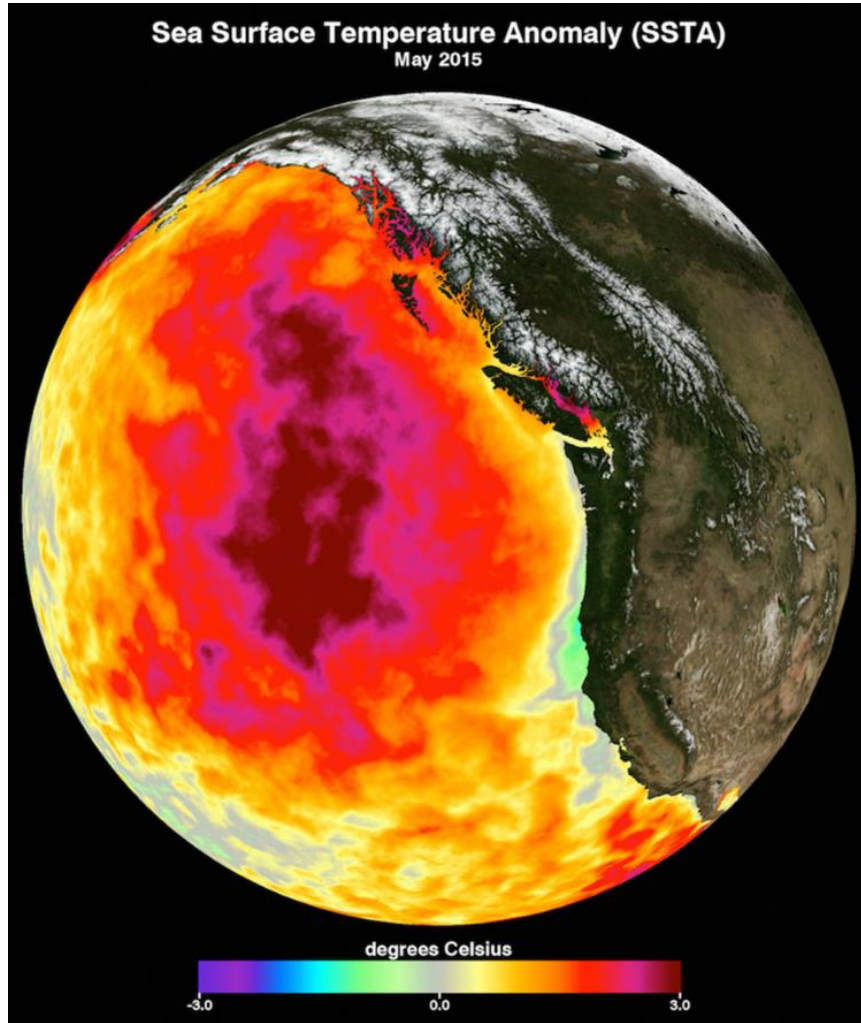


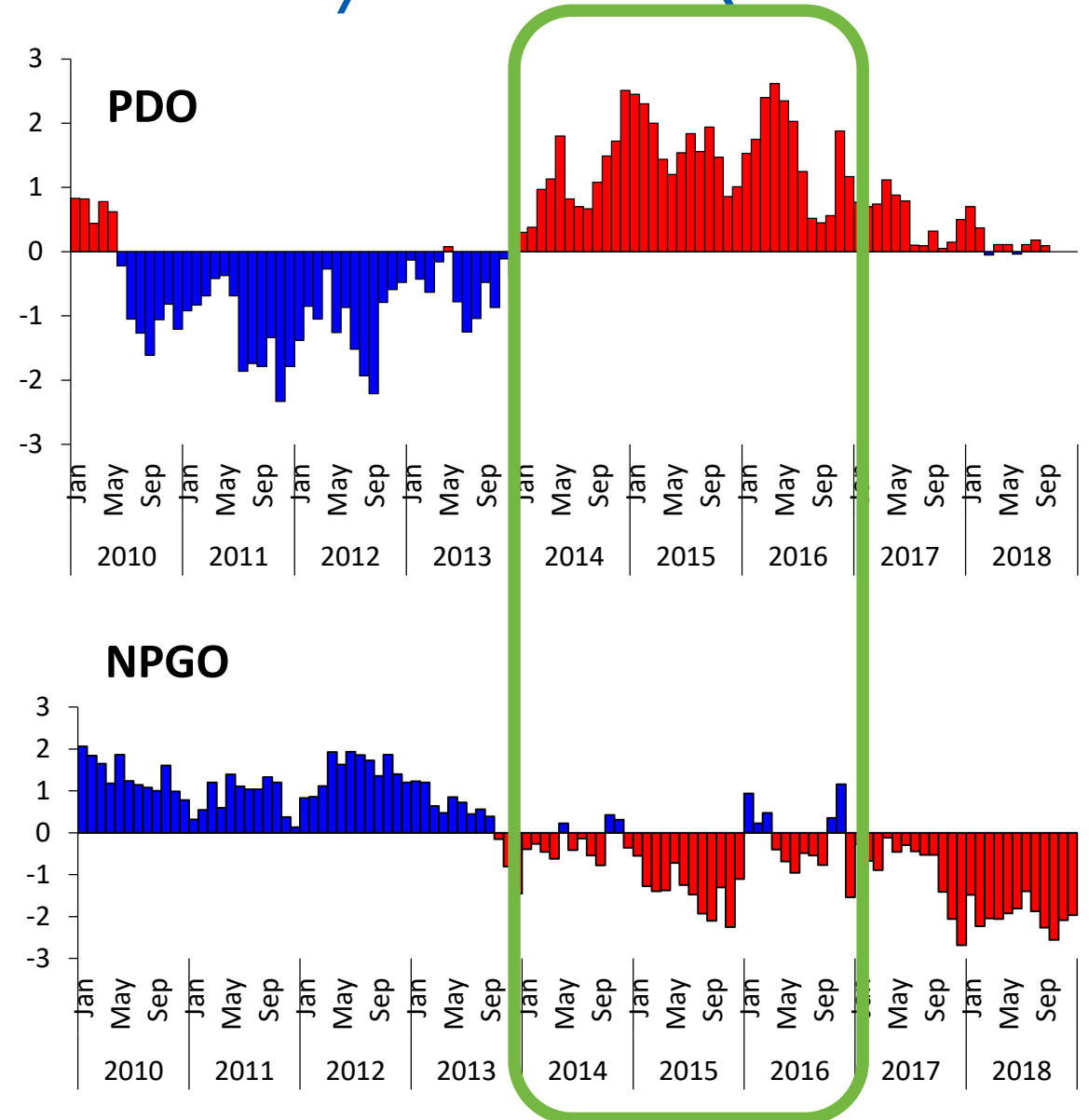
# The 2014-16 North Pacific marine heatwave's impacts on the marine ecosystem in central California, USA

Meredith L. Elliott, Jaime Jahncke, Danielle Lipski, and Jan Roletto  
PICES Conference, 10/22/2019

# North Pacific marine heatwave/El Niño (2014-16)



Gentemann et al. 2017. *Geophysical Research Letters* 44.1, 312.



# Goal

Show the oceanographic changes in the central California Current ecosystem during the North Pacific marine heatwave of 2014-16

## ACCESS

Research that supports marine wildlife conservation and healthy marine ecosystems to inform management, policy and conservation in central CA

**Founders:**



# ACCESS

Research that supports marine wildlife conservation and healthy marine ecosystems to inform management, policy and conservation in central CA

## Founders:



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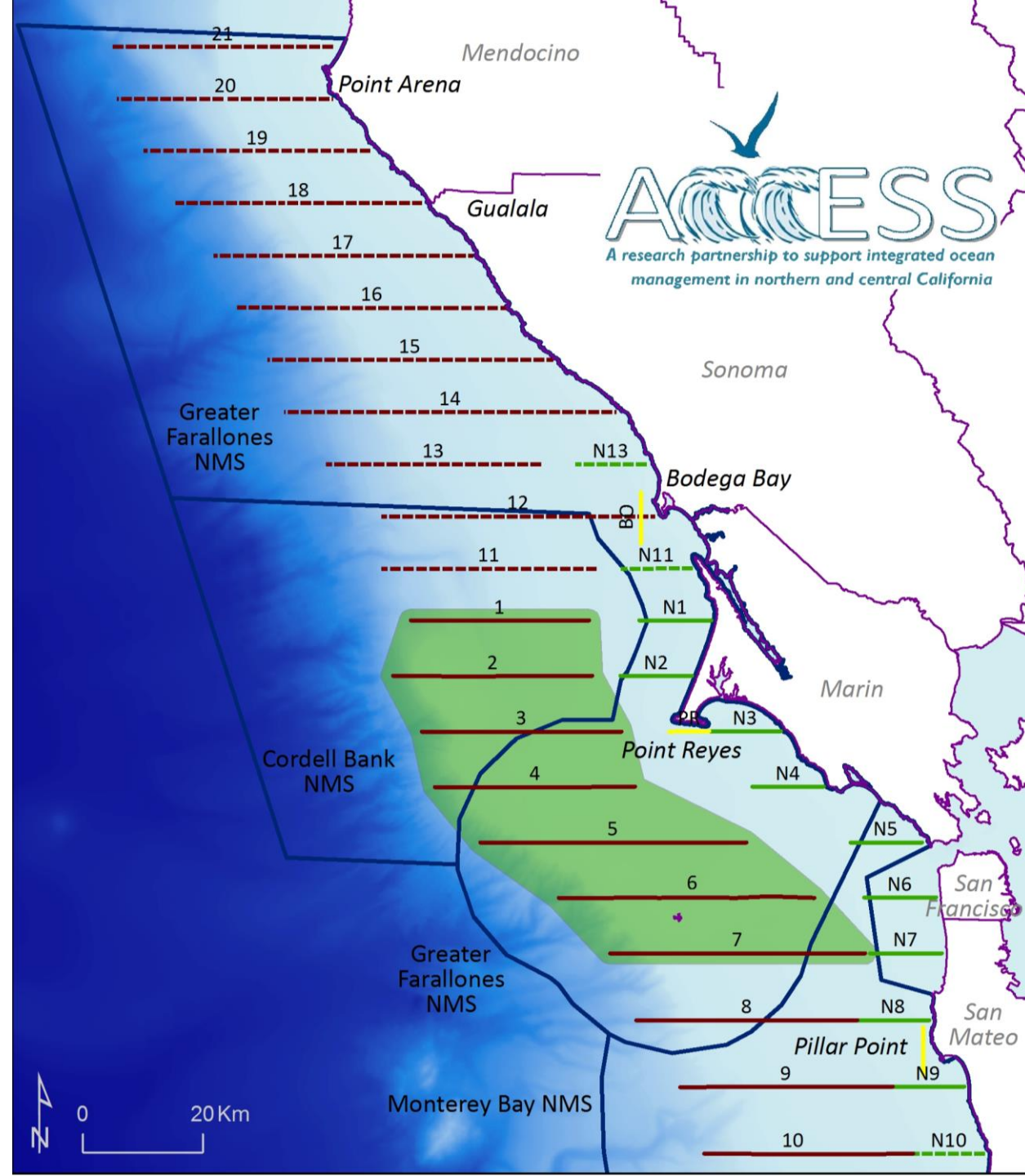
HAWAII PACIFIC UNIVERSITY  
HOLA IUA ME KA OIHO



POMONA COLLEGE



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# Research takes ecosystem approach

## Birds & mammals

- Standardized strip and line transects



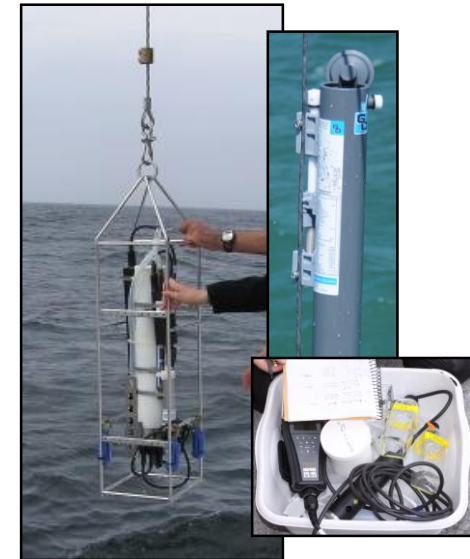
## Zooplankton, fish, & phytoplankton

- Hydroacoustics
- Nets

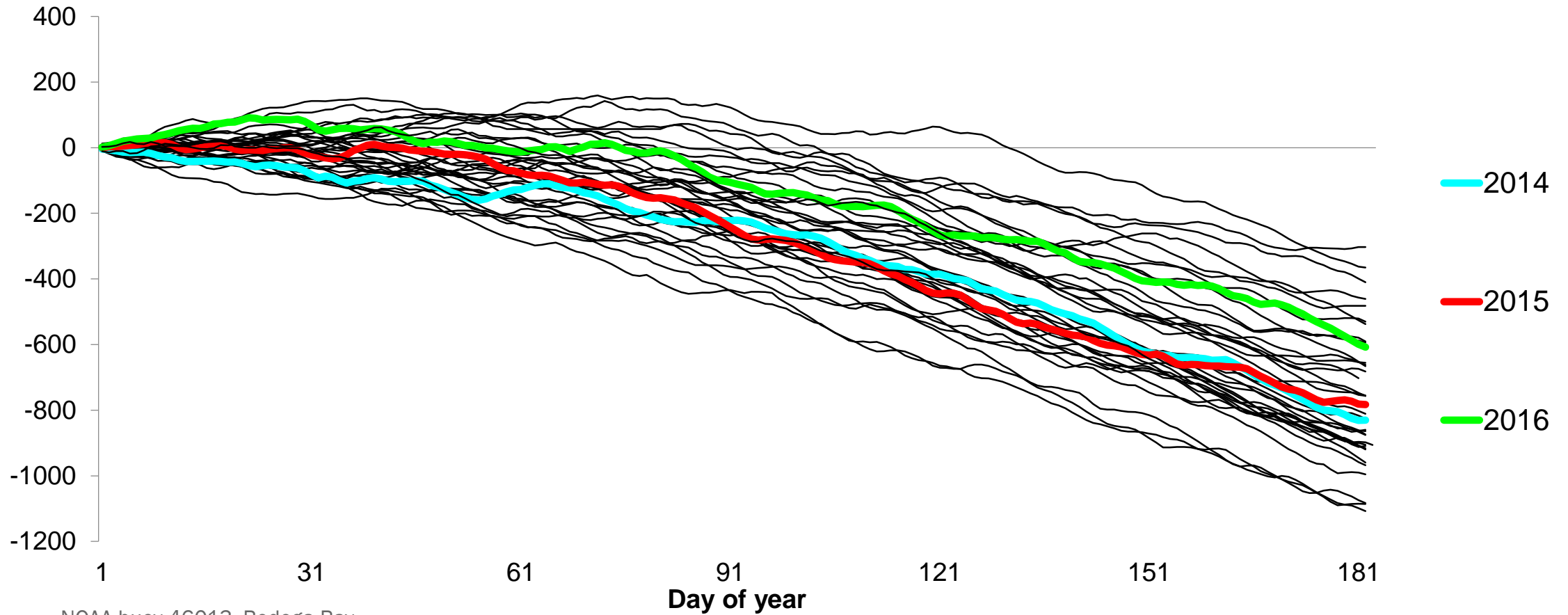


## Oceanography

- CTD
- Ocean acidification
- Nutrients
- Continuous TSG



# Variable alongshore winds

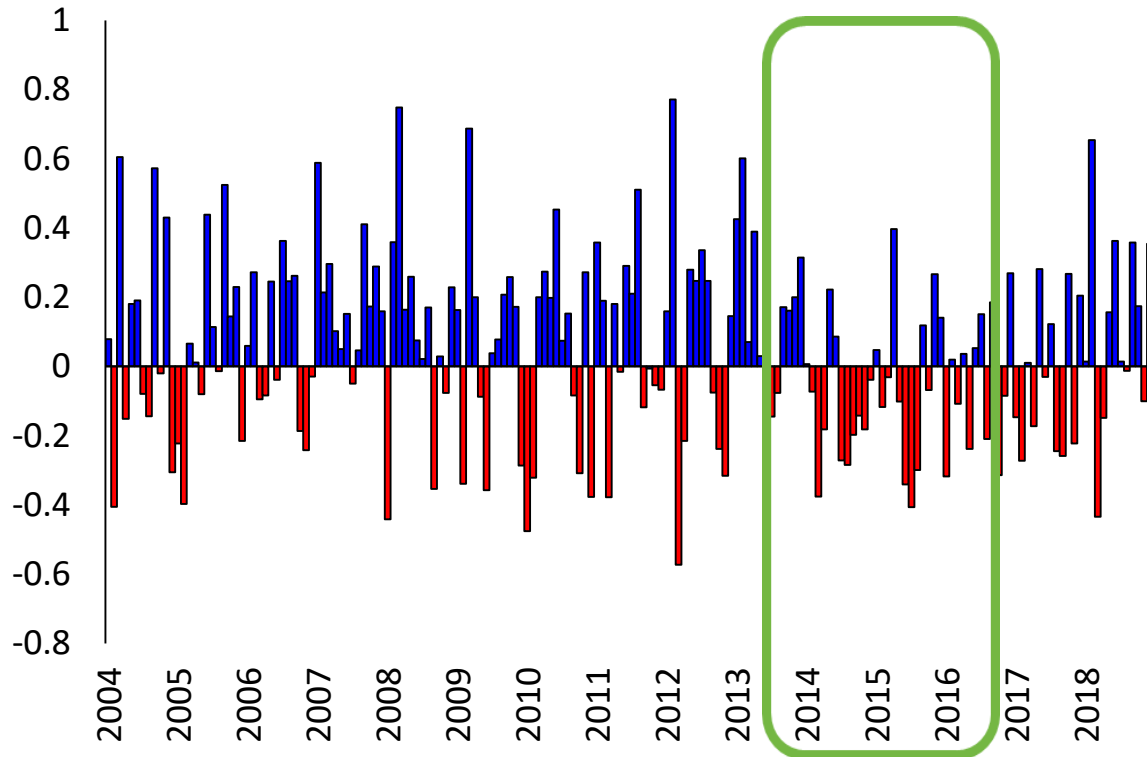


NOAA buoy 46013, Bodega Bay

[https://www.ndbc.noaa.gov/station\\_history.php?station=46013](https://www.ndbc.noaa.gov/station_history.php?station=46013)

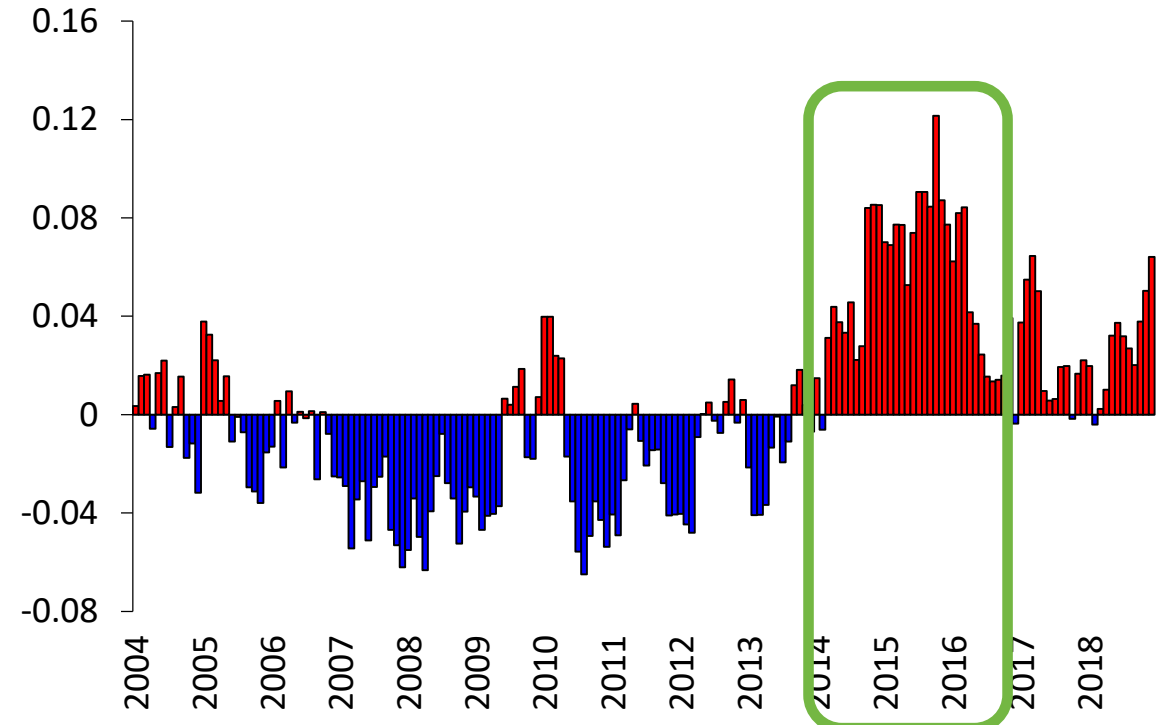
# Weak upwelling

## Weak upwelling



Coastal Upwelling Transport Index  
<http://mjacox.com/upwelling-indices/>

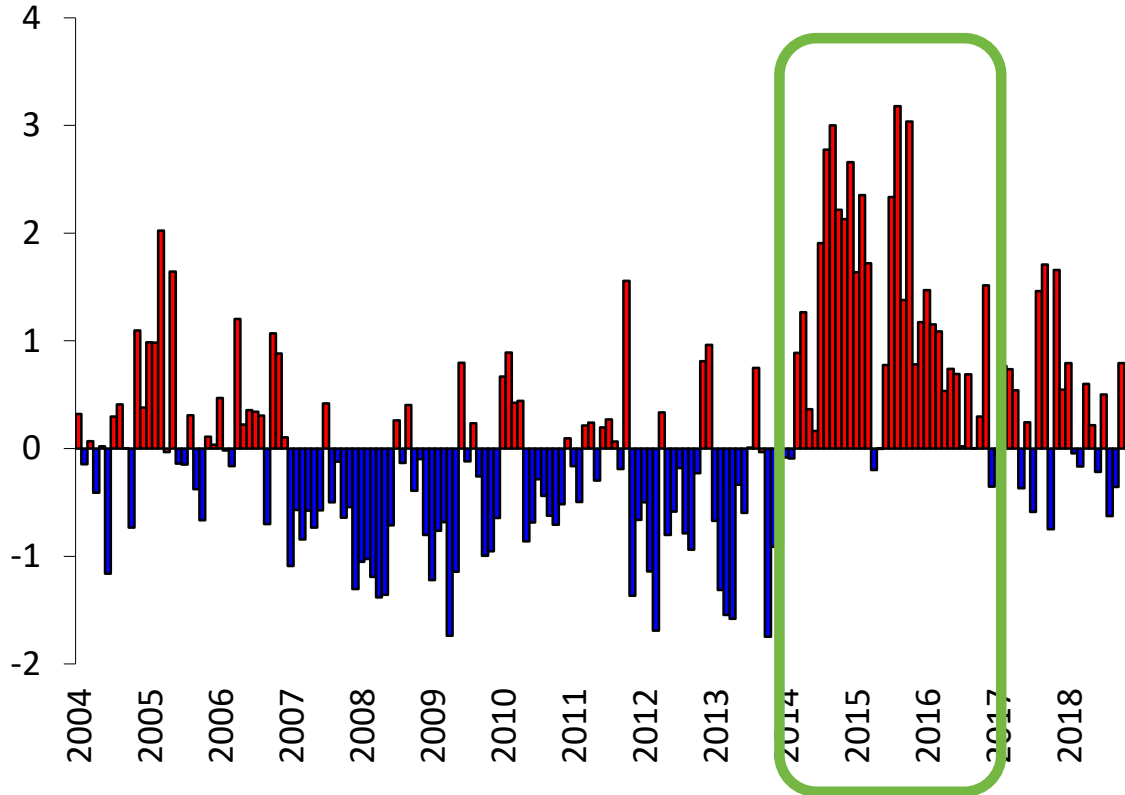
## High sea level heights (i.e., downwelling conditions)



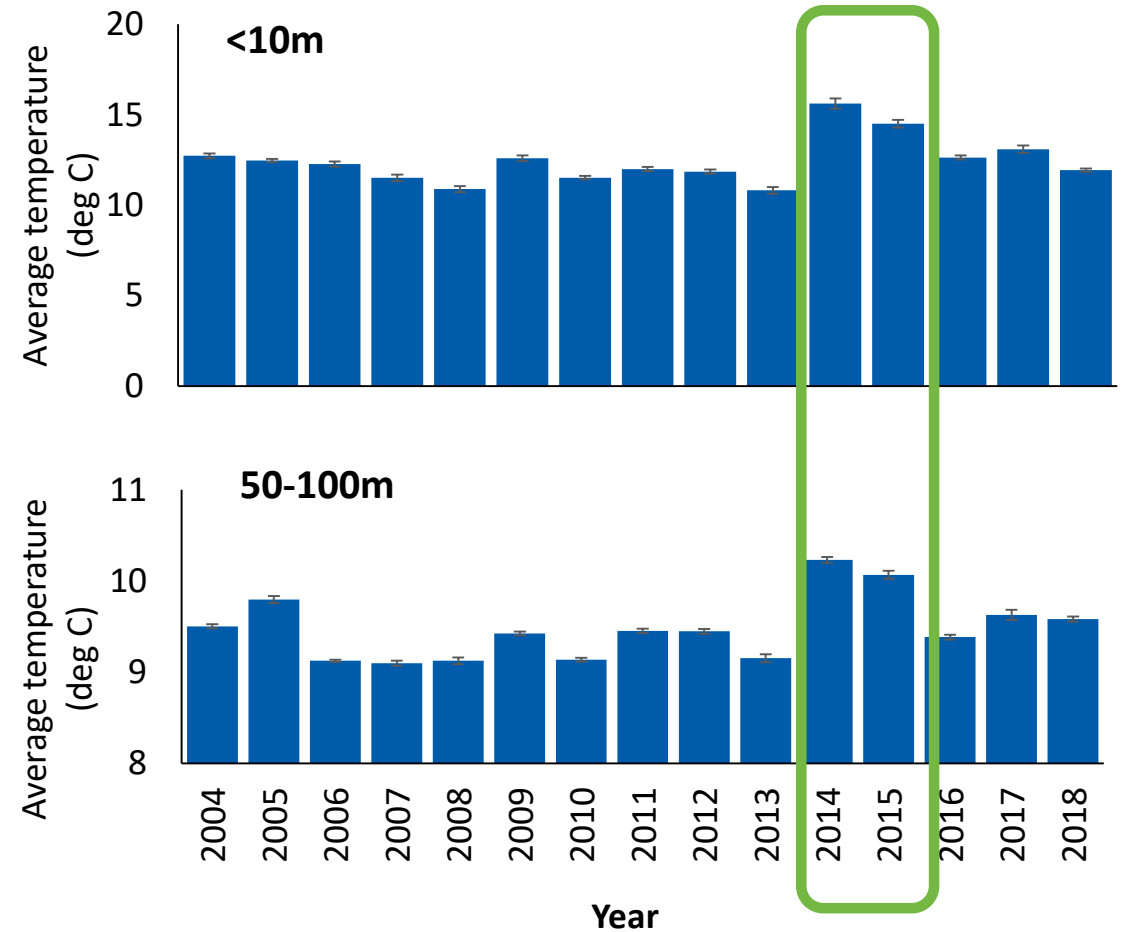
Sea level height data from satellites (<http://marine.copernicus.eu/>)

# Warm ocean temperatures

## Regional - Warm SSTs



## CTD - Warm waters at surface & depth

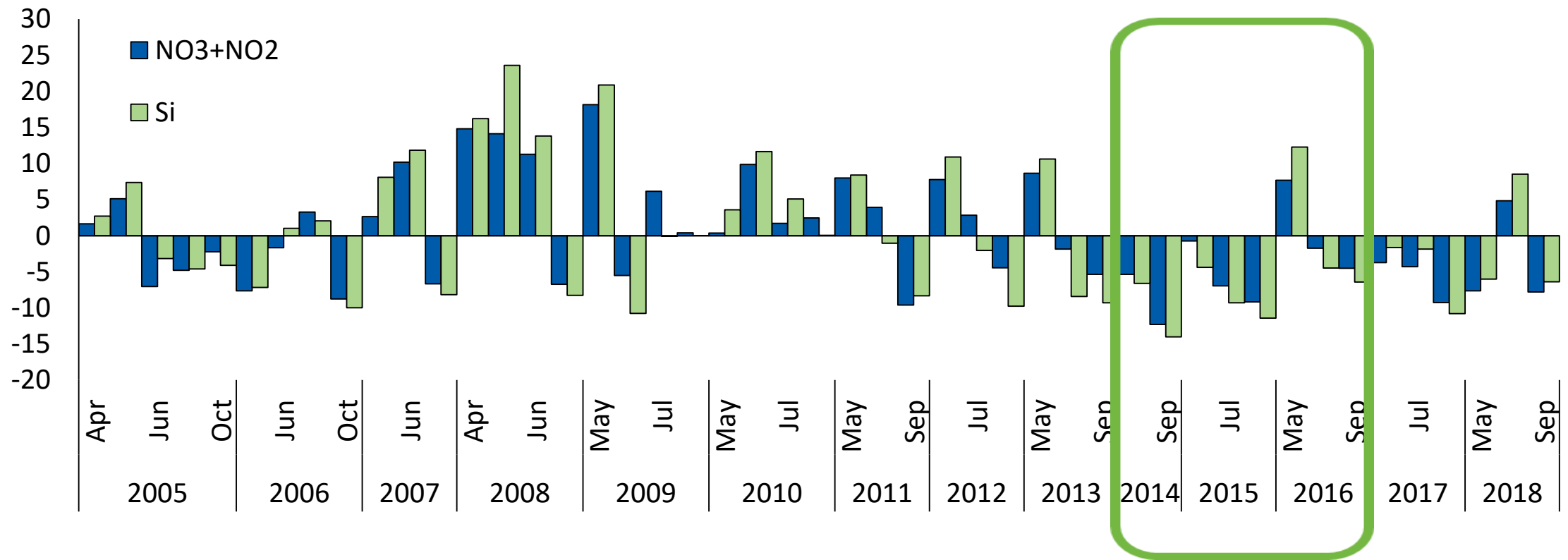


SST data collected from Farallon Islands  
(<https://shoestations.ucsd.edu/shore-stations-data/data-farallon/>)



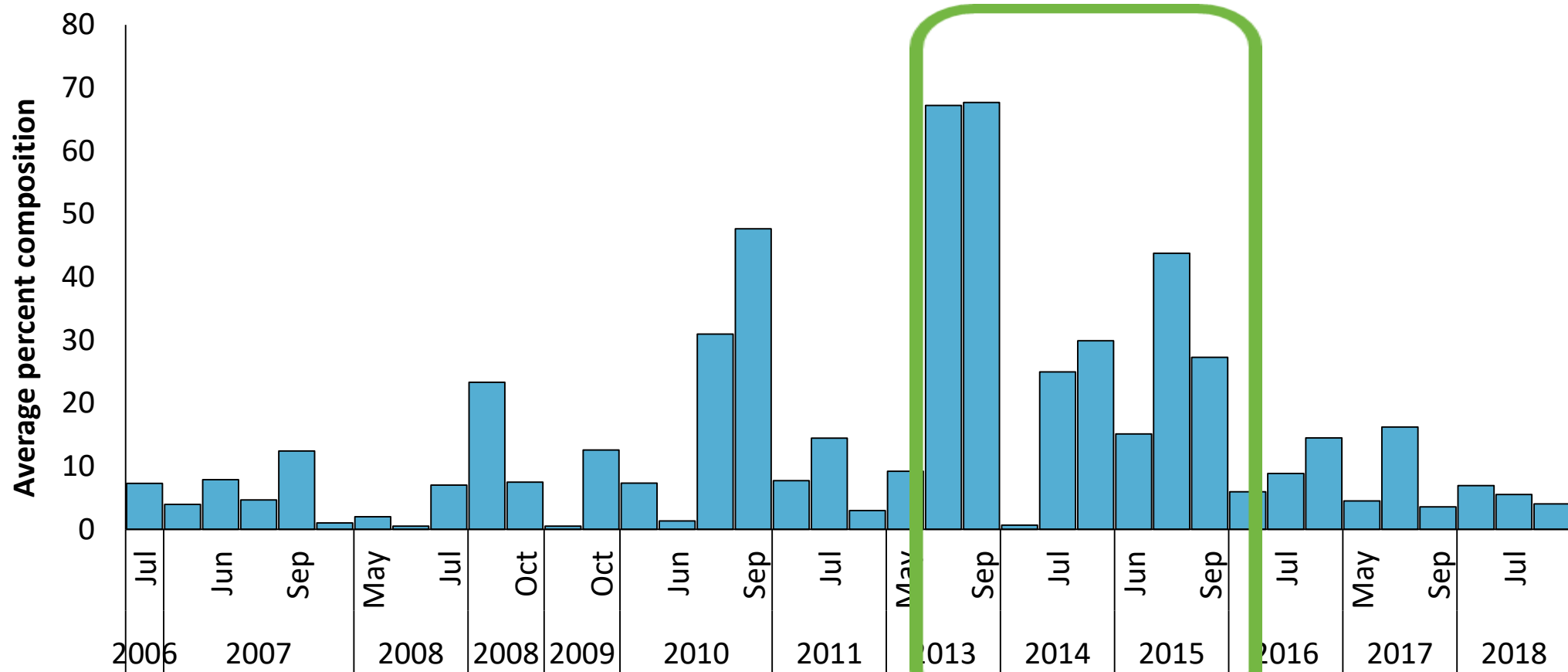
# Low nutrient concentrations

Nitrates, nitrites, and silicates



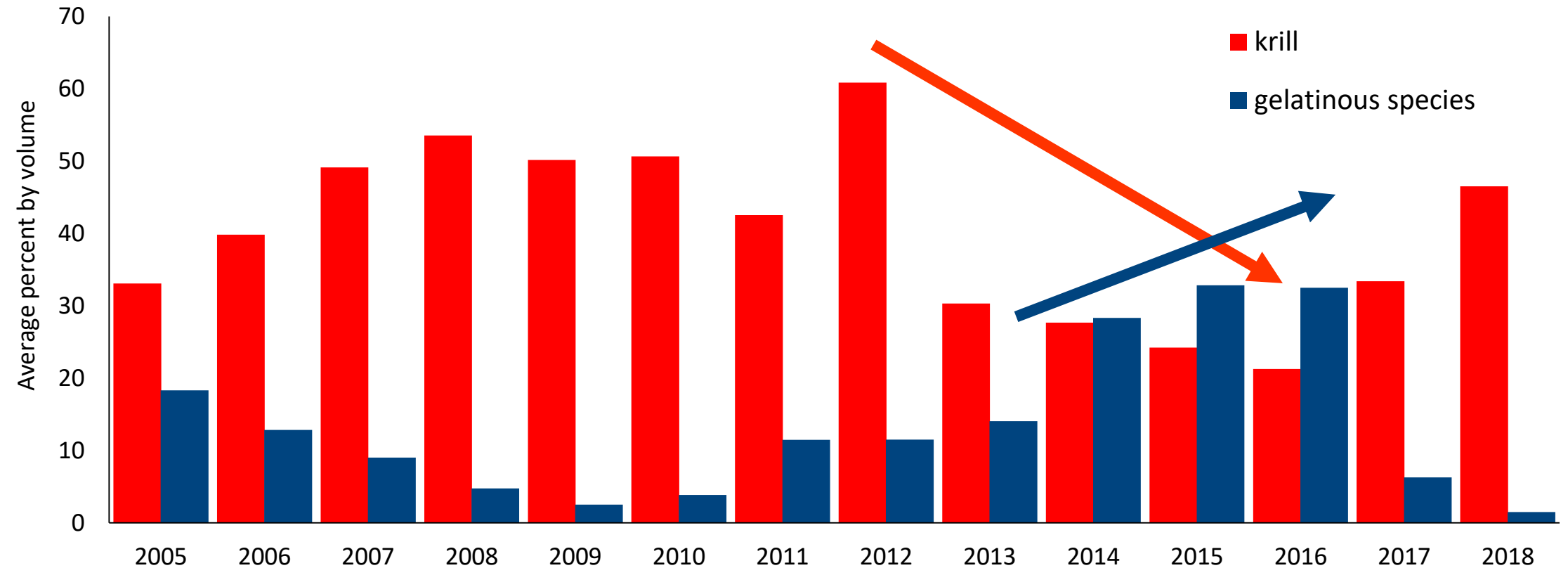
# High composition of *Pseudo-nitzschia* species

Spring/summer (May-July) and fall (Sept-Oct)



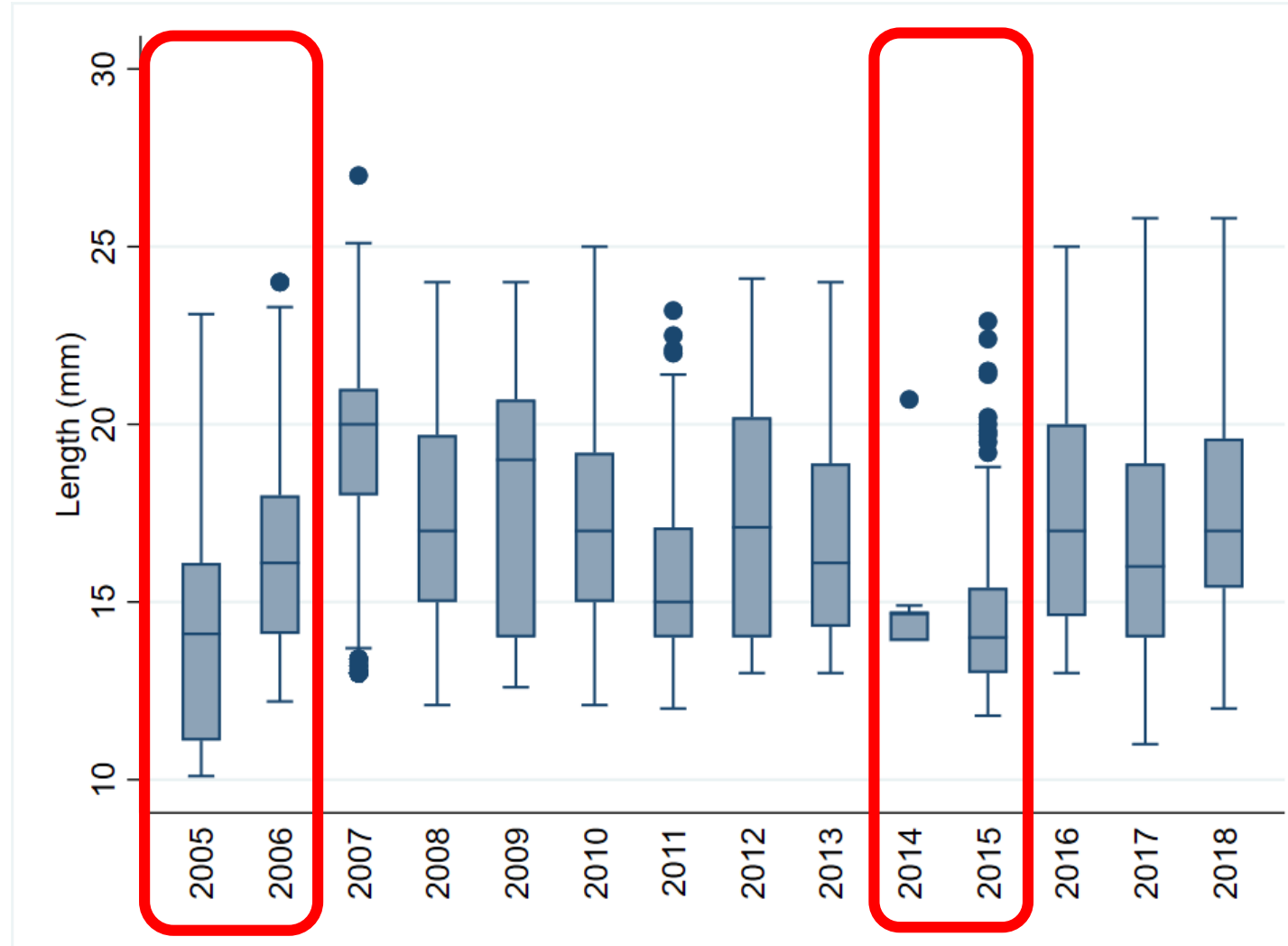
# Increase in gelatinous species

May-July Tucker trawl samples

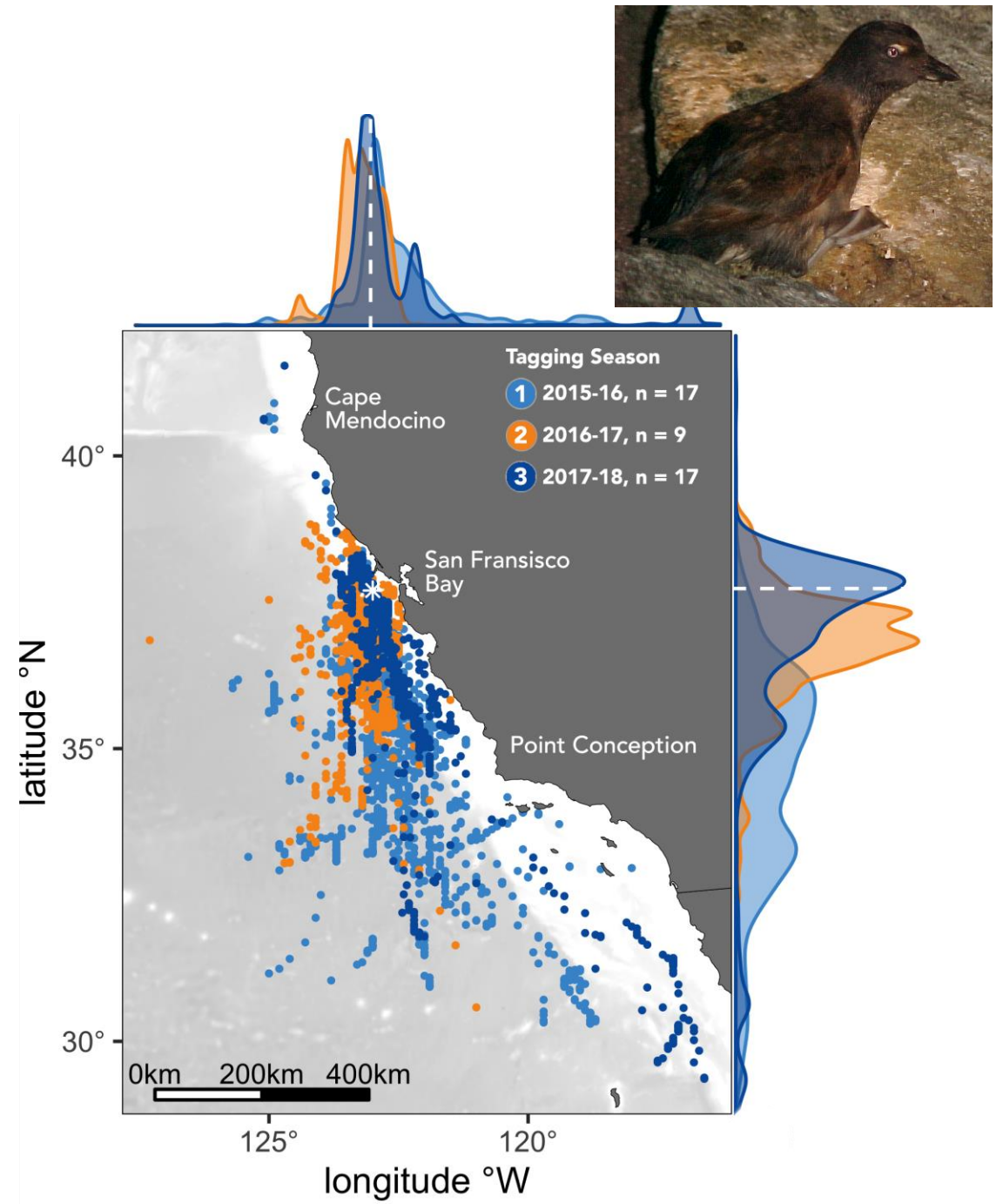
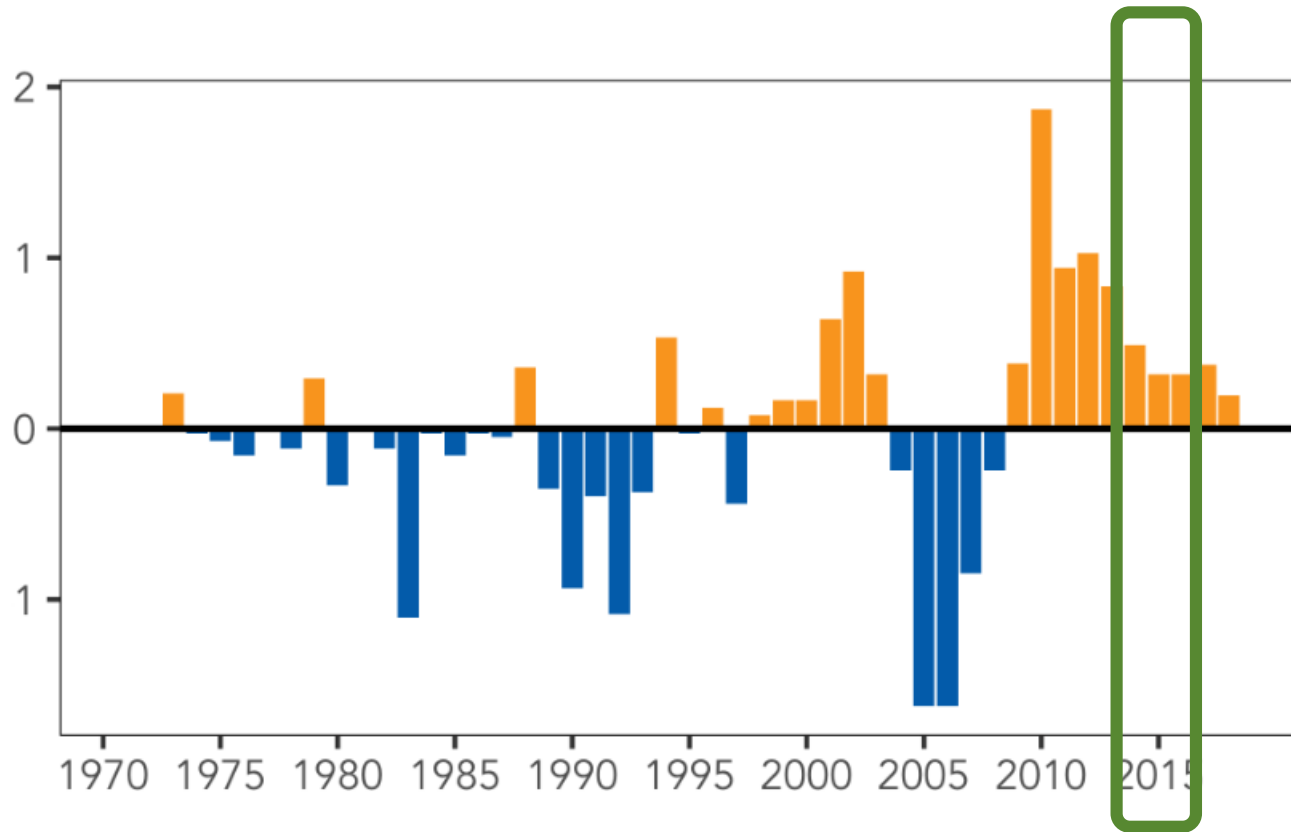


# Smaller krill

*Euphausia pacifica* adults, May-July Tucker trawl samples

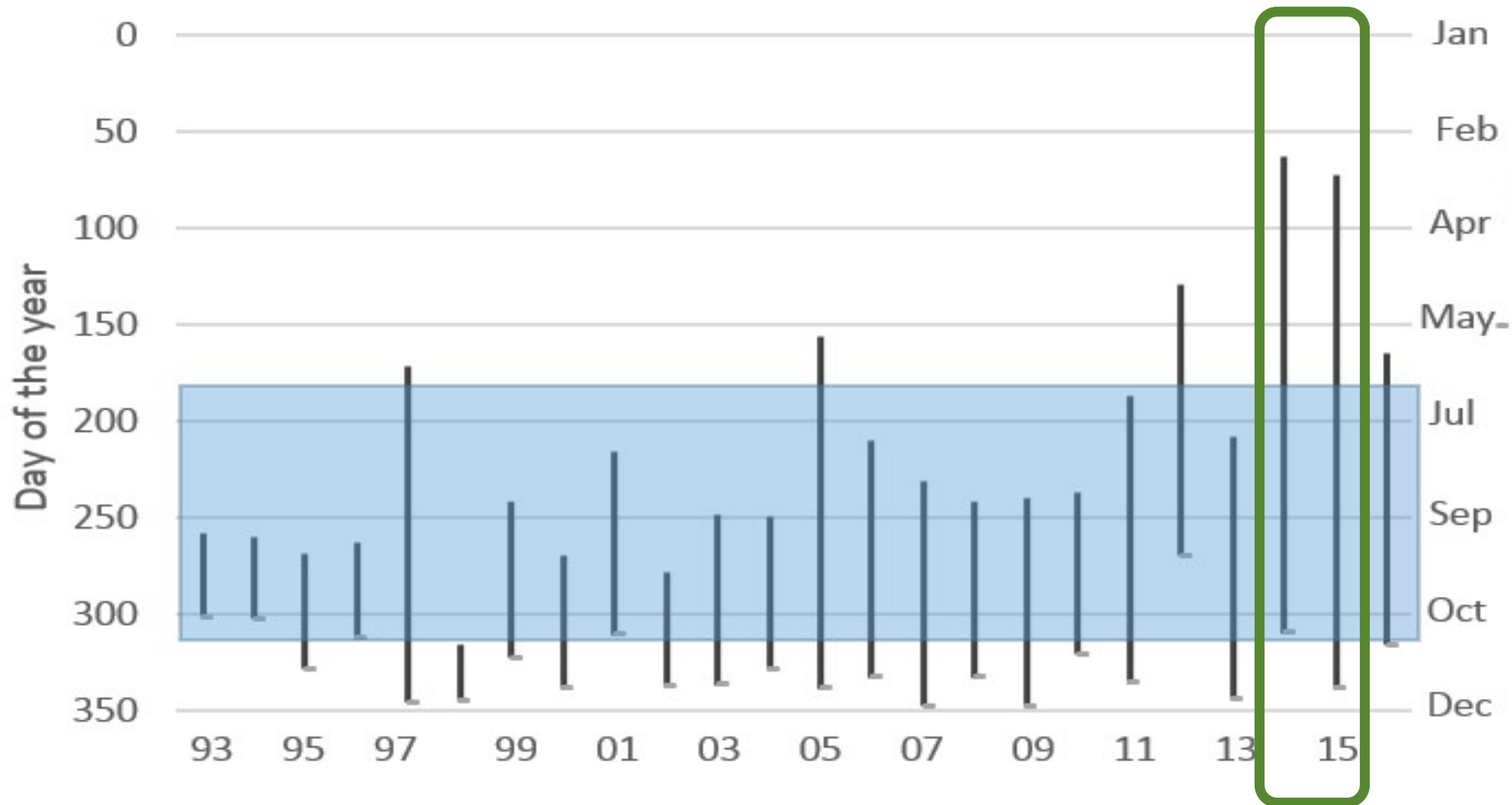


# Cassin's auklets



# Humpback whales are arriving earlier

Earlier arrival of whales = longer exposure period to fishing gear



Crab fishing  
**CLOSED**

# Conclusions

During the 2014-16 North Pacific marine heatwave, the central California Current was characterized by some typical warm water conditions:

- Weak upwelling conditions, warm ocean temperatures
- Low nutrient concentrations
- Higher compositions of domoic acid-producing phytoplankton
- Smaller krill, more gelatinous zooplankton

However, effects on some marine wildlife were not so bad:

- Cassin's auklet productivity was good (but wider foraging distribution in winter)
- Increase in whale numbers (but more entanglements)

New marine heatwave in the making.....?

# Thank you!

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