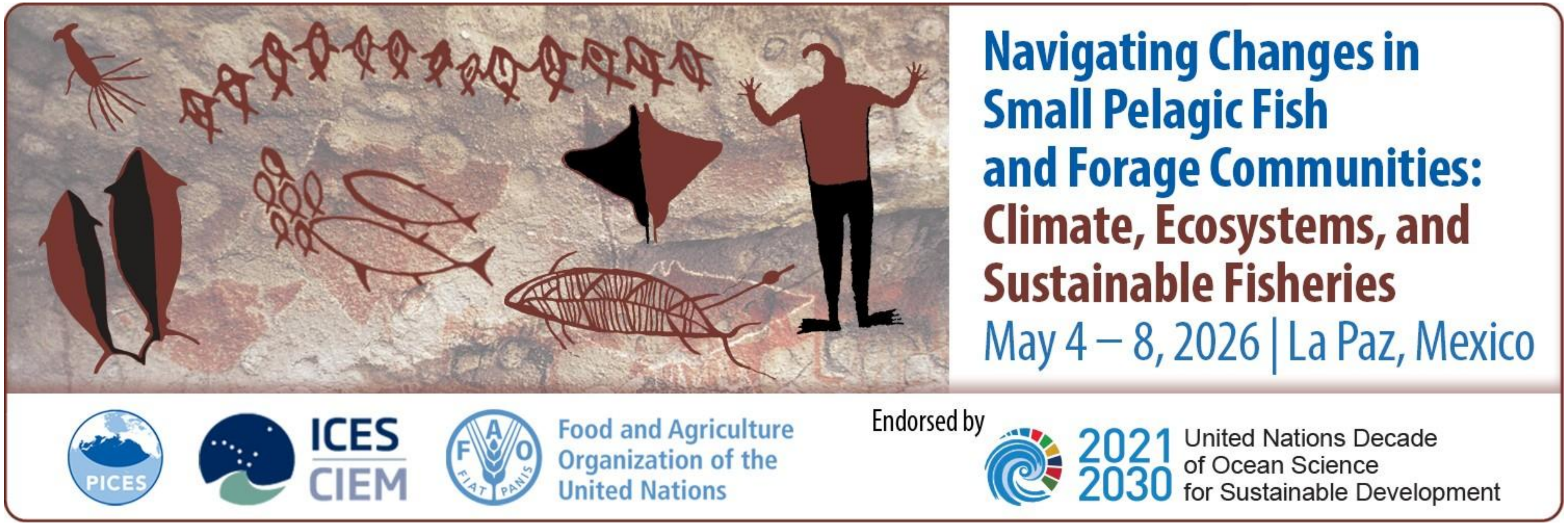

W5. Revisiting the Potential of Sedimentary Records: New Answers to Old (and Emerging) Questions on Forage Fish Ecology versus Climate Variability

Convenors:
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Bridging Past and Future Oceans: Paleo-reconstructions as Windows into Forage Fish Responses to Climate Change

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Kiel University
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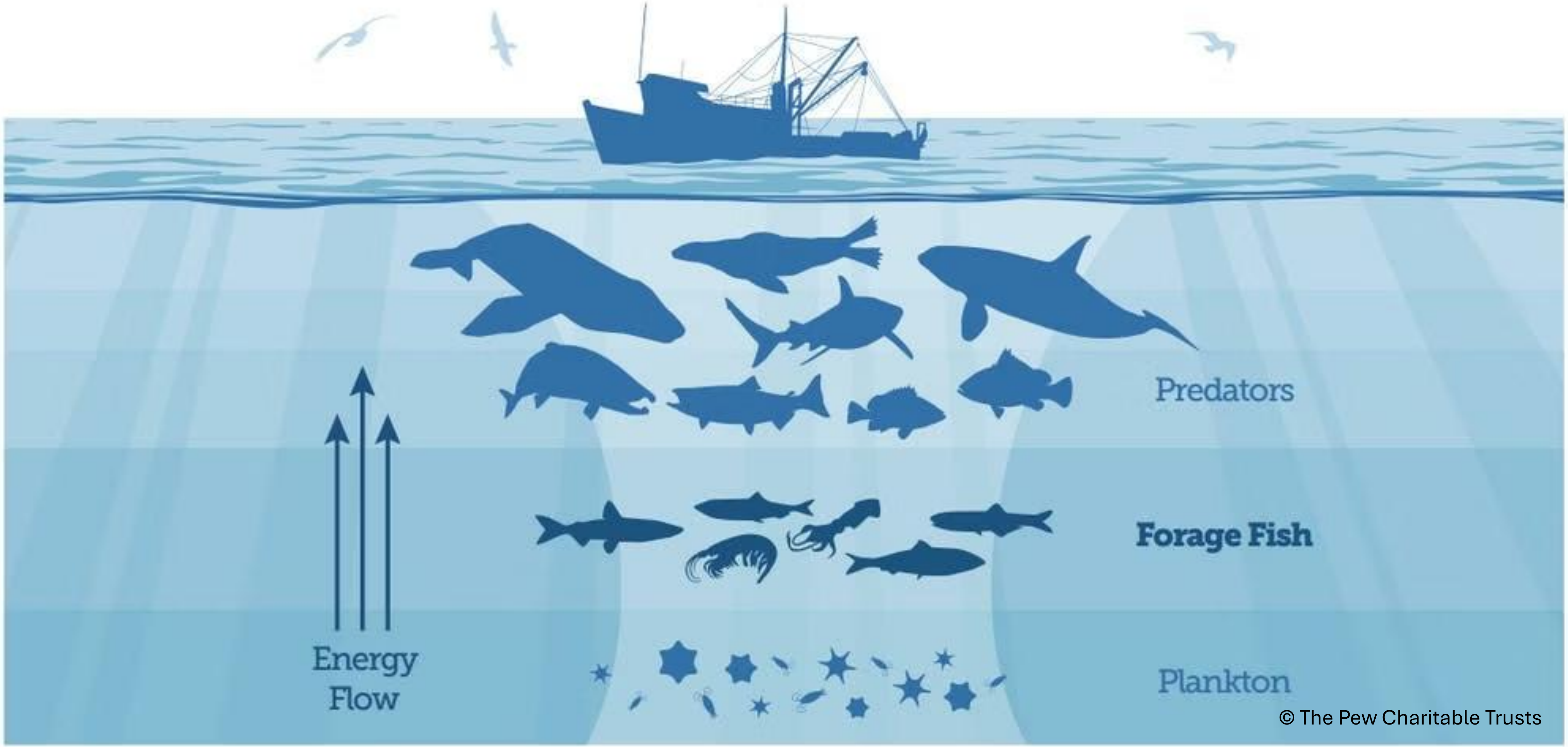
Center for Ocean and Society

W5. Revisiting the Potential of Sedimentary Records: New Answers to Old (and Emerging) Questions on Forage Fish Ecology versus Climate Variability

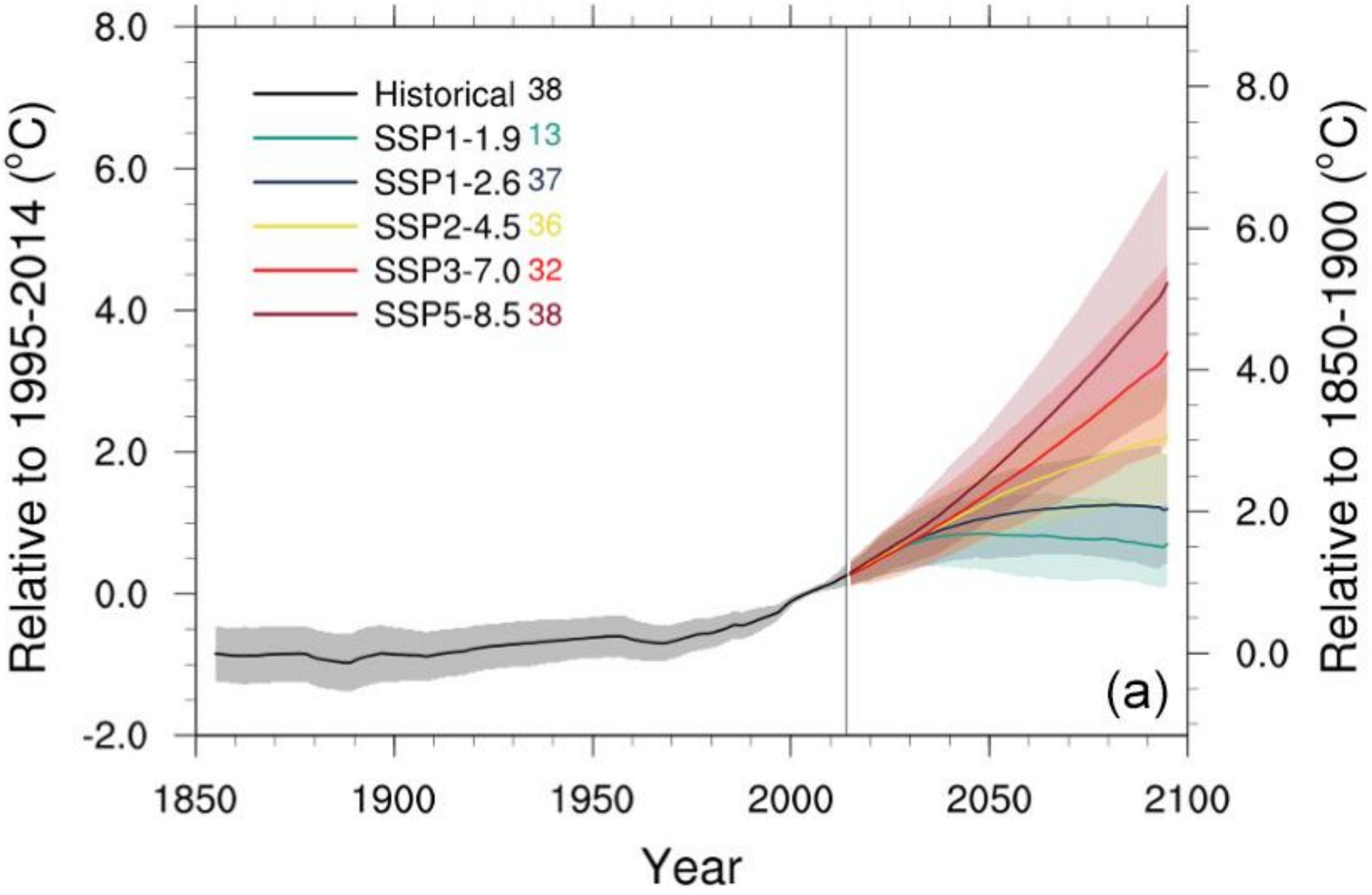
La Paz, 4th May, 2026

Why forage fish matter

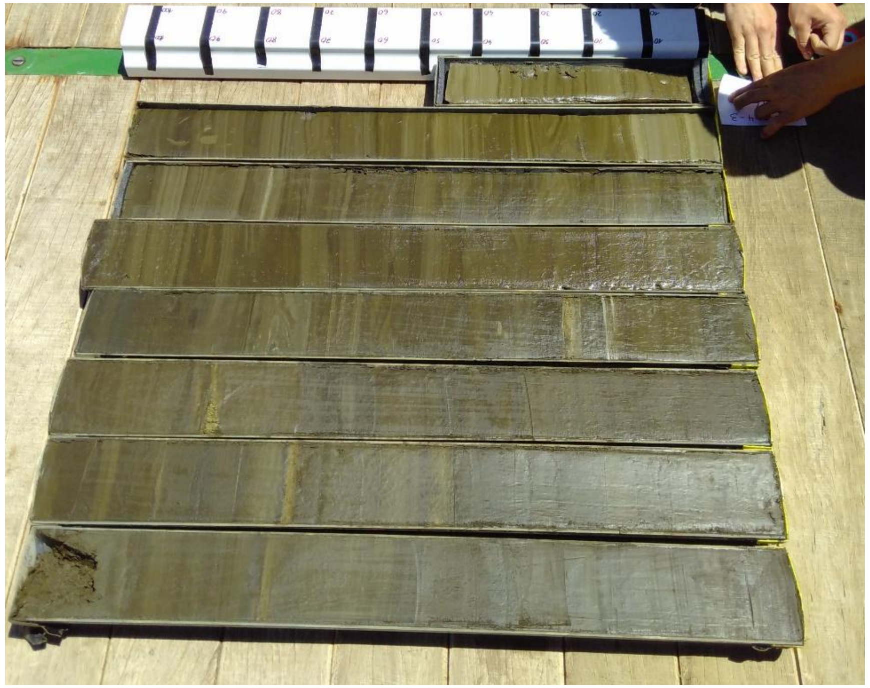


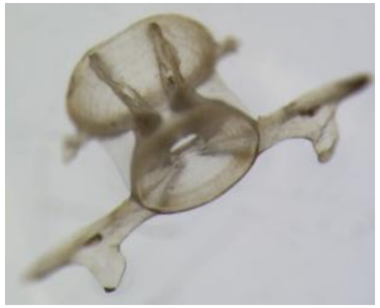
The response of Forage Fish to future global warming is uncertain

Future change will exceed observed variability



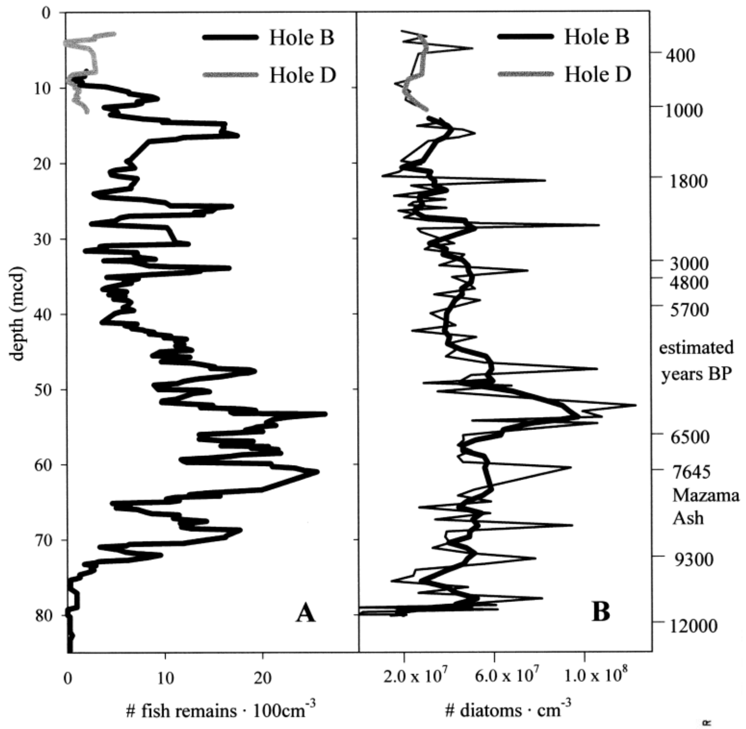
Paleo records provide access to centuries–millennia of variability



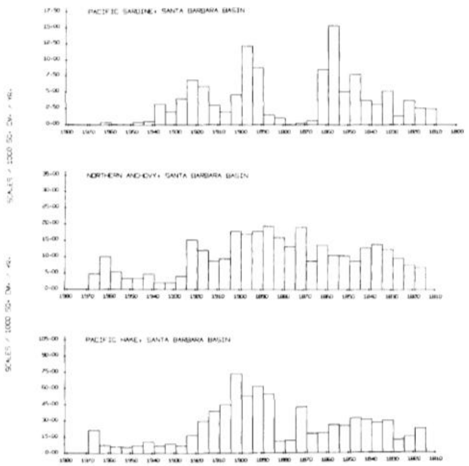


- Natural archive of past ocean variability
- We reconstruct ocean conditions and fish population variability in the geological past, and deduce potential scenarios for the near future

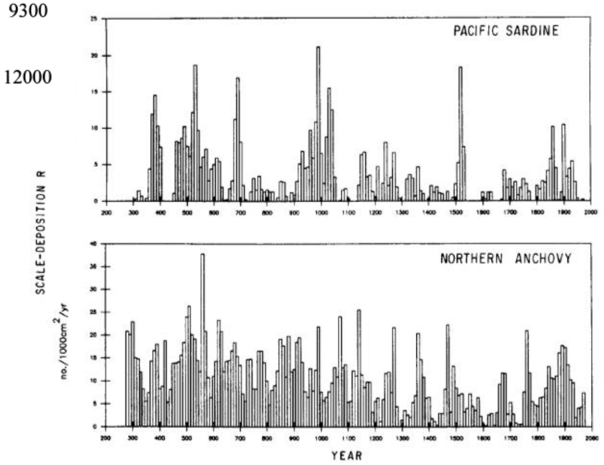
What paleo-records have shown



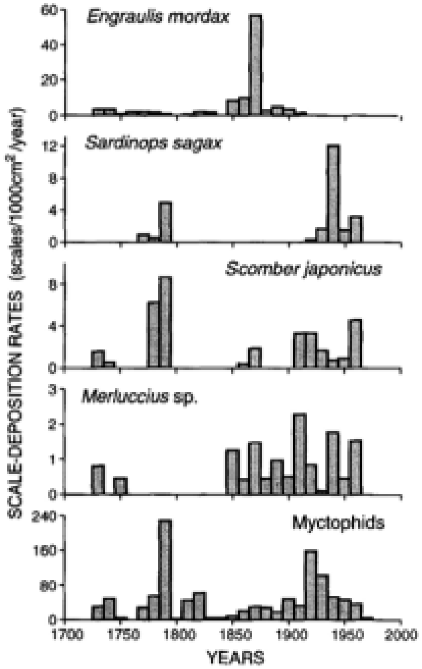
Saanich inlet, Canada
Tunnicliffe et al. (2001)



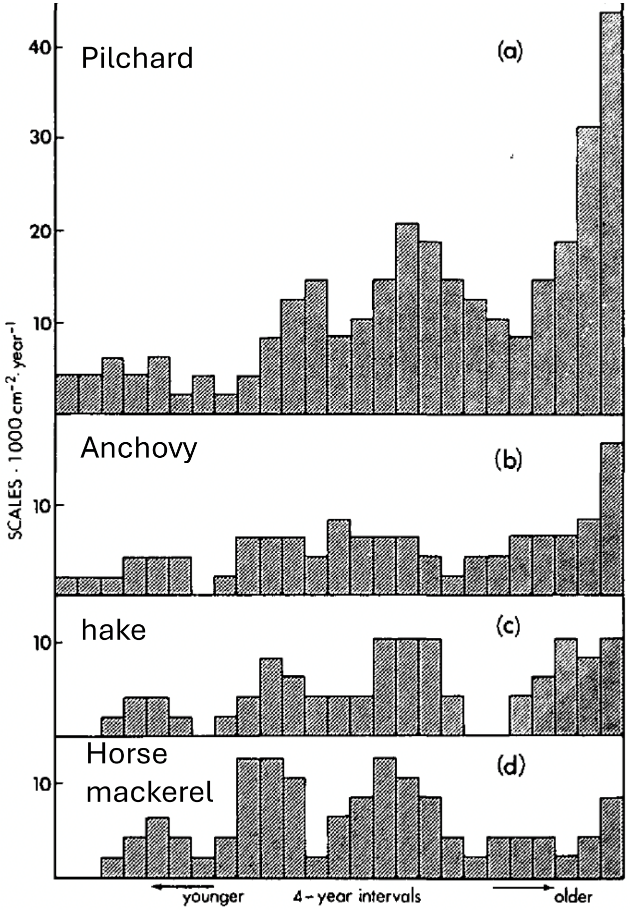
Soutar and Isaacs (1974)



California
Baumgartner et al. (1992)

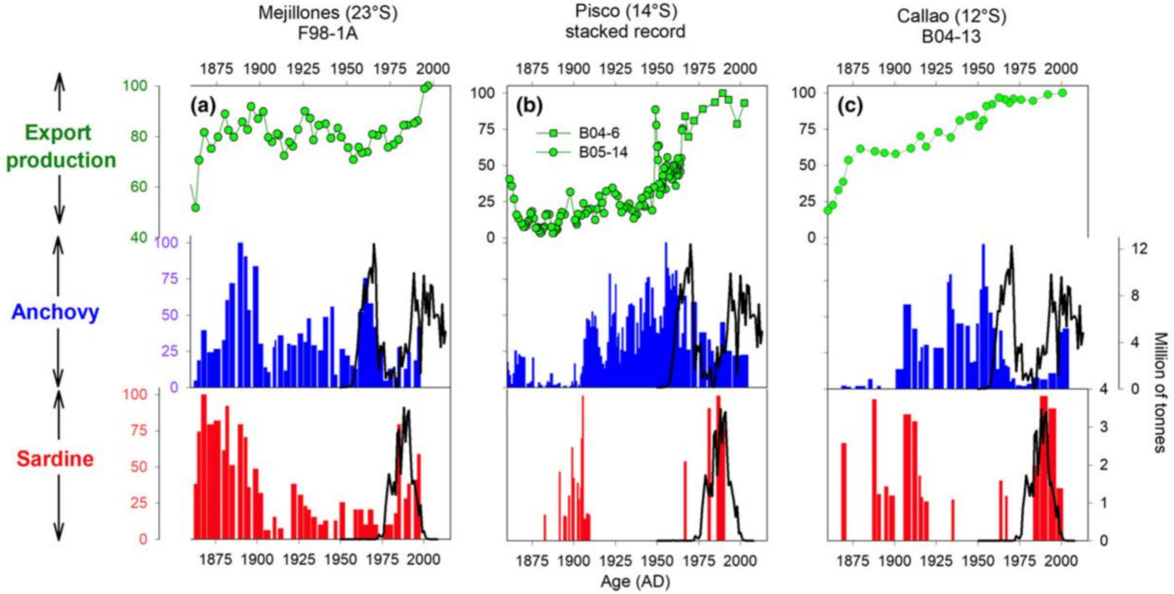


Gulf of California
Holmgren and
Baumgartner (1993)

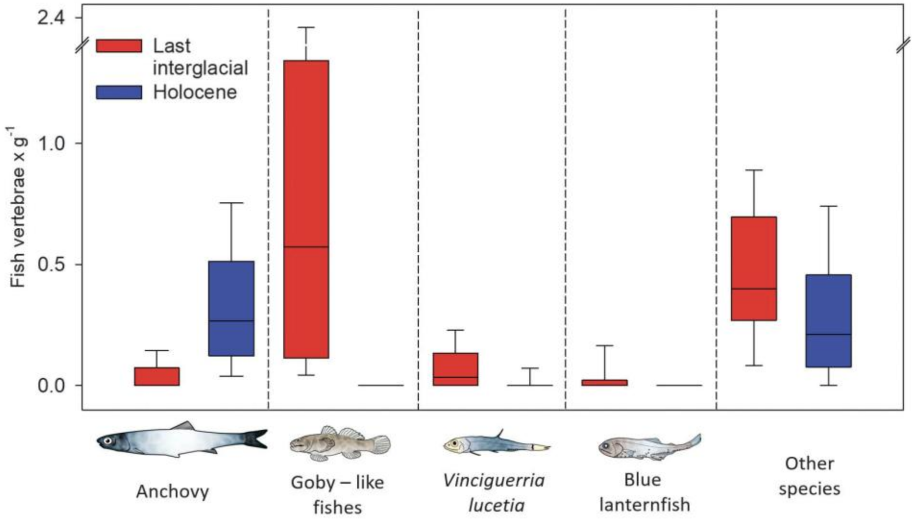


Namibia
Shackelton (1987)

Linking fish populations to environmental change HCS

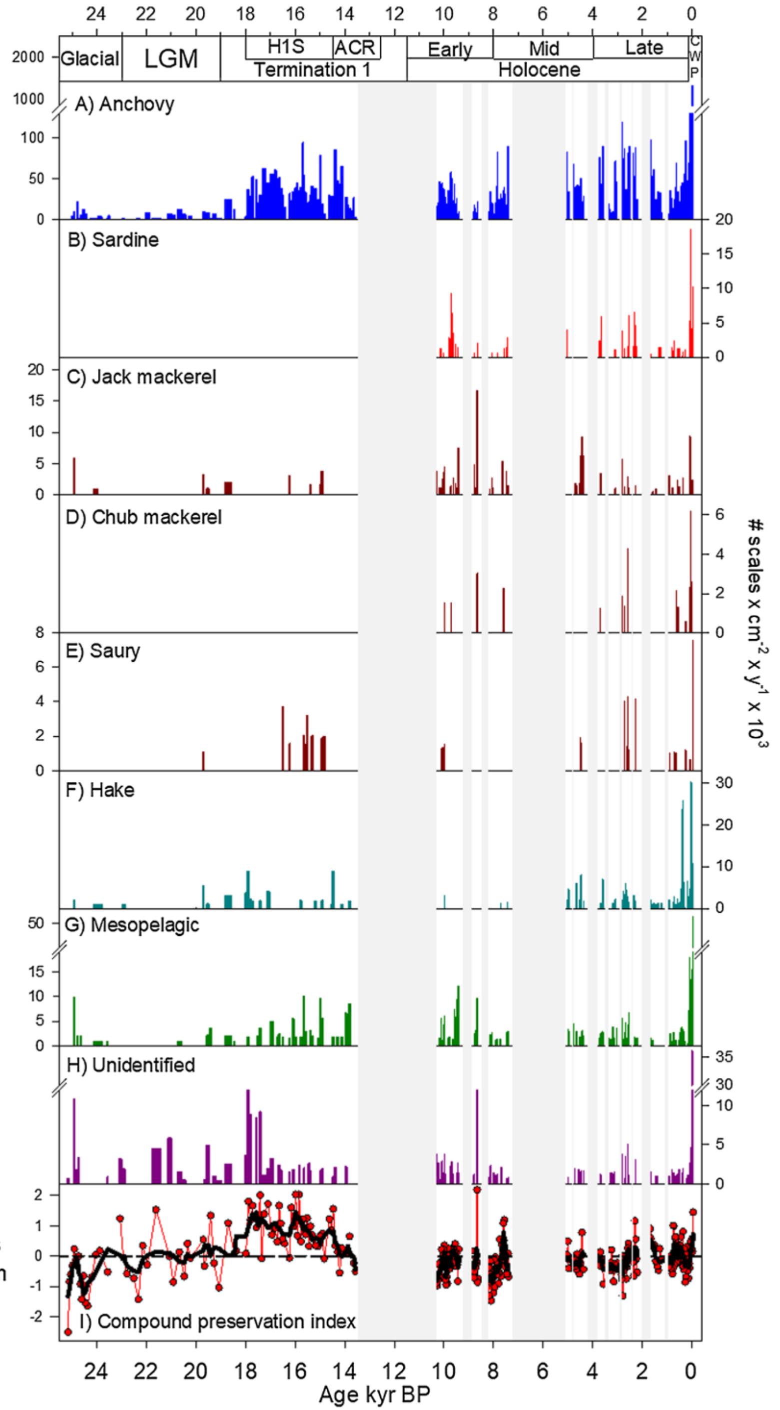


Peru and Chili, last 150 years
Valdes et al. (2008), Gutierrez et al. (2009), Salvatteci et al. (2018)

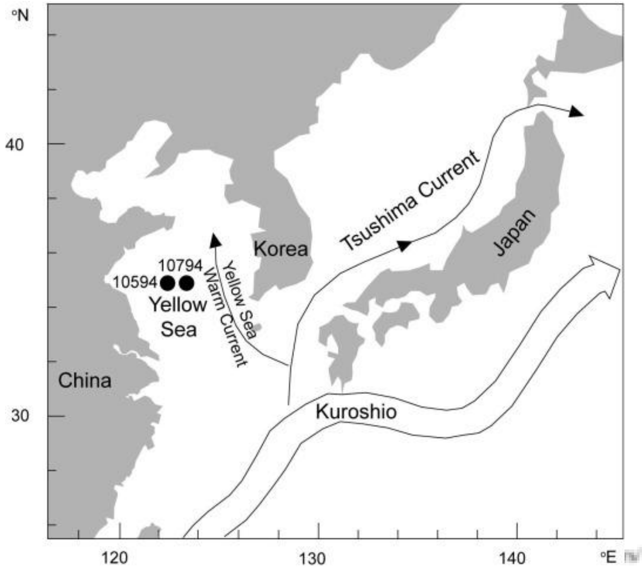


Last Interglacial
Salvatteci et al. (2022)

Peru last 25 000 years
Salvatteci et al. (2019)



Expanding paleo-records beyond classic upwelling systems



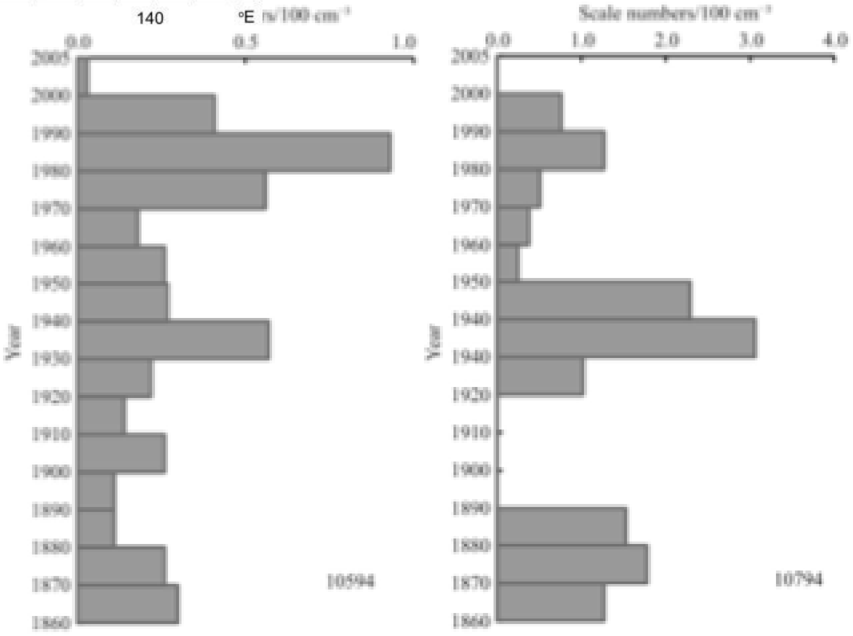
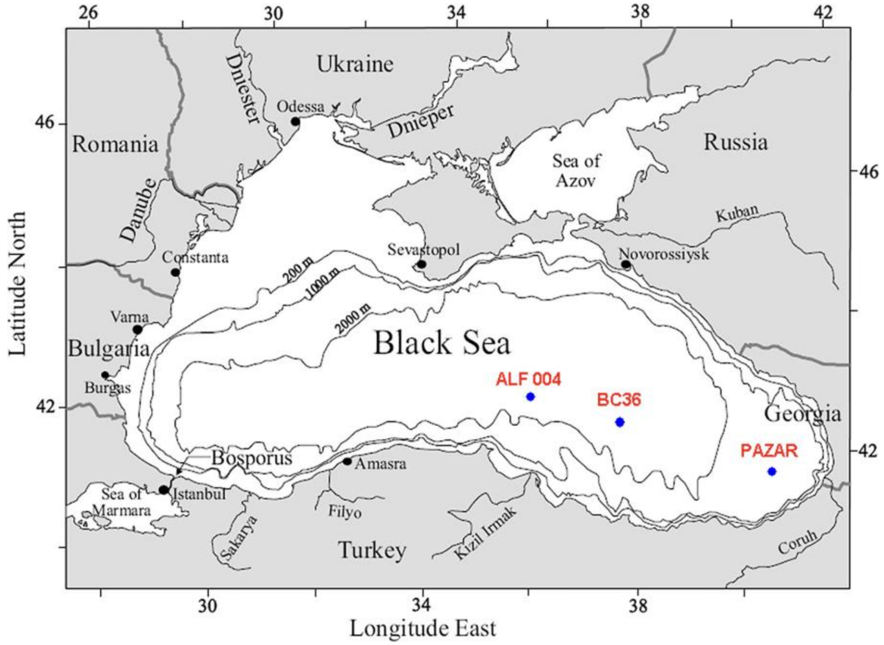


Fig.4. The downcore trends of Japanese anchovy (*Engraulis japonicas*) scales.

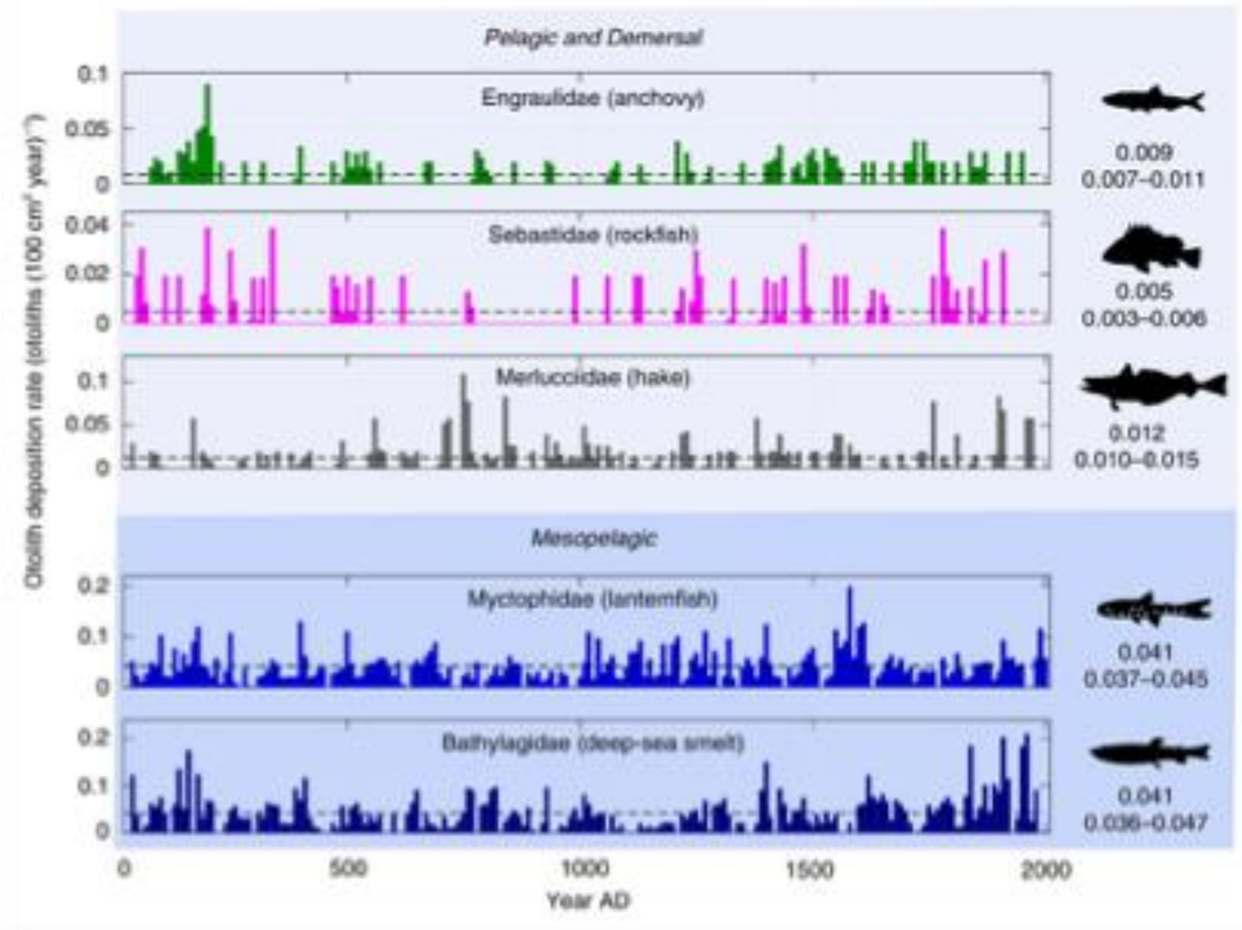
Yellow Sea and the East China Sea
Huang et al. (2014); Zhou et al. (2015)

s from the Baltic Sea.



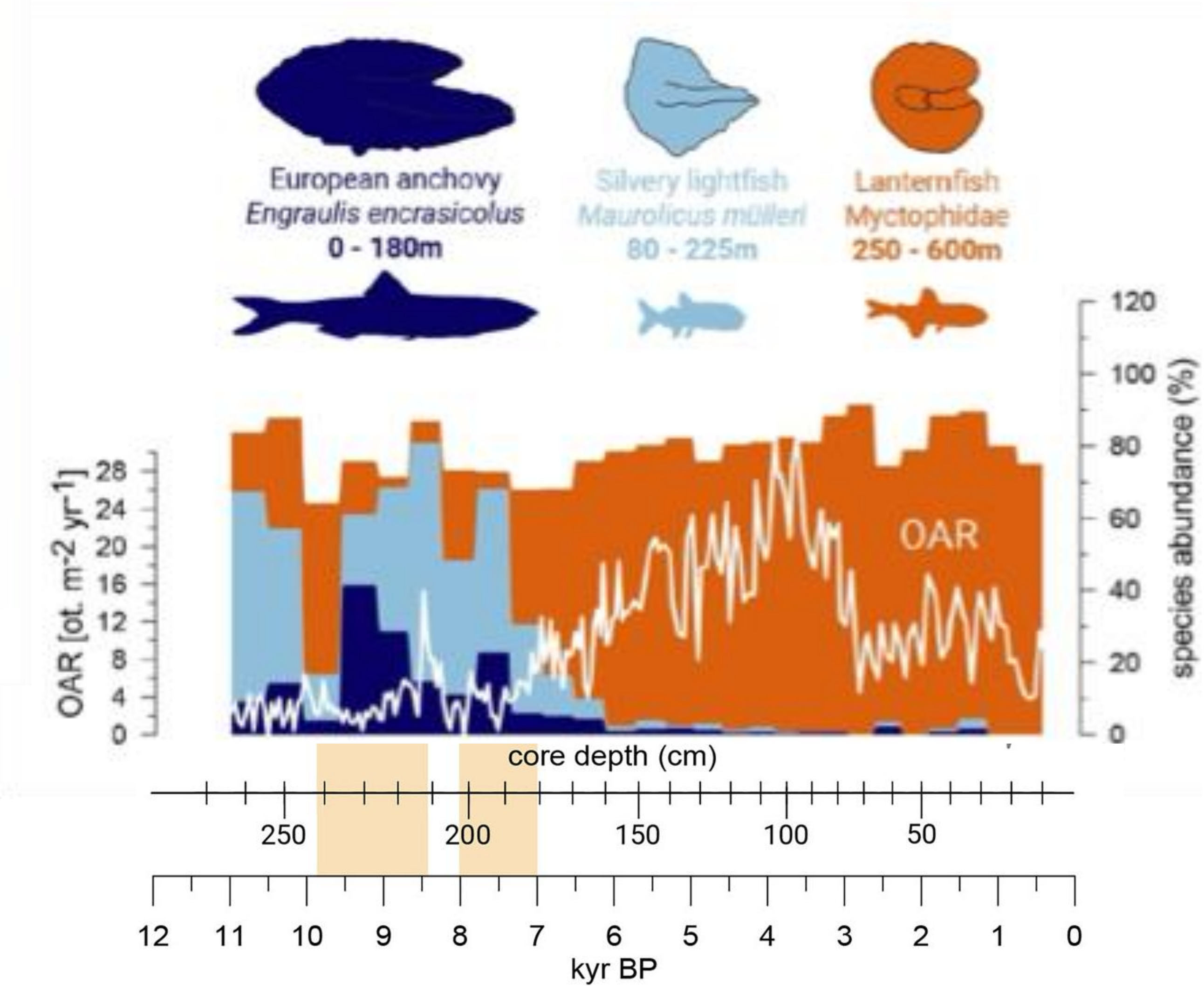
Baltic Sea and Black Sea, Enghoff and Ediger (2016)

Otoliths: a complementary archive of fish populations

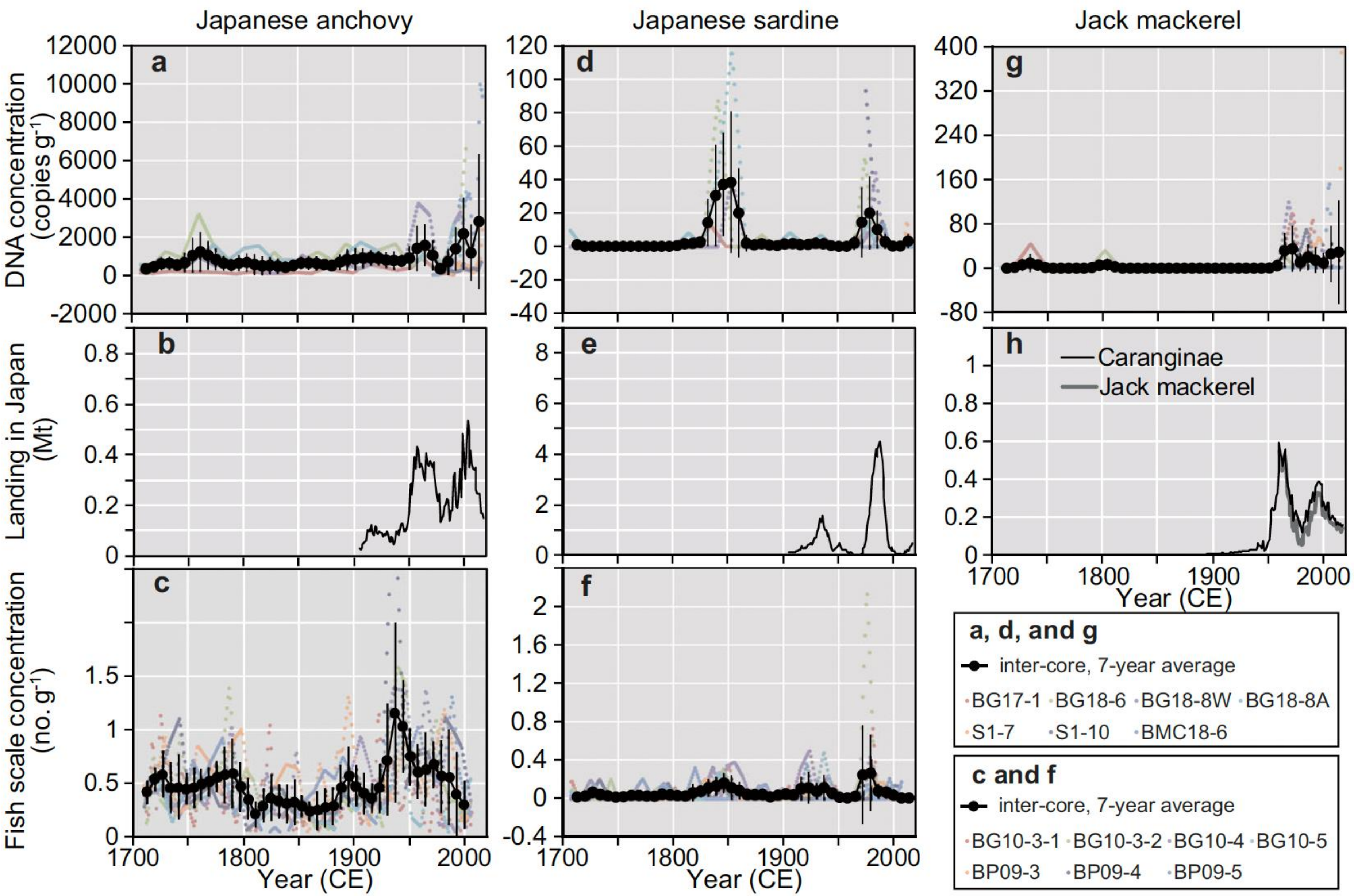


California, Jones and Checkley (2019)

Mediterranean Sea, Pallacks et al (2019), Agiadi and Albano (2020), Agiadi et al (2023)



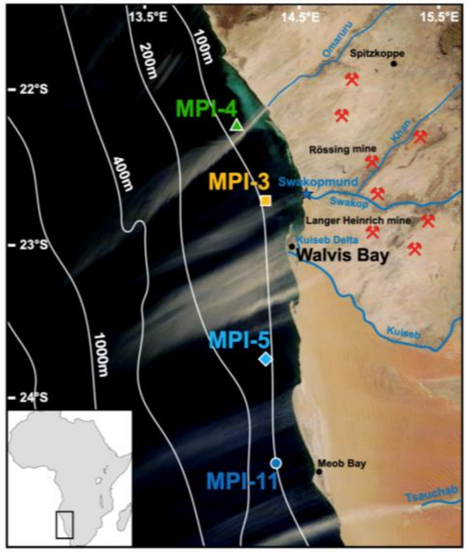
Reconstructing past ecosystems with sedimentary DNA



Comparison between temporal changes in sedDNA concentrations, landings and fish scales

Beppu Bay Japan
Kuwae et al (2021)

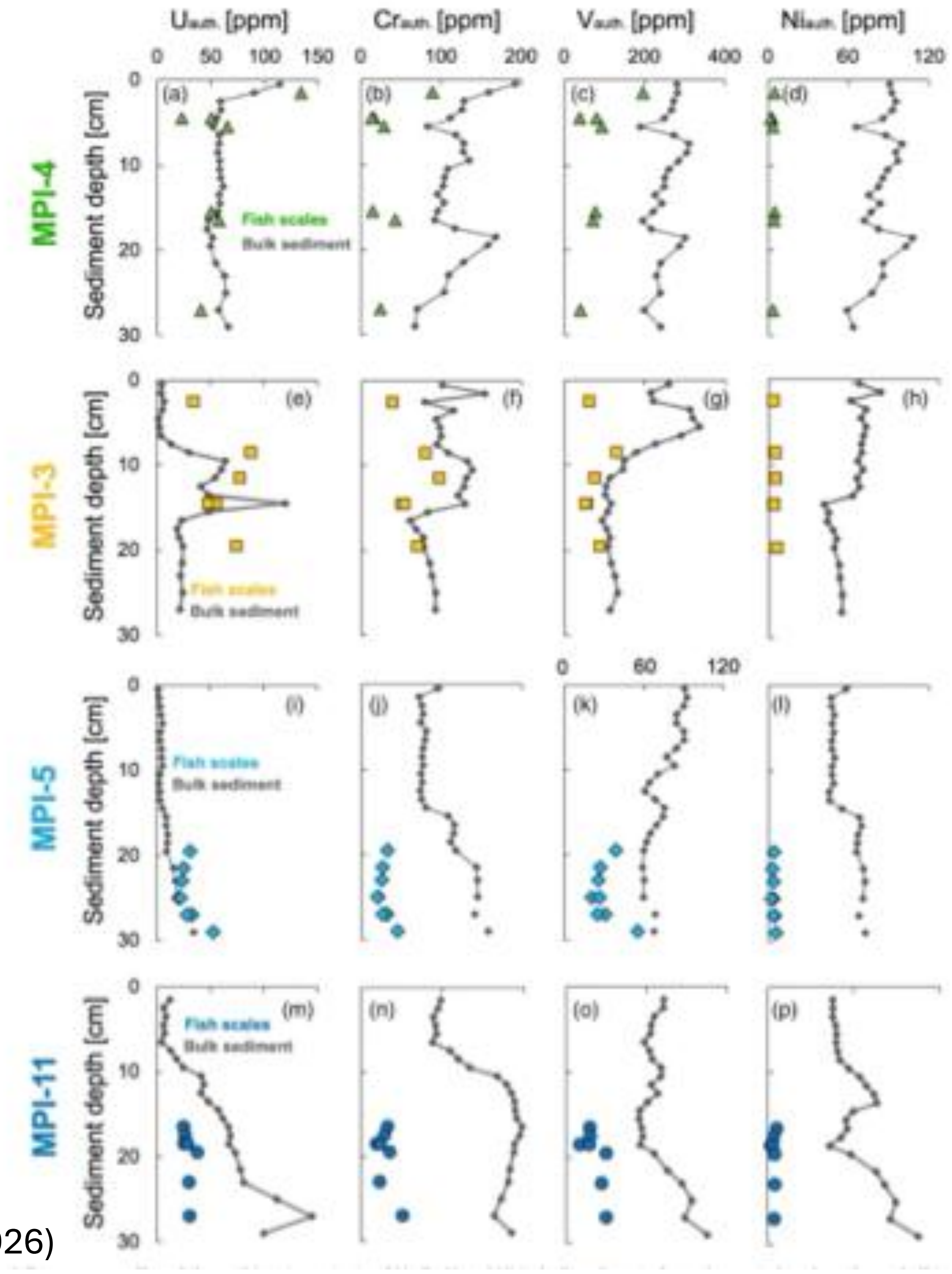
Fish scales as geochemical archives



- Fish scales enrich U, V, Cr via biological uptake → redox-independent pathway

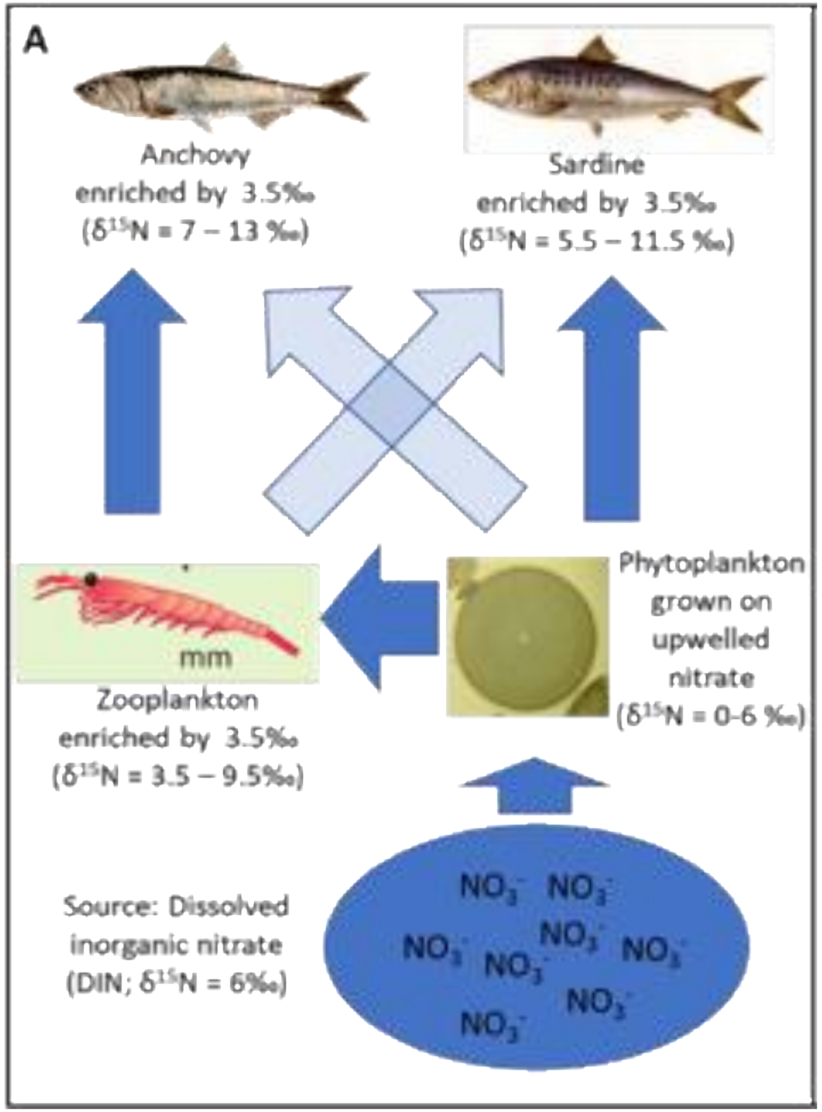
- Trace elements reflect dust inputs (Bergwinds) → link to terrestrial signals

- Proxy potential: U, V, Cr in scales track past Bergwind activity (lower dust → lower enrichment)



Gäng et al (2026)

Reconstructing trophic structure from fish scales

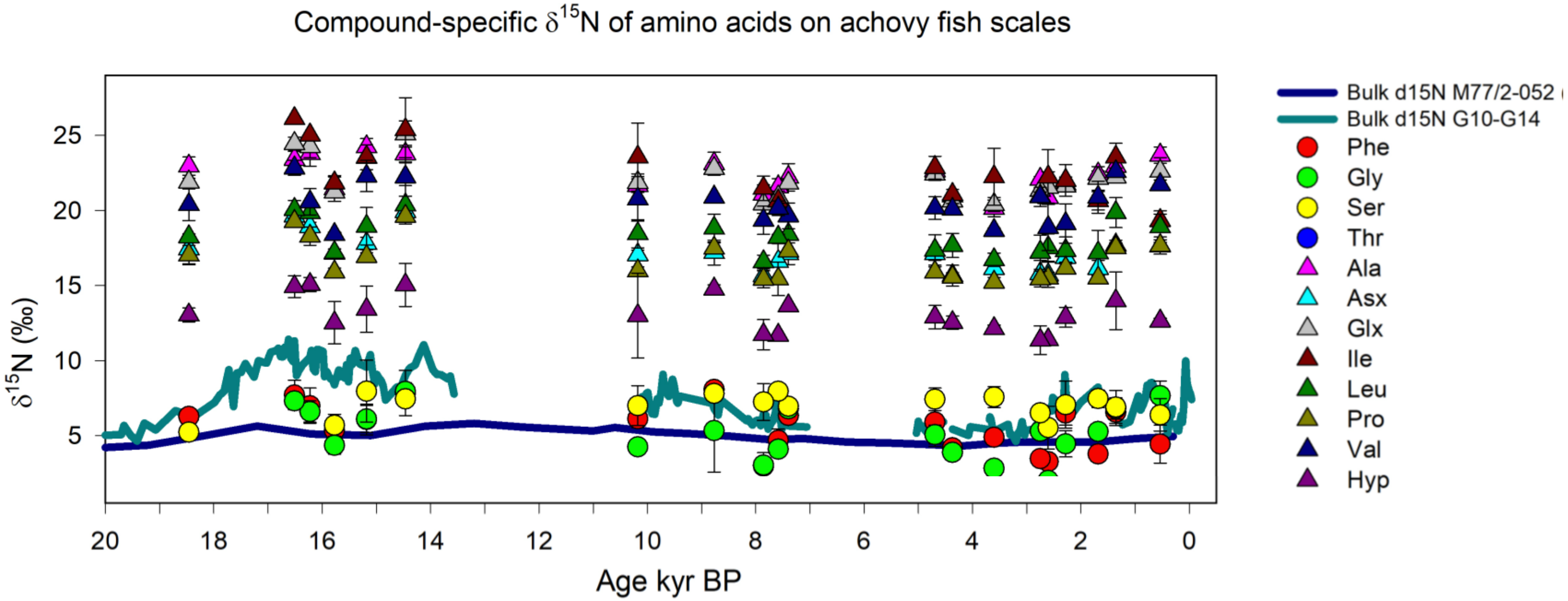


<u>Compound specific d15N of amino acids</u>

$\delta^{15}N$ of source AA (e.g. Phenylalanine) best preserves the baseline $\delta^{15}N$ values

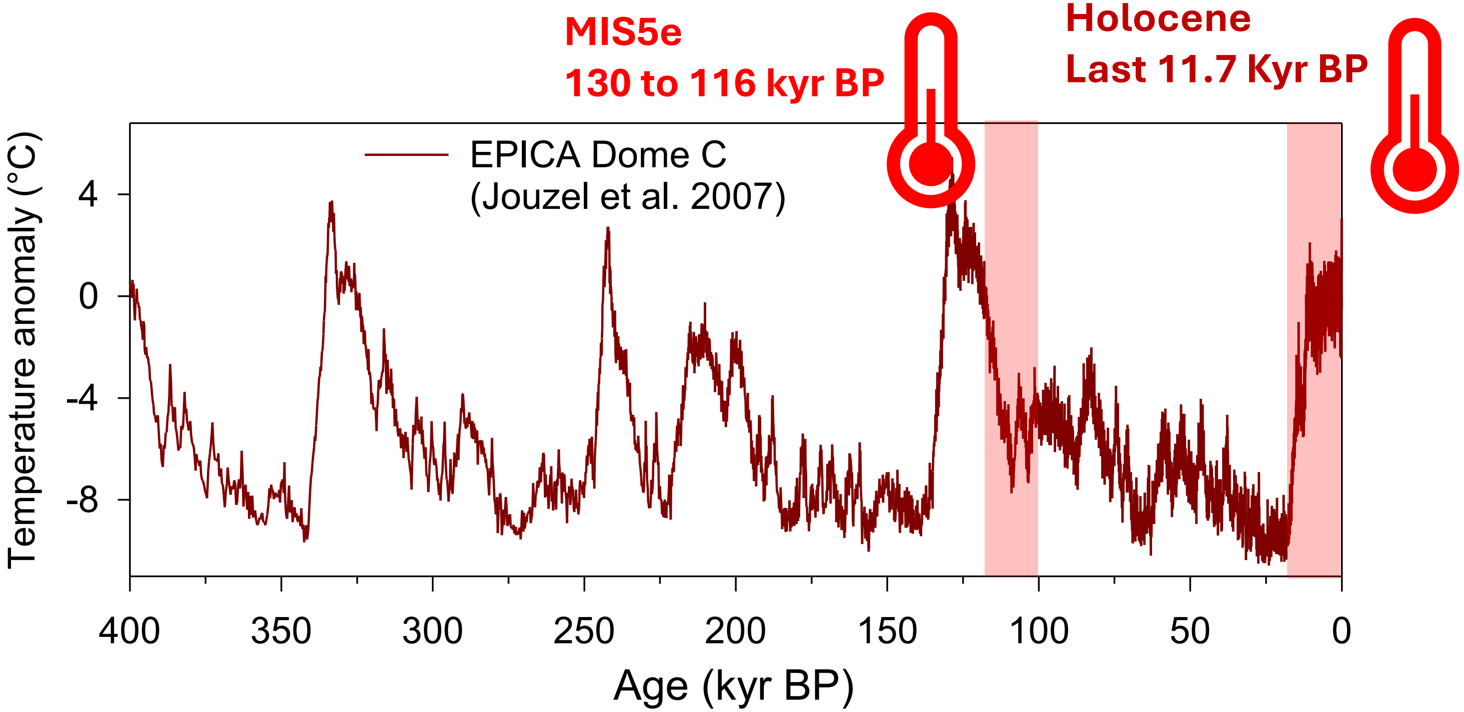
$\delta^{15}N$ of trophic AA (e.g. Glutamic acid) enriched in 15N with each successive trophic transfer

The offset in $\delta^{15}N$ between trophic and source amino acids can be used to estimate trophic position of forage fish



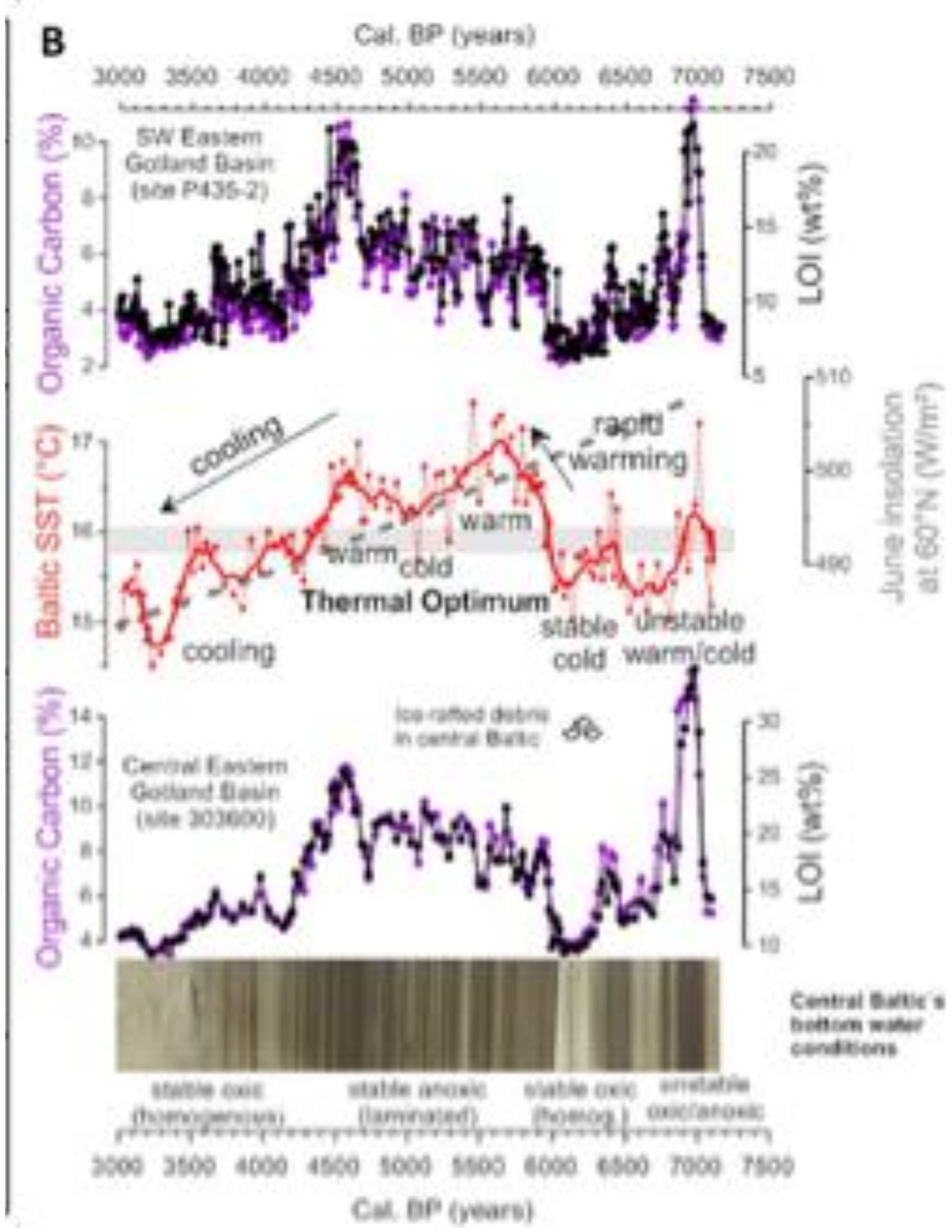
Salvatteci et al. in prep

Which past climates are relevant for future fish productivity?



Antarctica Dome C ice core, temperature estimates

Baltic Sea, Warden et al. (2017)



Potential time periods worth investigating:
MIS5e, Holocene, Thermal Optimum, Medieval Climate anomaly

Bridging Past and Future Oceans: Paleo-reconstructions as Windows into Forage Fish Responses to Climate Change

Key messages

- Paleo-records reveal long-term variability in forage fish systems
- New proxies allow reconstruction of ecosystems, not just populations
- We can now expand across systems and trophic levels

Key questions

What key uncertainties about forage fish responses to climate variability could paleo-records help resolve?

What types of paleo data are most useful for fisheries scientists and managers?

What would a paleo-informed fisheries forecasting or management framework look like?

How can state-of-the-art methods be applied to high-resolution laminated sediment records to reconstruct past forage fish dynamics?


Gracias