 = 0.28$
Southerns $R^2 = 0.34$

Our samples are collected at the high frequency sampling rate and equal intervals (over 15 years) needed to address these issues

Summary and future questions

- The biological transition and the physical transition are not always in sync
 - What is driving the biological transition?
- The strongest signal in the copepods is the seasonal cycle
- Underlying the seasonal cycle there are inter-annual fluctuations in the biomass of specific copepod groups
- Those fluctuations are correlated with the PDO, ONI, and NPGO and not so much with upwelling
 - Why do the northern copepods respond quicker to basin-scale forcing at NH05 but not at NH25?
 - Are we measuring the copepods on the proper time-scales to capture changes from local-forcing?
- It is important to incorporate the lagged response of biology to physical drivers into models
- We are not capturing the entire story
 - synoptic events and top-down processes (e.g. predation, mortality)

Acknowledgements

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