Relating albacore tuna resource use to forage composition through a traits-based lens

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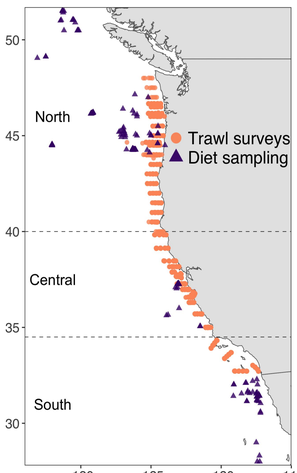
PROJECT BACKGROUND:

- Climate change is altering marine food web structure globally, leading to species redistributions and decoupling predator-prey interactions.
- Albacore tuna (*Thunnus alalunga*) are a highly migratory, commercially valuable predator managed across international jurisdictions.
- Albacore have diverse diets in the California Current system (>100 taxa), thought to vary in relation to environmental drivers.
- Trait-based approaches enable scientists to make predictions about food web dynamics beyond the taxonomic identity of key players.

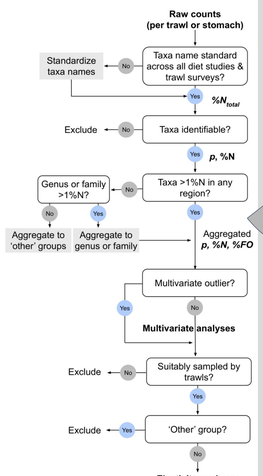
OBJECTIVE:

- Identify prey taxa and traits indicative of high interactions strength with albacore predators in the CCLME for use in distribution and food web modeling under future climate scenarios.

METHOD - TAXA-BASED ANALYSES



Map of sampling efforts from albacore diet studies and systematic midwater trawl surveys in the CCLME.

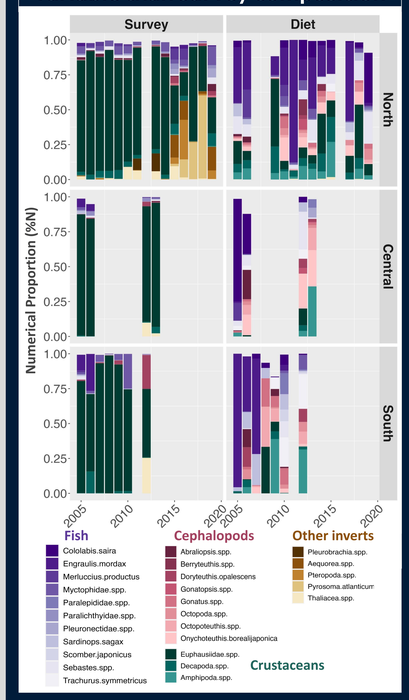


Data manipulation framework for comparing diet information with scientific surveys.

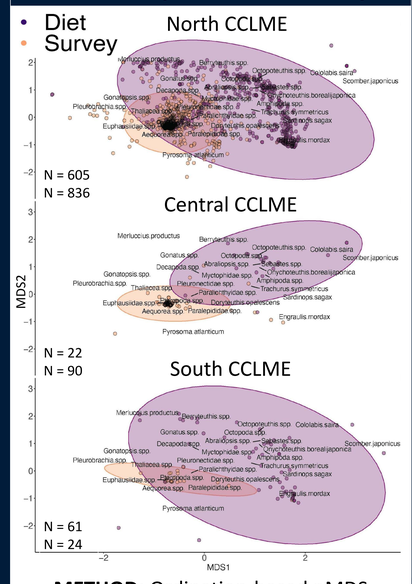
Albacore diet datasets	Years
Catherine Nickels et al (*in press*), NOAA SWFSC	2007 – 2019
Daniel Madigan et al (2015)	2008 - 2010
Sarah Glaser (2010)	2005 - 2006
Midwater trawl survey datasets	
Rockfish Recruitment & Ecosystem Assessment Survey, NOAA SWFSC	2005 – 2018
Stock Assessment Improvement Program, NOAA NWFSC	2005 - 2011
Coastwide Cooperative Pre-Recruit Survey, NOAA NWFSC	2011 – 2019

- We integrated data from 3 different diet sampling programs and 3 systematic surveys on forage assemblage in the CCLME from 2005–2019.
- We standardized taxonomic identifications and counts; aggregated rare taxa (< 1% N).
- Ultimately, we identify taxa that are suitable for comparison.

Albacore diet composition more variable than survey composition

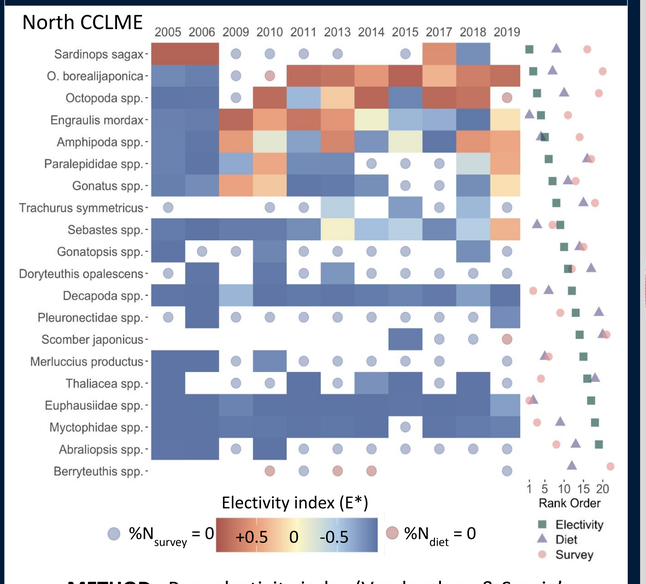


Albacore diet composition broader than survey with some overlap



METHOD: Ordination-based nMDS (Non-metric dimensional scaling) of diet and forage assemblages across regions of the CCLME (Bray-Curtis dissimilarity).

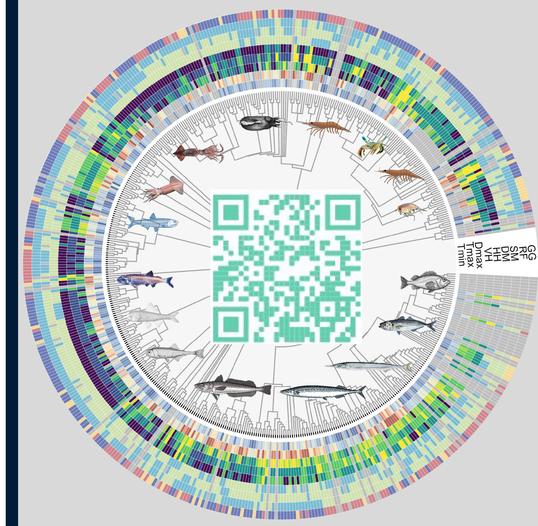
Most taxa with high electivity were not the most abundant in diets



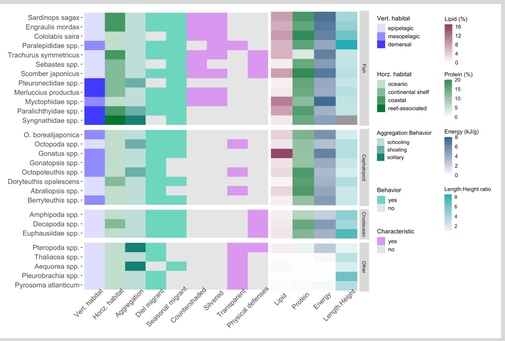
METHOD: Prey electivity index (Vanderploeg & Scavia's relativized electivity). Excluded taxa undersampled by surveys (Pacific saury & *Octopoteuthis* spp.), based on a frequency of occurrence suitability analysis.

METHOD – TRAIT-BASED ANALYSES

→ 13 traits applied to taxa using the Pelagic Species Trait Database



Including habitat use, behavior, morphological and nutritional composition traits for 32 taxa.



NEXT STEPS:

Detect trait-based shifts in albacore diets across past climate regimes, and make predictions for the future.

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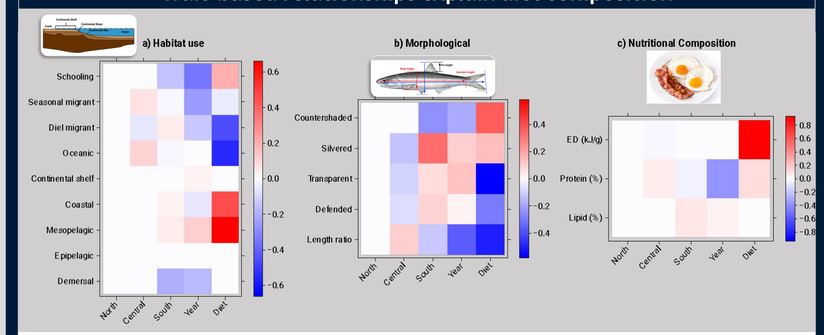
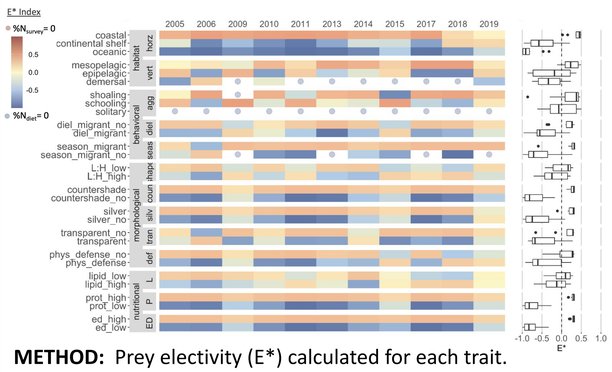
Traits simplify spatiotemporal variance in albacore prey electivity in the California Current

Trait-based relationships explain diet composition



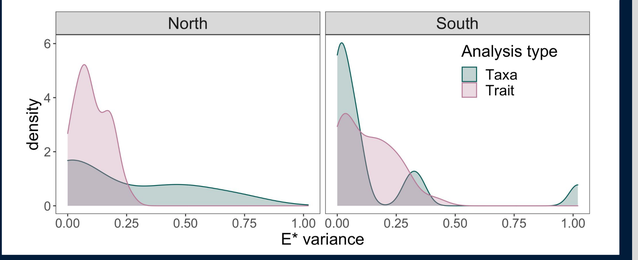
METHOD: Modelled relationships between traits and explanatory variables – regions, year, diet vs. survey composition using multi-matrix modeling (RLQ & 4th corner).

Consistent trait electivity across years



METHOD: Prey electivity (E*) calculated for each trait.

Traits reduce variance in prey electivity



Traits indicative of albacore prey

coastal, mesopelagic, non-diel migrants
silvered, countershaded, undefended
energy-rich, protein-rich

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