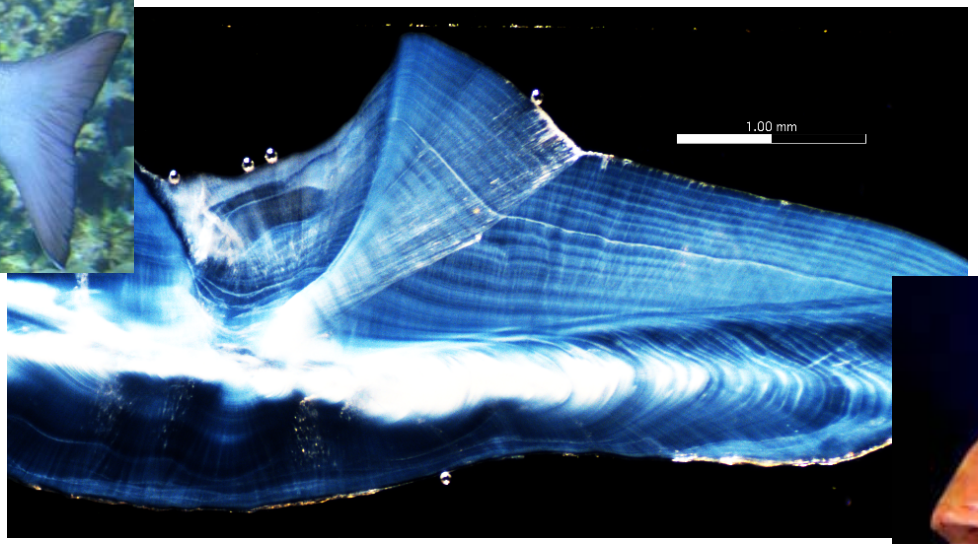
# Drivers of synchrony among snappers




RUTGERS
School of Environmental and Biological Sciences

Joyce Ong

Co-authors: Stephen Newman, Corey Wakefield, Malin Pinsky

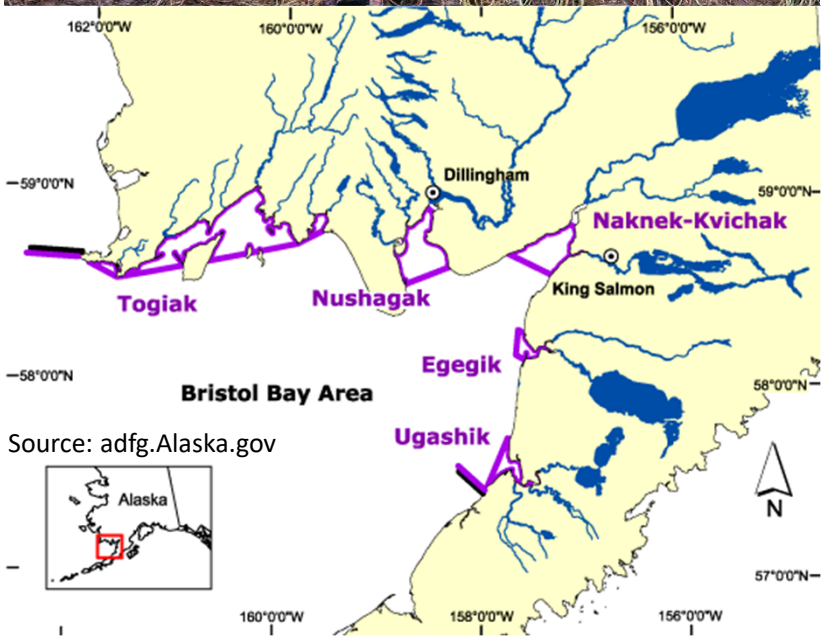
# Why synchrony matters

US financial crisis of 2008

# Why synchrony matters

## US financial crisis of 2008


Schindler et al 2010 Nature


Source: adfg.Alaska.gov

# Forms of Synchrony

## Spatial synchrony
## – populations across locations

Koenig & Liebhold 2016 Nat Clim Chang

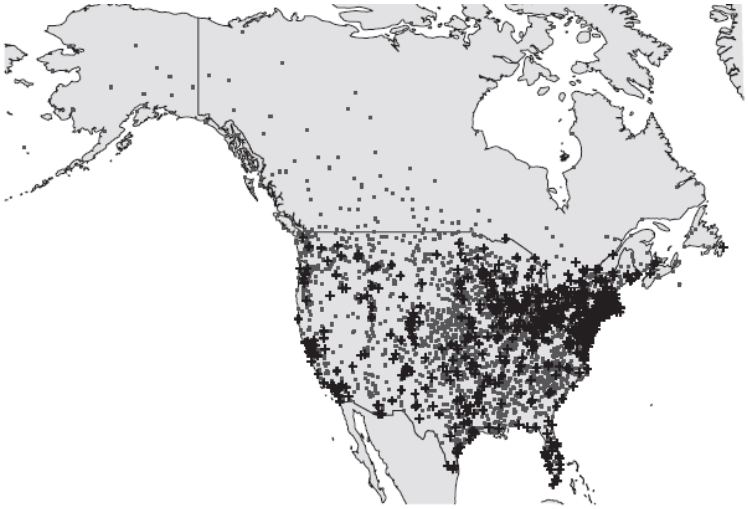


**Figure 1 | Locations of North American bird survey sites and weather stations used in the analyses of spatial synchrony.** Black crosses are sites of Christmas Bird Count circles ($N \approx 550$ sites) and grey dots are sites providing 40 or more years of temperature ($N \approx 1{,}350$) and/or rainfall ($N \approx 1{,}005$) data between 1960 and 2009.

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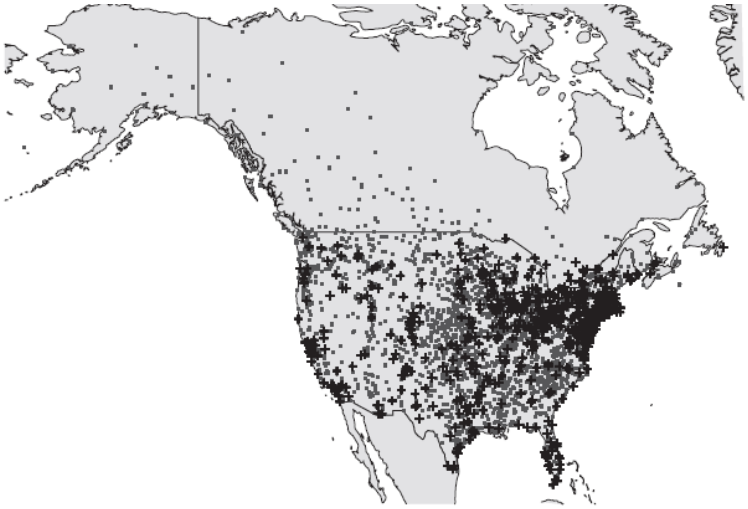

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## Interspecific synchrony
## – different species, same location

Hansen et al 2013 Sci

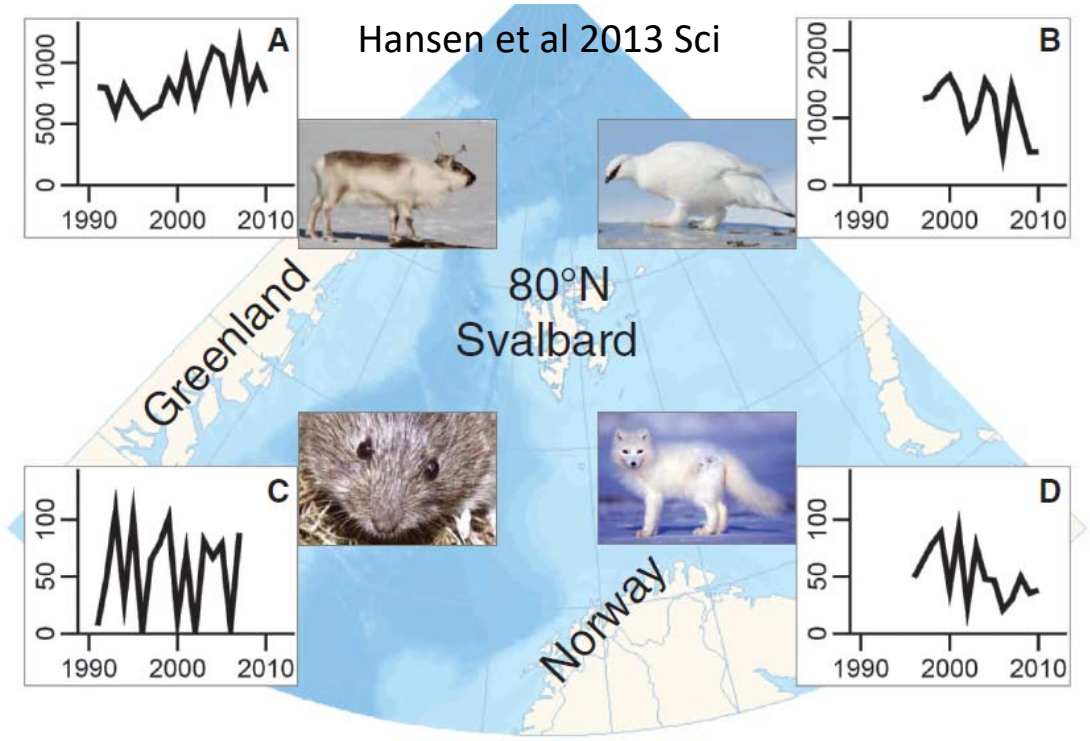
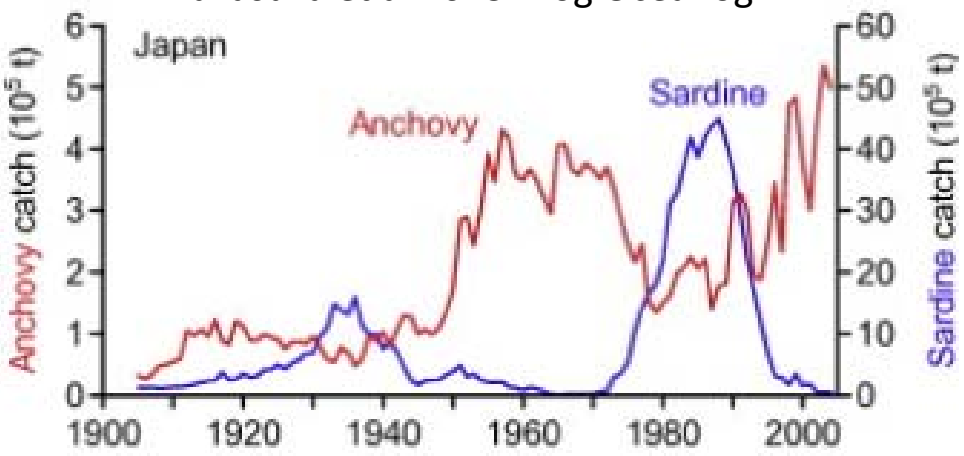



**Fig. 1.** The study system in high-arctic Svalbard. Annual population abundances (or indexes) are shown for the overwintering vertebrates: (**A**) wild reindeer, (**B**) rock ptarmigan, (**C**) sibling vole, and (**D**) arctic fox (advanced by 1 year).

# Drivers of Synchrony

## Moran effect

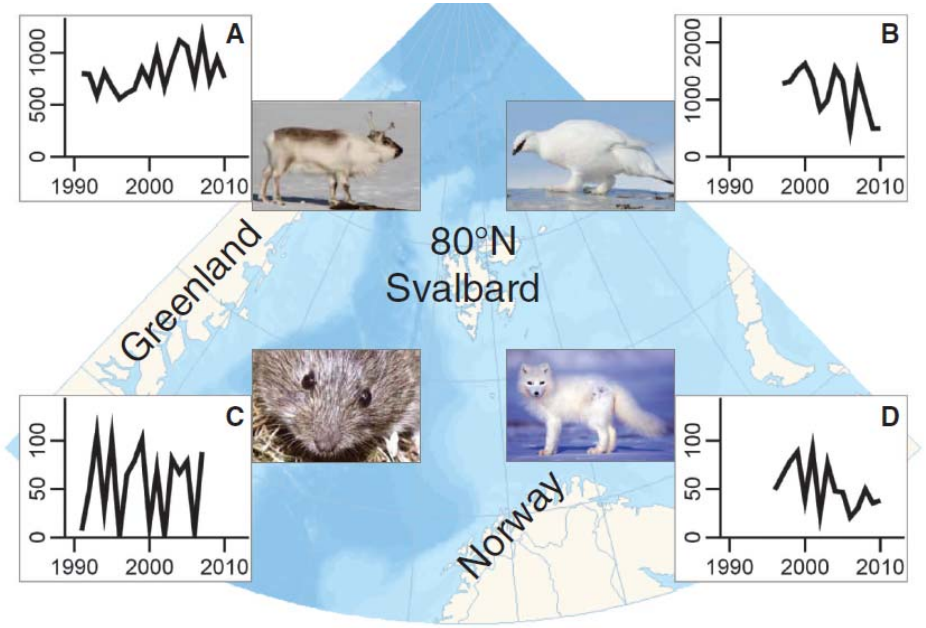
Takasuka et al 2013 Prog Oceanogr



# Drivers of Synchrony

## Trophic interactions

Hansen et al 2013 Sci

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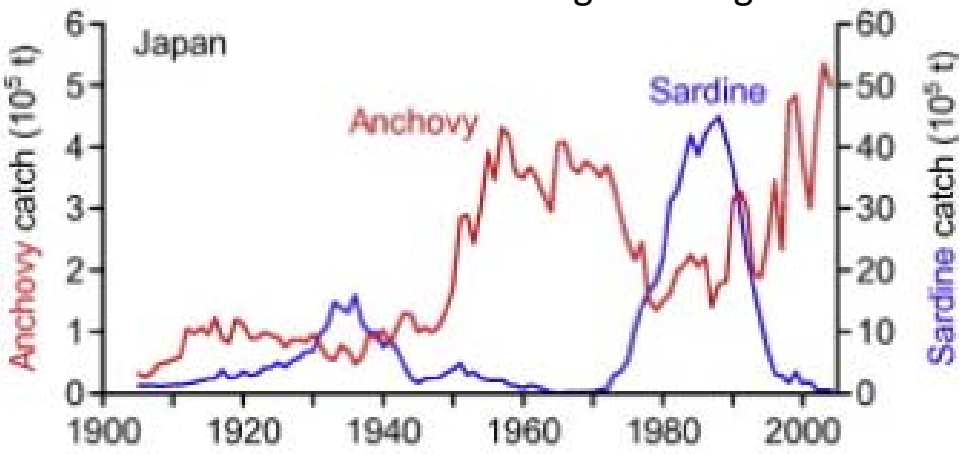

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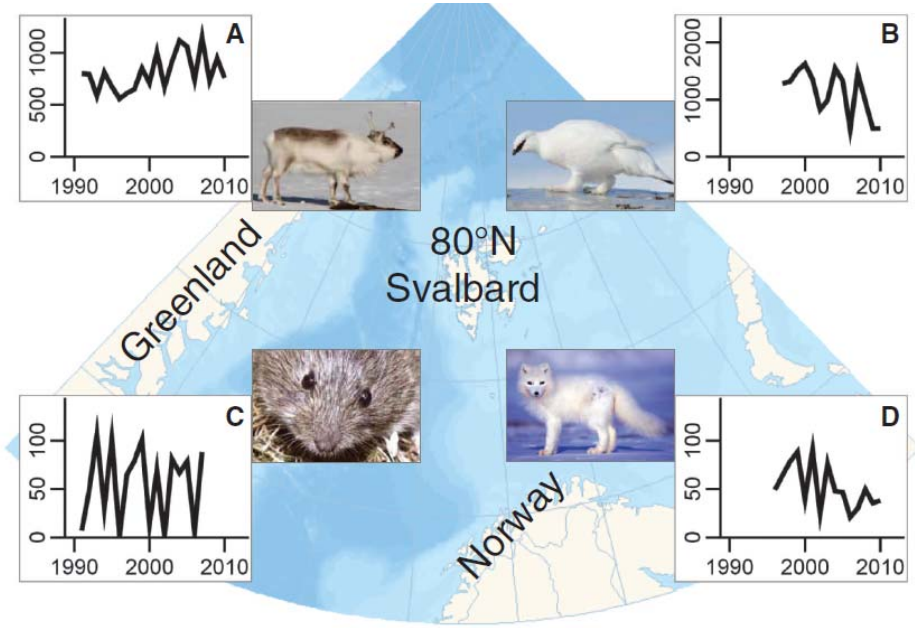


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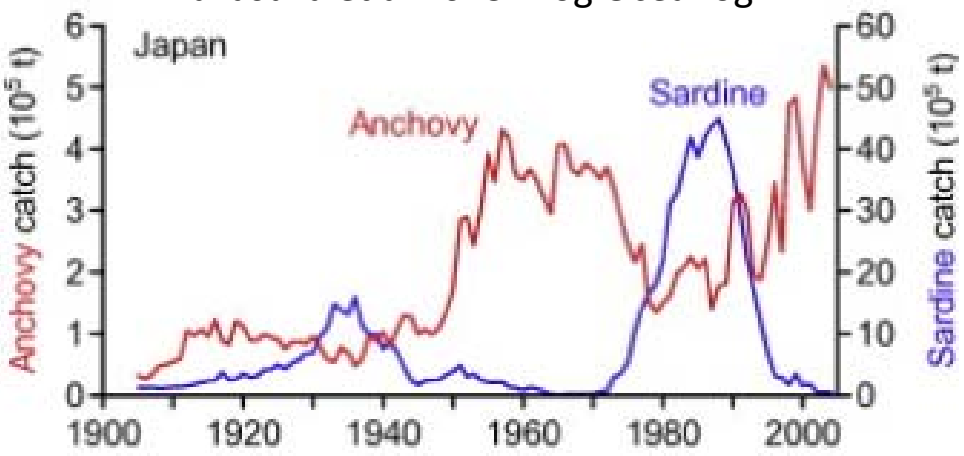
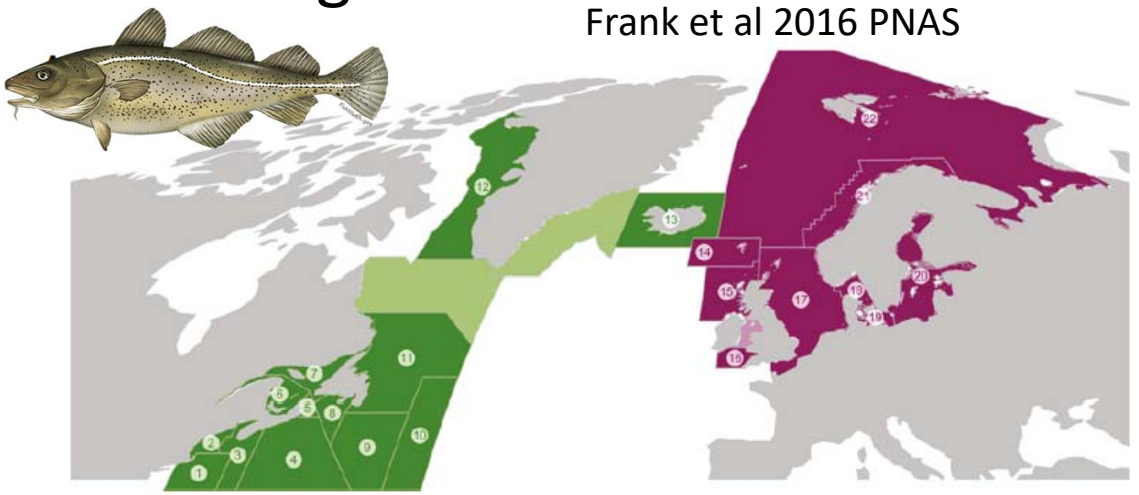
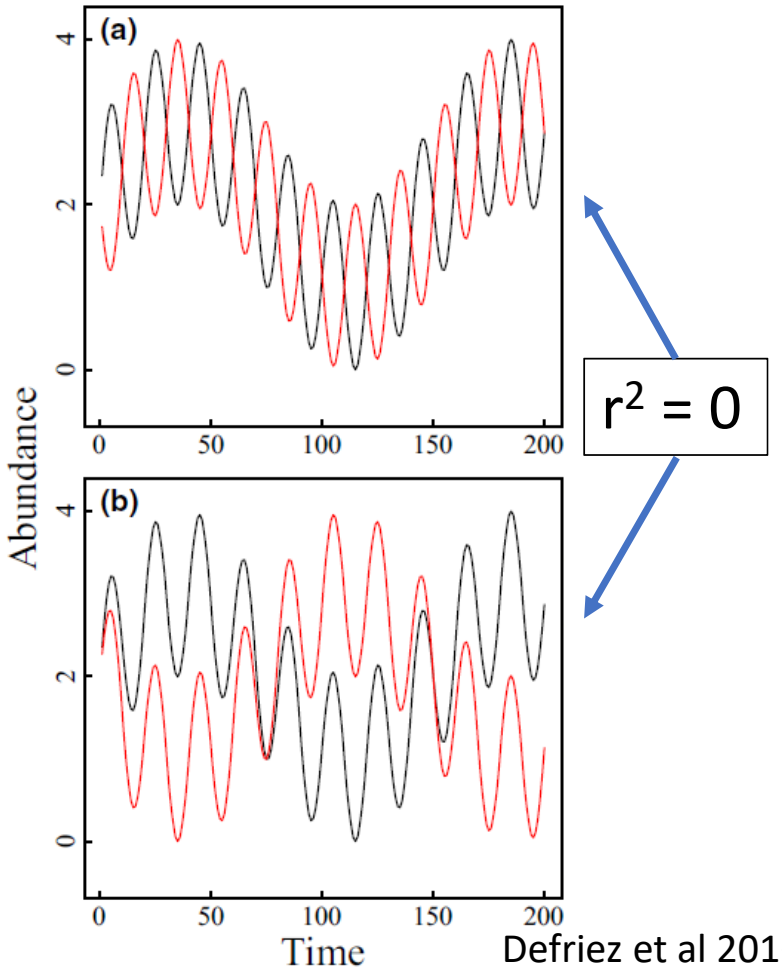



## Fishing

Frank et al 2016 PNAS



# Wavelet analyses




Defriez et al 2016 GCB

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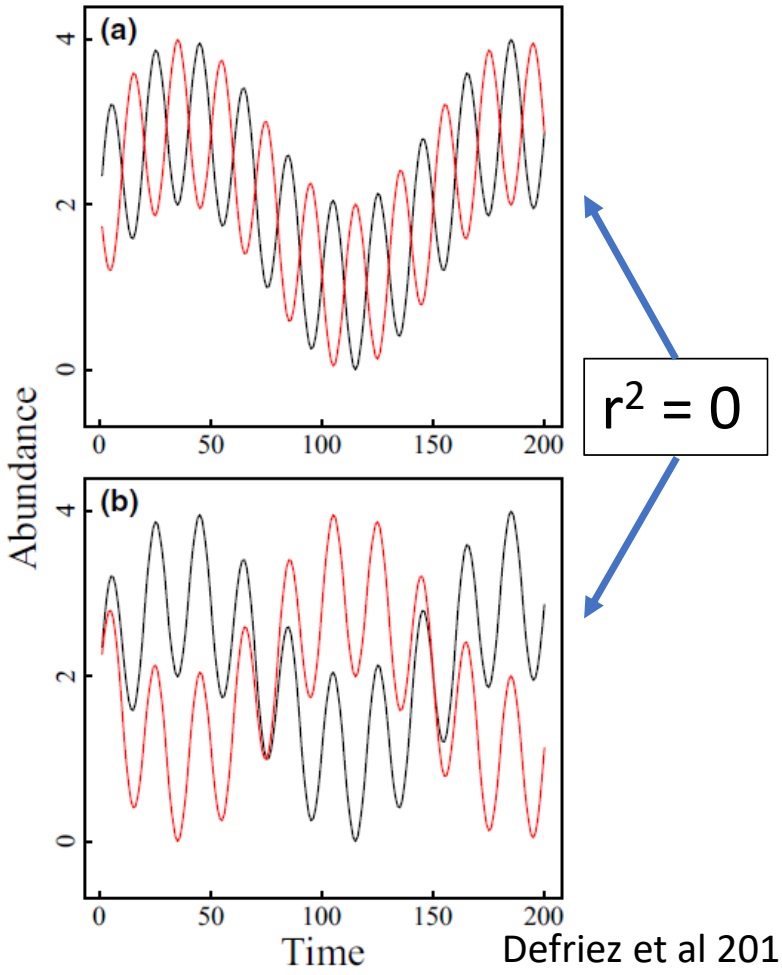
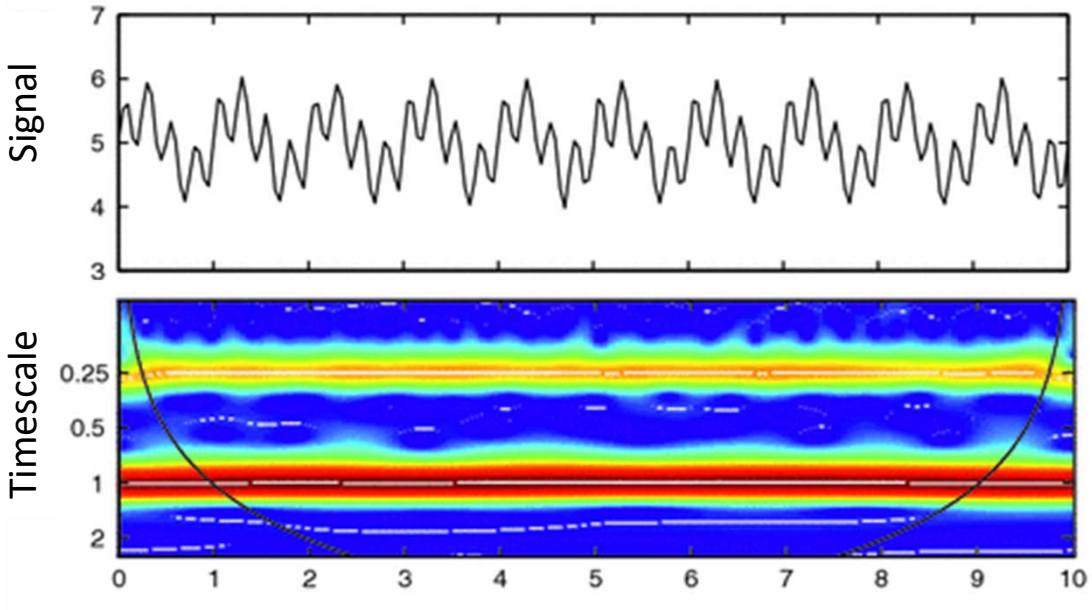



$r^2 = 0$

Defriez et al 2016 GCB



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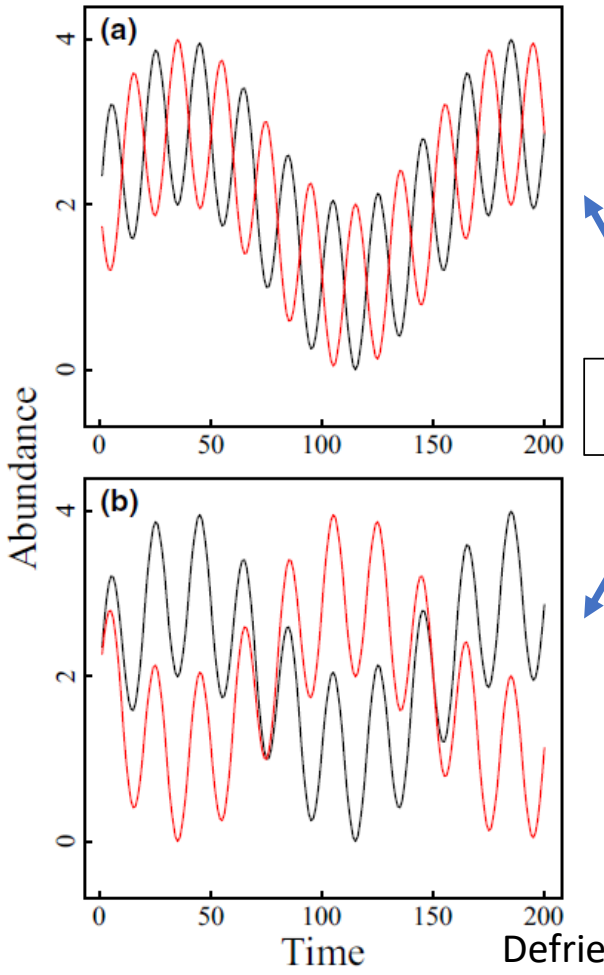


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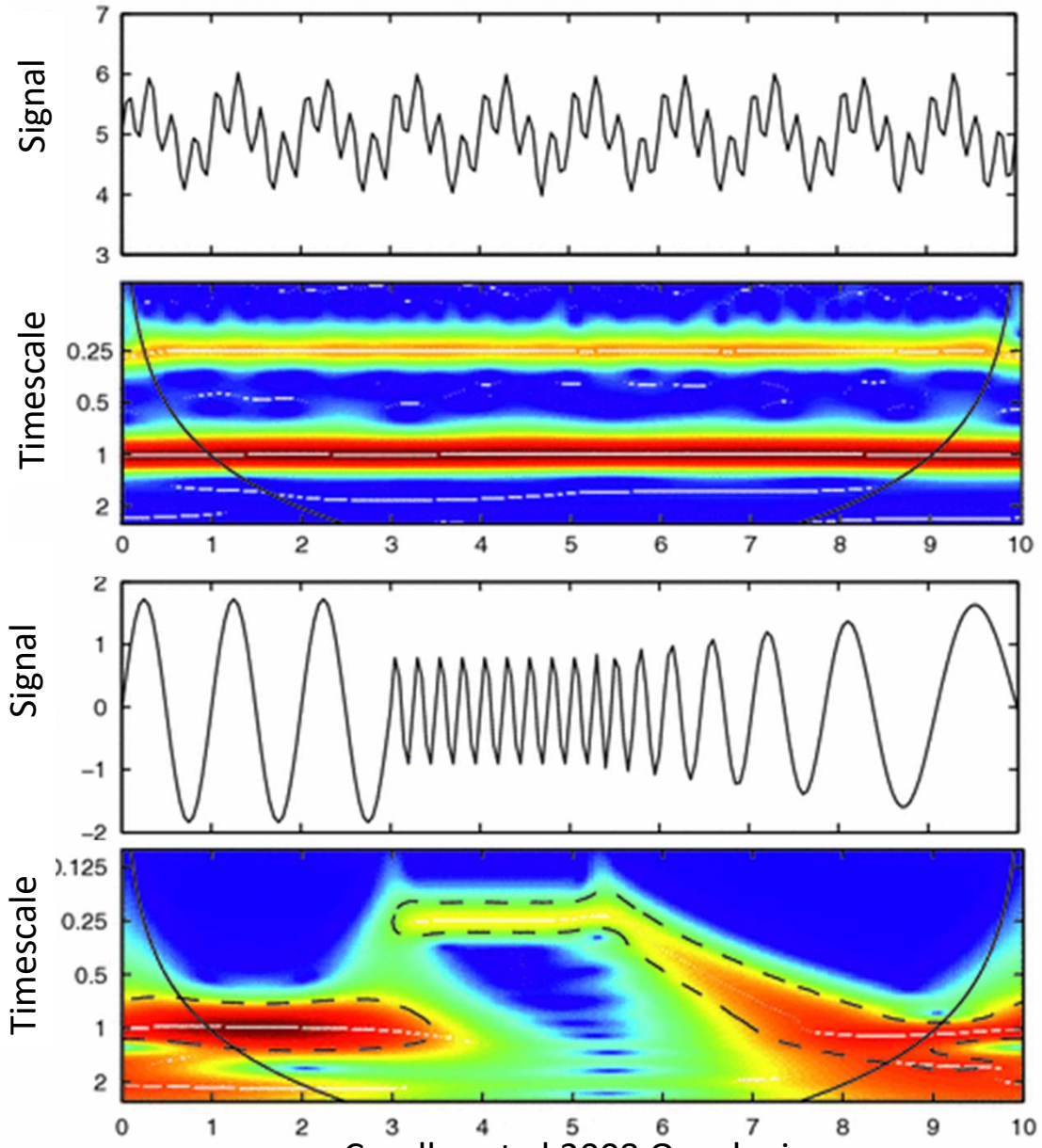



Cazelles et al 2008 Oecologia

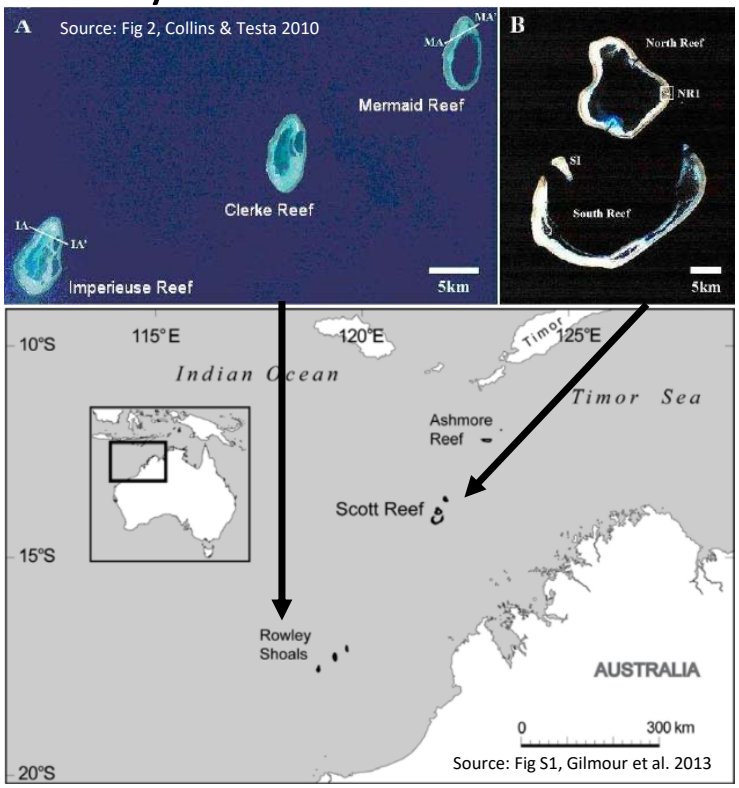
# Research system

*Lutjanus bohar*

*Pristipomoides zonatus*


Rowley Shoals

Scott Reef



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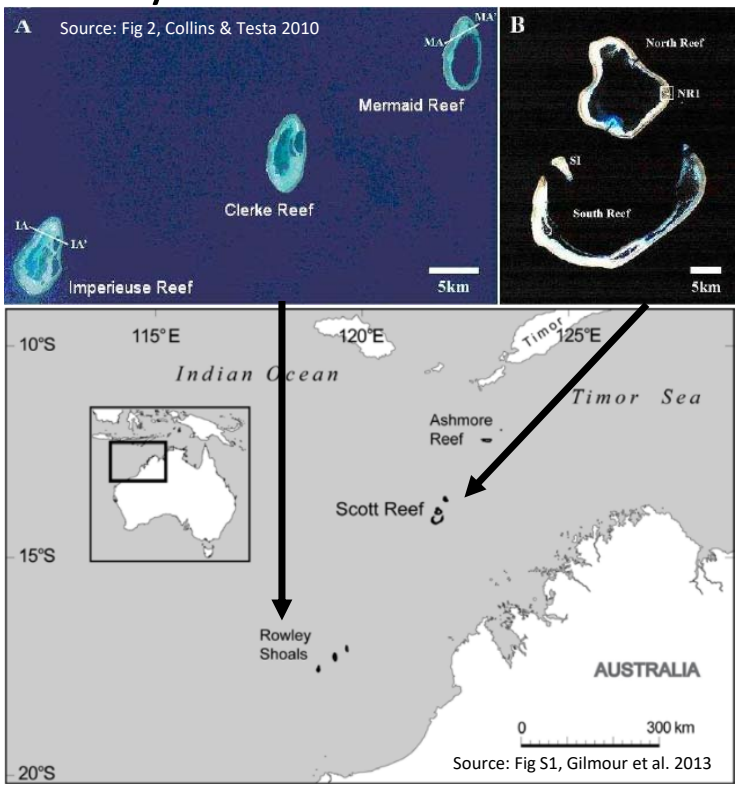
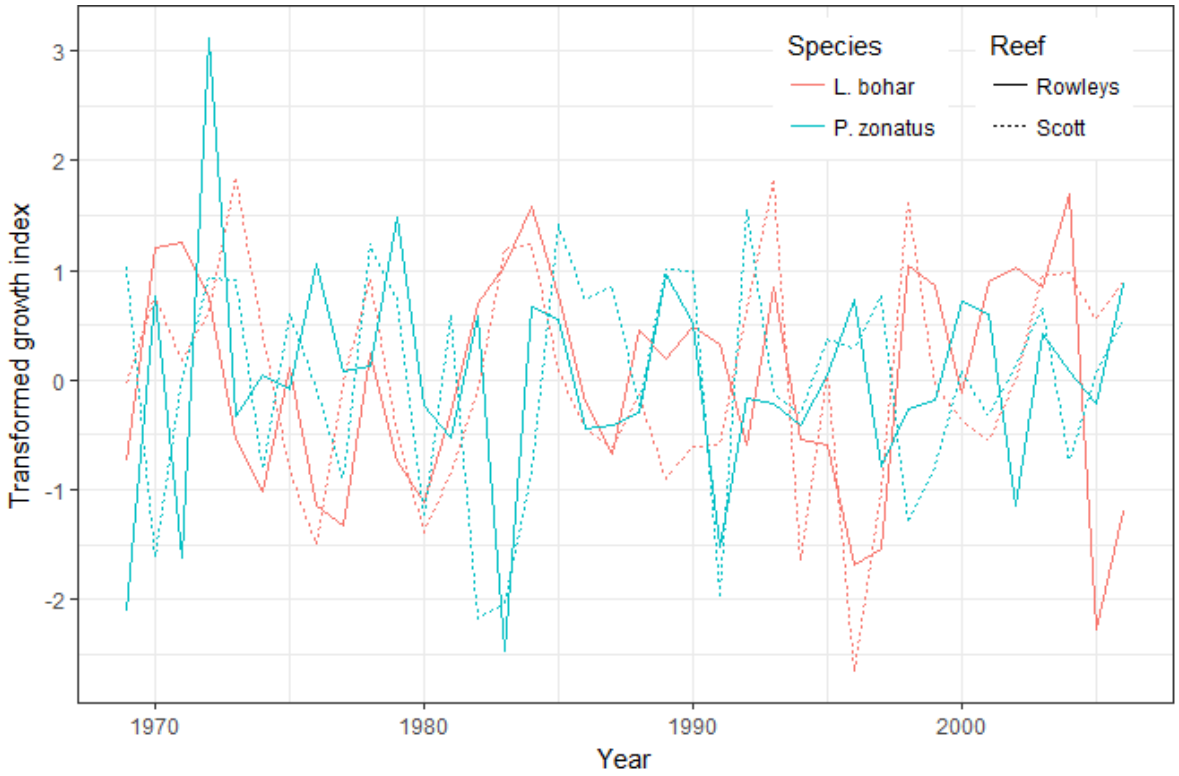
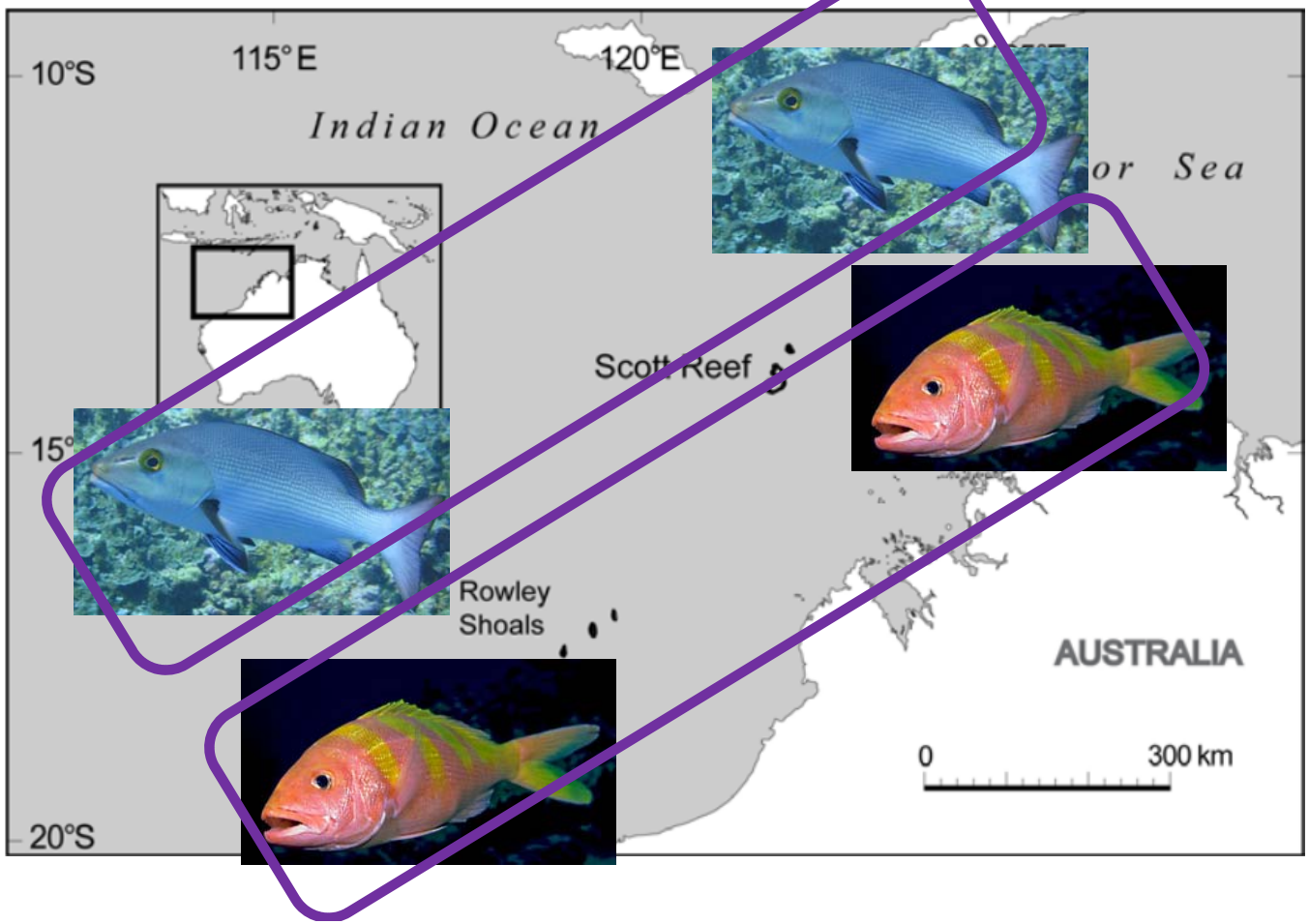


# Research questions

Q1. Spatial synchrony or interspecific synchrony?



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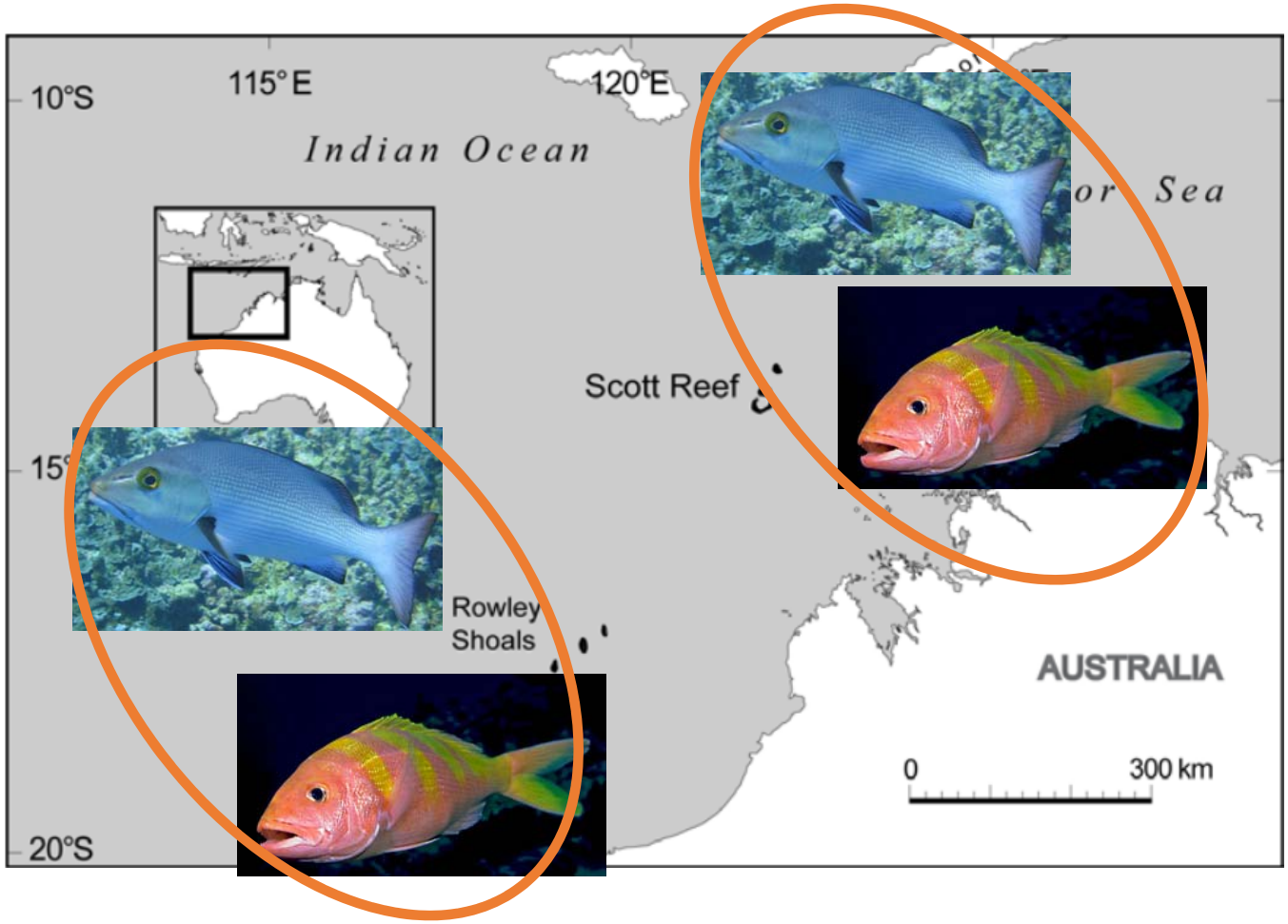

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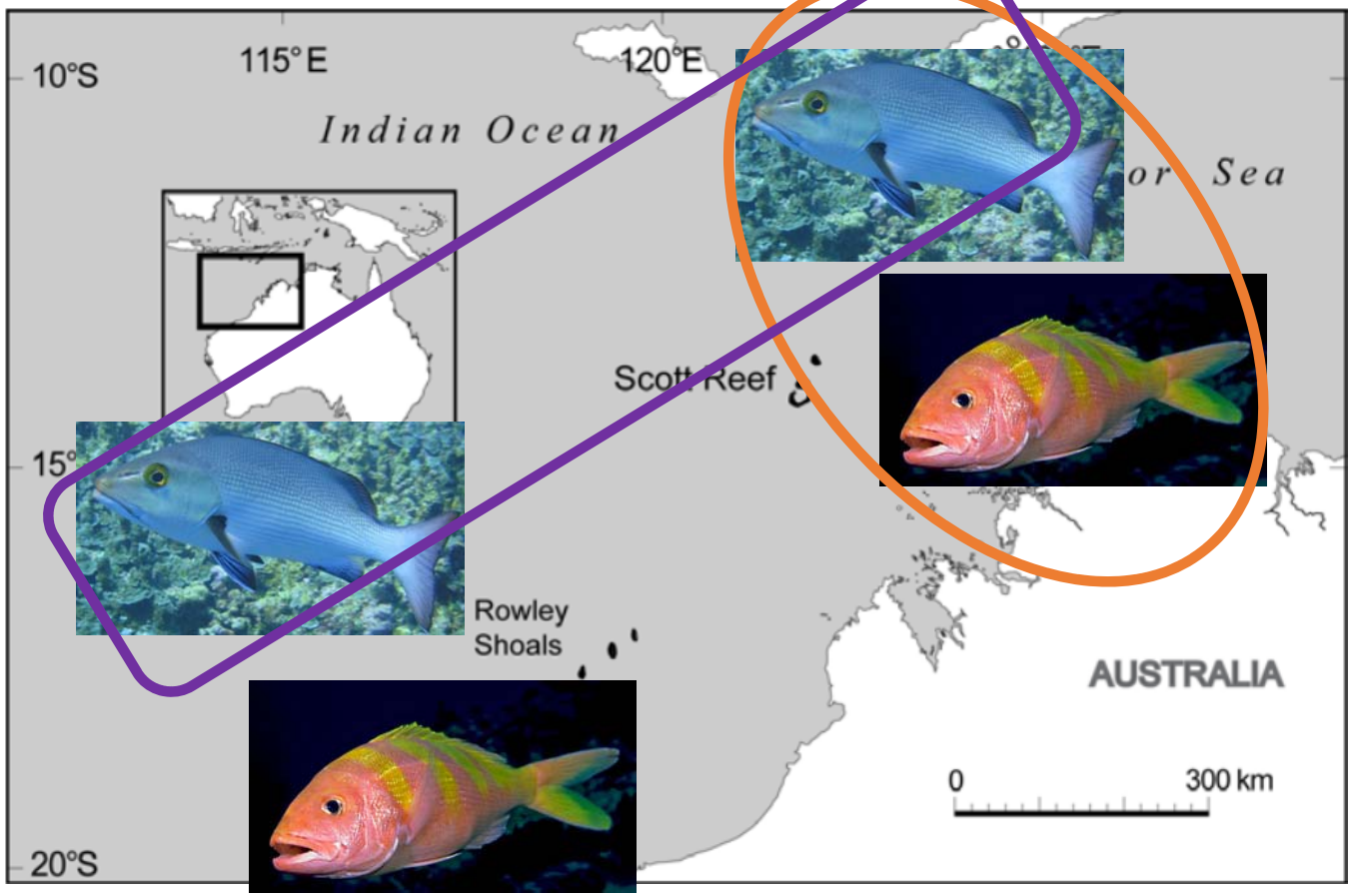
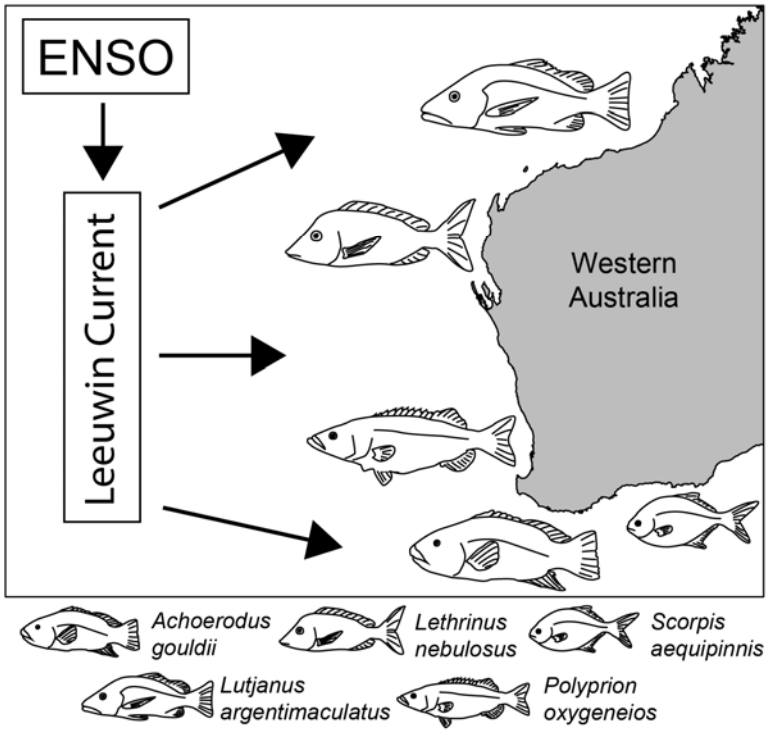
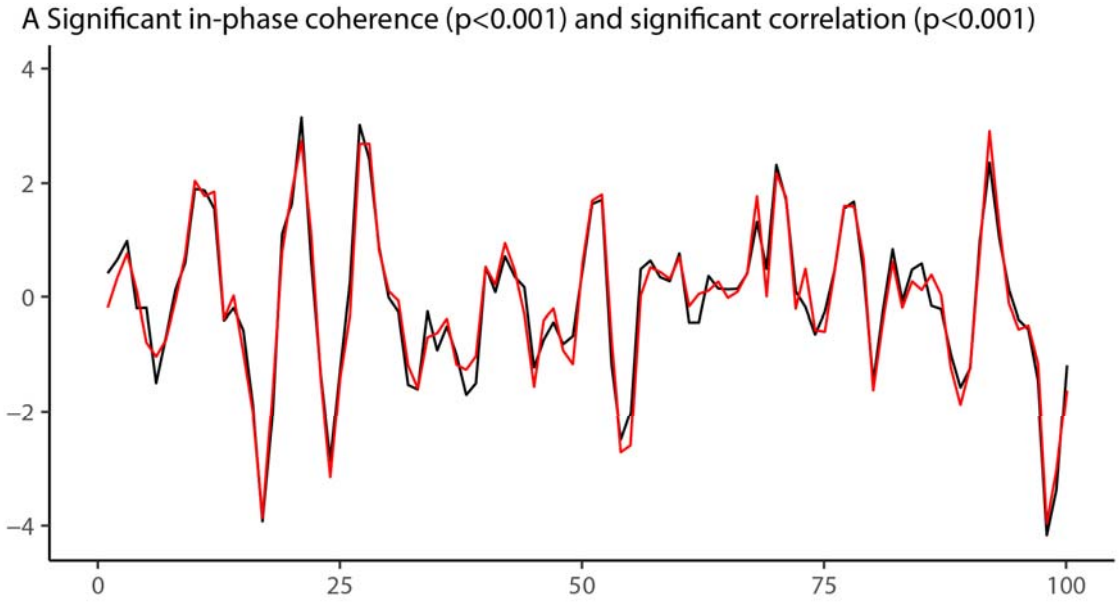



Q2. What are the factors driving synchrony?



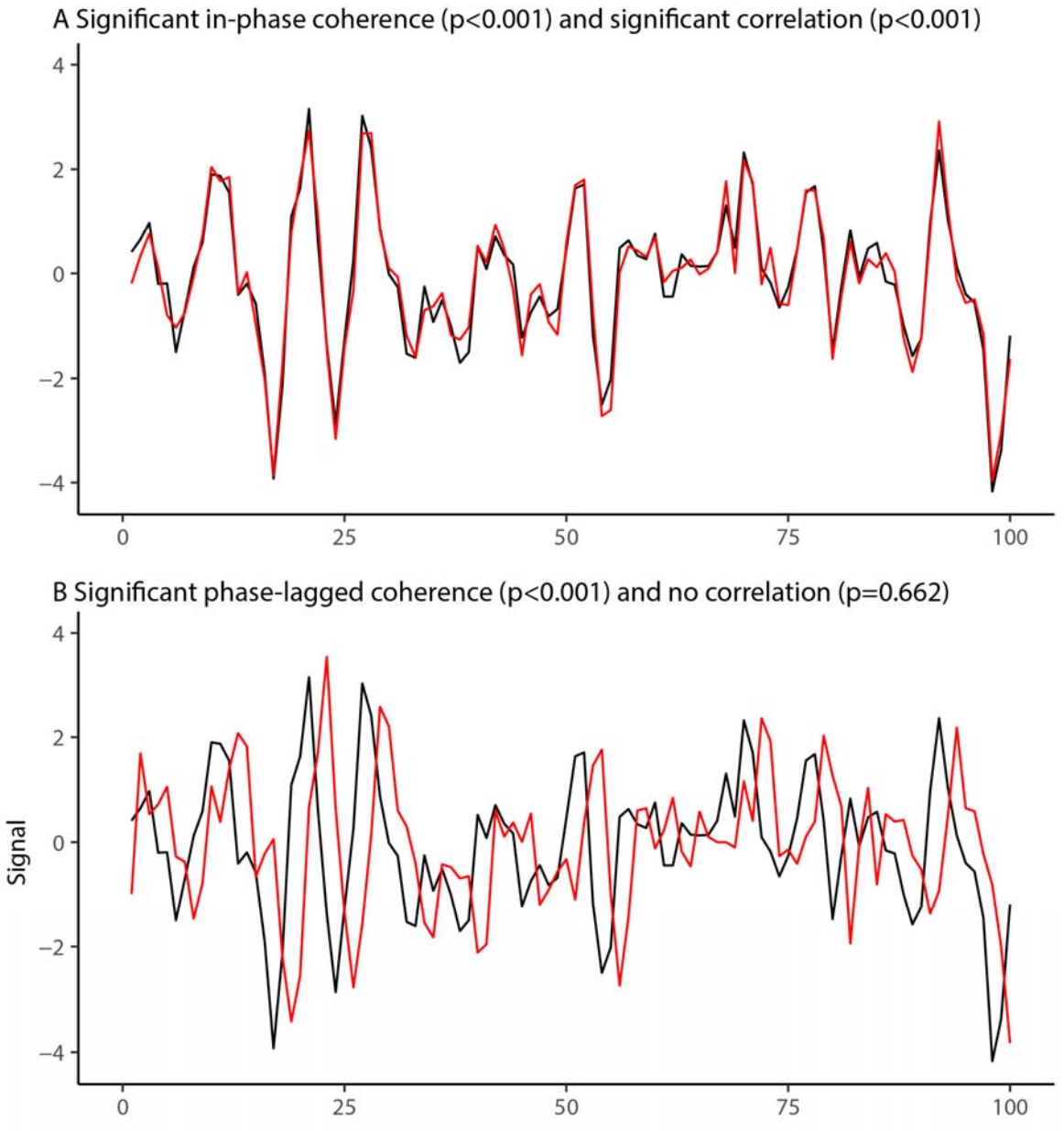
# Wavelet Coherence

- Value from 0 to 1
- High (1) if correlated oscillations & consistent phase difference



# Wavelet Coherence

- Value from 0 to 1
- High (1) if correlated oscillations & consistent phase difference
- Accounts for temporal lags
- Info on phase relationship (in-phase, lagged or anti)



# Type of Synchrony

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Timescales: 2-5 years

5-8 years

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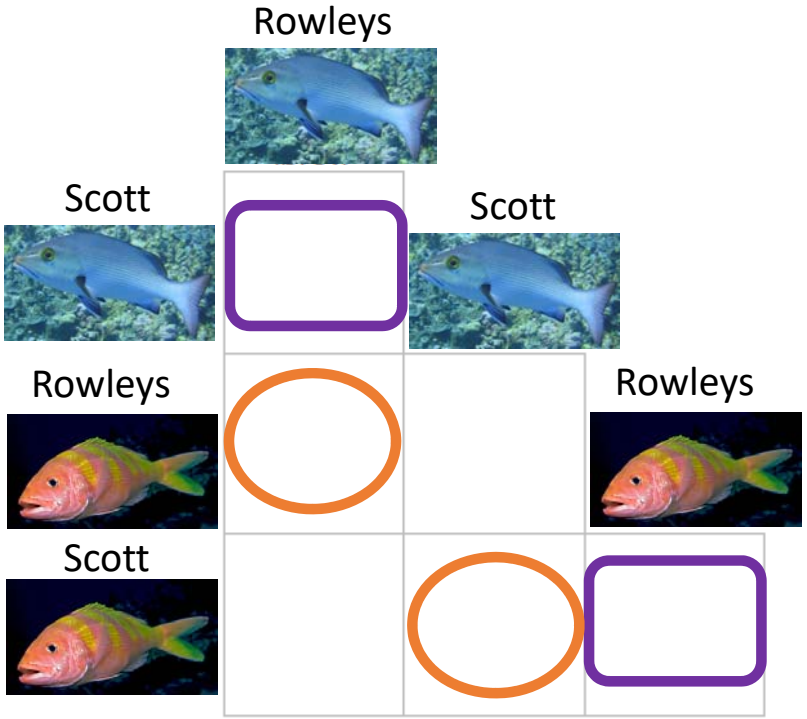

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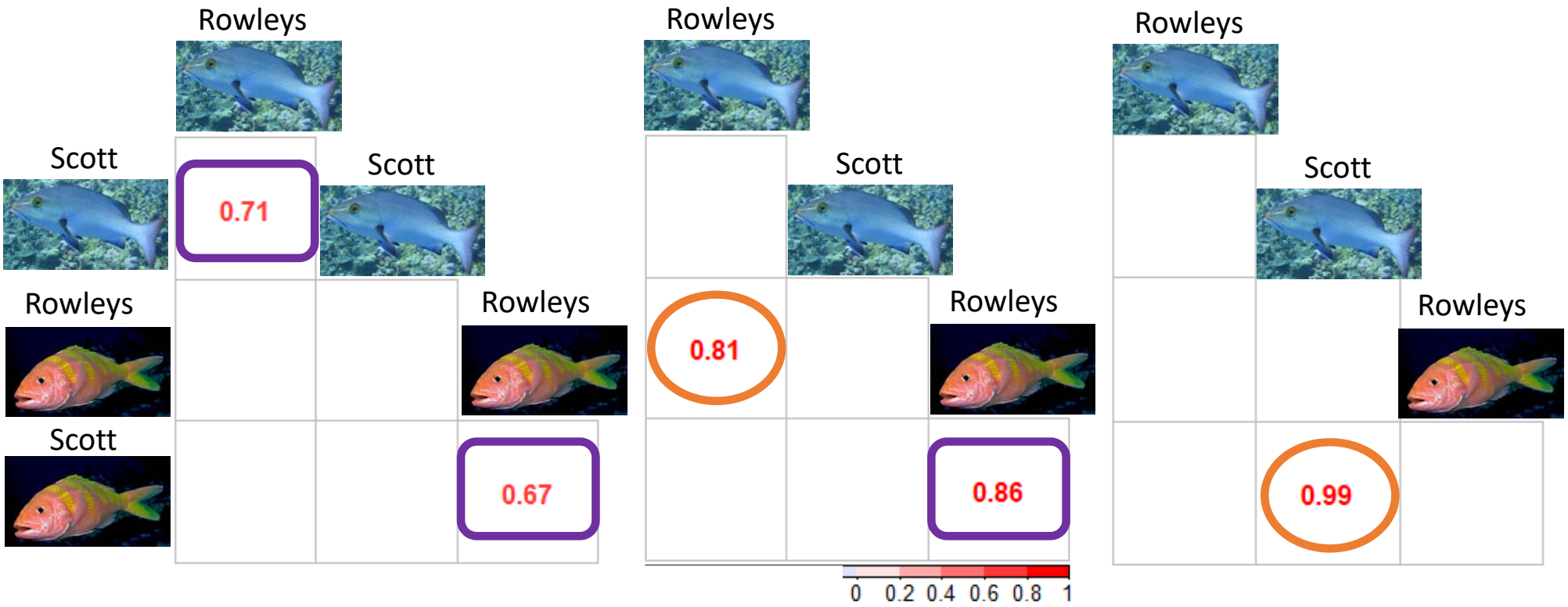

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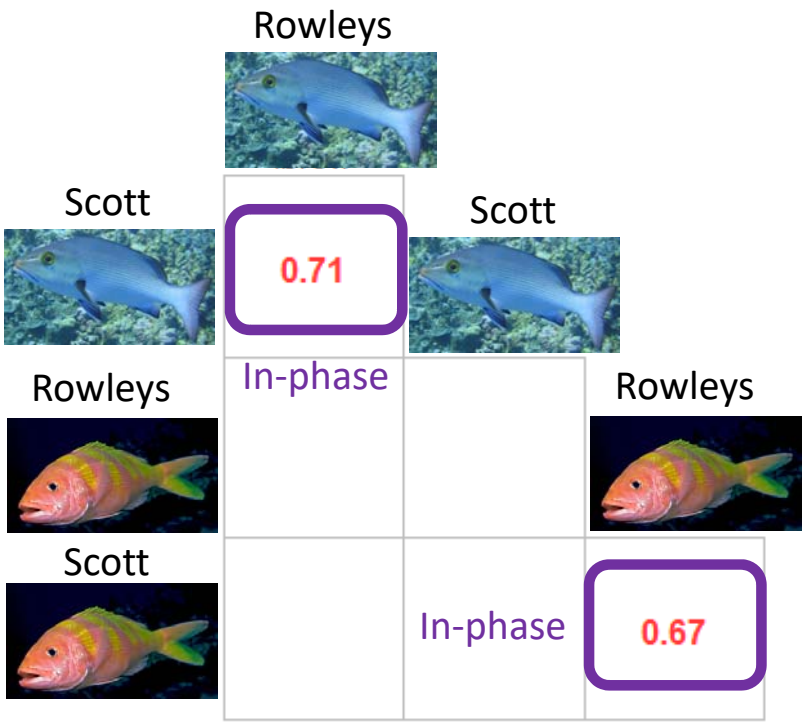


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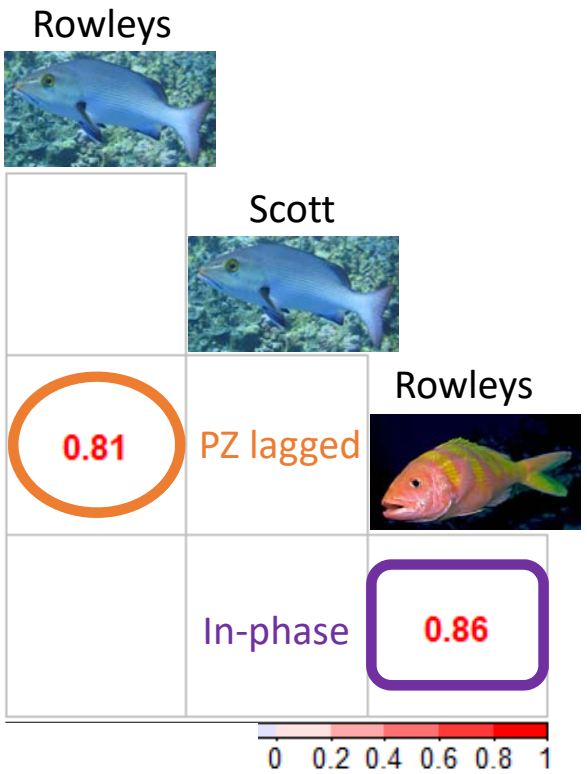
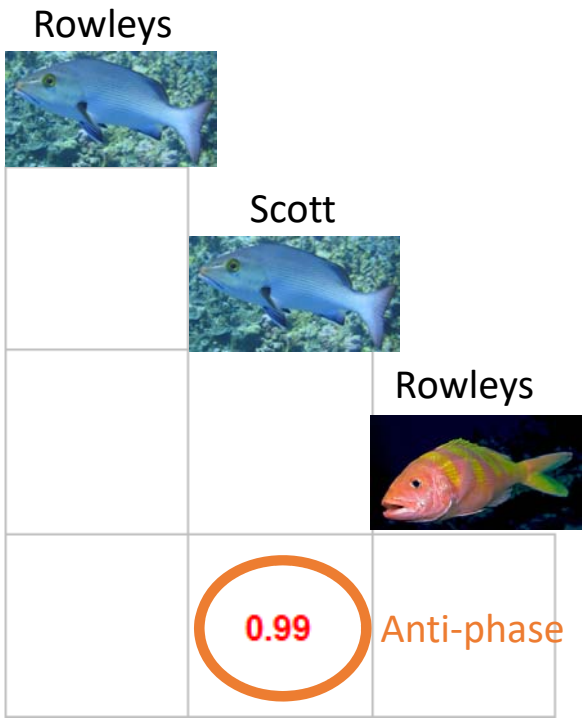



8-12 years



# Drivers of Synchrony

Timescale band: 2-5 years

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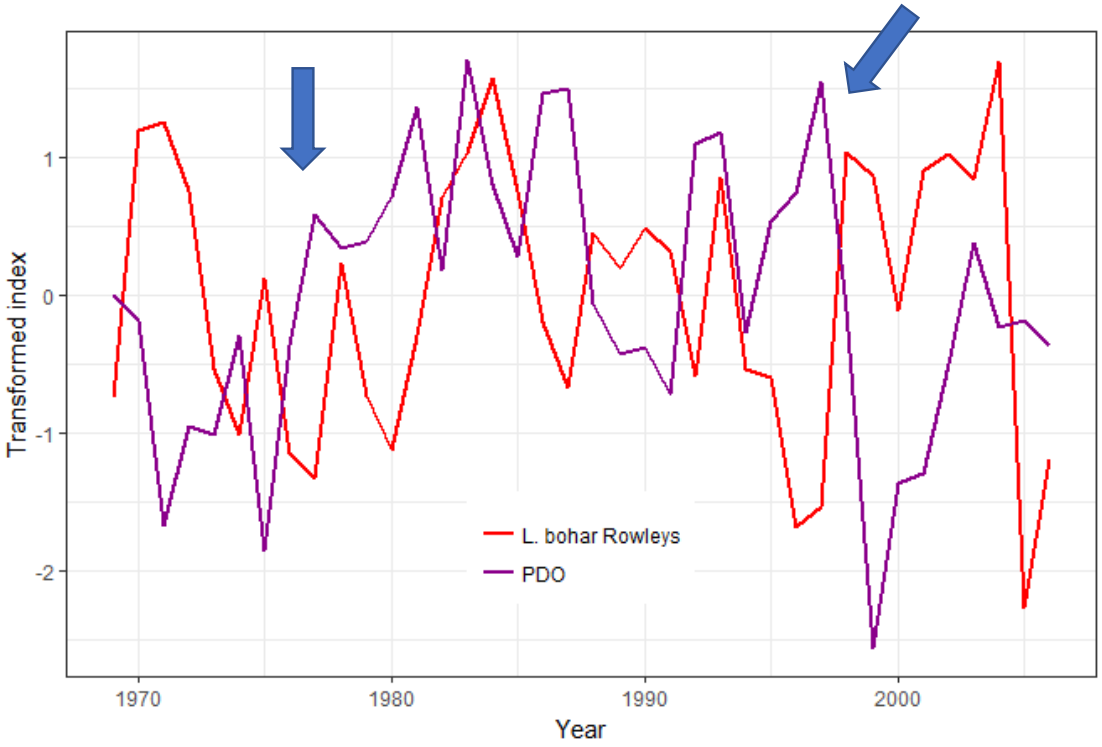
PDO leading Bohar at Rowleys



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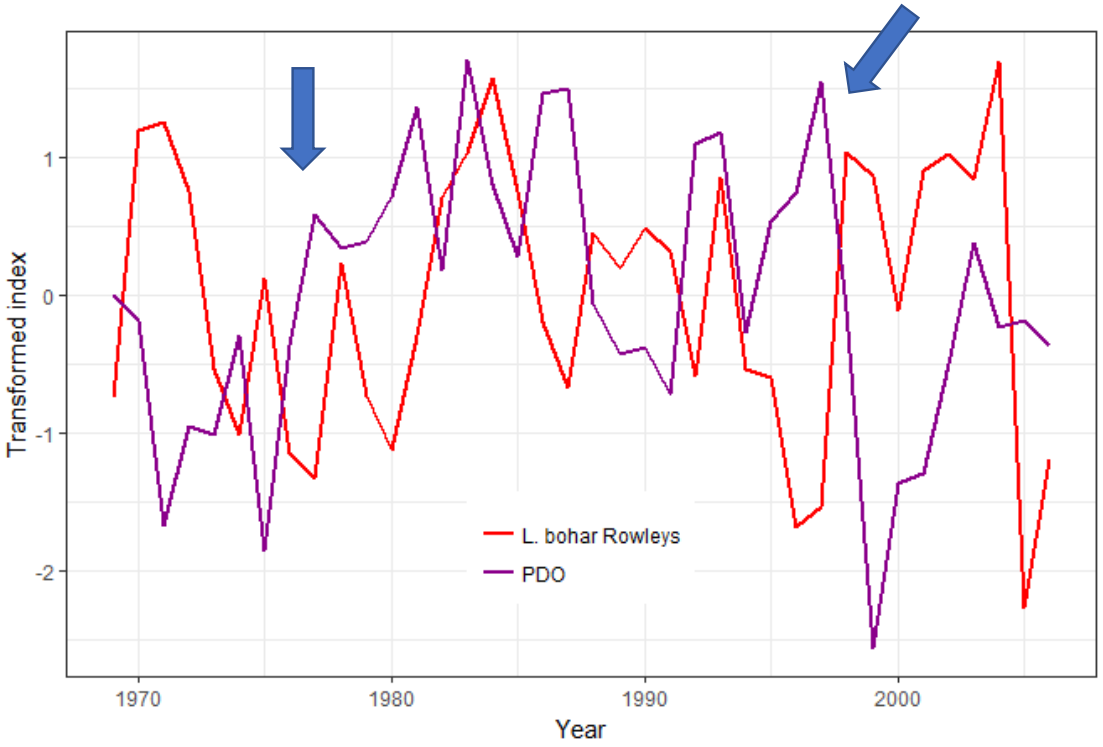
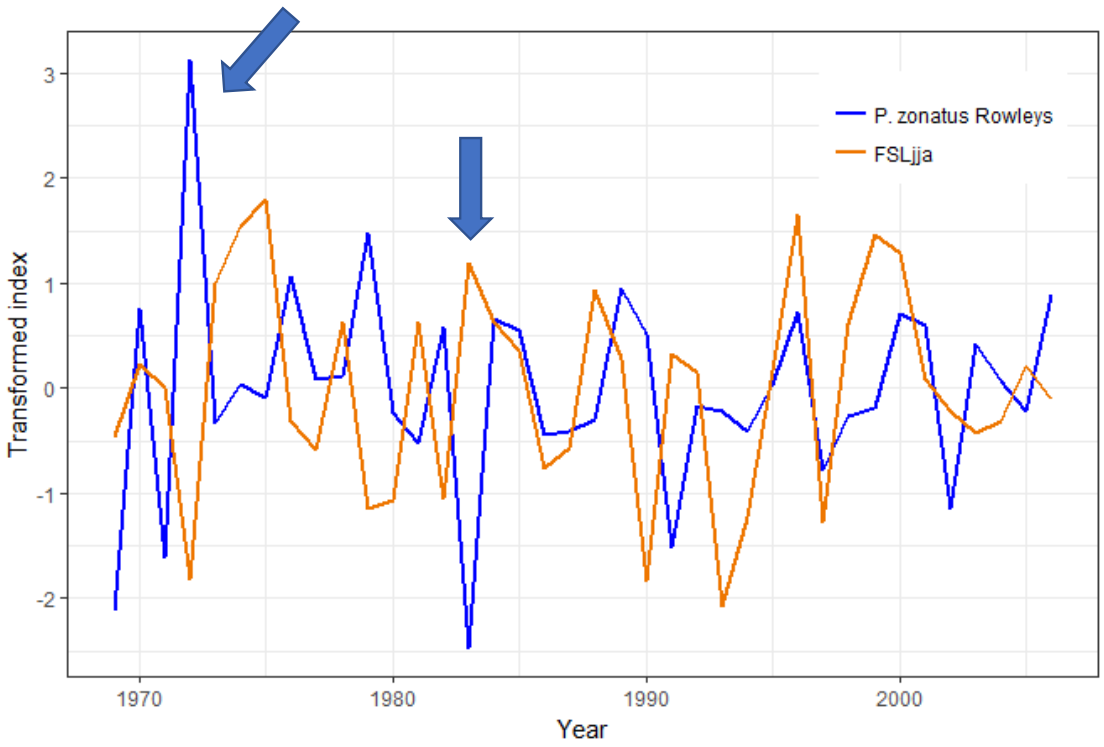
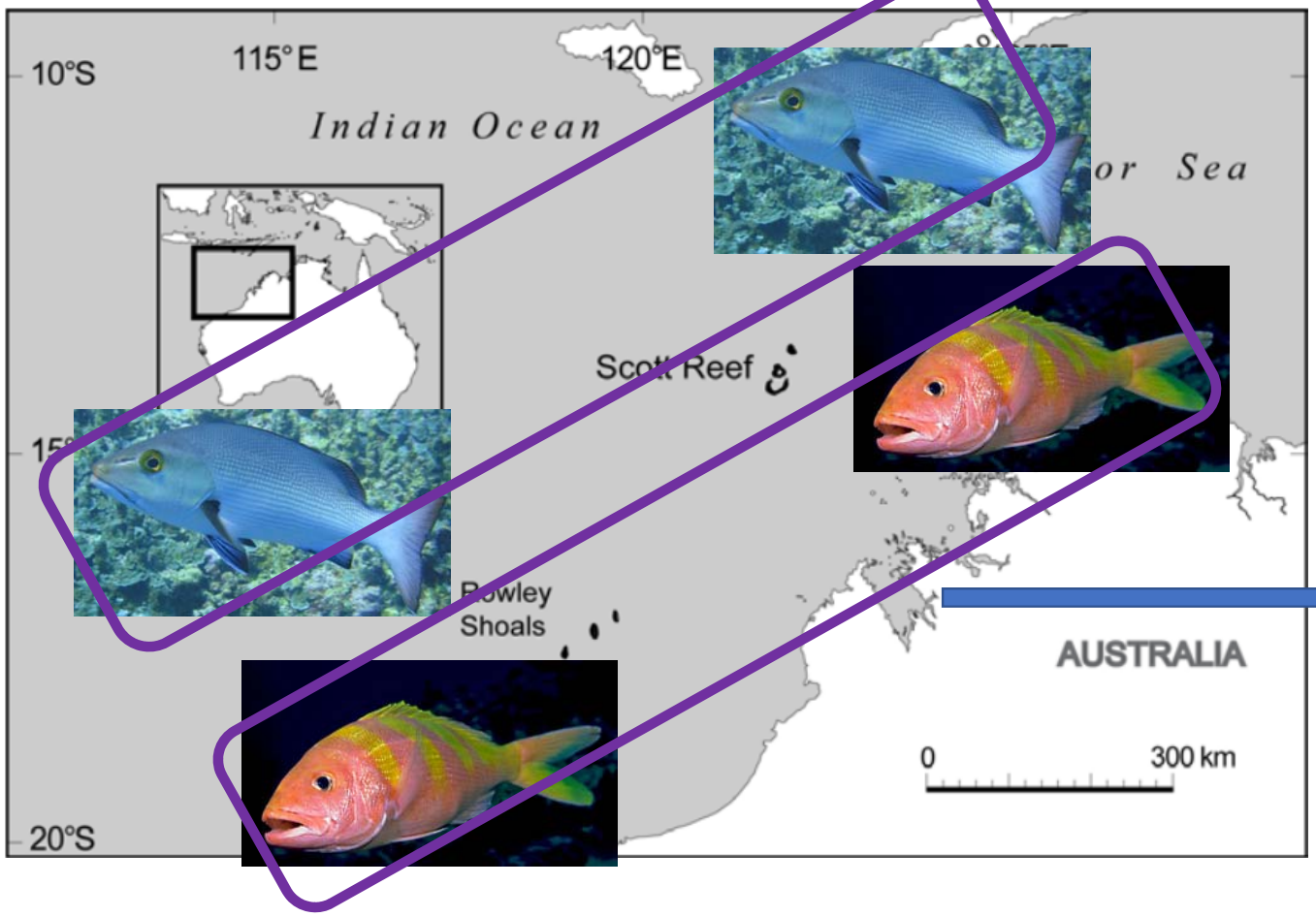



LC anti-synchronous Zonatus at Rowleys



# Summary

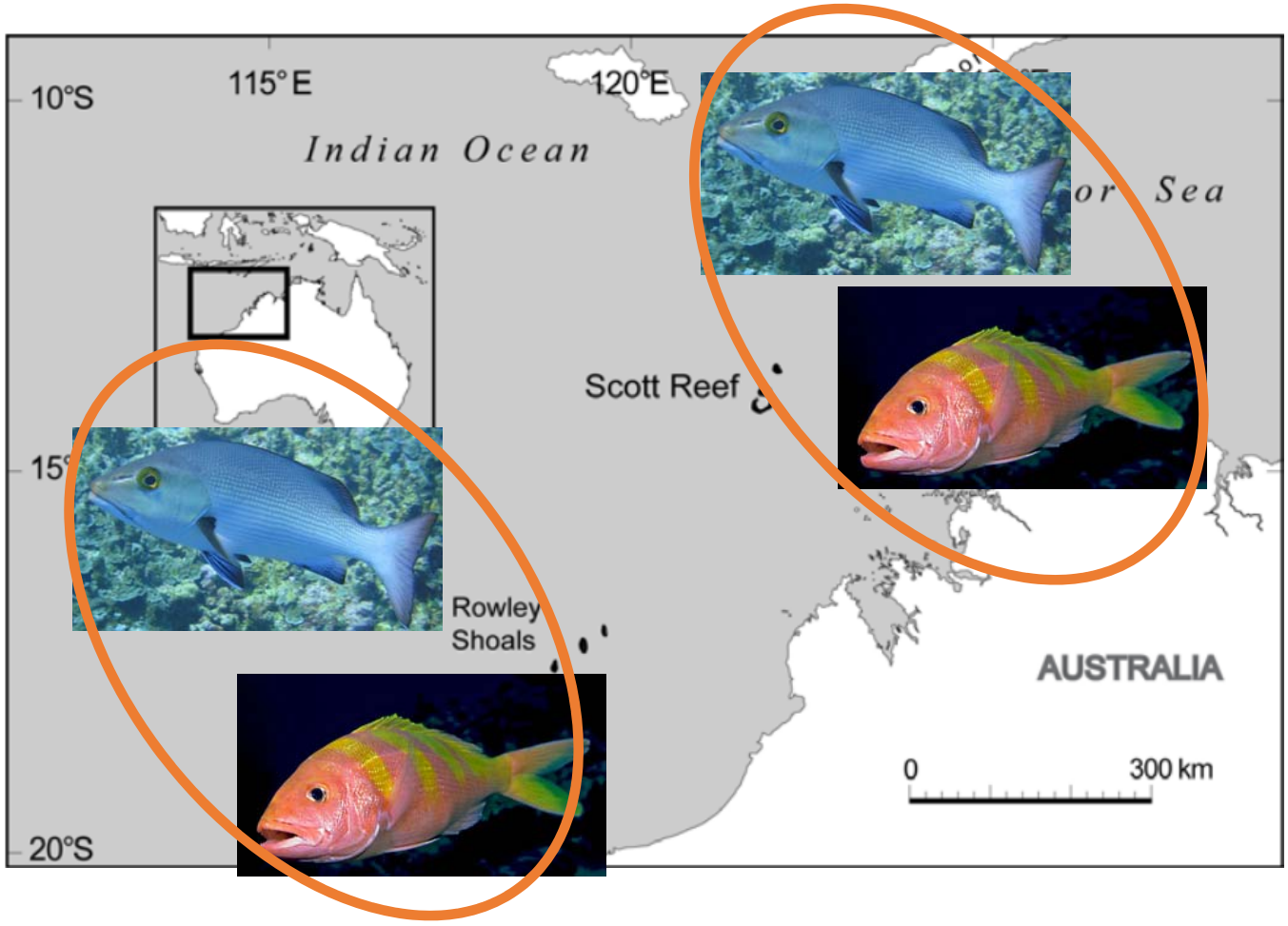
Multivariate ENSO index (MEI)
Pacific Decadal Oscillation (PDO)




- ✓ Spatial synchrony
- Short timescales
- Climate variables leading fish growth

Leeuwin Current (winter)

# Summary

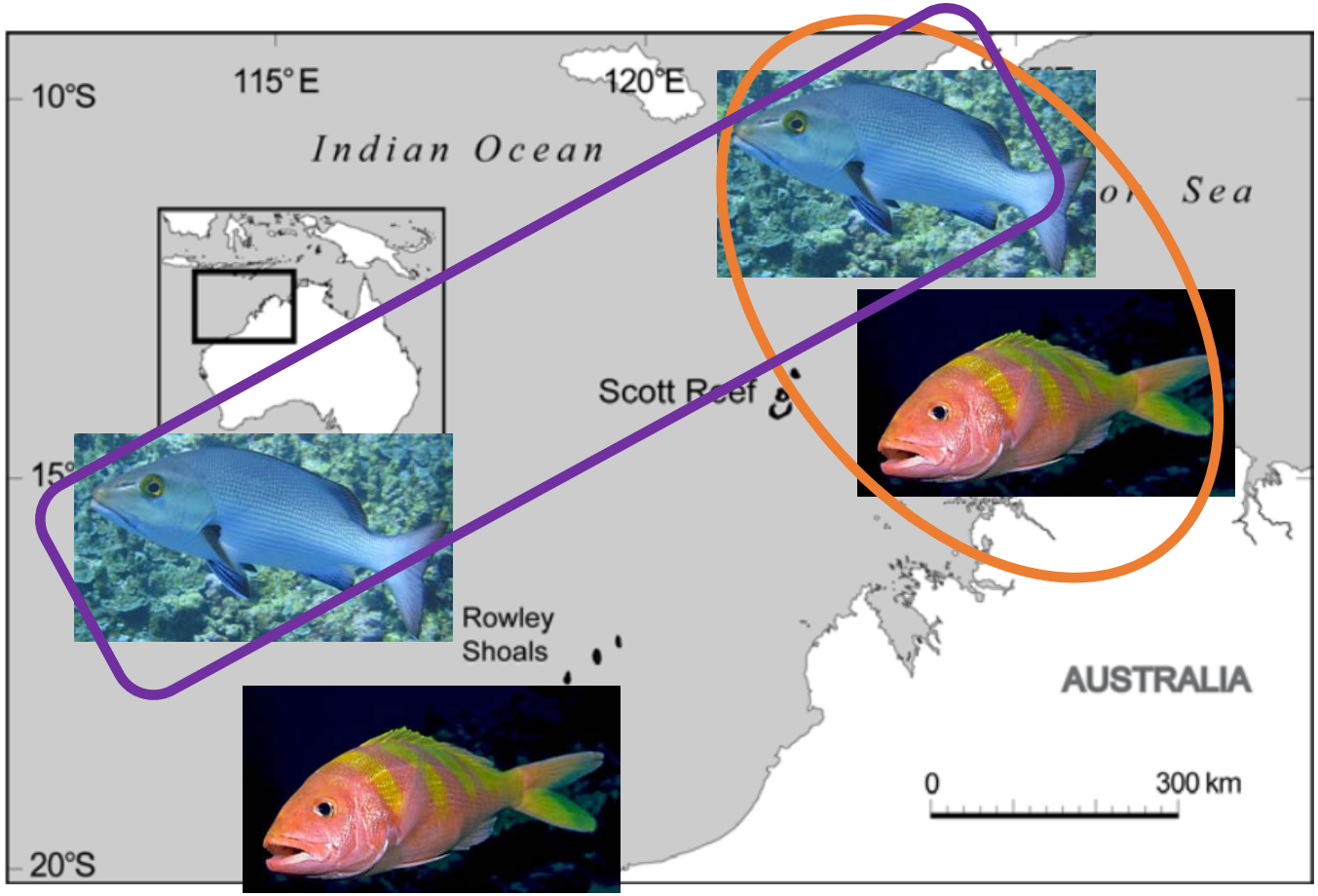



- ✓ Interspecific synchrony
- Long timescales
- Lagged/anti-phase
- Drivers???

  Regional oceanography, trophic interactions, fishing pressure?

# Implications

1. Spatial synchrony and interspecific synchrony can co-occur at different timescales



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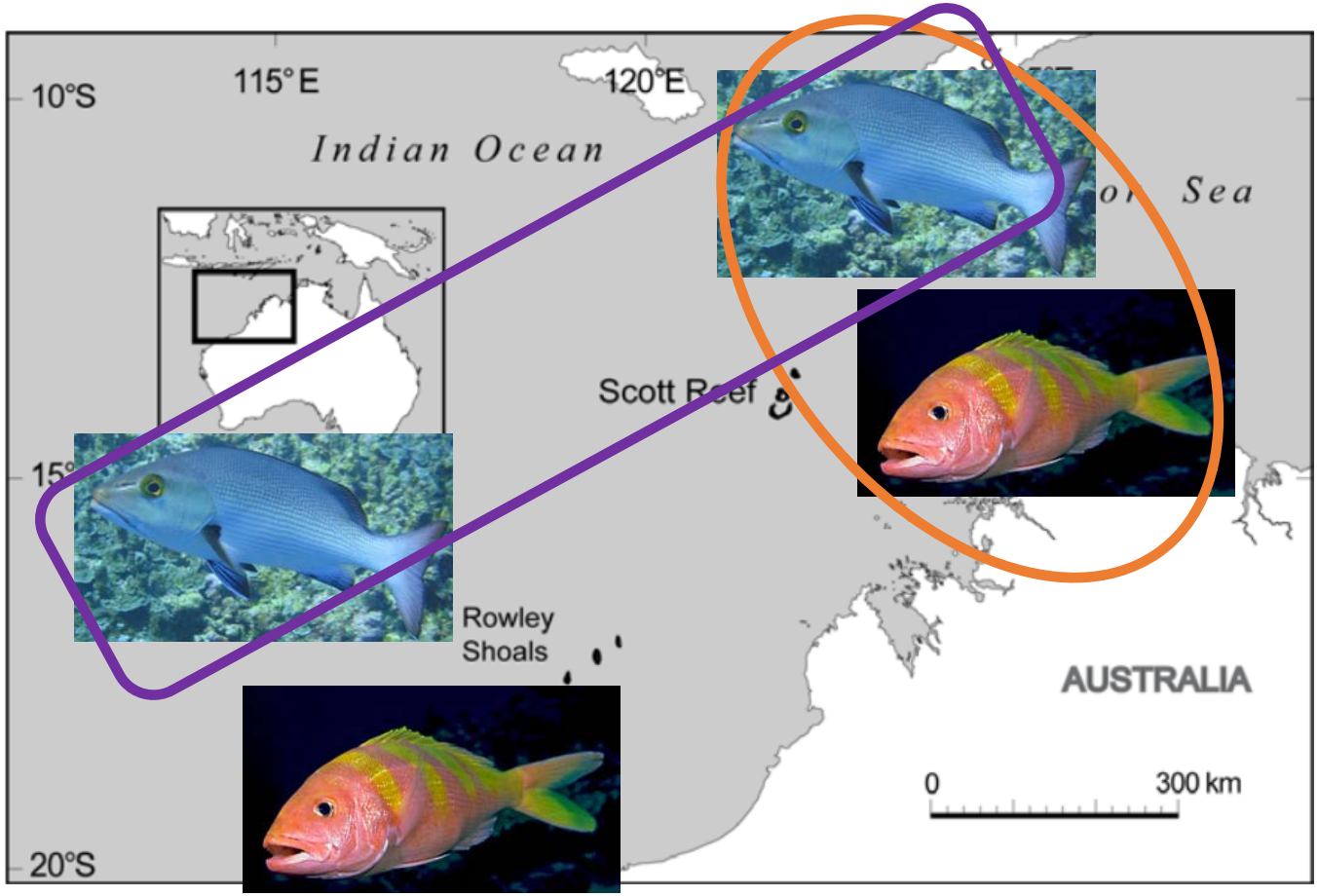
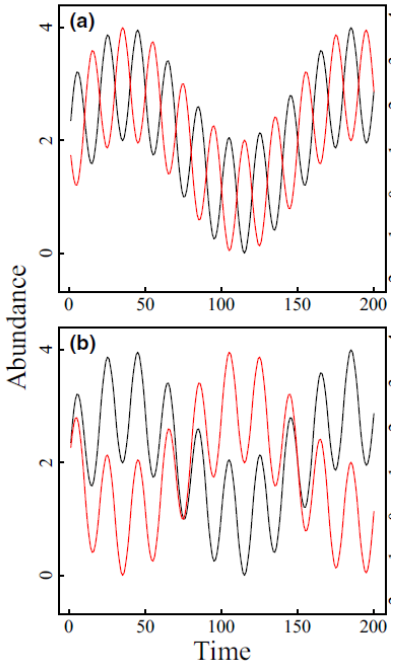



2. Wavelet methods are useful for synchrony at different timescales



# Acknowledgements

Pinsky lab, Rutgers University

Jonathan Walter, University of Virginia

UNIVERSITY of VIRGINIA

# References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