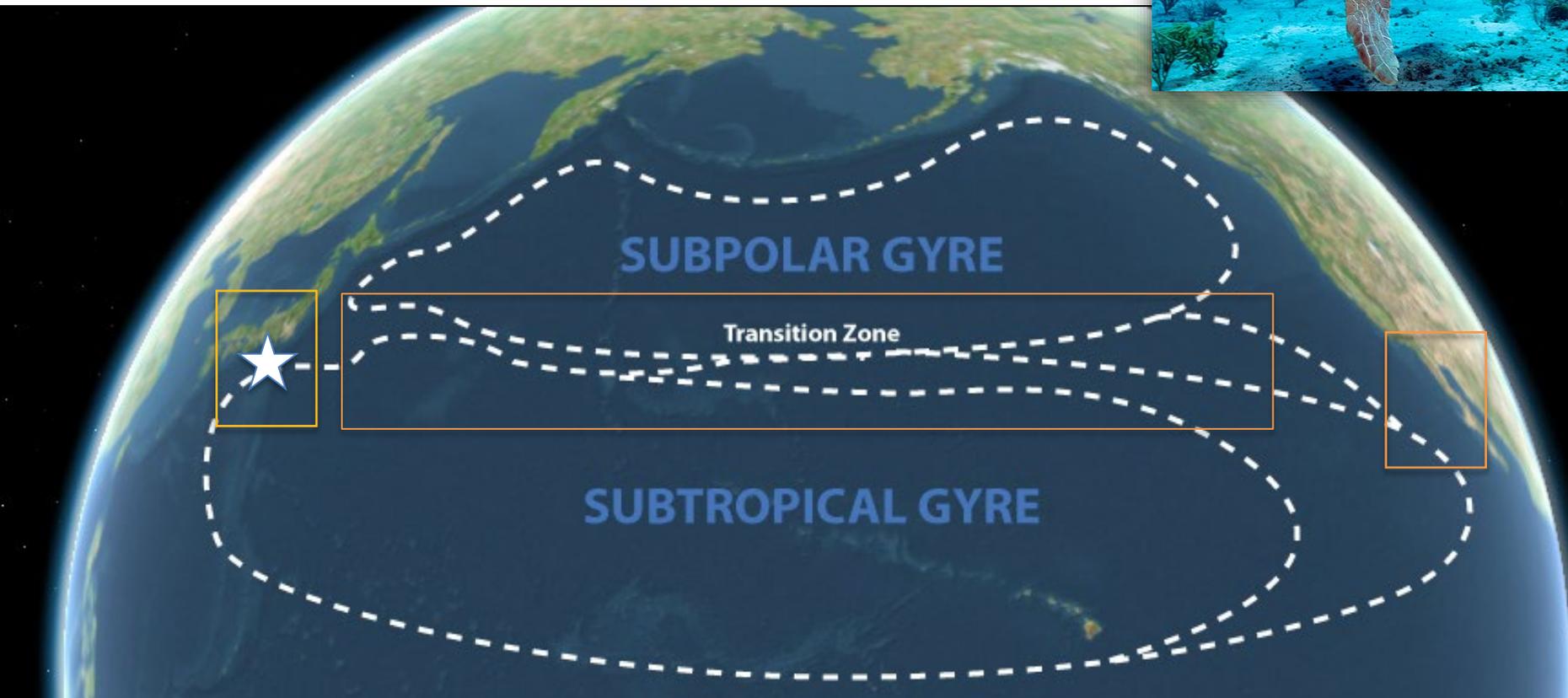


Unraveling the migratory mysteries of North Pacific loggerheads using experimental oceanography

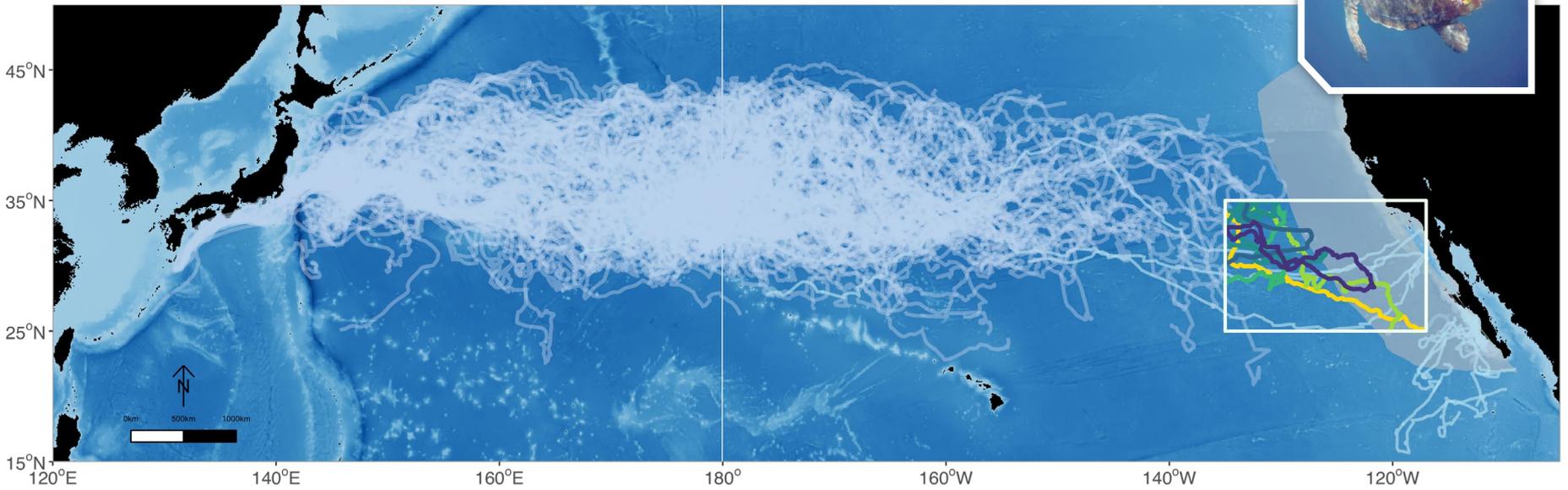


Crowder, L.B., D.K. Briscoe, G.H. Balazs, and the STRETCH Consortium.

North Pacific Loggerhead Sea Turtles (*Caretta caretta*)

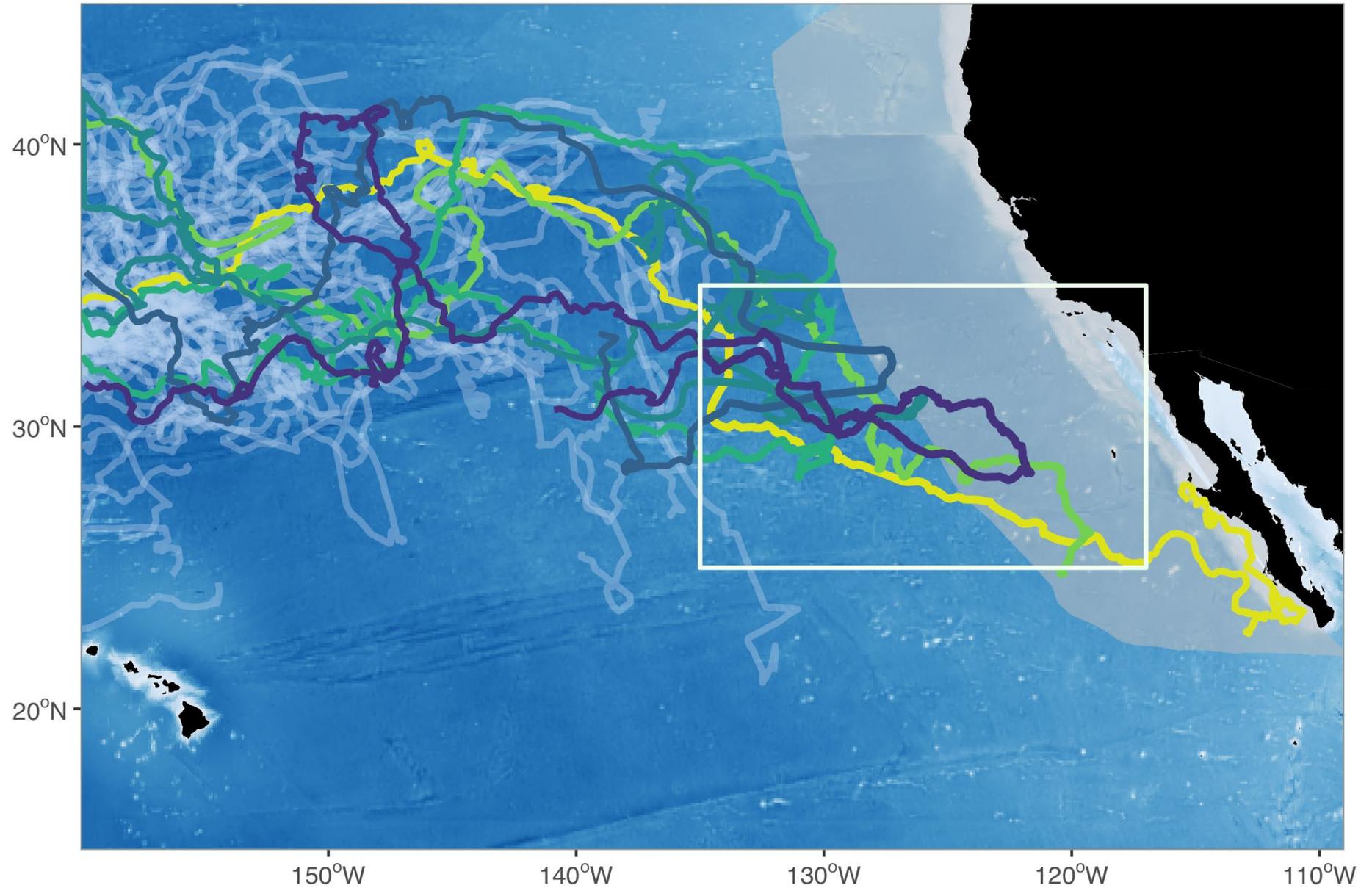


Satellite tracked North Pacific loggerhead sea turtles (1997 – 2013, n = 281)



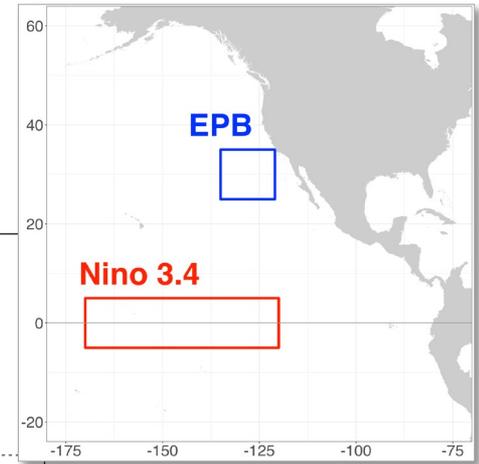
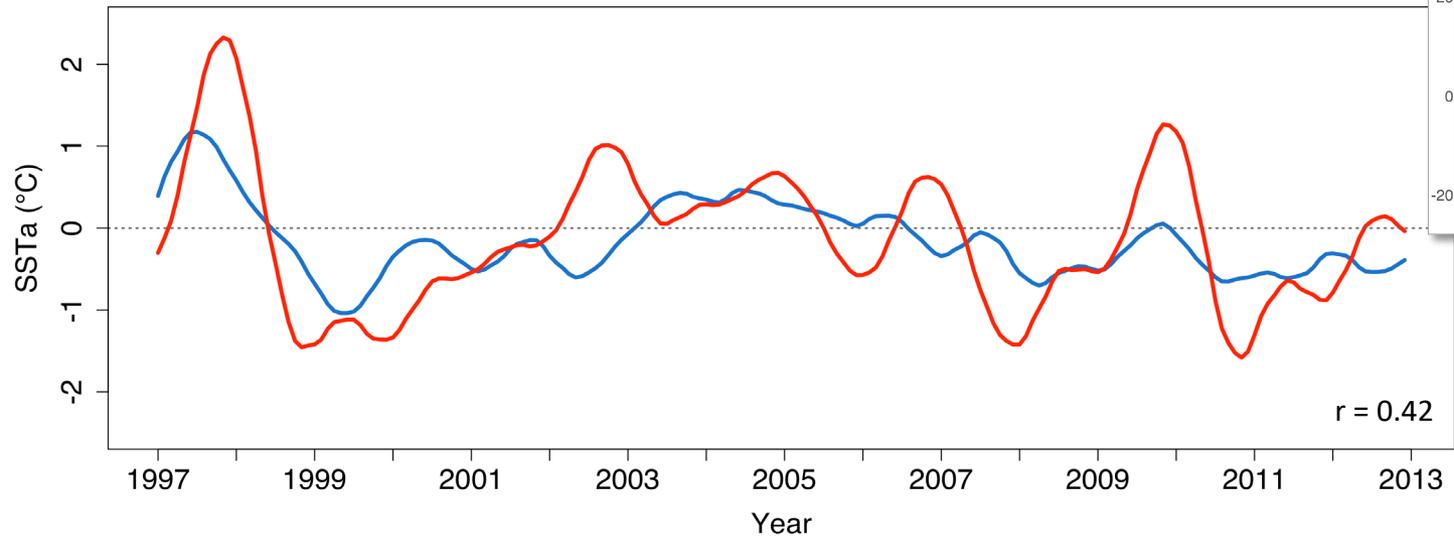
Briscoe et al. 2021

Region utilized by six 'sentinel' individual loggerheads to reach Baja California, Mexico



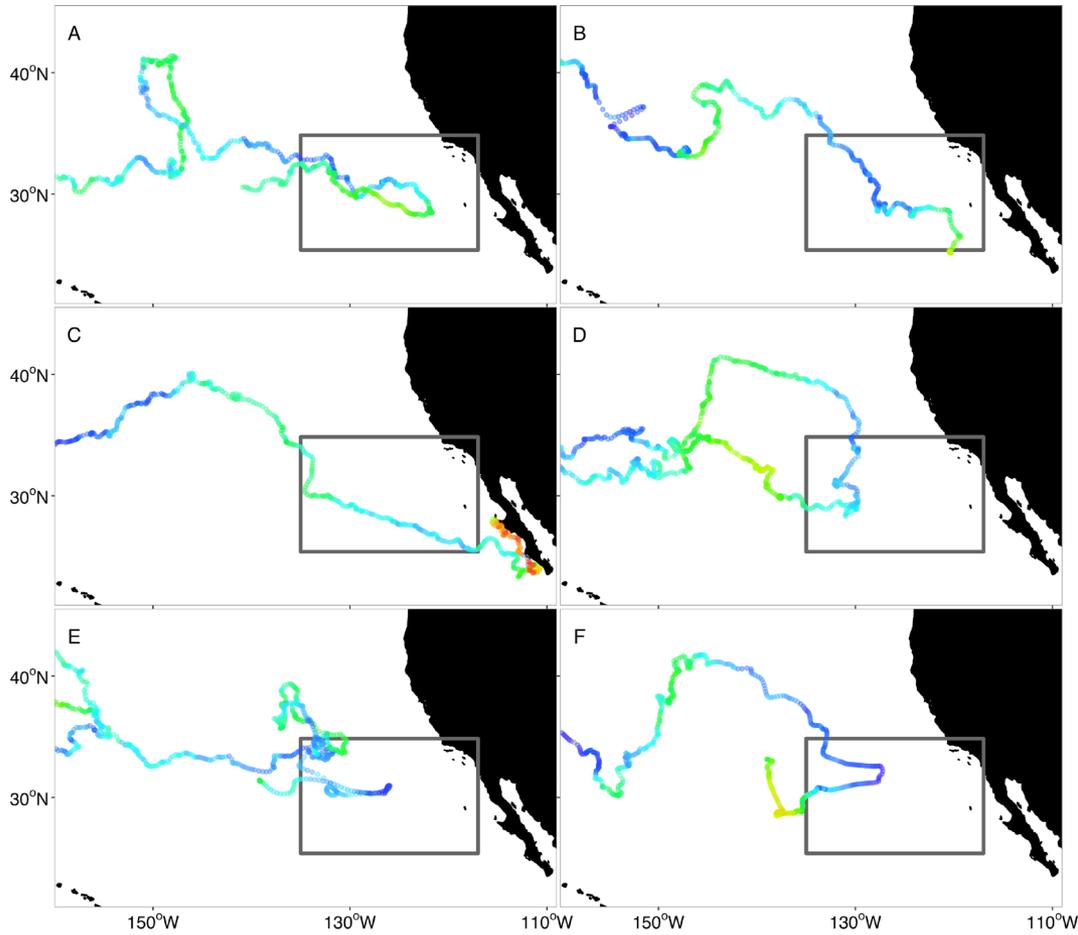
Hypothesized increased recruitment with warmer SSTs

Remotely-sensed SST time-series

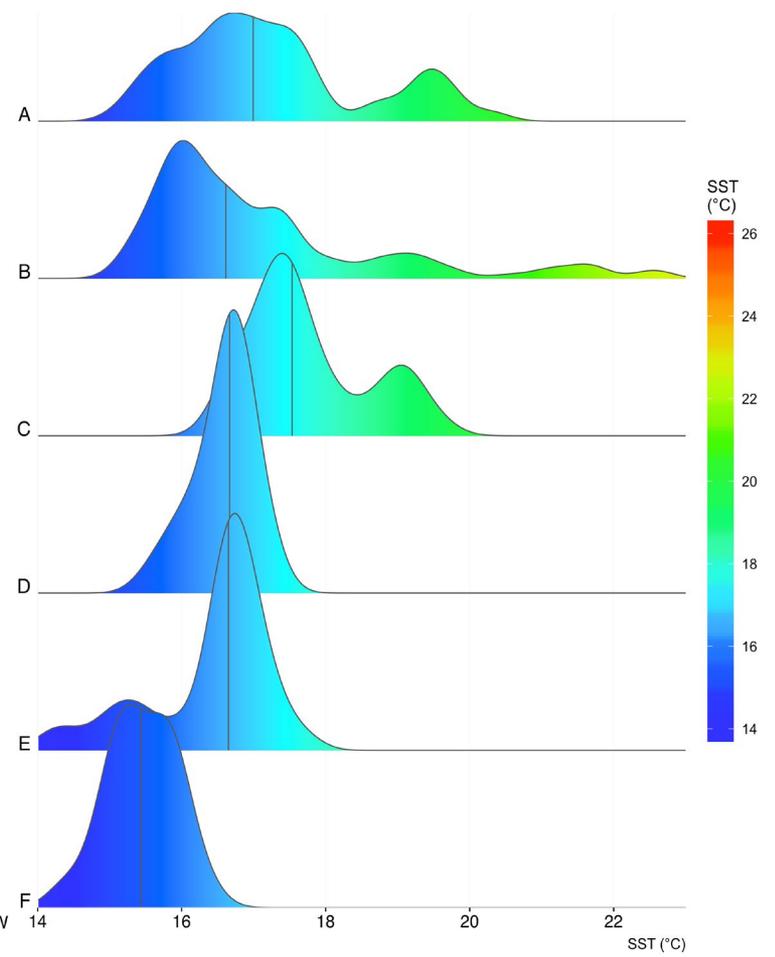


Classified warm vs cool regional ocean conditions: 3-month mean ± 0.5 °C

Real-time SST sampled under turtle tracks

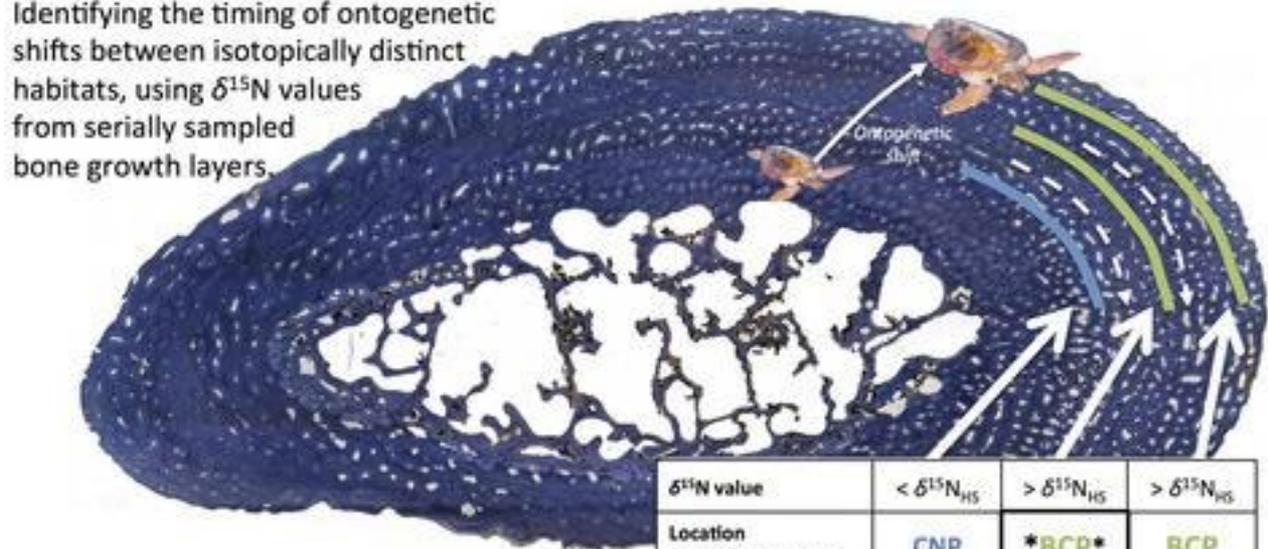


Density histogram of sampled SSTs

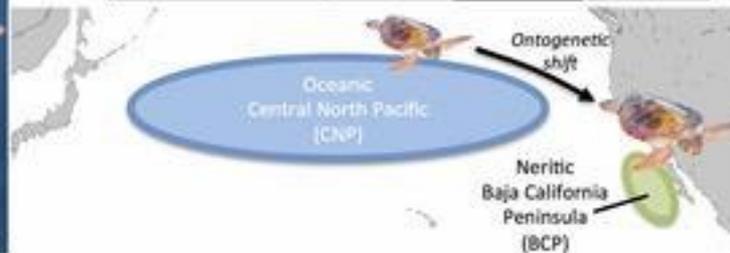


Stable Isotopes to Recruitment

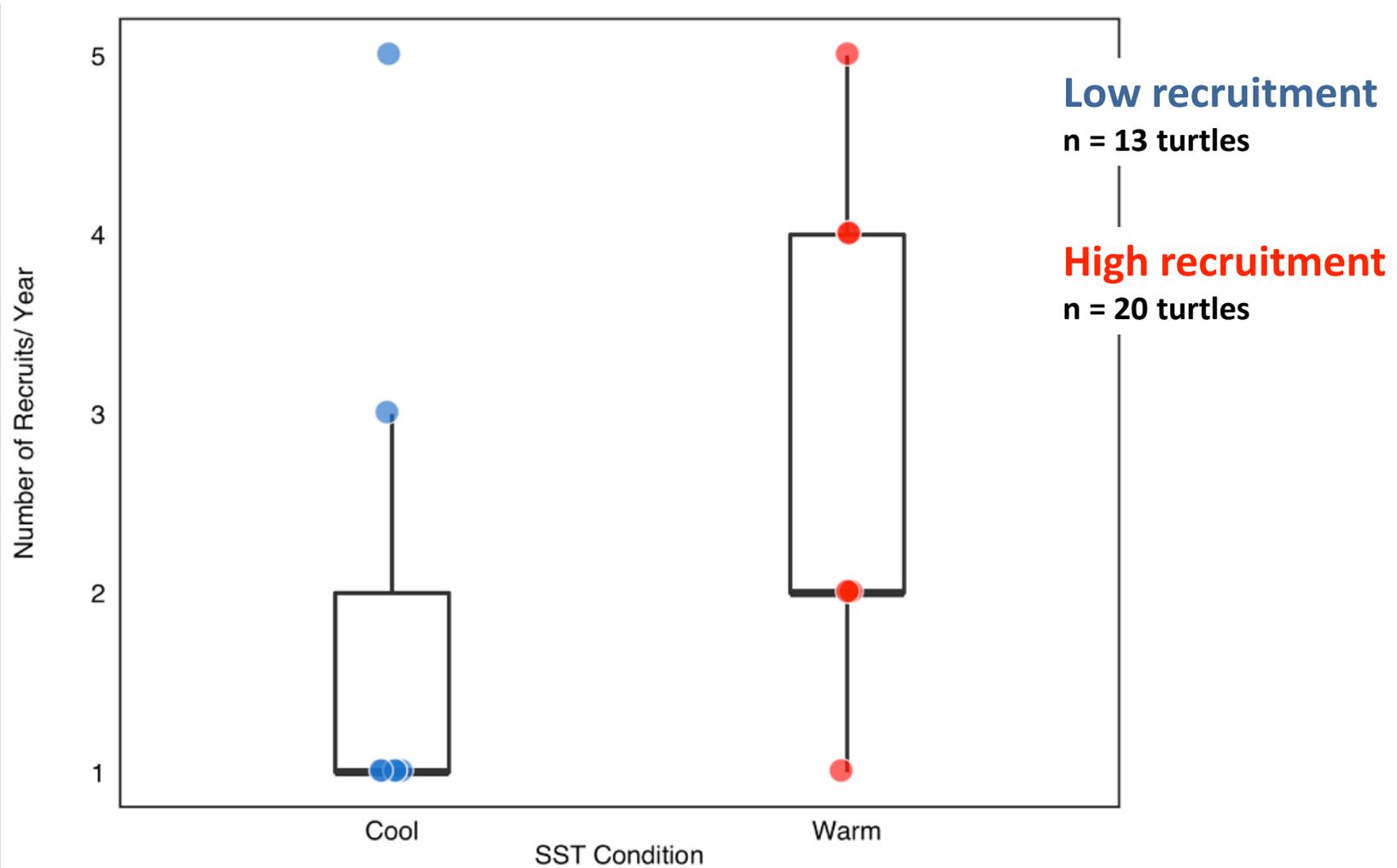
Identifying the timing of ontogenetic shifts between isotopically distinct habitats, using $\delta^{15}\text{N}$ values from serially sampled bone growth layers.



$\delta^{15}\text{N}$ value	$< \delta^{15}\text{N}_{\text{HS}}$	$> \delta^{15}\text{N}_{\text{HS}}$	$> \delta^{15}\text{N}_{\text{HS}}$
Location	CNP	*BCP*	BCP
* recruitment year			
Estimated age (yr)	6	7	8
Back-calculated body size (cm)	44	48	52



Relative number of annual recruits during 'cool' & 'warm' years

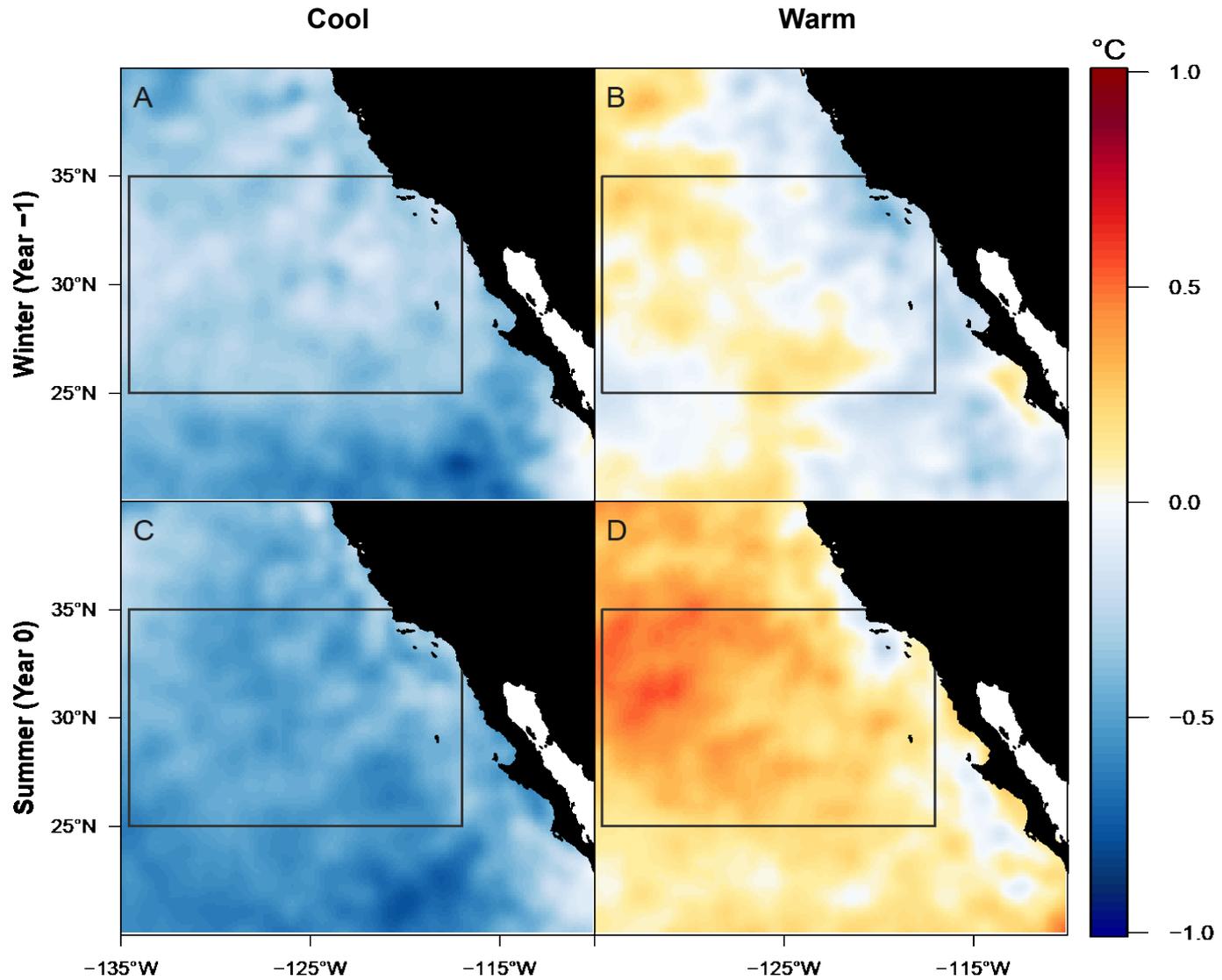


In 2016, El Nino and Blob Conditions



Aerial surveys estimated 70K turtles, but where did they come from?

Thermal corridor illuminates dynamic ocean pathways



STRETCH Consortium

- PIs
- Larry B. Crowder, Hopkins Marine Station, Stanford University, Pacific Grove, PI and team coordinator.
- George H. Balazs, Golden Honu Services of Oceania and NOAA (retired), Honolulu. Co-PI.
- Dana K. Briscoe, Cawthron Institute, Nelson, NZ, Co-PI.
- Jeffrey A. Seminoff, NOAA-Southwest Fisheries Science Center, La Jolla. Co-PI.
- Jeffrey J. Polovina, NOAA, Honolulu, (retired).
-
- Local partners on this and previous research:
- Alberto Abreu, Professor, Institute of Marine Science and Limnology, UNAM, Mexico City, Mexico.
- Masanori Kurita, Director, Port of Nagoya Public Aquarium, Nagoya, Japan.
- Tomomi Saito, Professor, Usa Marine Biology Institute, Kochi University, Kochi, Japan.
-
- Other Collaborators
- Denise M. Parker, Golden Honu Services of Oceania, Newport, OR.
- Marc R. Rice, Hawaii Preparatory Academy, Kamuela.
- Bianca S. Santos, EIPER, Stanford University.
- Calandra N. Turner Tomaszewicz, NOAA-Southwest Fisheries Science Center and The Ocean Foundation.

STRETCH Experimental Design



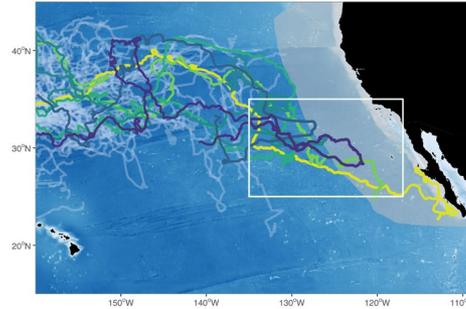
- Experimental deployments of 25 aquarium reared, satellite-tagged loggerheads each year for 4 years.
- Turtles will be released in the east end of the CNP. Given the variation in ocean climate, we should experience both warm and cold years.
- Ocean forecasts will allow us to predict whether the Thermal Corridor is open or closed in a particular year and so predict loggerhead movements.

First Cohort at PNPA



Collected from nesting beaches late summer 2021 for April 2023 release

STRETCH Outreach



- Interactive website to report loggerhead movements in near real time.
- Allow researchers, school children, and the public to follow our experiment, from Japan to the California Current.
- Emphasize that the oceans are changing, and that these changes affect the entire planet, and all creatures, including people.
- Highlight sea turtles as amazing and captivating creatures that move and impact environments across entire ocean basins

Acknowledgements

- Thanks to the STRETCH Consortium for their support. In particular, George Balazs and Jeff Polovina who offered access to the legacy data set which led to the Thermal Corridor Hypothesis. And to Dana Briscoe and Cali Turner Tomaszewicz, who deftly combined tracking and oceanographic data with stable isotope analysis to develop the TCH.
- Thanks also to our partners Masanori Kurita and Tomomi Saito for carefully rearing our experimental turtles for the first release in April 2023.
- Thanks to National Geographic and Gordon and Betty Moore Foundation for their support of this research.