Species range shifts, long term variability of temperature on coastal systems, and insights into the future

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Tijuana River National Estuarine Research Reserve

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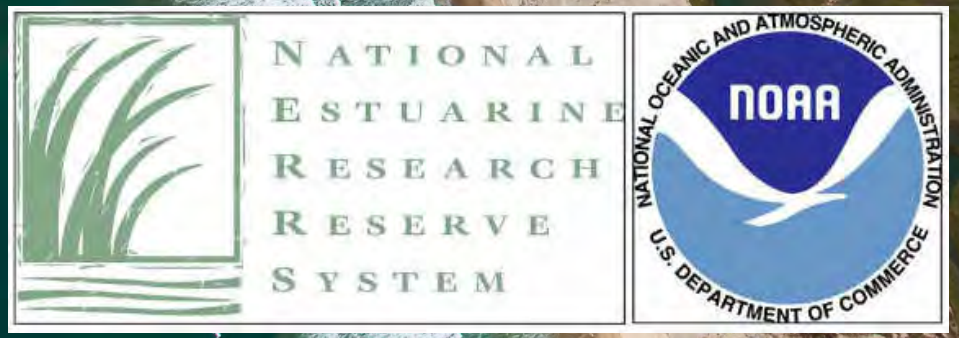
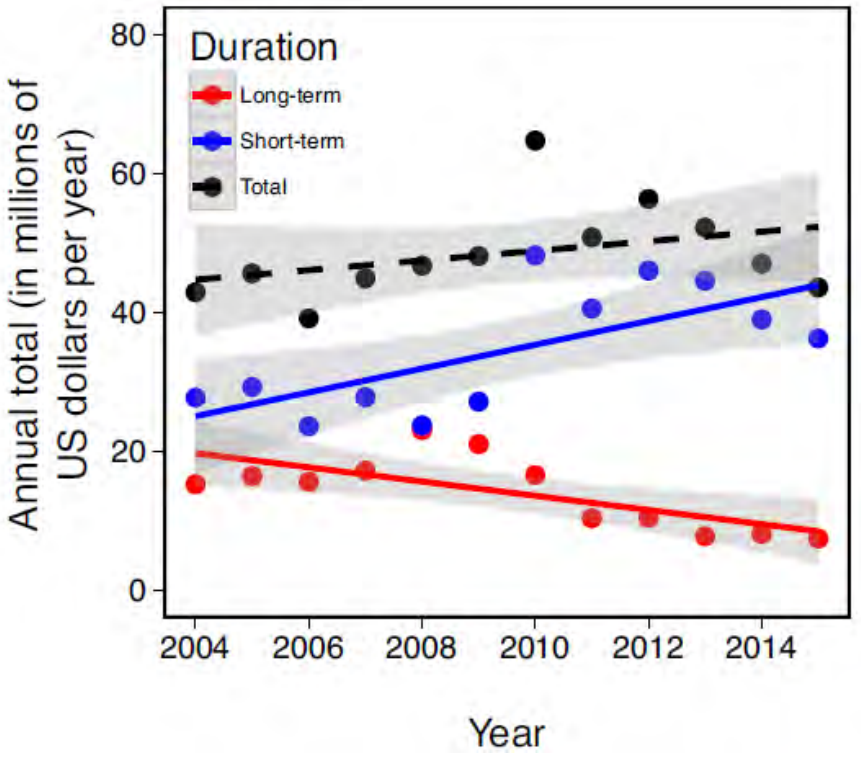


Monitoring programs

- Understand how species and ecosystems respond to a changing global climate and other anthropogenic forces.

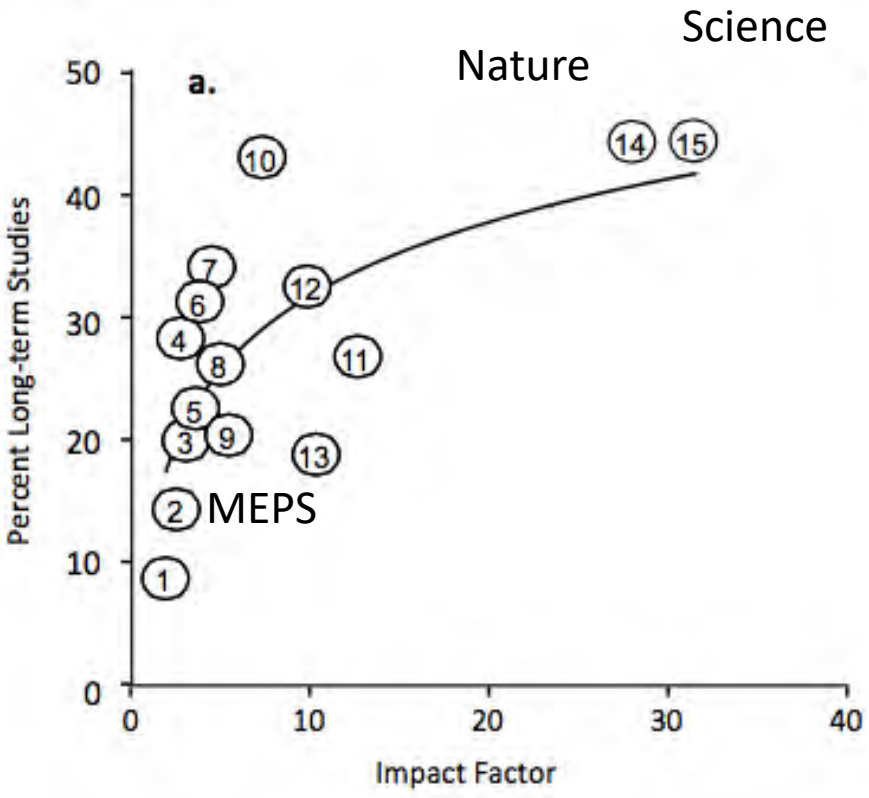
  but…

- Funding for long term projects is declining .



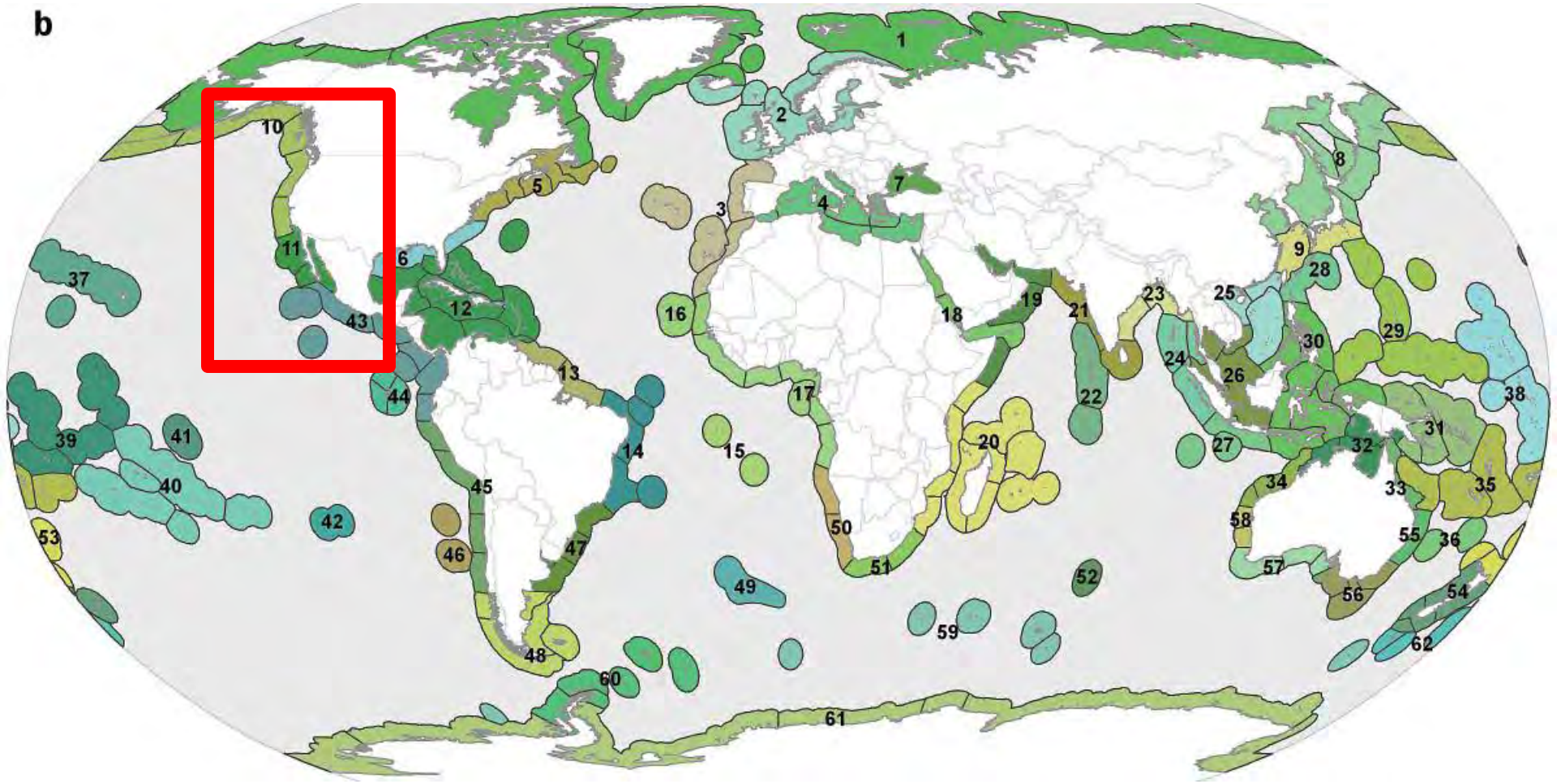
Hughes & Beas *et.al*. (*2017)*

Long term studies contribute disproportionately to ecology and policy



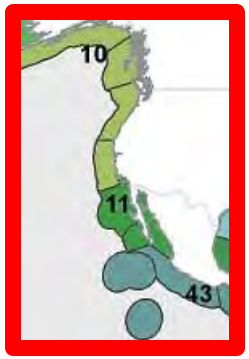
Hughes & Beas *et.al*. (*2017)*

Provinces and Ecoregions- Transitional Areas



Spalding *et.al*. (*2007)*

Provinces and Ecoregions- Transitional Areas



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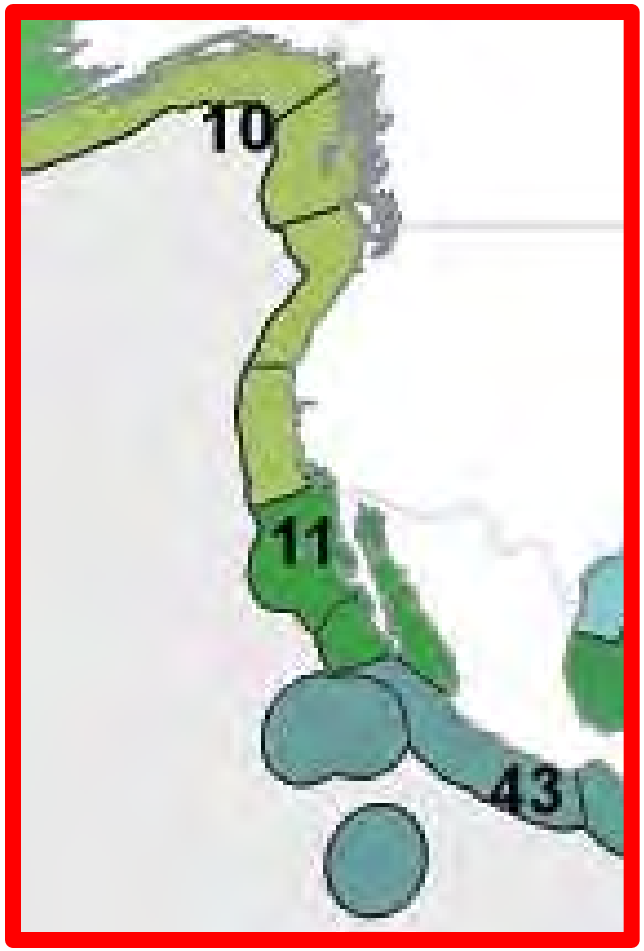
Provinces and Ecoregions- Transitional Areas



Cold Temperate Northeast Pacific

Warm Temperate Northeast Pacific

Tropical East Pacific

Spalding *et.al*. (*2007)*

First records and range shifts of multiple marine species along the Eastern Pacific associated with a warm water anomaly

Steve Lonhart, Rikke Jeppesen, Rodrigo Beas-Luna, Jeff Crooks, Julio Lorda, Fiorenza Michelli

National Marine Sanctuaries
Monterey Bay

ESNERR

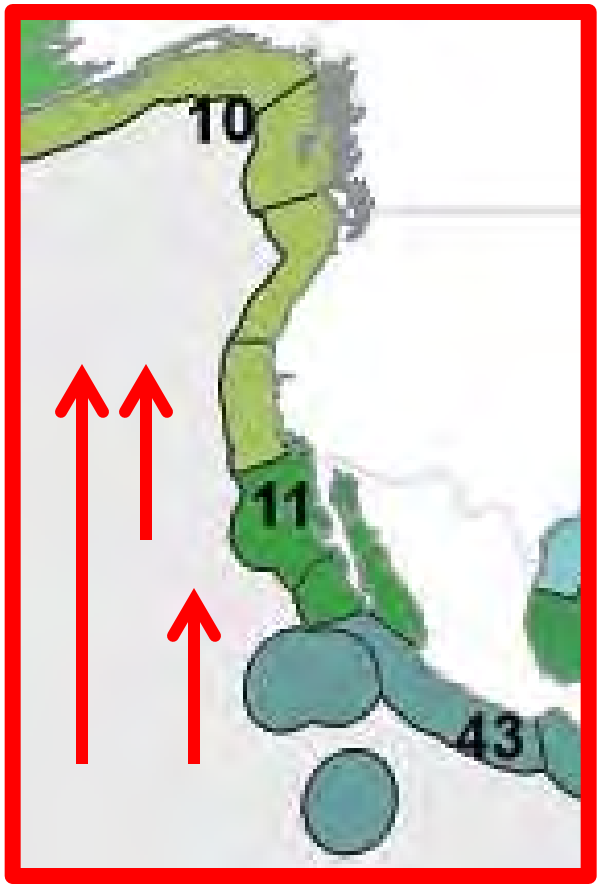
MexCal

Tijuana River
National Estuarine Research Reserve

Hopkins Marine Station
of Stanford University

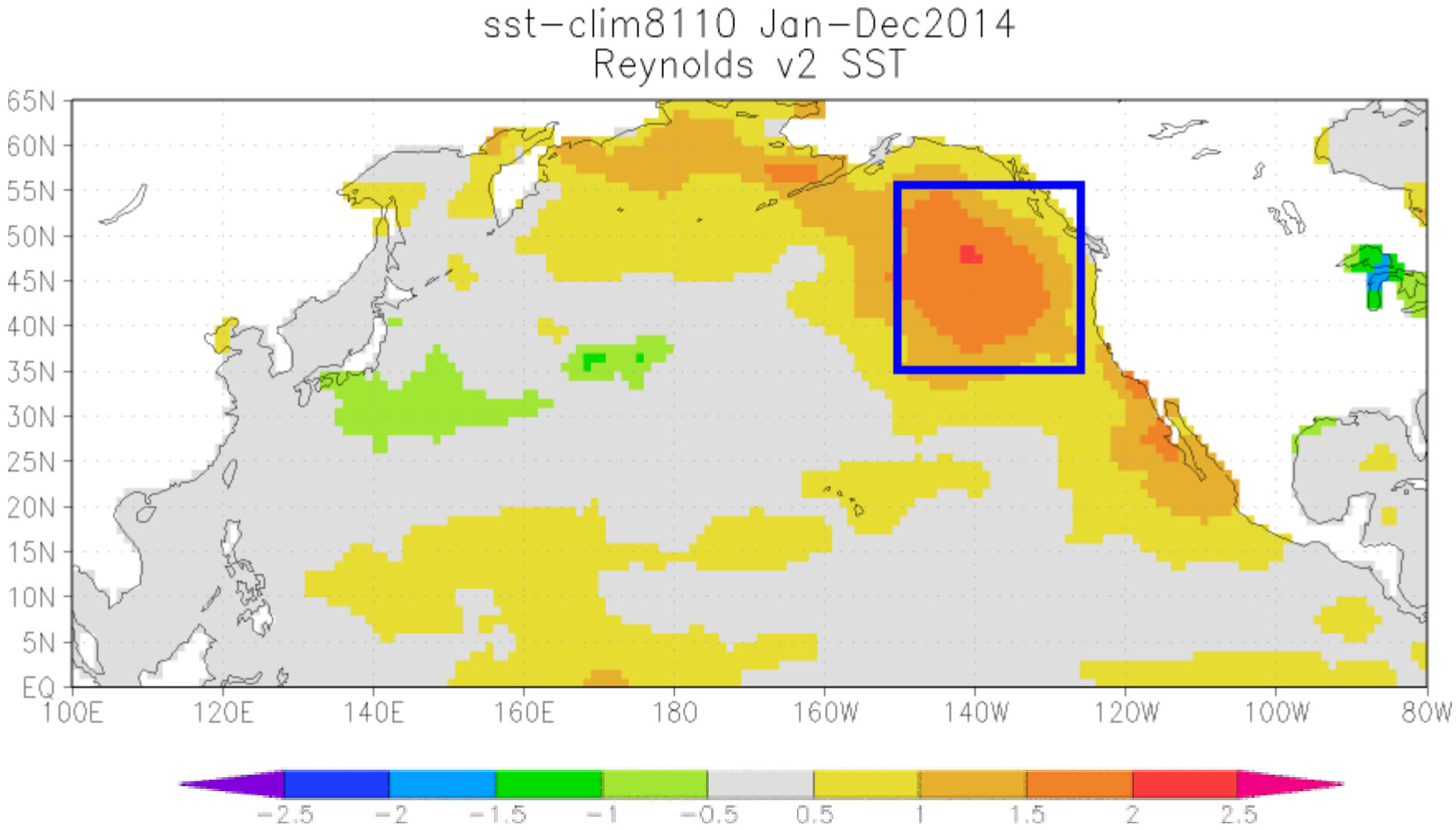
First records and range shifts of multiple marine species along the Eastern Pacific associated with a warm water anomaly

- Around 30 species with range extensions/expansions, or increasing abundances close to their northern range limits.

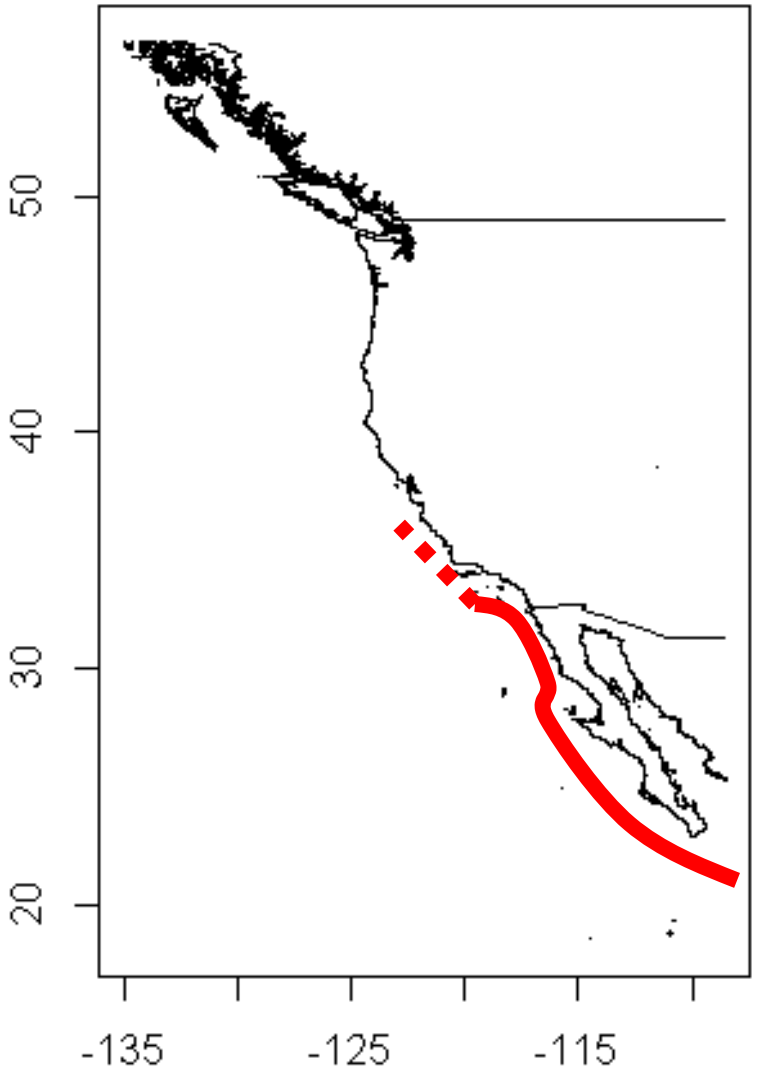


Lonhart *et.al*. (*in prep)*

Warm Anomaly in the Northeast Pacific 2013-2015

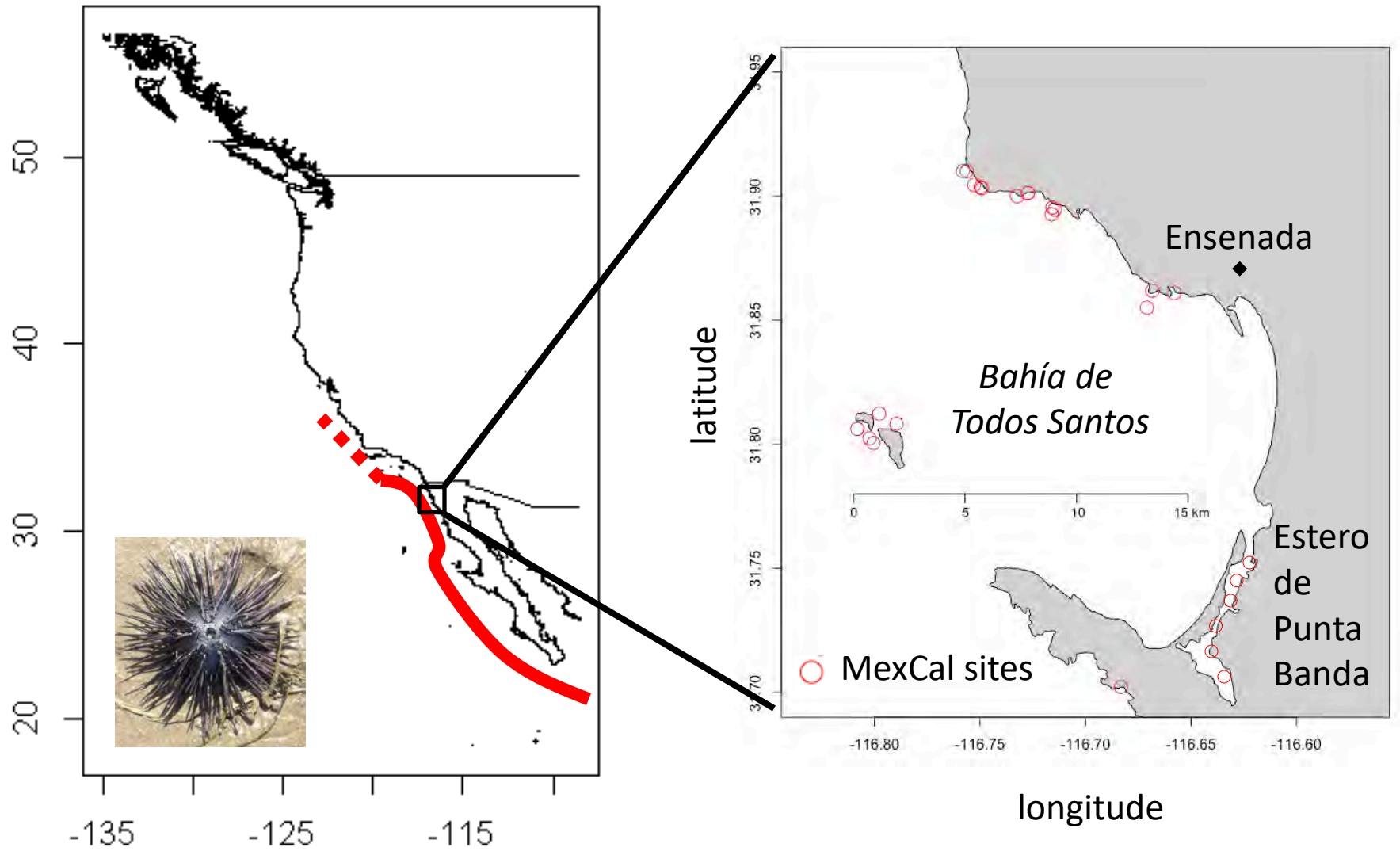


Example: *Arbacia stellata*
black urchin



- Range expansion to Cannery Row, Monterey, CA

Example: *Arbacia stellata*
black urchin



Example*: Arbacia stellata*
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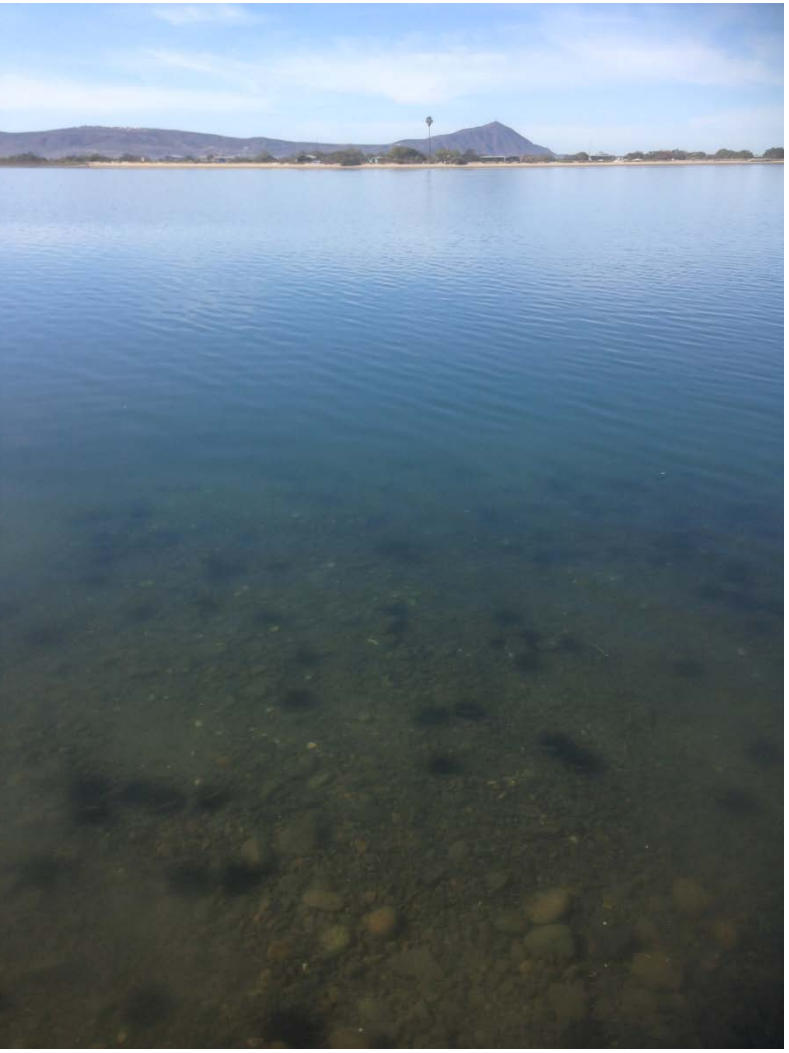


- Abundant in Estero de Punta Banda!
- Very abundant in Bahía de Todos Santos
- An order of magnitude higher than previously reported in ecoregion

Schramm-Loza et al. (*in pre*p)

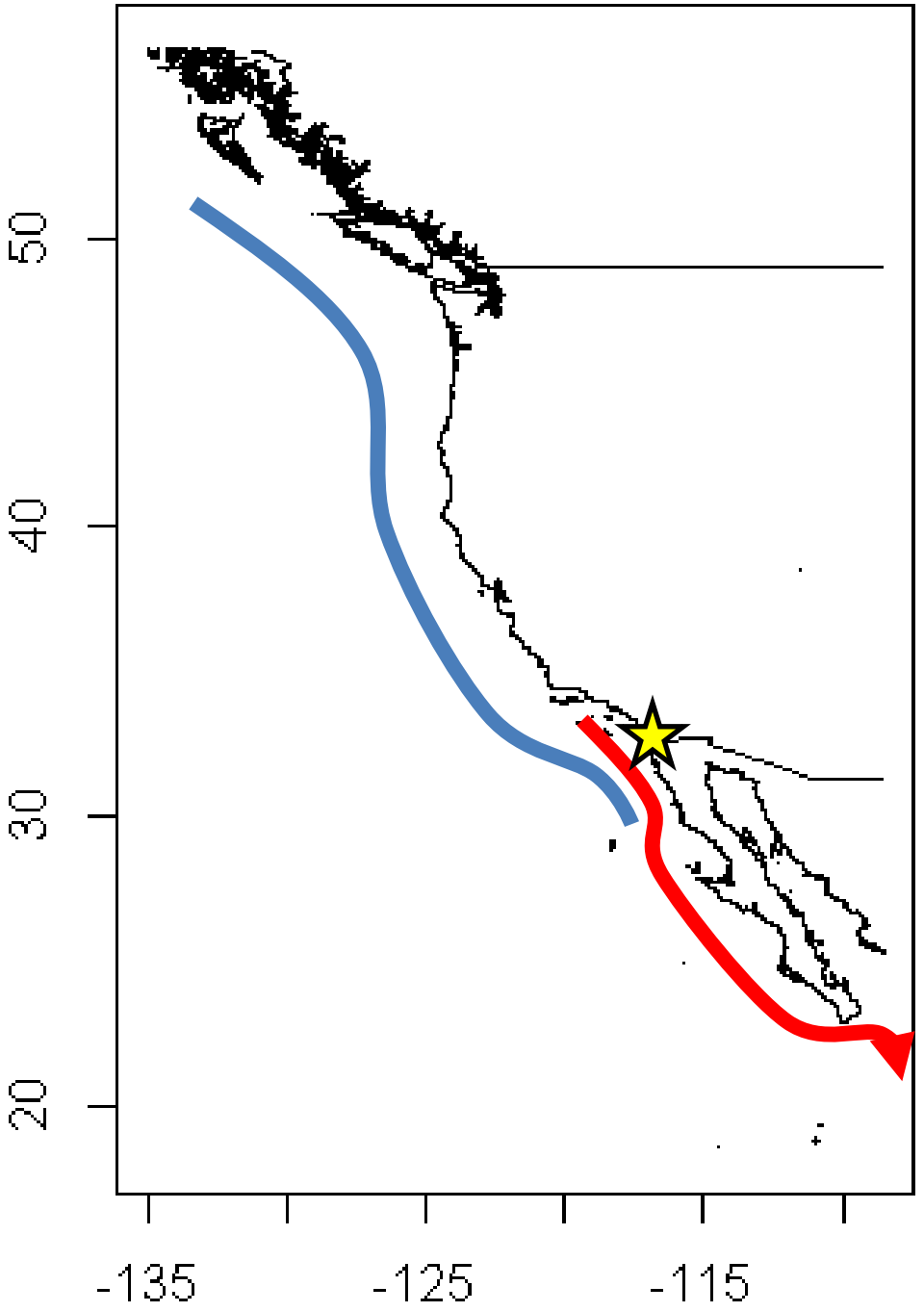
Tijuana River National Estuarine Research Reserve (TRNERR) Monitoring

- Monitoring
  - Fishes
  - Benthic macro invertebrates
  - Plants

Example: Crabs

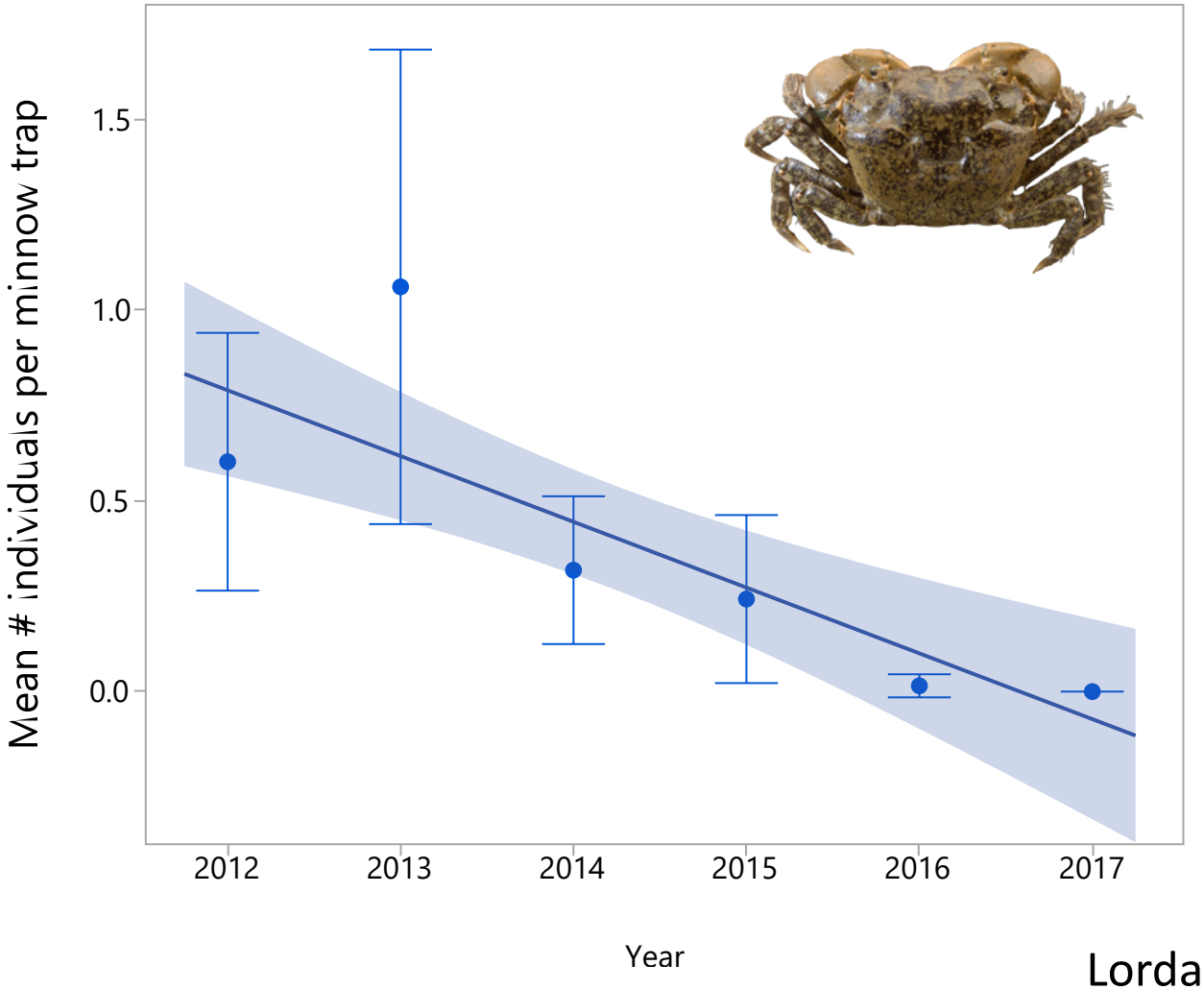
Hemigrapsus oregonensis
yellow shore crab

Callinectes arcuatus
arched swimming crab



Hemigrapsus oregonensis

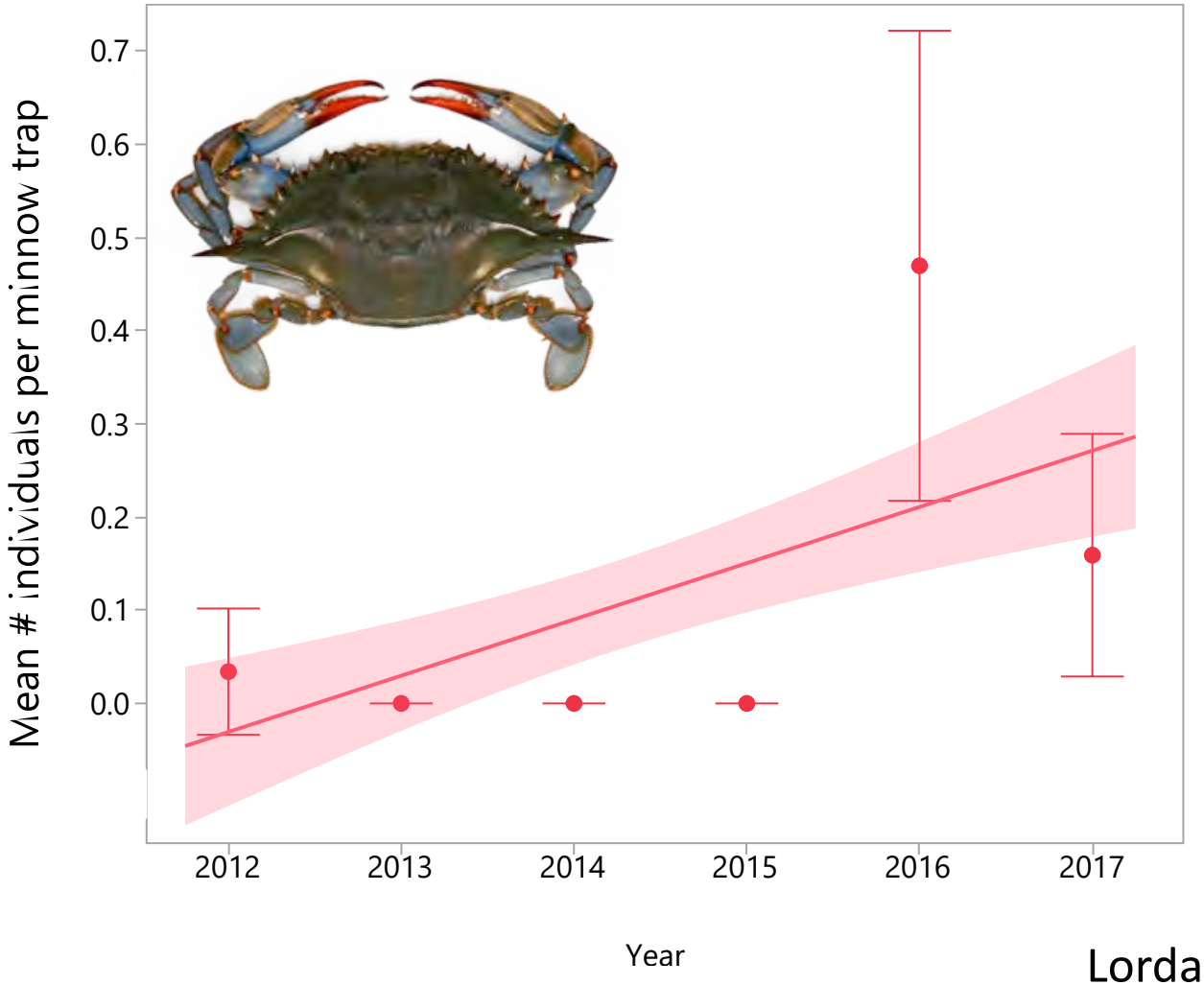
yellow shore crab



Lorda et al. (*in prep*)

Callinectes arcuatus

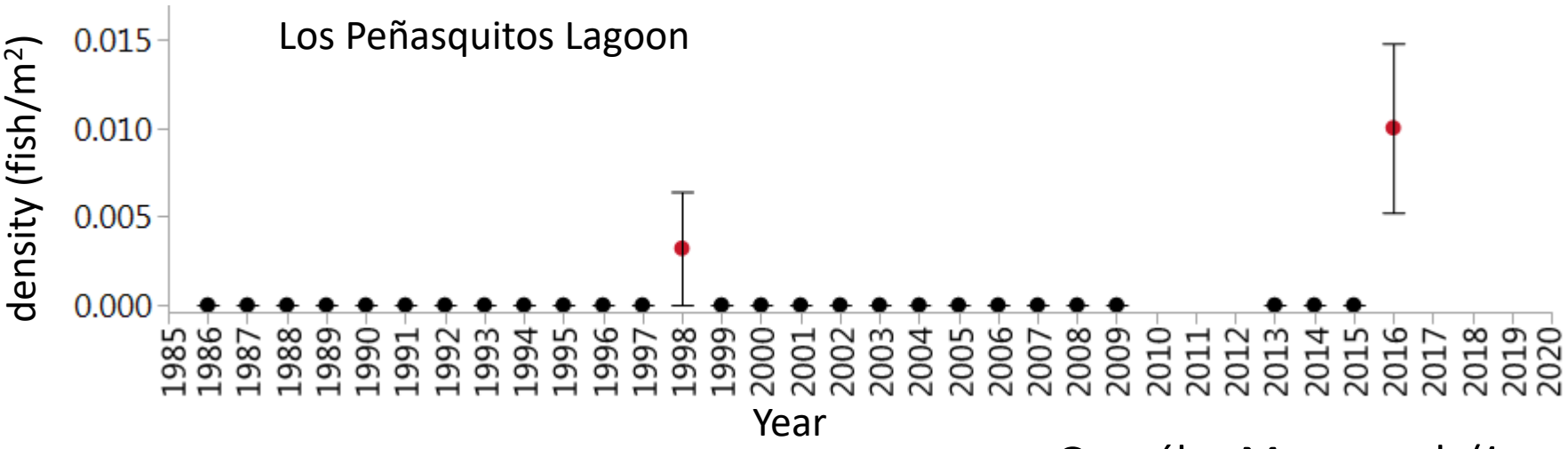
arched swimming crab



Lorda et al. (*in prep*)

Example: *Ctenogobius sagittula* long tail goby

- Reported in Baja California and California during the 1998 Niño
- Also 2016 and 2017

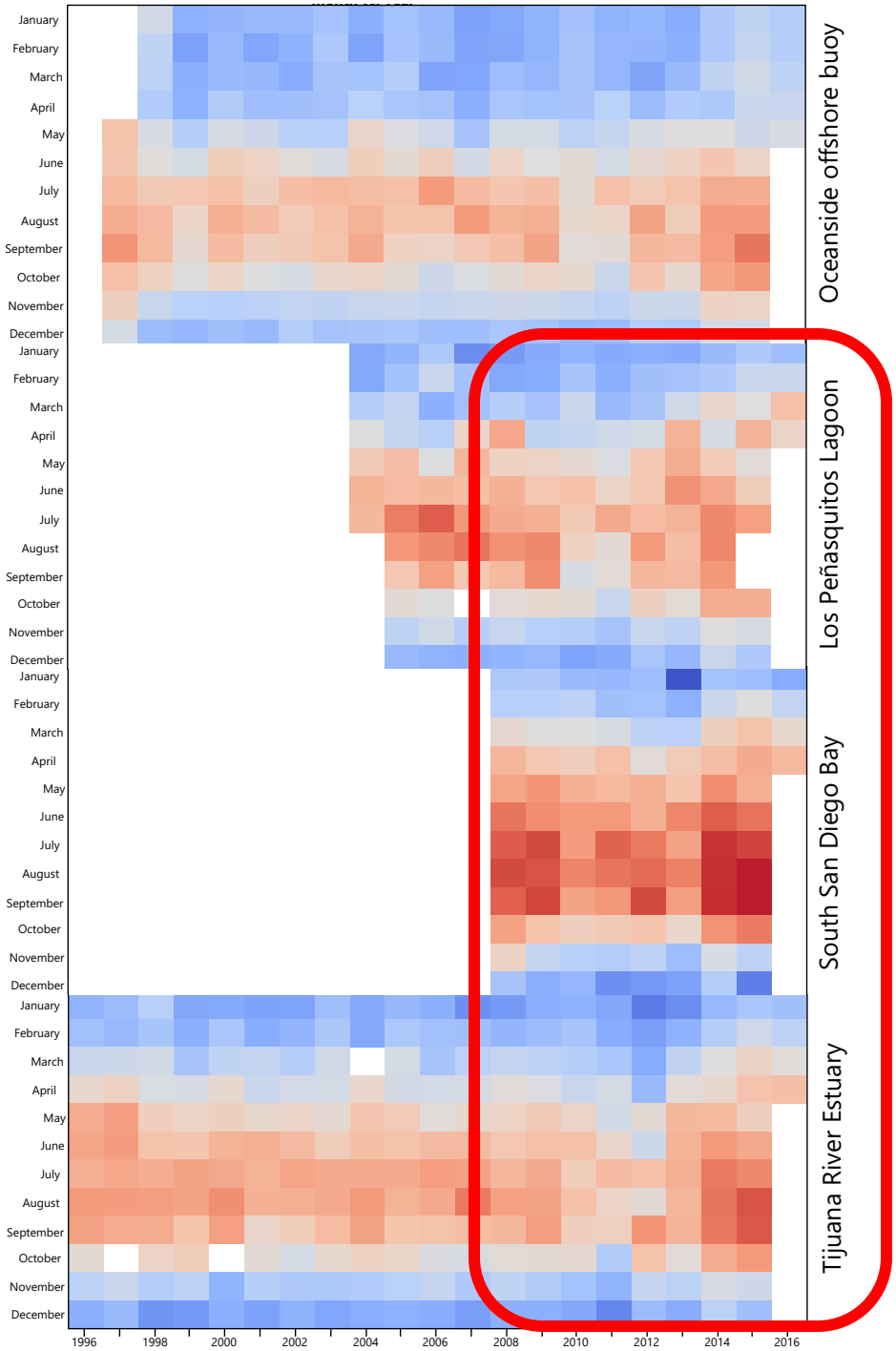


González Mena et al. (*in prep*)

National Estuarine Research Reserve System-wide Monitoring Program

- Water quality monitoring
  - pH
  - Temperature
  - DO
  - Salinity
  - Turbidity
  - Depth
  - Conductivity
  - Fluorescence (Chlorophyll a)

TRNERR Coastal Lagoons



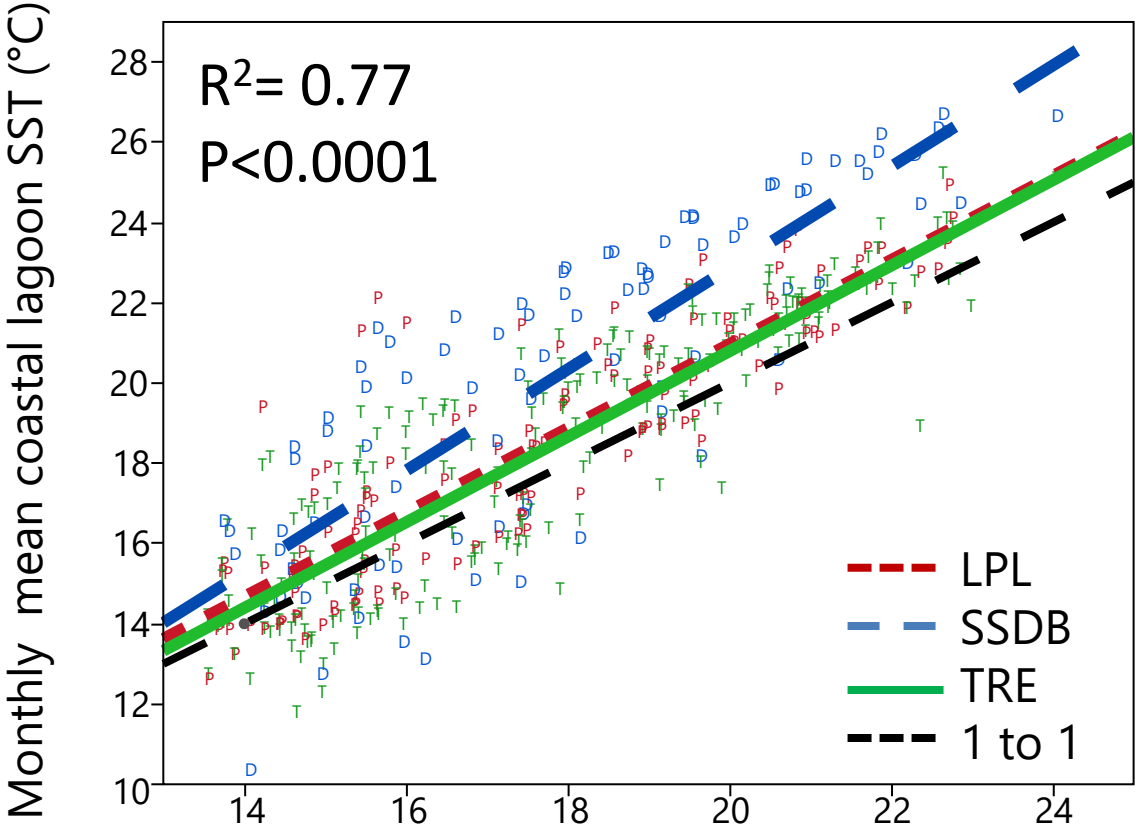
Temperature Open Ocean and Coastal Lagoons

Monthly mean SST (°C)

10 12 14 16 18 19 21 23 25 27

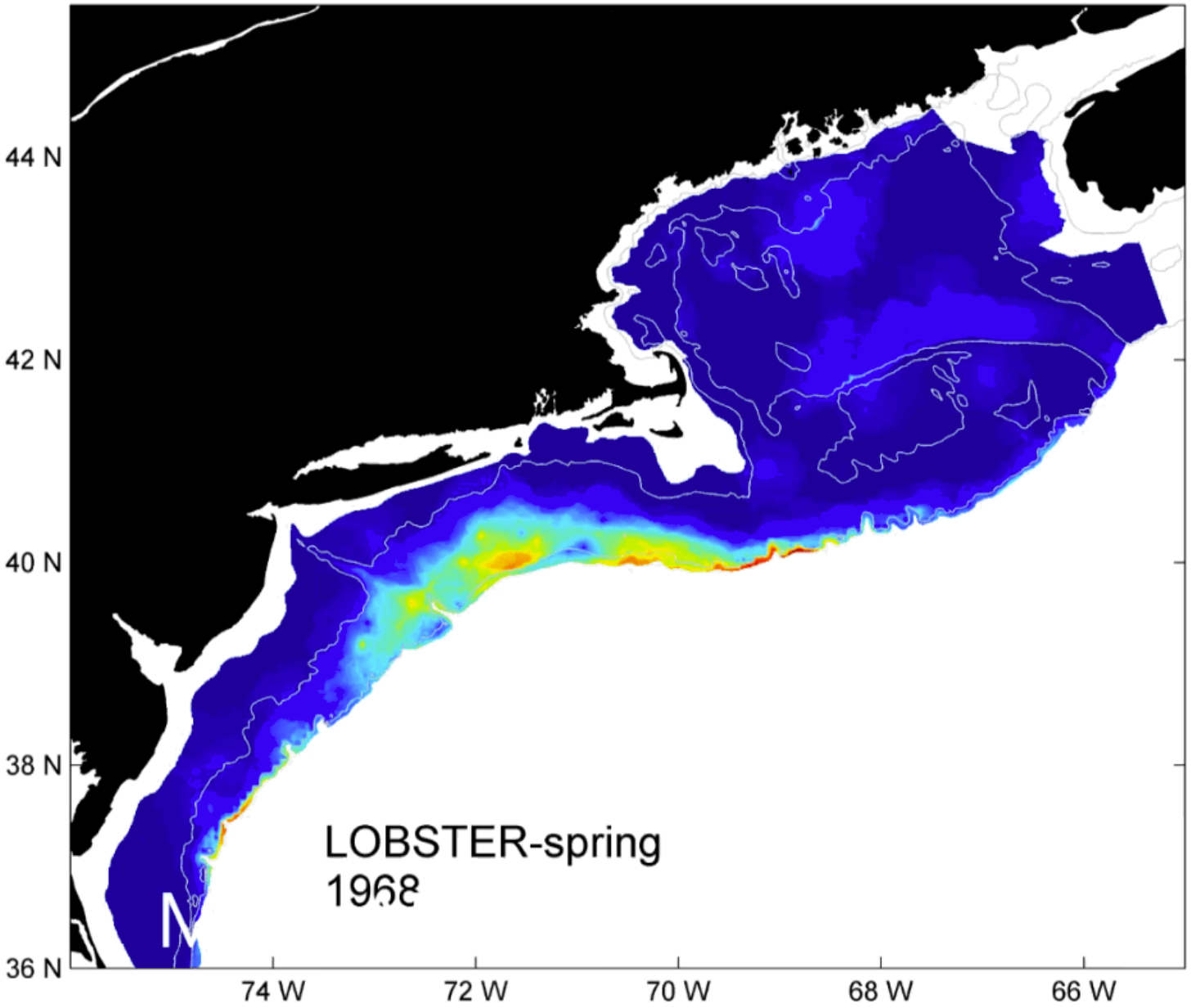
Lorda et al. (*in prep*)

Temperature
Open Ocean and Coastal Lagoons



1.5 up to 2 °C

Lorda et al. (*in prep*)


44 N
42 N
40 N
38 N
36 N
74 W
72 W
70 W
68 W
66 W
LOBSTER-spring
1968
N

Conclusions

- Coastal temperature (and other abiotic factors) can vary between nearby sites (thermal refugia).
- We should expect to see variability (timing and/or intensity) in the effects of climate change in nearby sites.
- We should increase the spatial resolution of monitoring in transitional areas.

More info at:

juliolorda.org

mex-cal.org

trnerr.org