Projected climate impacts on seabird distributions in the California Current

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NOAA SWFSC

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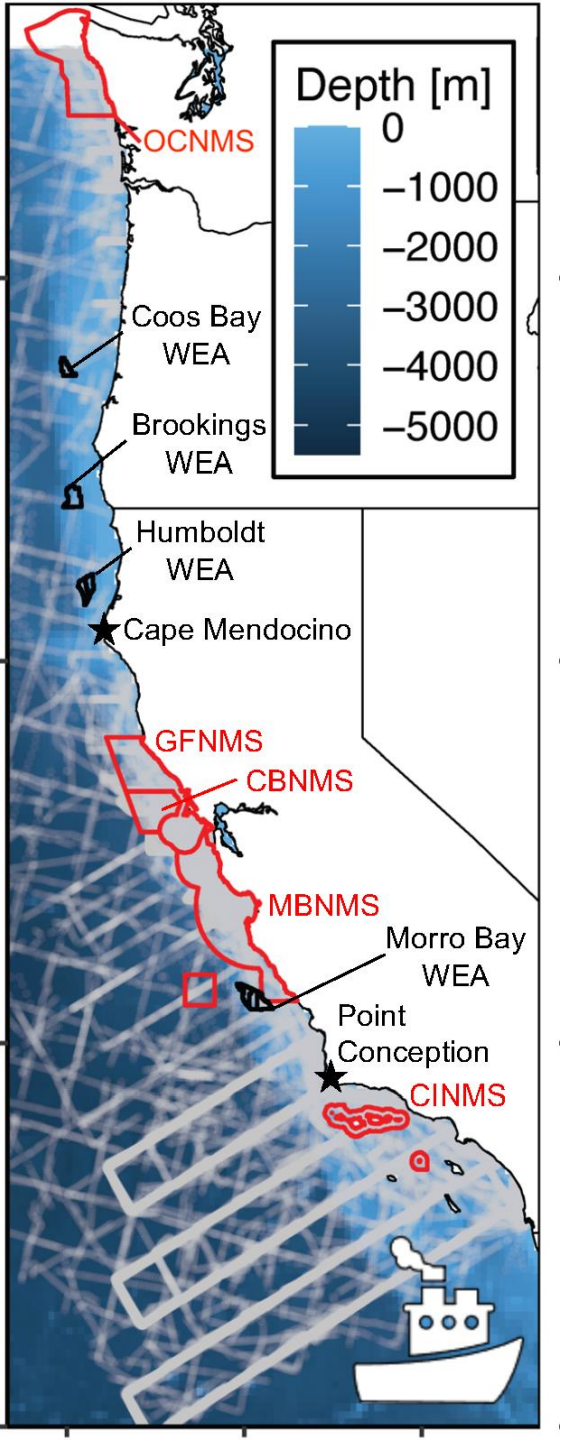


Seabirds in the California Current

– Abundant food-web components linking predators to mesozooplankton & forage fishes

– Vary across CCE biogeographic provinces, ocean seasons

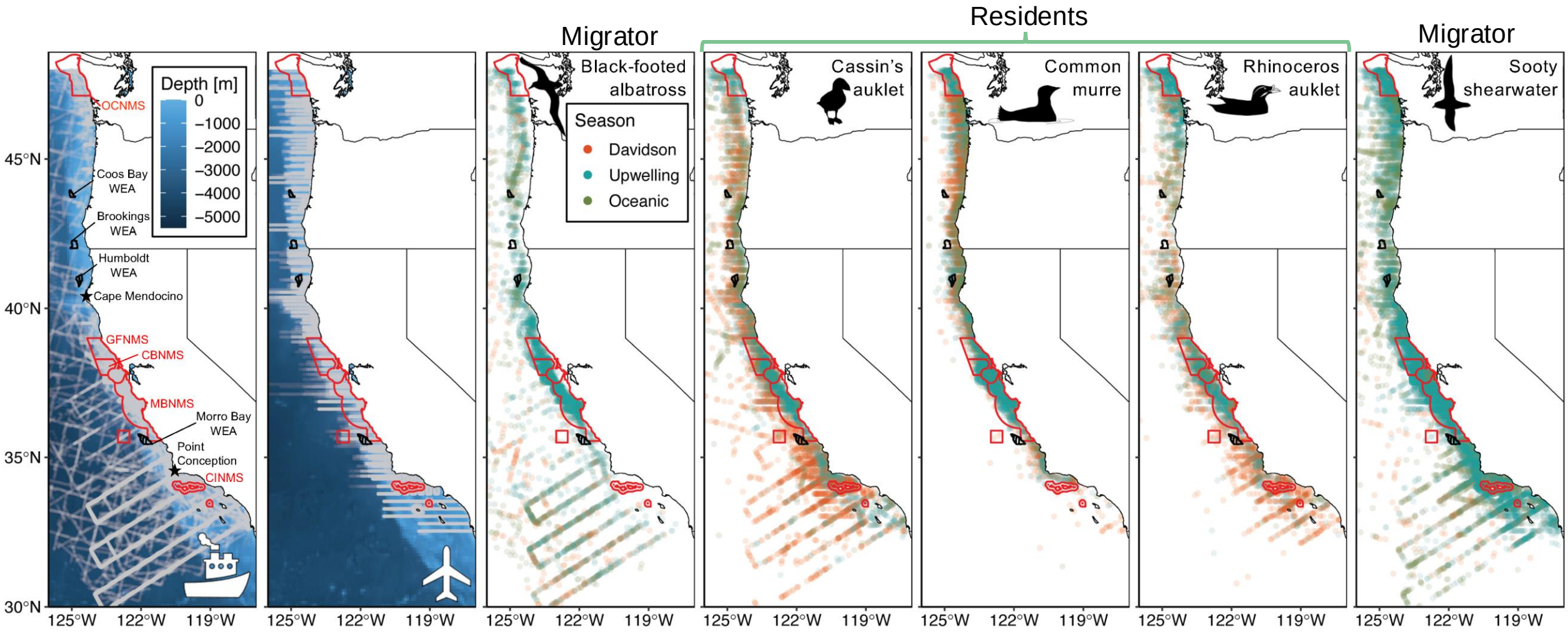
– Sentinel species – vulnerable to climate change & changes in ocean uses
  – Need information to account for this in marine spatial planning

Objectives:

1. Quantify & map the spatiotemporal extent of historical & future habitat
2. Evaluate species responses to climate stressors & intra-annual availability of habitat
3. Identify potential refugia, changes in spatiotemporal extent of suitable habitat in areas of interest for marine spatial planning

Species	CCE Use	IUCN Status
Black-footed albatross	Seasonal migrant	Near threatened
Sooty shearwater	Seasonal migrant	Near threatened
Cassin's auklet	Resident	Near threatened
Rhinoceros auklet	Resident	Least concern
Common murre	Resident	Least concern

At-sea distribution data



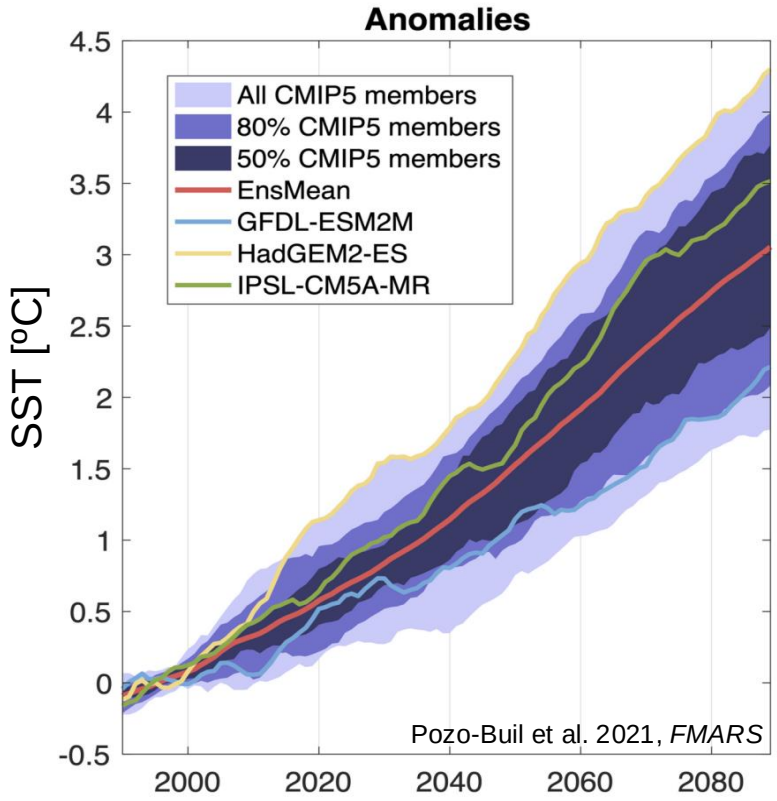
Compilation of aerial (n = ~41k) and ship (n = ~92k) transects from 1980-2017 (Leirness et al. 2021)

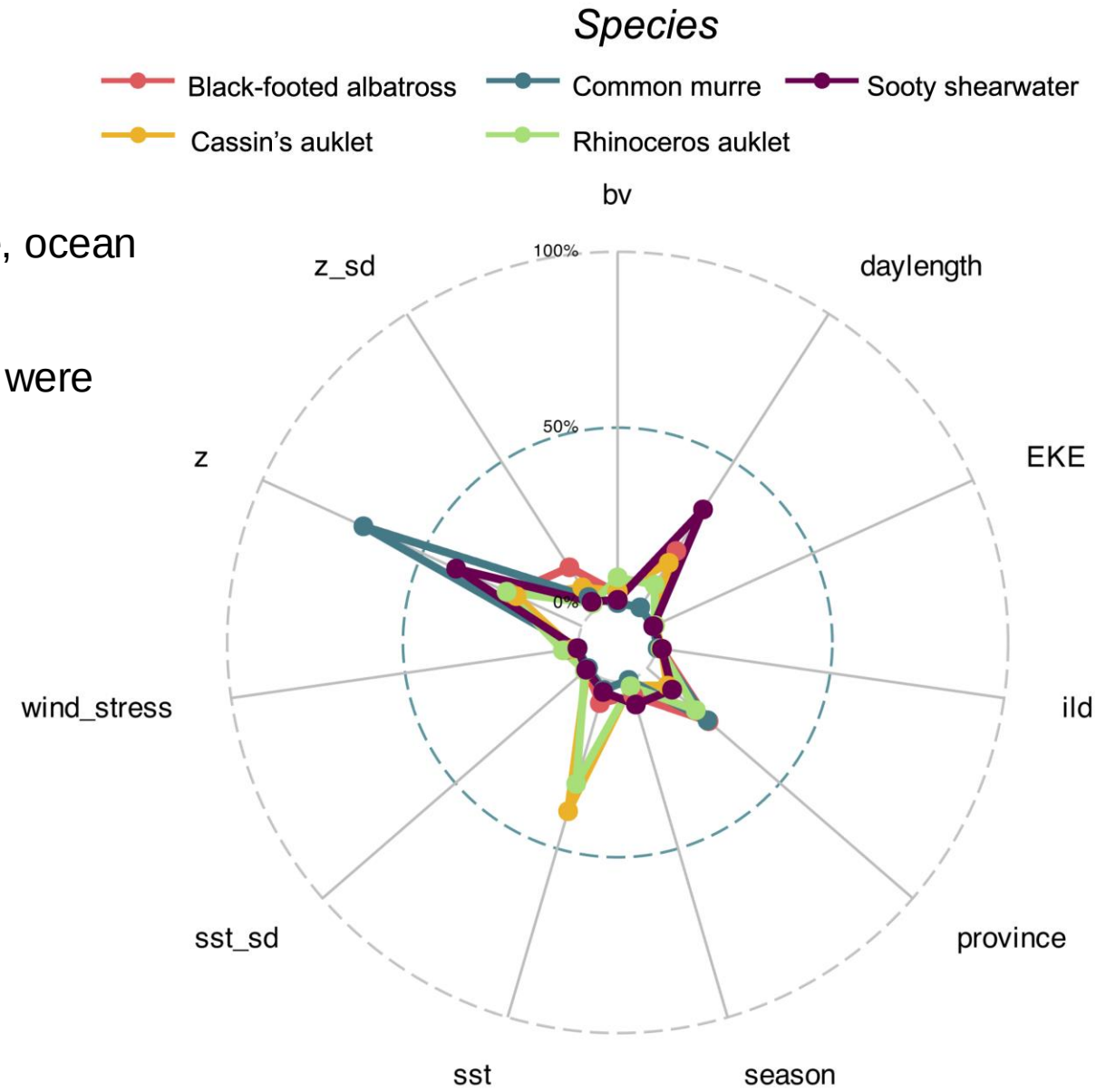
–Boosted regression tree SDMs

– Oceanographic data from ensemble of three dynamically downscaled earth-system models (RCP8.5; Pozo-Buil et al. 2021)

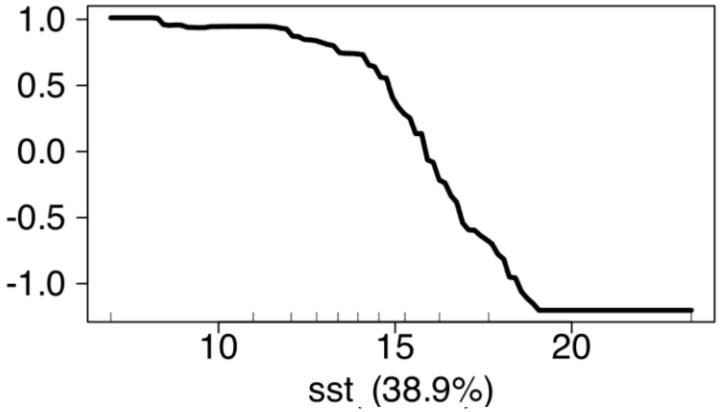
– Other: bathymetry (*z*), rugosity (*z_sd*), daylength, province, ocean season

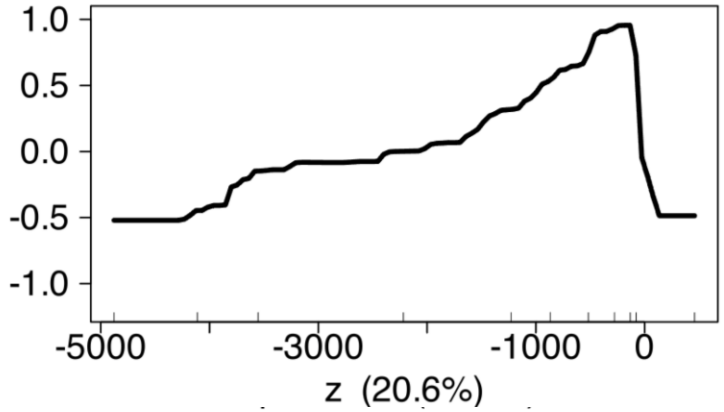
– Bathymetry (*z*), SST, daylength, & biogeographic province were the most important variables

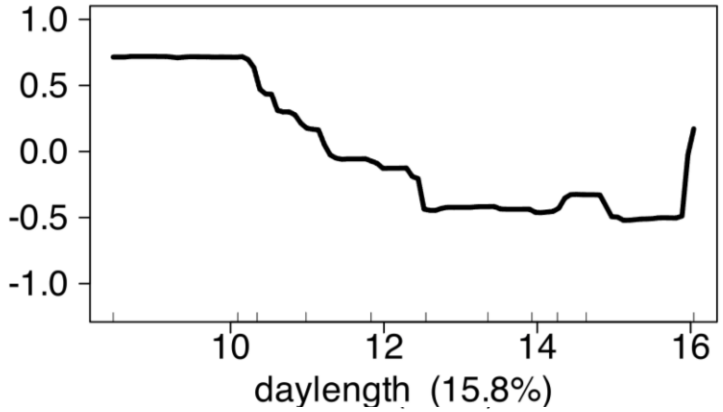




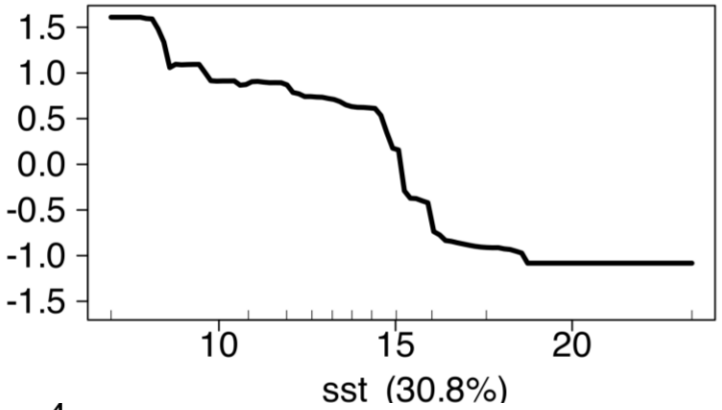
Species Response Curves: Resident Species

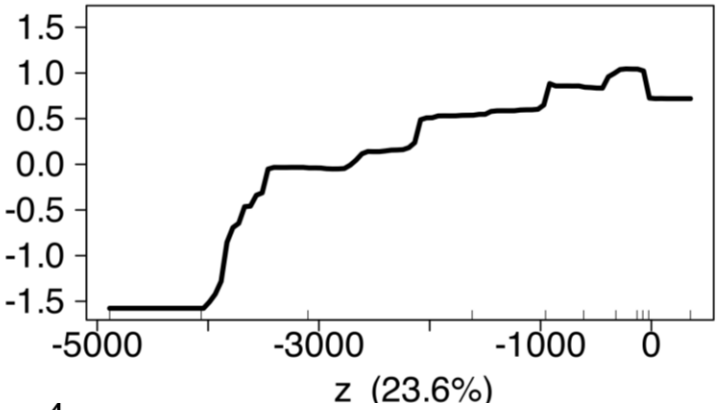


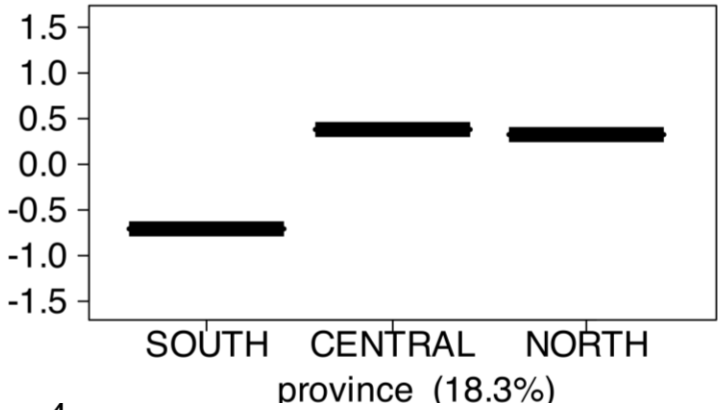




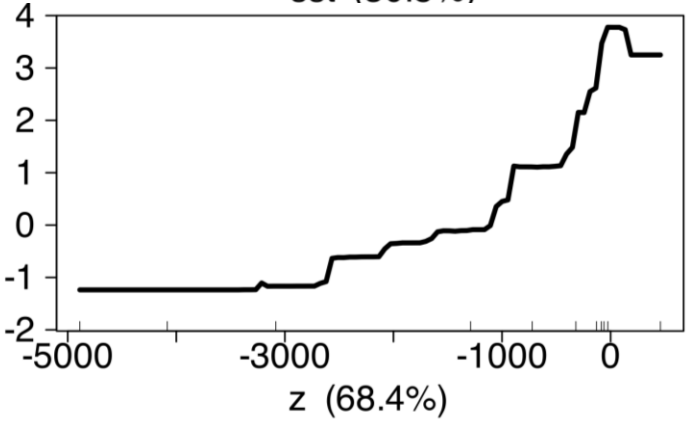
Cassin's auklet

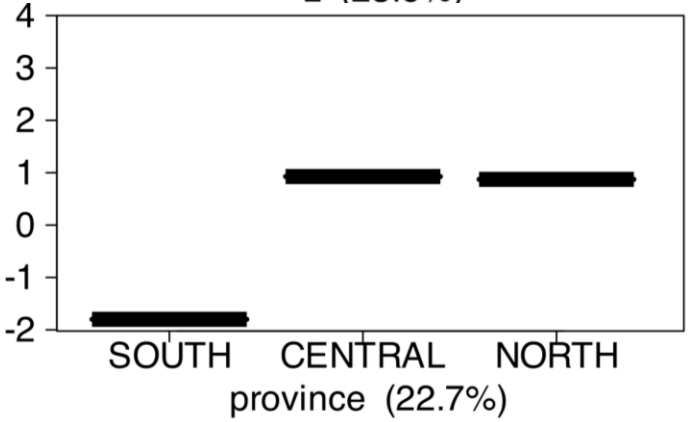


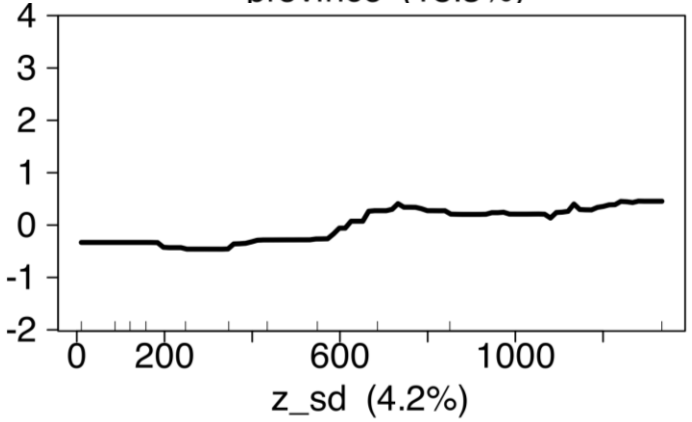




Rhinoceros auklet

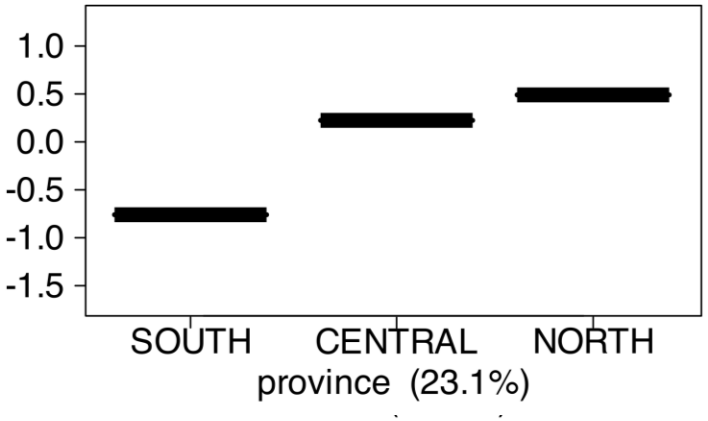


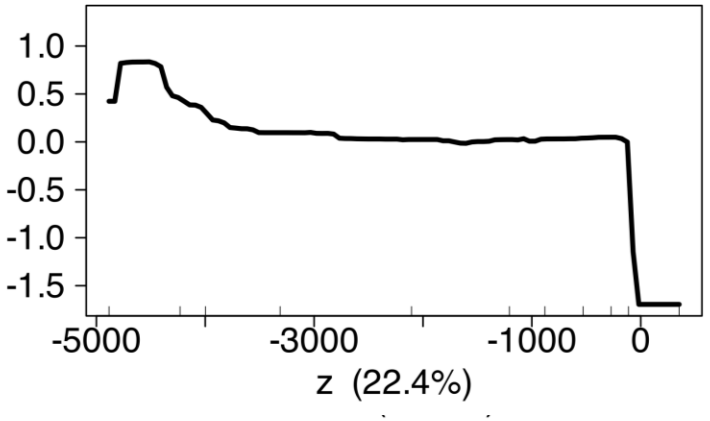


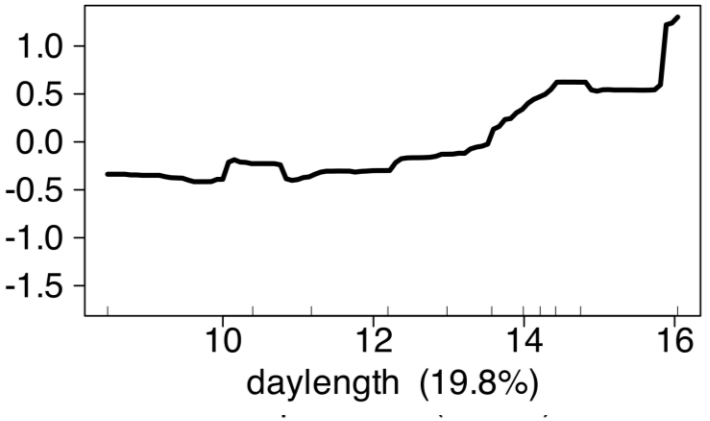


Common murre

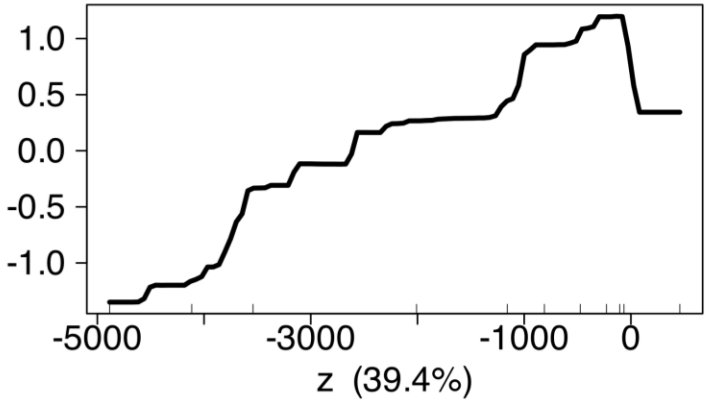
Species Response Curves: Migratory Species

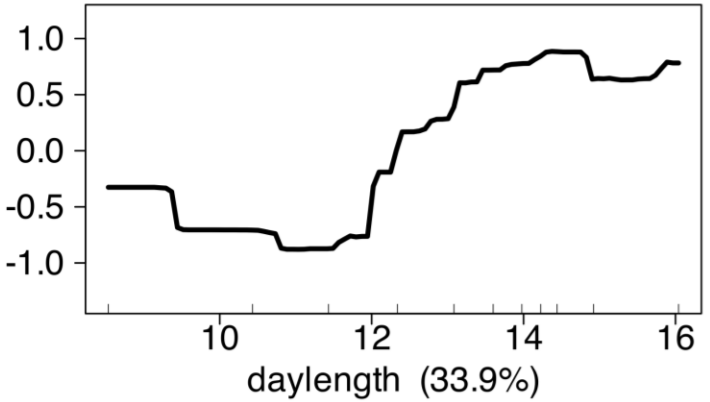


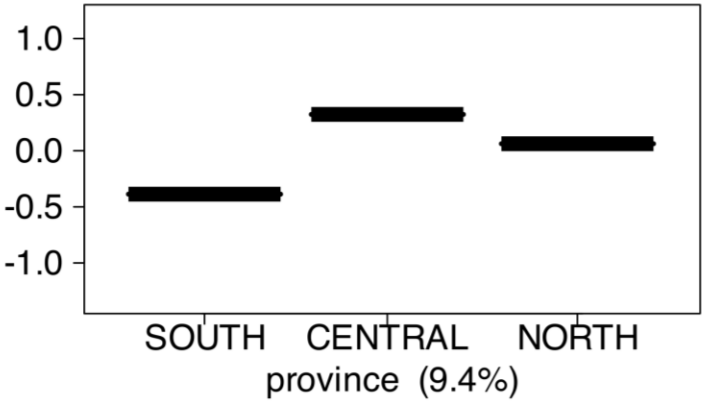




Black-footed albatross





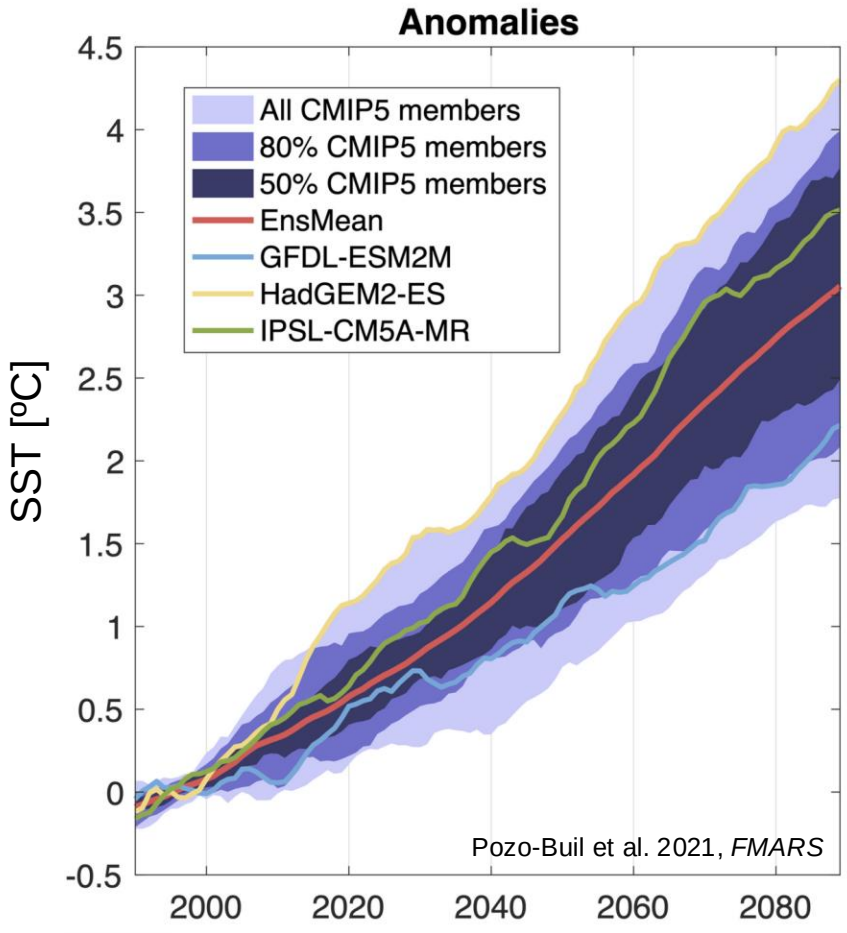


Sooty shearwater

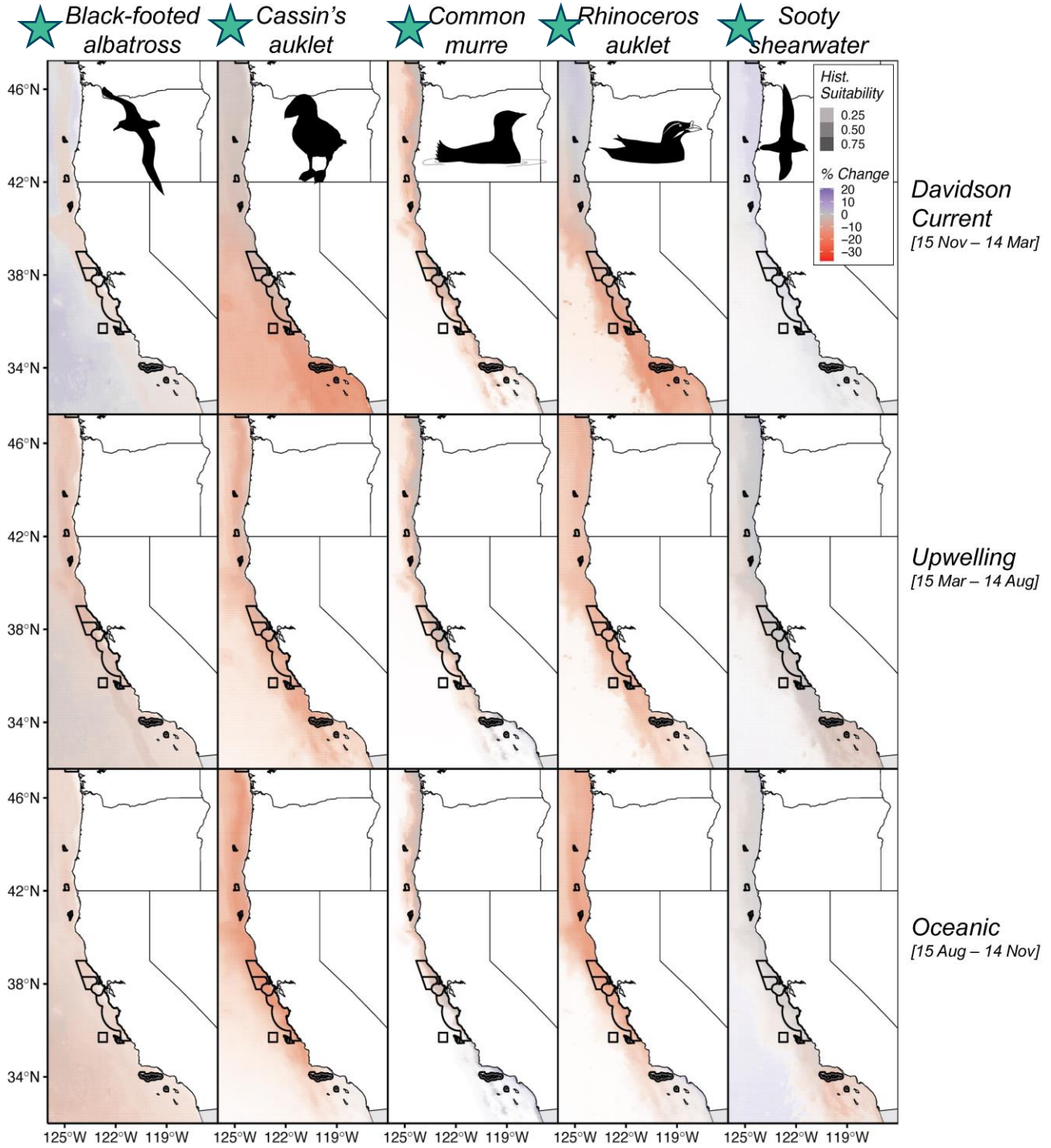
– Negative response to increasing temperatures, but less influential in models (< 5%)

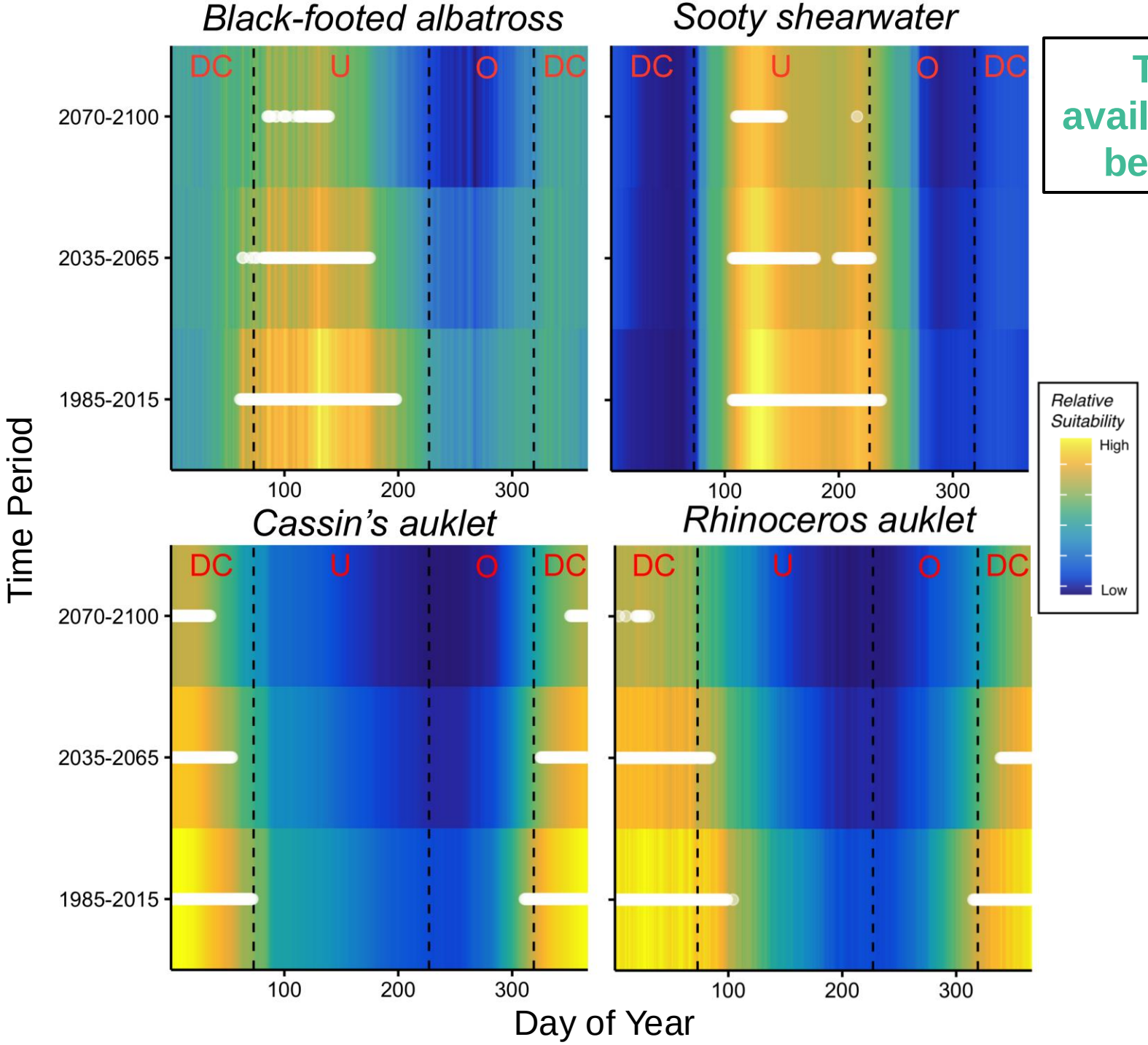
Projecting Suitable Habitat

Future [2070-2100] – Historical [1985-2015]



Daily projections from 1980-2100



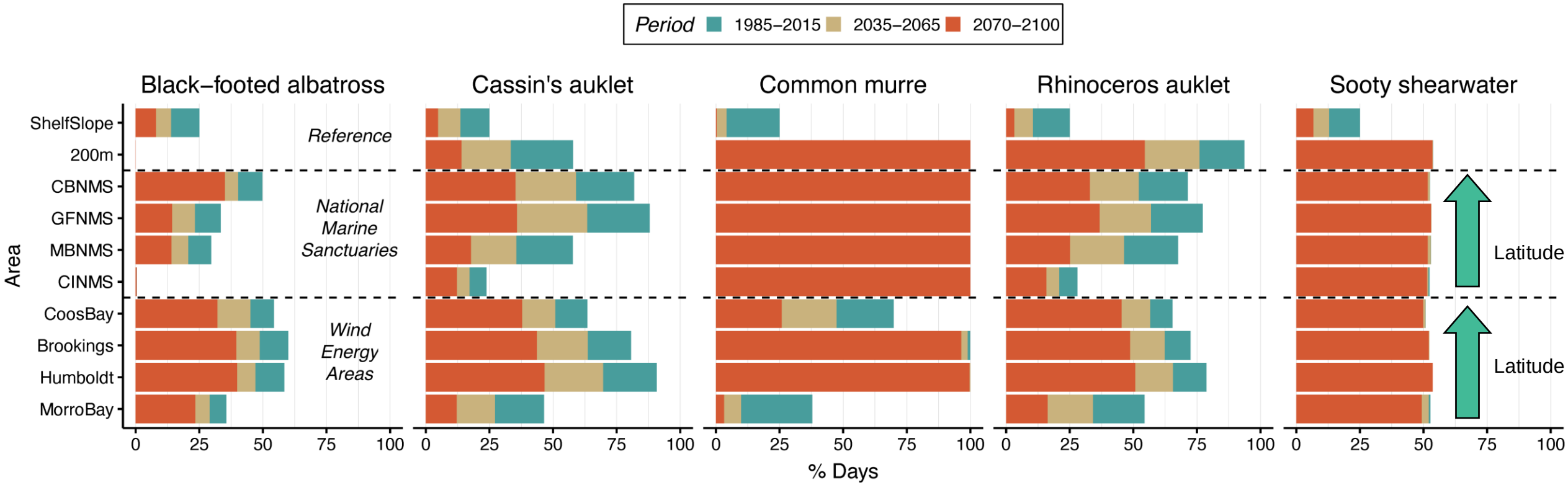


Temporal compression of habitat availability on shelf & upper slope varies between migratory, resident species

- Overall greater impacts on auklets
- Timing of impacts varies
  - For migrators, Spring/summer habitat generally remains, little change or increase in Winter
  - Summer/early Fall increasingly unsuitable for residents
- How do these patterns vary across the CCE?
  - National Marine Sanctuaries & Wind Energy Areas

How much of the year does each area contain quality habitat?

(i.e. ≥ 75th percentile of each species' historical suitability scores)



Residents

Cassin's, Rhino Auklets
- Greatest declines, more severe in the South CCE
- Some refugia in North CCE winter

Common Murre
Coastal refugia persist, lack of seasonality

Migrators

Sooty Shearwater, Black-footed Albatross
Some overall decline in BFAL, SOSH declines mostly off-shelf & outside of Upwelling season

Wind Energy Areas

Overall, seabird overlap predicted to decrease

But, overlap with seasonal auklet refugia

Better habitat in Humboldt, Brookings WEAs overlying depths < 1000 m

Morro Bay contains mostly unsuitable habitat there by 2100

National Marine Sanctuaries

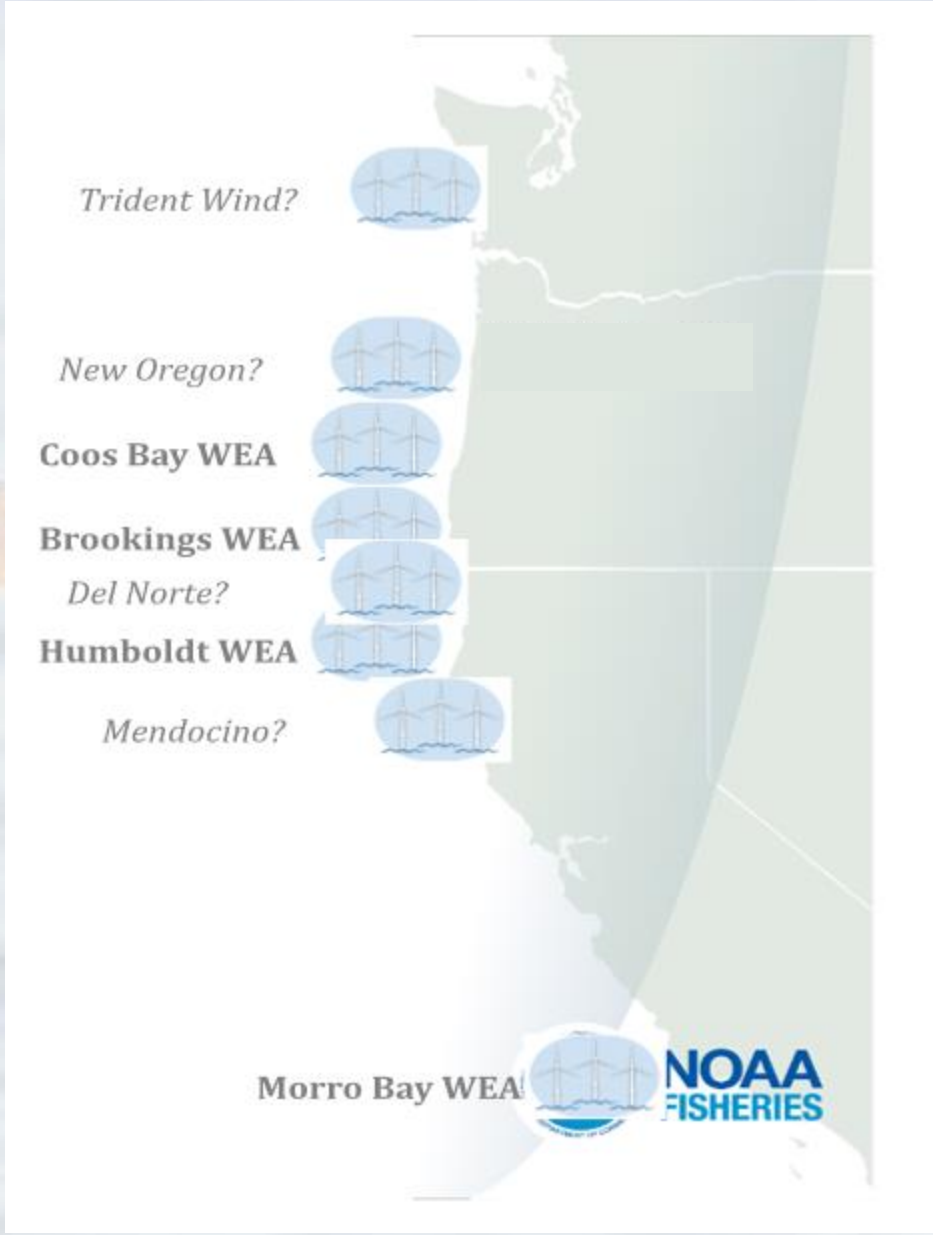
Capture shelf & seasonal refugia

Overall, seabird overlap predicted to decrease

Lesser declines than in WEAs

Conclusions & Next Steps

- Suitable habitat shifts in space & time, will prey resources?
- Overlap with offshore wind decreases, but quality habitat remains present for parts of the year – projections may inform future siting
- NMS protect seasonal & coastal climate refugia
- Integration & evaluation with other data, models



Thank you!

Data Providers & Stewards

- ACCESS: Jaime Jahncke
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- PaCSEA and Southern California Bight Surveys: Josh Adams
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- Wind to Whales: Don Croll

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NOAA Fisheries Ecology Division (Santa Cruz)

Sanctuary Futures team

CCIEA Wind

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MAPP Modeling, Analysis, Predictions, and Projections

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