

# NOAA's California Current Integrated Ecosystem Assessment: indicators of climate change and indicators of risk.

Moving from single species stock assessments to an ecosystem integrated approach, as well as providing resource and protected species managers with the information they need.

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NOAA/NMFS/SWFSC

CalEPA: Indicators of Climate Change in California  
June 17, 2015  
Sacramento, CA

http://www.noaa.gov/iea/CCIEA-Report/pdf/index.html



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[CCIEA Report >> pdf](#)

Detailed reports and PDFs 

Each 2012 and 2013 report chapter is available as a separate PDF document, accessible below.

[2013 Report Overview and synthesis.](#)

[Primary report chapters and appendices](#)

[Anthropogenic drivers 2013](#)

[Ocean and climate drivers 2013](#)

[Ecological integrity 2013](#)

[Ecological Integrity Indicator 2013 Appendix EI](#)

[Coastal pelagics and forage fish 2013](#)

[Coastal pelagics indicator evaluation 2013 Appendix](#)

[Groundfish 2013](#)

[Salmon 2013](#)

[Habitat 2013](#)

[Human dimensions 2013](#)

[Human dimensions 2013 Appendix HD](#)

[Risk assessments](#)

[Coastal pelagics and climate risk 2013](#)

[Pelagic predator risk 2013](#)

[Seabird risk 2013 \[in progress\]](#)

[Management testing scenarios](#)

[Management strategy evaluation overview: Climate change 2013](#)

[MS2013-01 Climate change and ocean acidification 2013](#)

[MS2013-02 Snake River Chinook and climate change 2013](#)

[MS2013-03 Ocean conditions and Wenatchee River Chinook 2013](#)

[MS2013-04 ECOTRAN model output: Pelagic ecosystem scenarios 2013](#)


[MS2013-05 Ocean acidification risk to crustaceans 2013](#)

[MS2013-06 West coast shipping scenarios 2013](#)


[MS2013-07 Risk of ship strikes to whales 2013](#)


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<http://oceanview.pfeg.noaa.gov/cciea-table/>

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Totals:	164	199

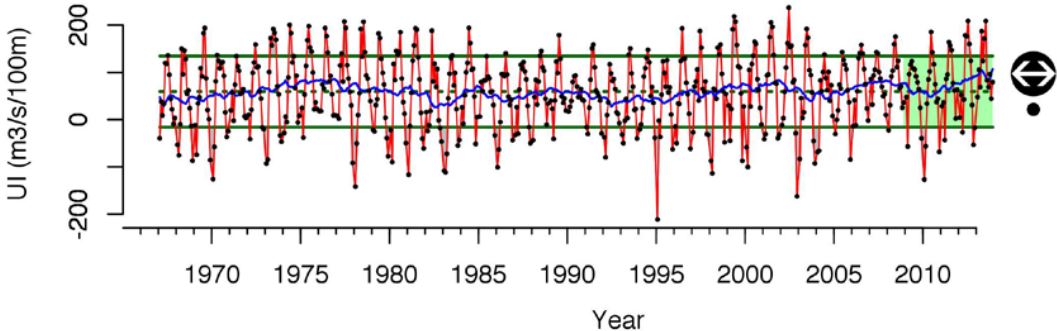
## Physical, Chemical and Climate Indicators

Indicator	Site	Monthly Trend	Status	Winter Trend	Status	Summer Trend	Status	
Multivariate El Nino Index	basin-scale	↔	●	↔	●	↔	●	↕
Northern Oscillation Index	basin-scale	↔	●	↗	●	↔	●	↕
North Pacific Gyre Oscillation	basin-scale	↔	+	↔	●	↔	●	↕
Pacific Decadal Oscillation	basin-scale	↔	●	↔	●	↔	●	↕
Eddy Kinetic Energy	45N	↘	●	↔	●	↘	●	↕
	39N	↔	●	↔	●	↔	●	↕
	33N	↔	●	↔	●	↔	●	↕
Upwelling Index	45N	↔	●	↔	●	↗	●	↕
	39N	↔	●	↗	●	↗	●	↕
	33N	↔	●	↔	●	↗	●	↕
Sea Level Height	South Beach, OR	↔	●	↘	●	↔	●	↕
	San Francisco	↔	●	↔	●	↔	●	↕
	San Diego	↔	●	↔	●	↔	●	↕
Sea Surface Temperature	NOAA Buoy 46050	↔	●	↔	●	↔	●	↕
	NOAA Buoy 46014	↔	●	↘	●	↘	●	↕
	NOAA Buoy 46025	↔	●	↔	●	↘	●	↕
Meridional Winds	NOAA Buoy 46050	↔	●	↔	●	↔	●	↕
	NOAA Buoy 46014	↔	●	↘	●	↘	●	↕
	NOAA Buoy 46025	↔	●	↔	●	↘	●	↕
Pycnocline Depth	NH25	↘	●	↔	●	↘	●	↕
	CalCOFI 67.55	↔	●	↔	●	↘	●	↕
	CalCOFI 93.30	↔	●	↔	●	↔	●	↕
Pycnocline Strength	NH25	↔	●	↗	●	↘	●	↕
	CalCOFI 67.55	↔	●	↔	●	↘	●	↕
	CalCOFI 93.30	↔	●	↔	●	↘	●	↕
NO2 + NO3 @150m	NH25	↔	●	↔	●	↔	●	↕
	CalCOFI 67.55	↔	●	↗	●	↗	●	↕

	33N	↔	•	↔	•	↔	•	▼
Upwelling Index	45N	↔	•	↔	•	↗	•	▼
	39N	↔	•	↗	•	↗	•	▲

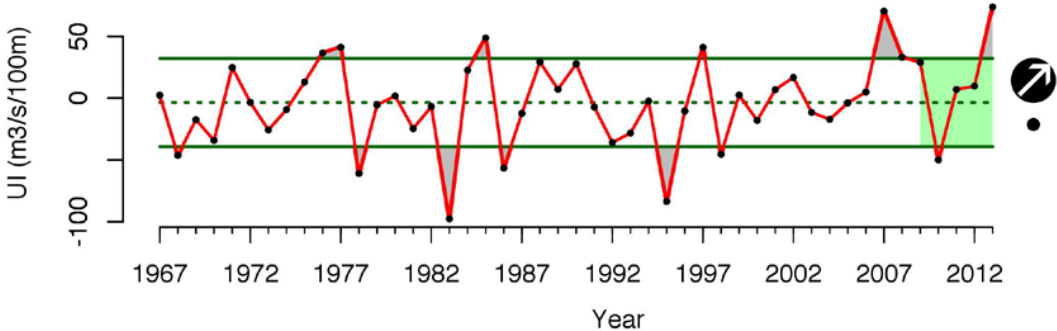
Text goes here

Monthly Upwelling Index: UI39 (39N 125W)

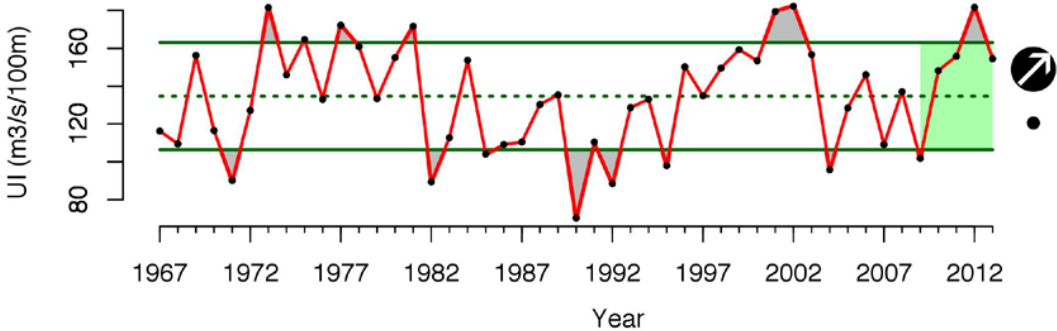


There will be explanatory text alongside each plot.

Winter Upwelling Index: UI39 (39N 125W)



Summer Upwelling Index: UI39 (39N 125W)



The user will be able to customize any plot.

[link to custom plotting](#)



There are two parts to coastal ocean temperatures, local and basin-scale

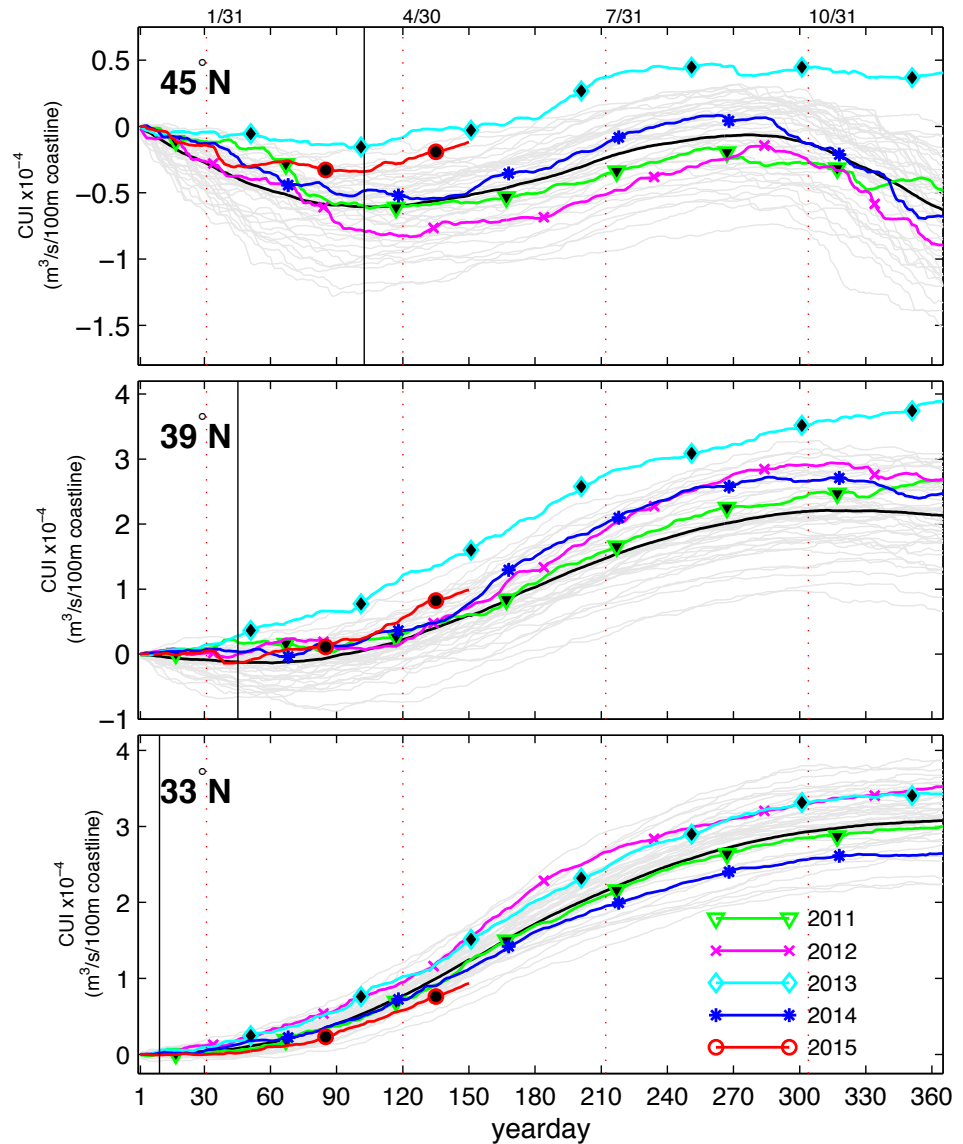
Bakun Cumulative Upwelling Index at 45°N, 39°N & 33°N provides local influence

Upwelling is really important for local coastal conditions and three factors are important:

- 1) the upwelling start date
- 2) the upwelling strength,
- 3) and the upwelling duration.

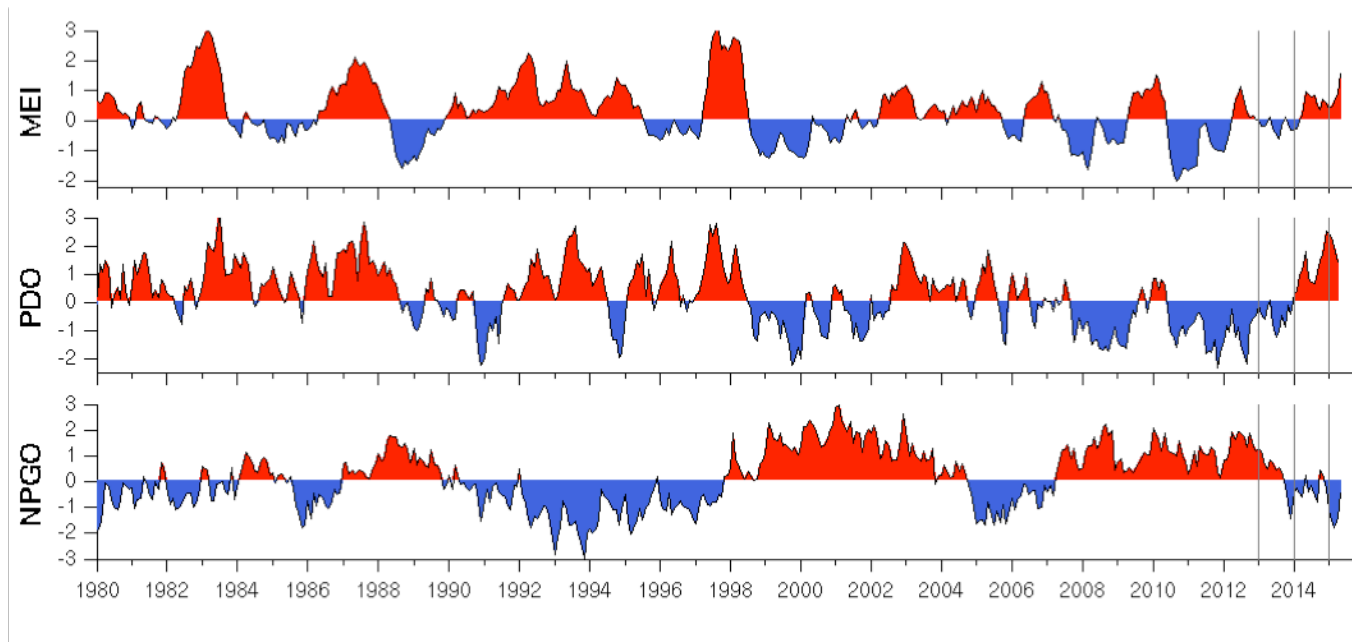
Upwelling impacts the nutrient supply, the oxygen concentration and the ocean acidity.

Note that the scales are not the same for the three areas, off WA/OR, north of San Francisco, and SoCal bight.



The “basin-scale” indices are all pointing to warmer, less productive condition sin the California Current System.

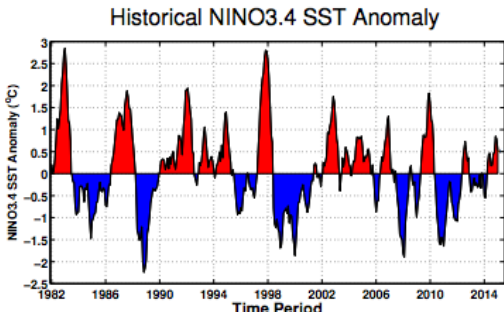
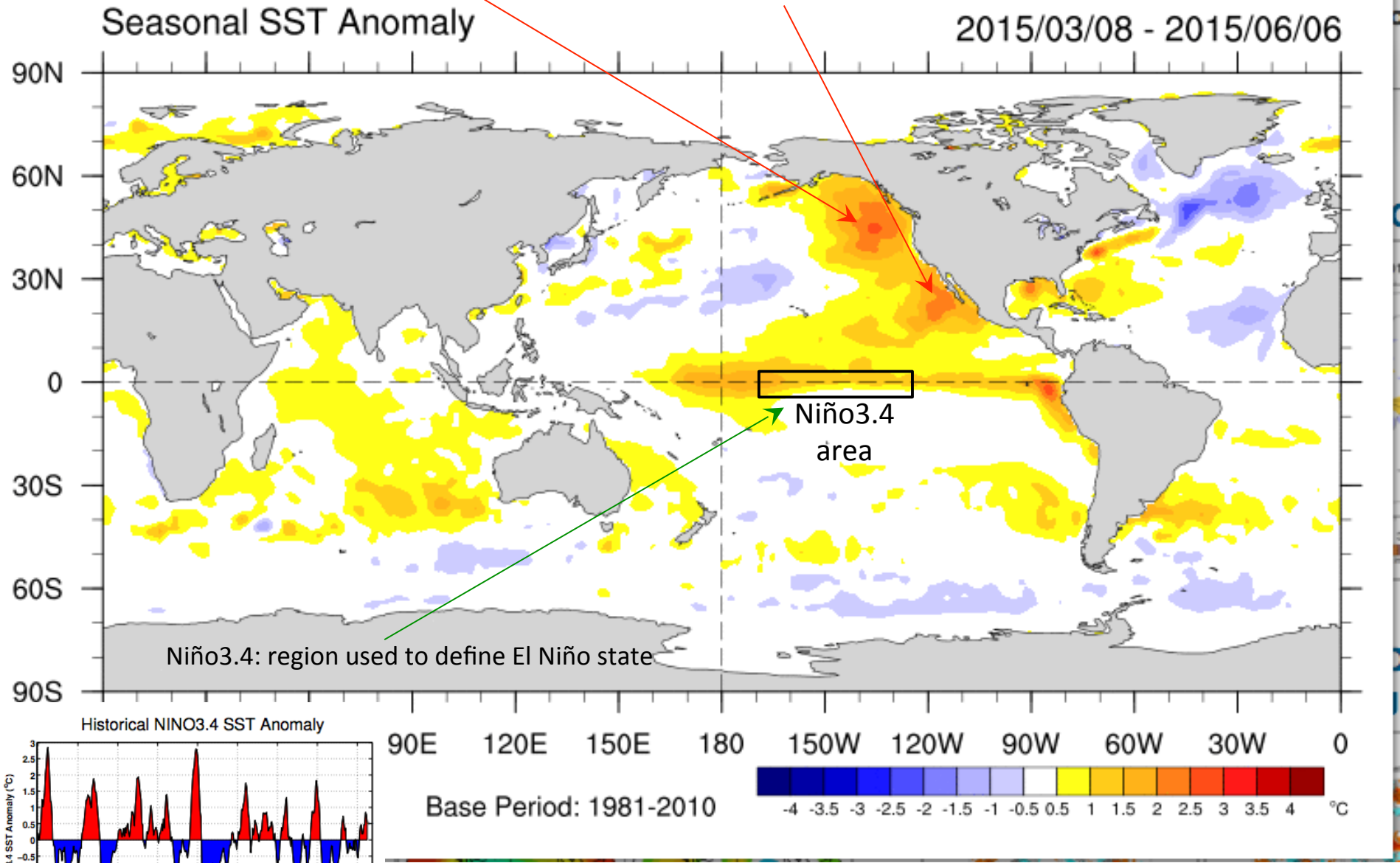
That said, some species take advantage of these conditions.



Positive MEI & PDO and negative NPGO all suggest warmer and less productive activity in the CCS.

# Eastern Pacific sea surface temperatures (SST) were (and are) anomalously warm in 2014-2015

The Gulf of Alaska and the ocean off Baja California were  $>3^{\circ}\text{C}$  warmer than average

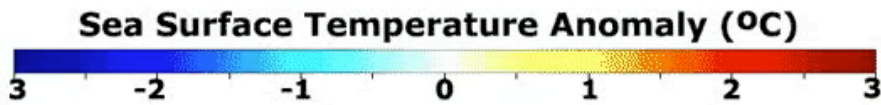
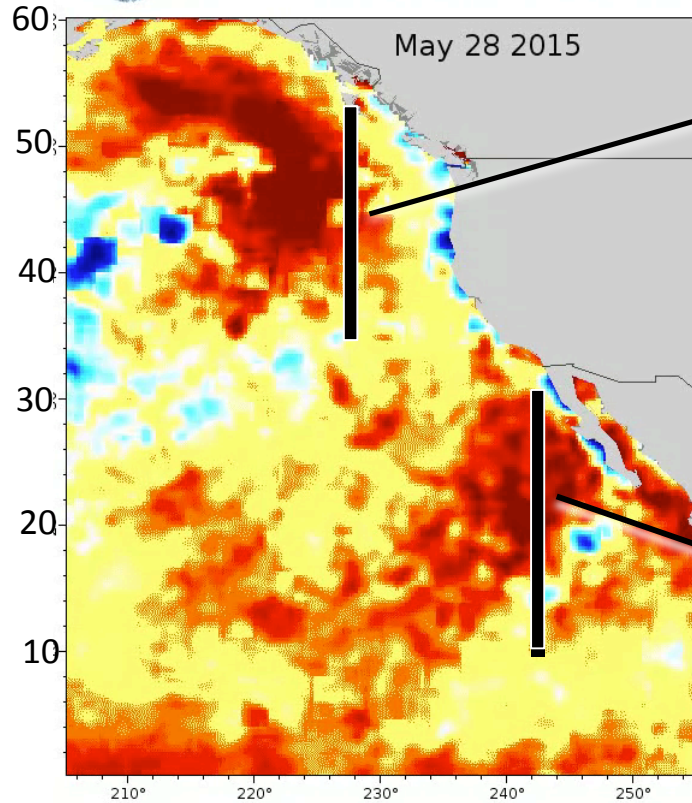


Conditions along the equator were within normal ranges, warm in the west and cooler in the east.

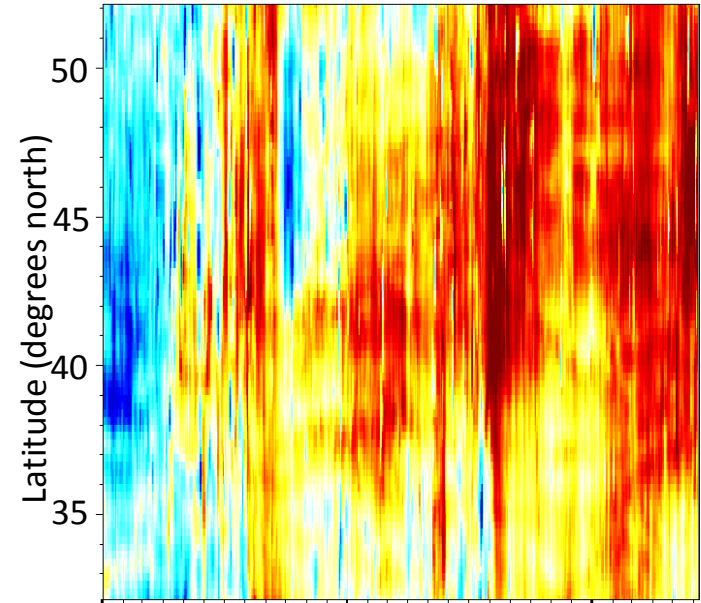


# Capturing the two warm anomalies

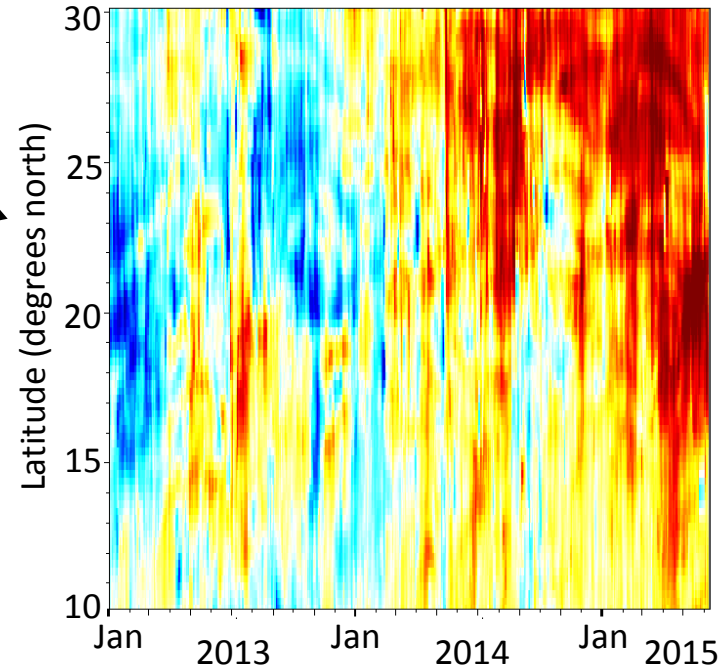
 **NOAA** COASTWATCH  
WEST COAST REGIONAL NODE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



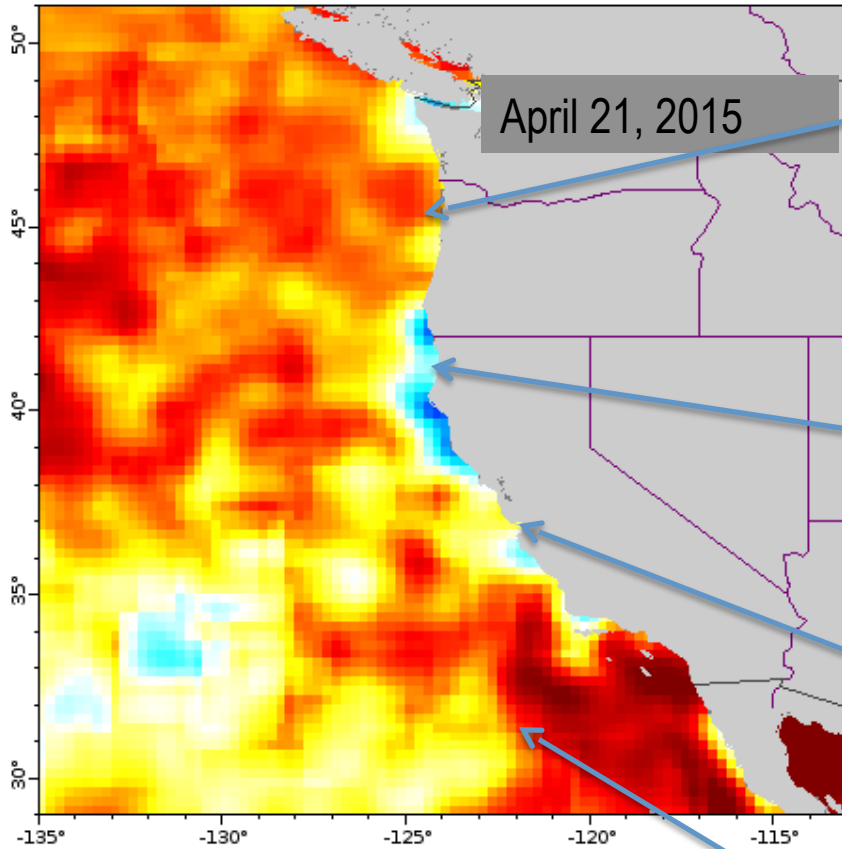
Off US West Coast at 135° W Longitude



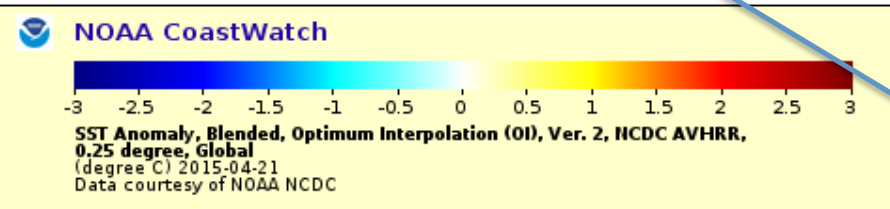
Off Baja at 118° W Longitude



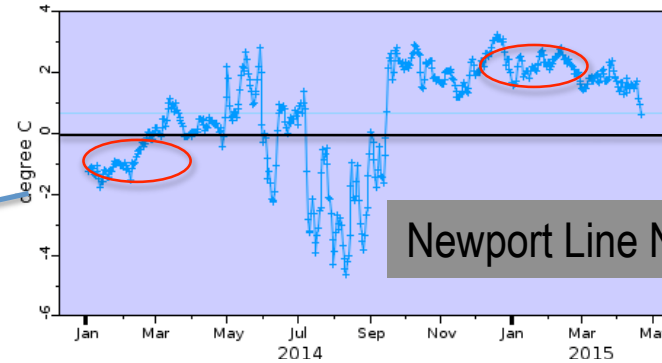
# 2014/15 SST anomaly



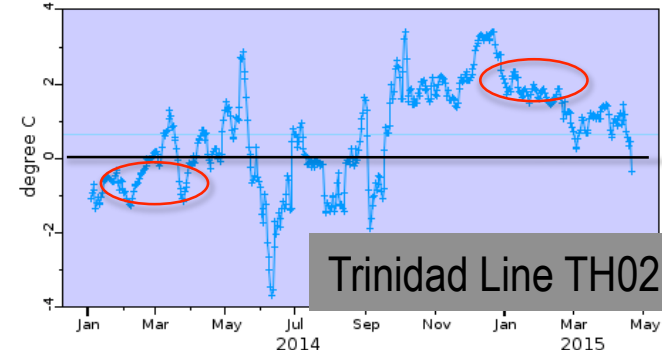
April 21, 2015



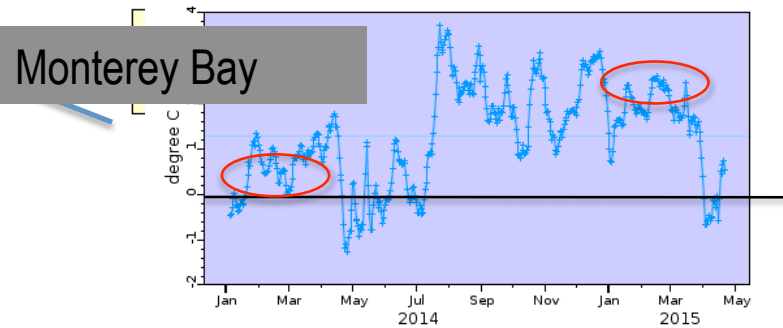
It's early to describe this spring's upwelling, but the winter ocean was much warmer.



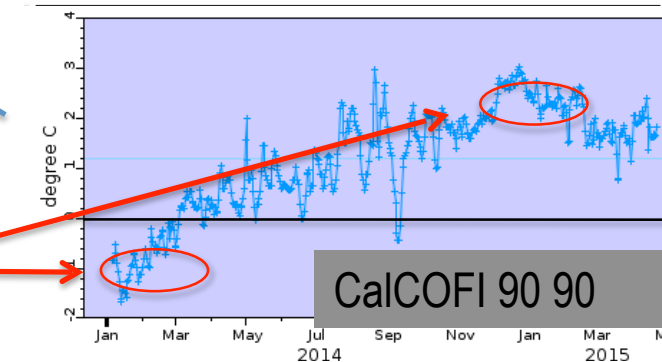
Newport Line NH20



Trinidad Line TH02



Monterey Bay



CalCOFI 90 90

# IRI/CPC Pacific Niño 3.4 SST Model Outlook

Almost all of the models indicate Niño 3.4 SST anomalies will remain greater than or equal to +0.5C through the end of 2015.

However, there is a large amount of spread in the potential strength of El Niño.

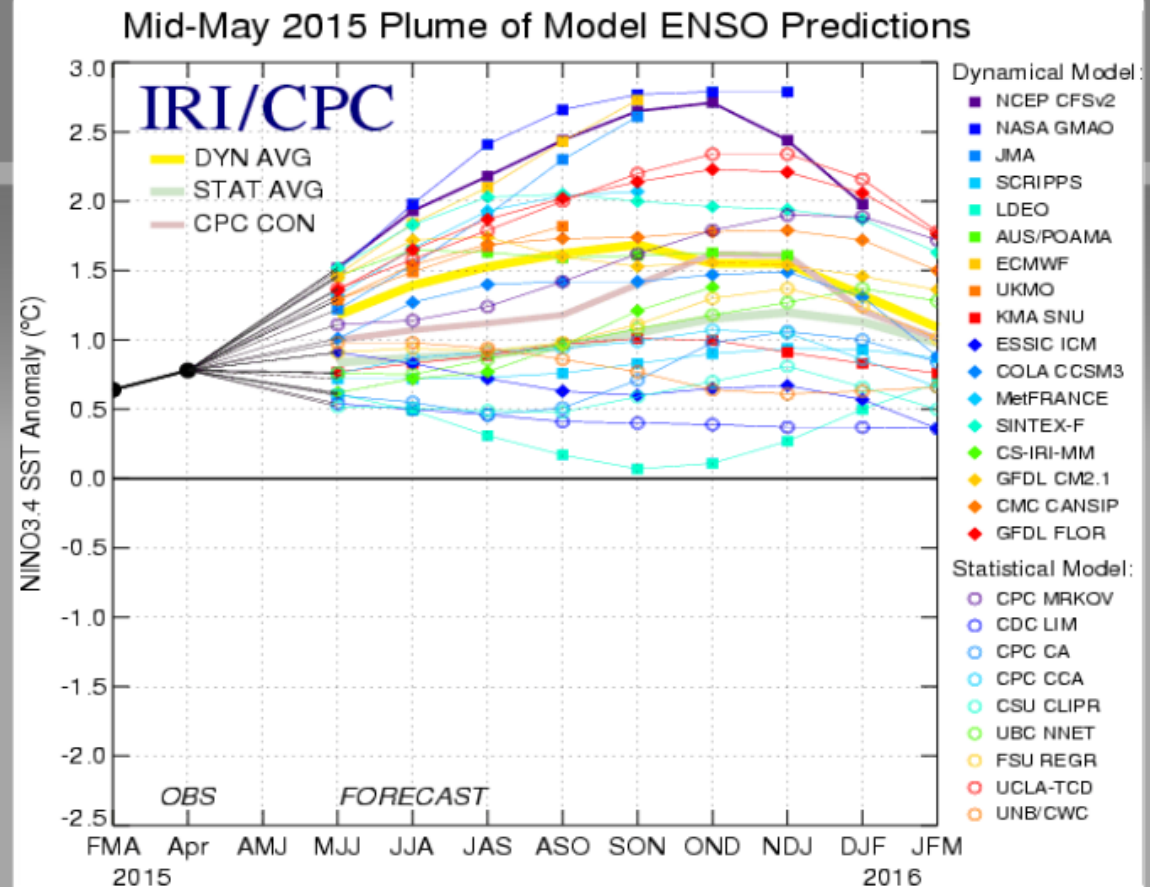
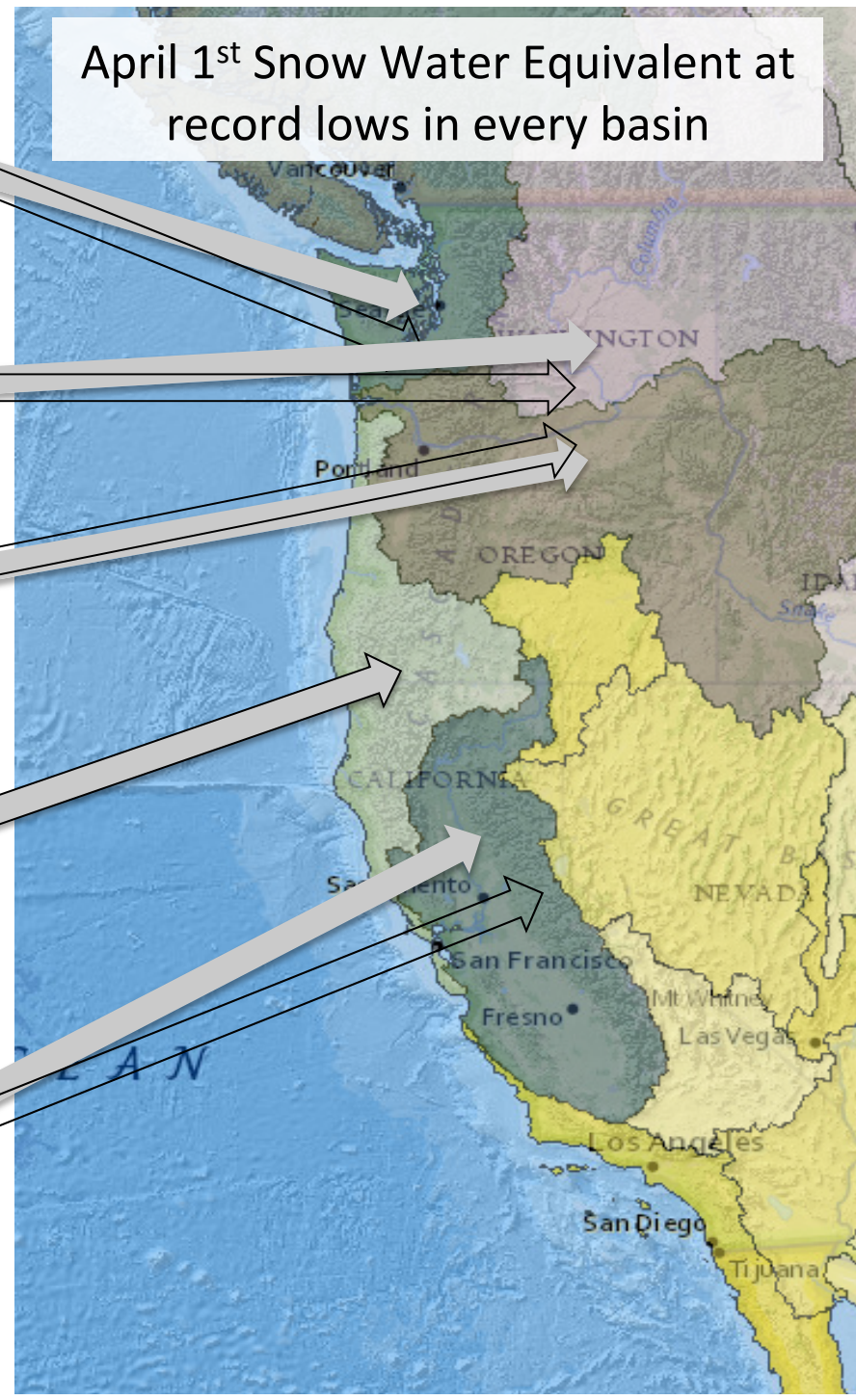
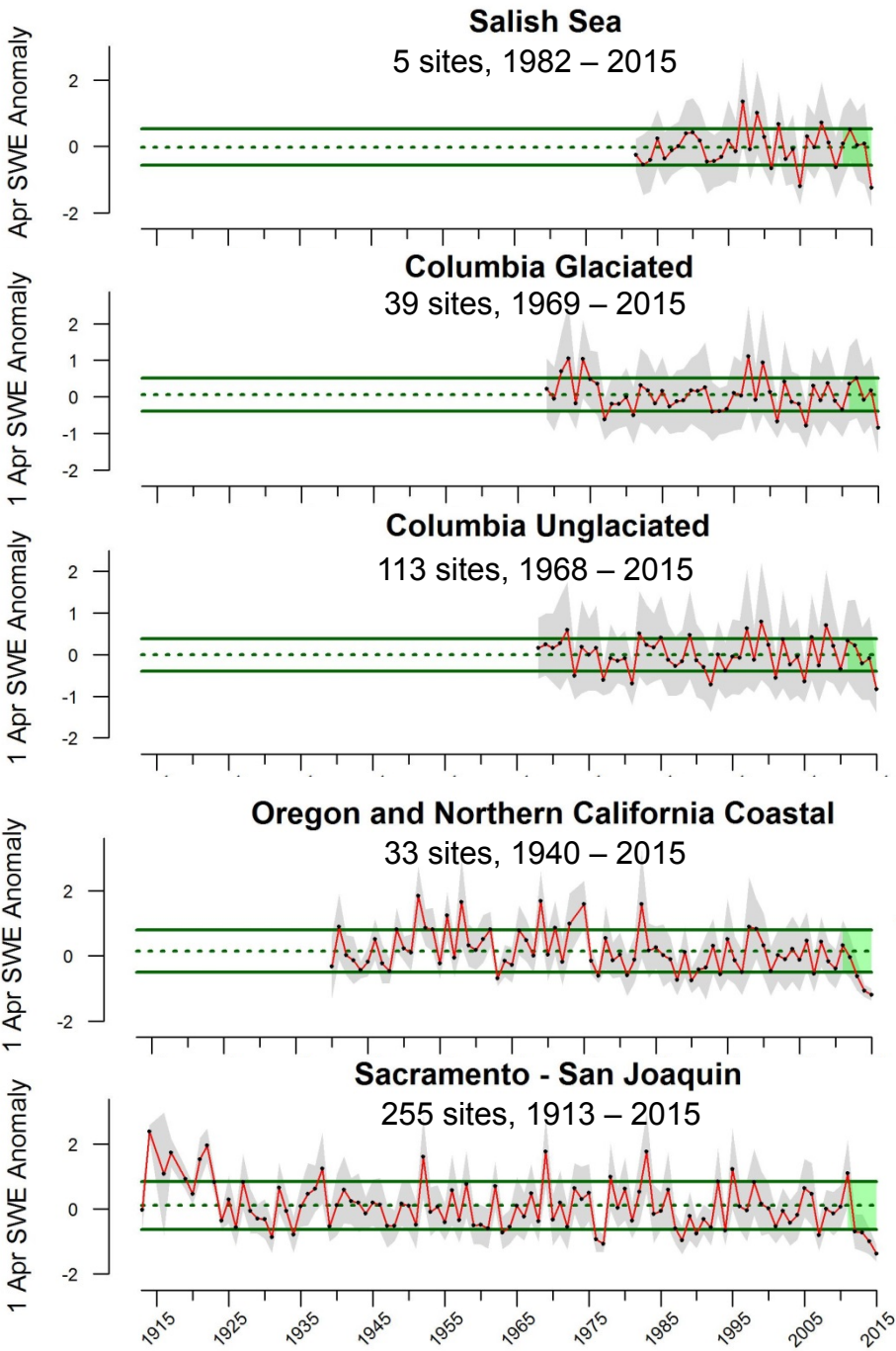


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 May 2015).

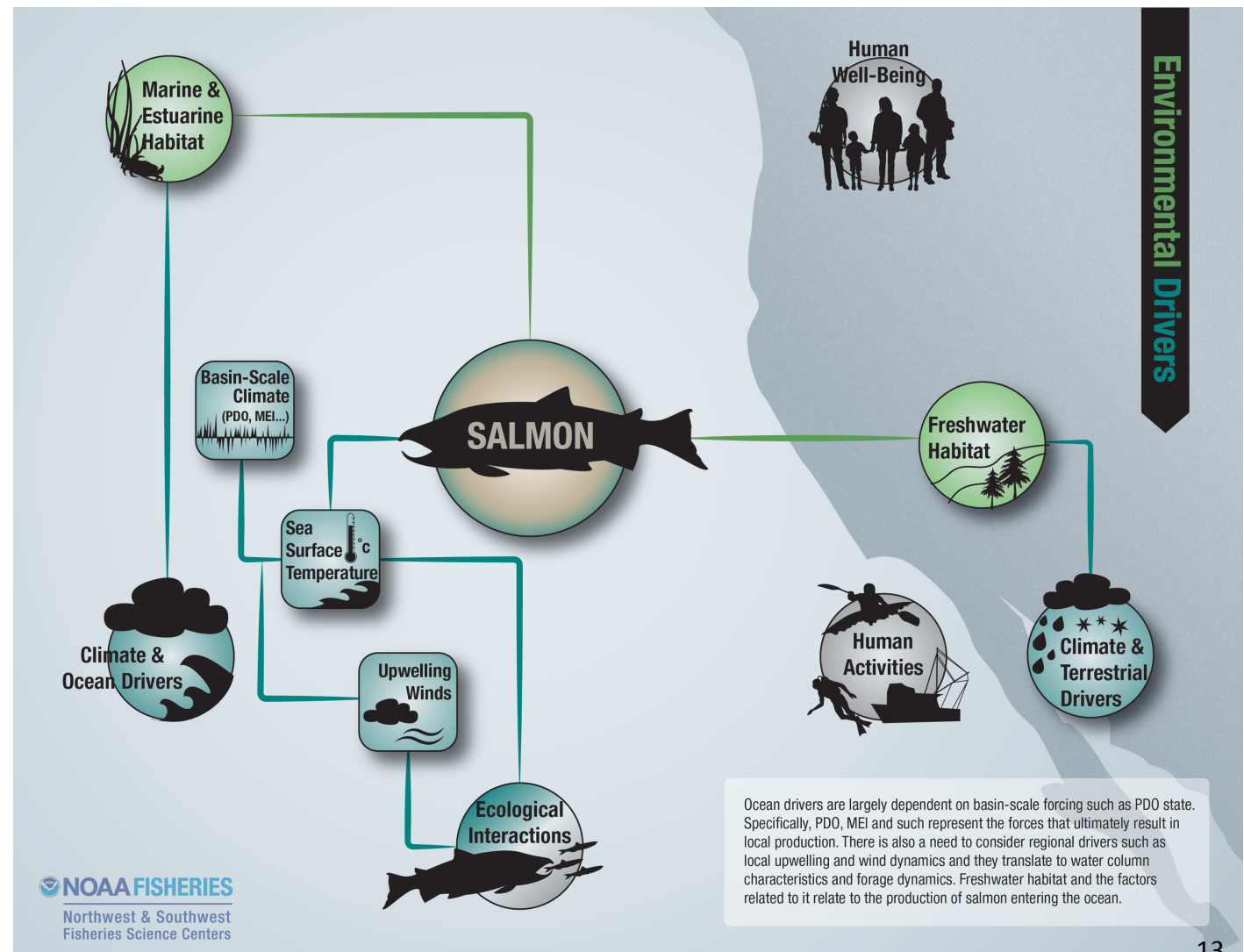
The majority of the models predict El Niño conditions continuing until winter 2016



# How do these anomalies affect us?

(case study: salmon)

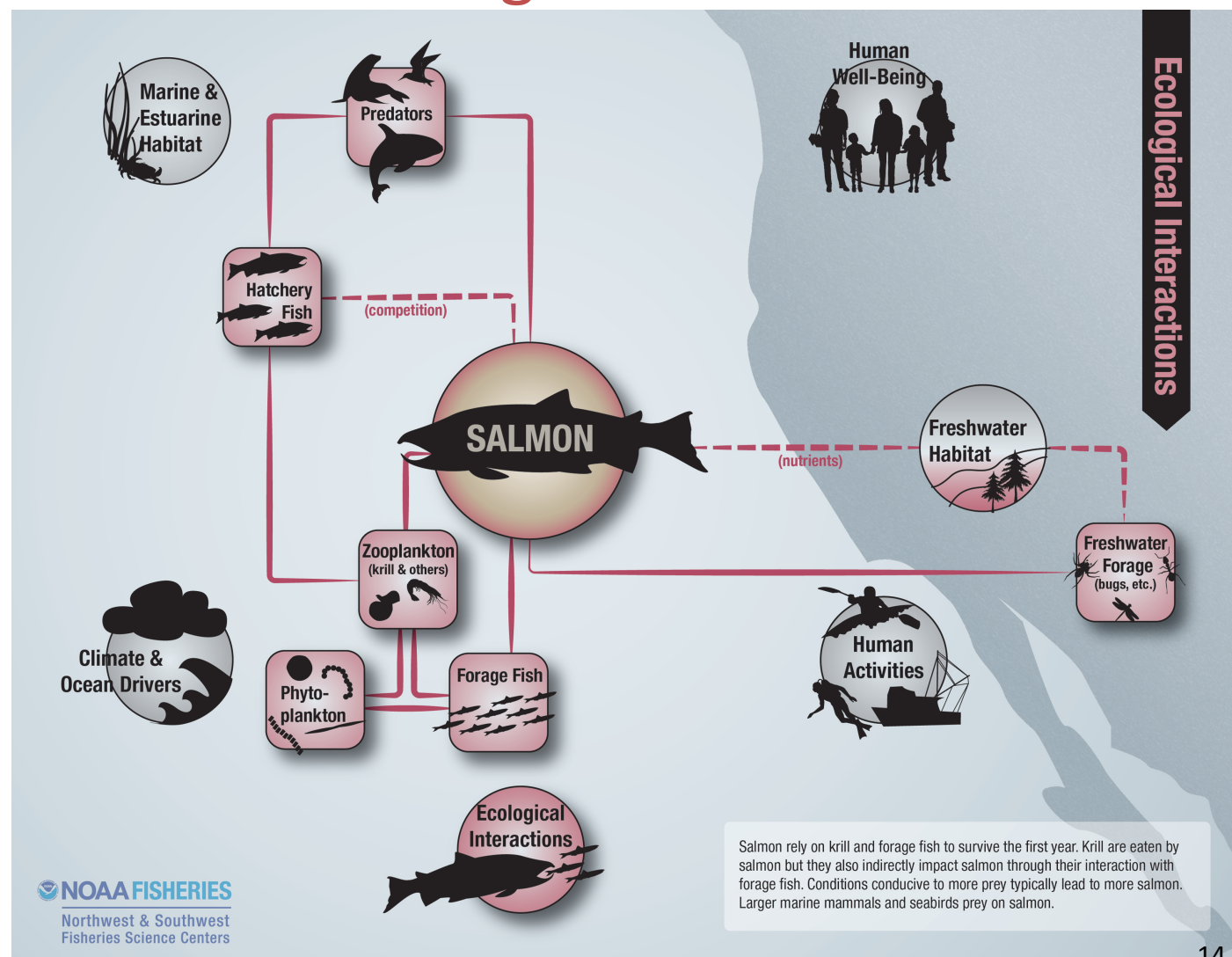
## Environmental Drivers



# How do these anomalies affect us?

(case study: salmon)

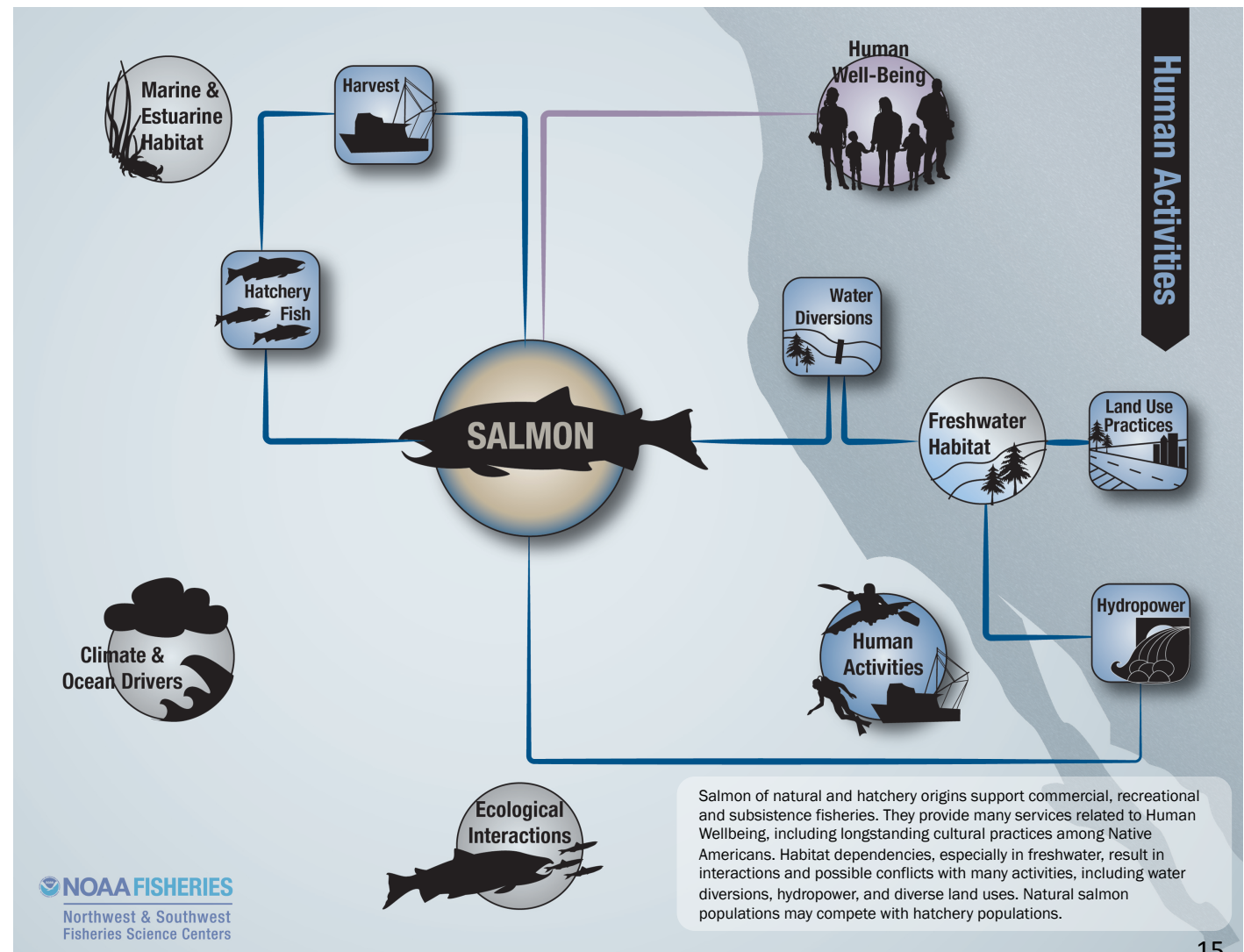
## Ecological Interactions



# How do these anomalies affect us?

(case study: salmon)

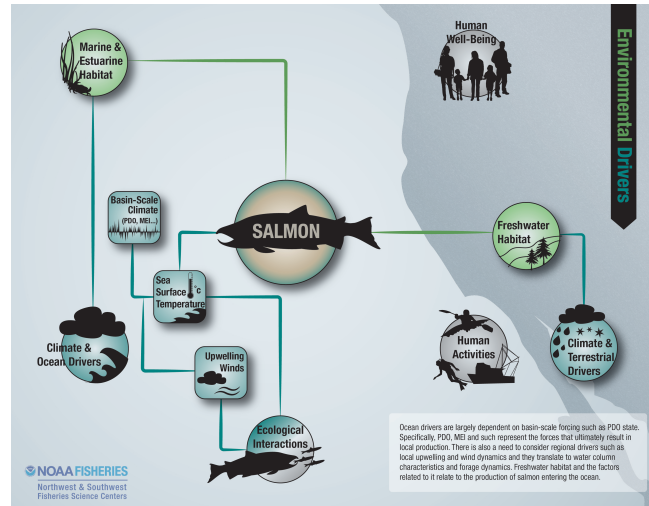
## Human Activities



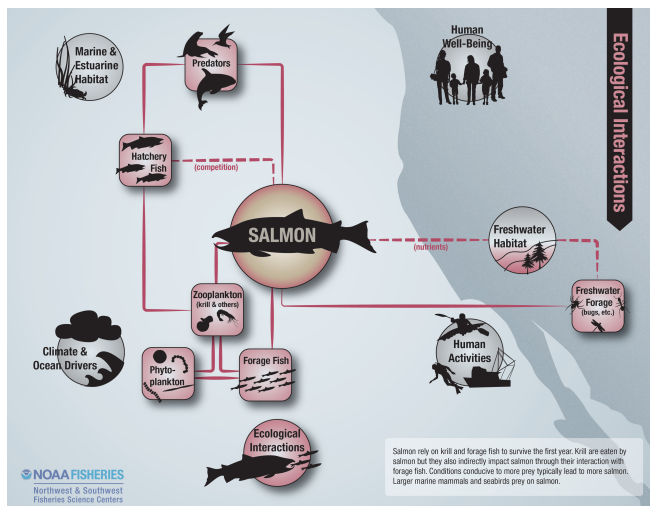
# How do these anomalies affect us? (case study: salmon)

It's necessary to examine all aspects of the ecosystem to determine the impact on the salmon and humans.

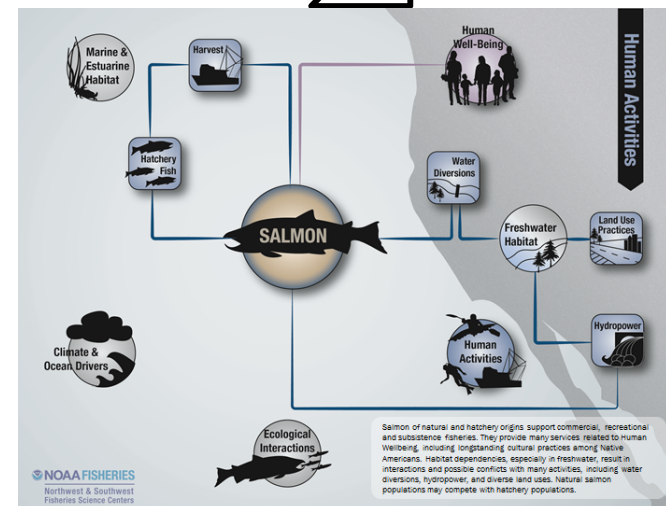
## Environmental Drivers



## Ecological Interactions



## Human Activities





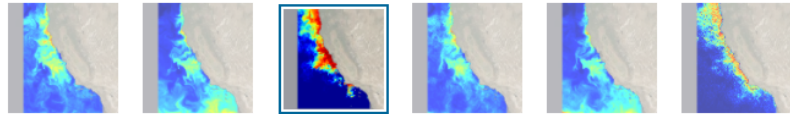
In the 2013 report  
HABs were listed as  
a new biological  
concern.

That concern is  
real.

**CeNCOOS** Data Portal    Catalog Portal Settings BETA

...to make 10-day projections, we ran DINEOF on POMO projected temperature, salinity, and ocean currents along with existing ocean color data in order to project the biological variables (i.e. chlorophyll) forward in time. We then compute future bloom likelihoods from these projections.

Map images provide these probabilities for *Pseudo-nitzschia* "blooms" and for domoic acid "events." The domoic acid predictions are divided into "particulate," meaning how much total domoic acid is present, and "cellular," referring to the amount of domoic acid being produced by an individual cell (i.e. how toxic are those cells). The predictions are updated daily and soon will include 1-3 day forecasts.



Forecast probability of cellular domoic acid > 10 picograms/cell

Forecast probability of particulate domoic acid > 500 nanograms/L

Forecast probability of Pseudo-Nitzschia > 10,000 cells/L

Nowcast probability of cellular domoic acid > 10 picograms/cell

Nowcast probability of particulate domoic acid > 500 nanograms/L

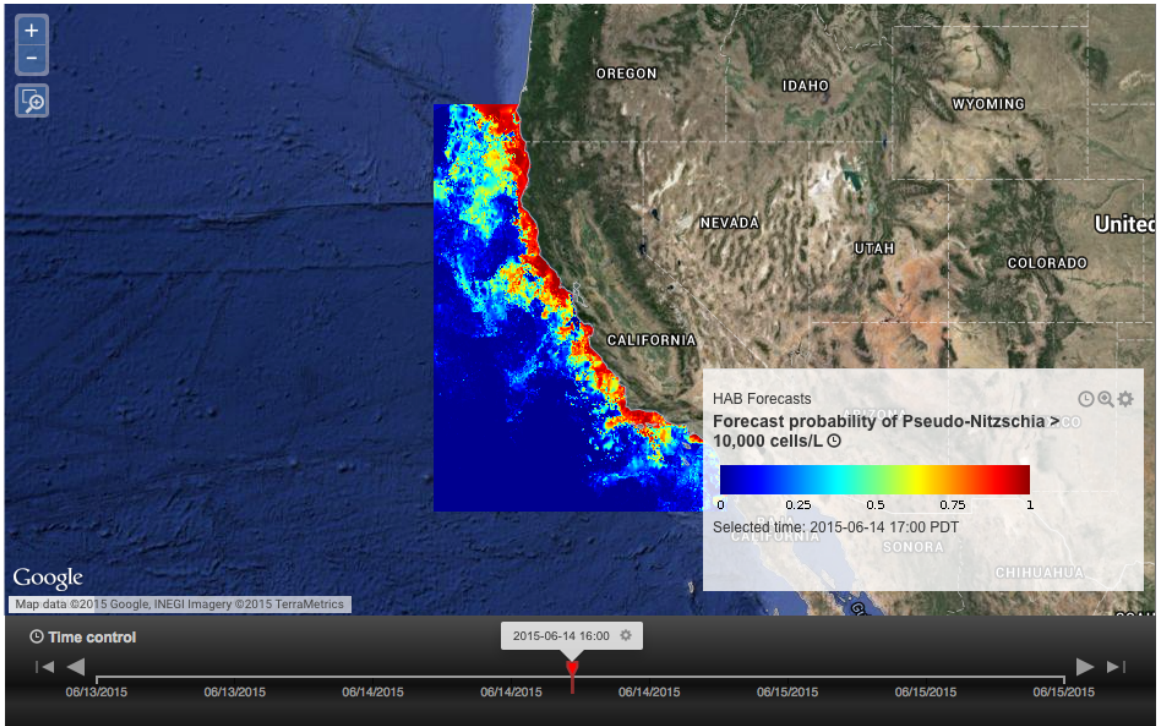
Nowcast probability of Pseudo-Nitzschia > 10,000 cells/L

---

**Forecast probability of Pseudo-Nitzschia > 10,000 cells/L**

- Metadata URL:
- Date Range: 06/13/2015 17:00 - 06/15/2015 17:00

Forecast probability of Pseudo-Nitzschia > 10,000 cells/L



HAB Forecasts  
Forecast probability of Pseudo-Nitzschia > 10,000 cells/L

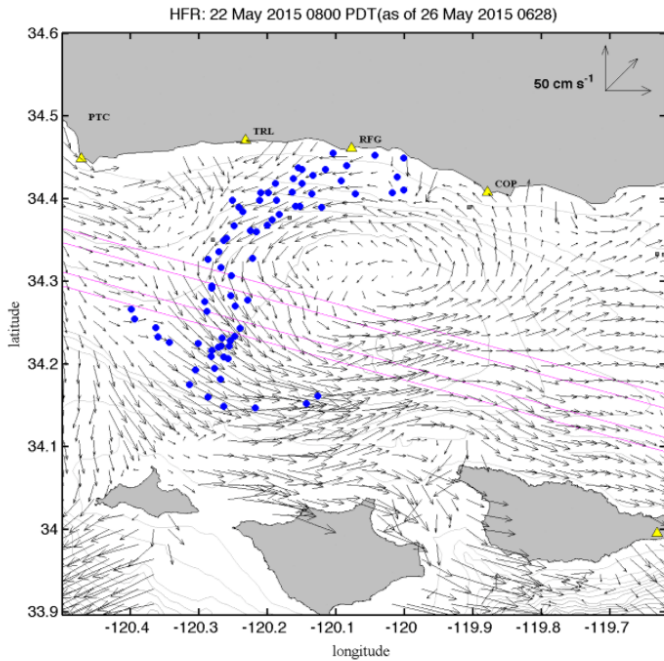
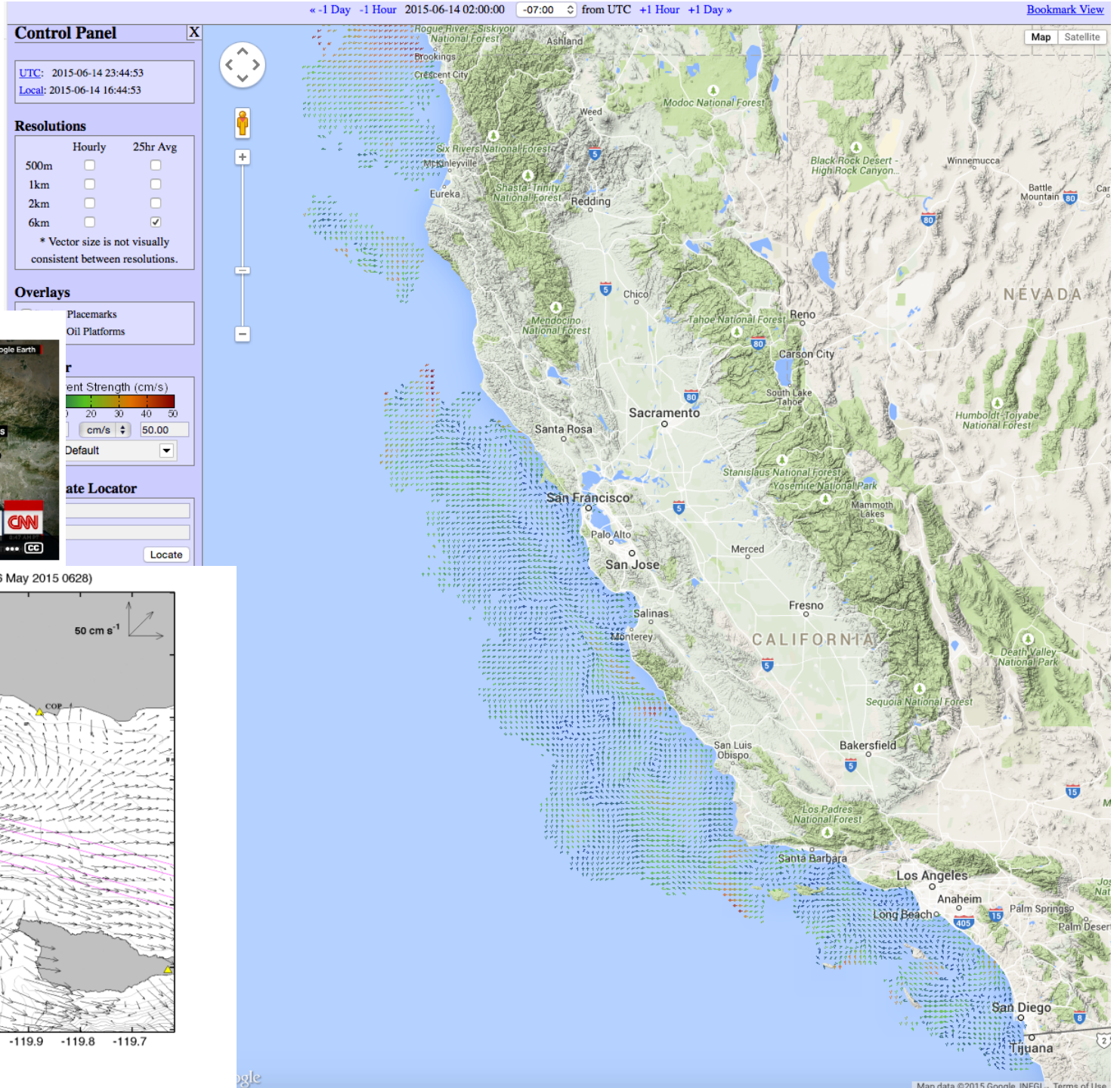
Selected time: 2015-06-14 17:00 PDT

Time control: 2015-06-14 16:00

feedback

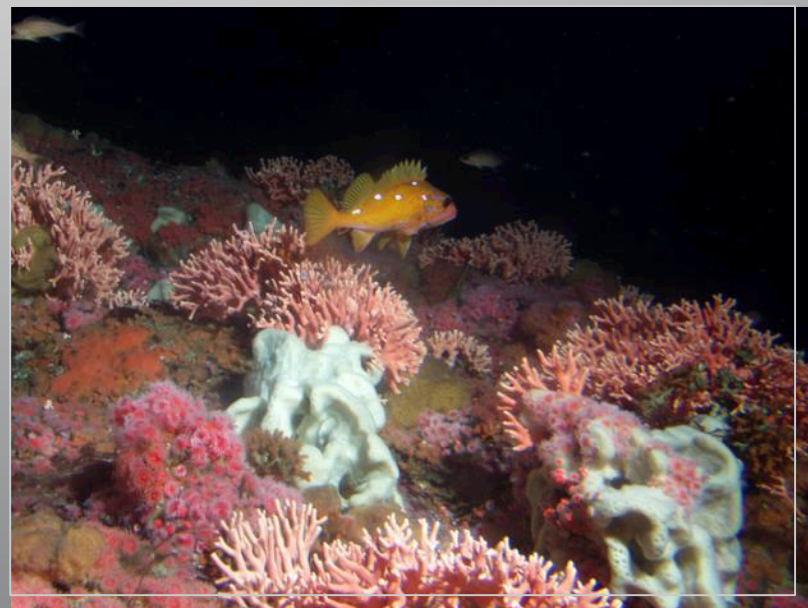
Continued (real time) monitoring is critical for tracking variability and climate change.

### CNN - California oil spill



# Indicators in the 2013 report

- Ocean Acidification
- Depth of the O<sub>2</sub> minimum zone
- Snow-water content
- Coastal ocean temperature
- Upwelling systems
- Basin scale indices
- Copepod populations
- Forage fish
- HABS
- Sacramento Fall run Chinook Salmon Abundance
- Cassin's Auklet Breeding Success
- Shearwater and Auklet populations of So Cal
- Sea Lion pup mortality
- An IEA approach



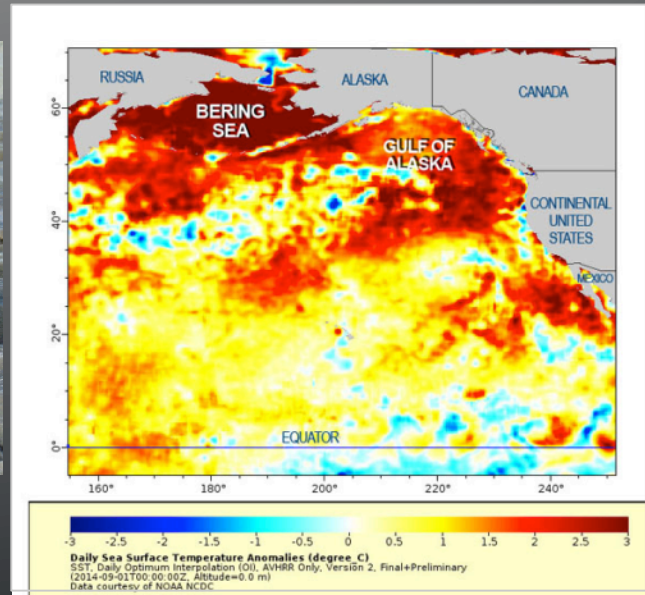
Commercial albacore fishing off Oregon. (Helena Aryafar, NOAA)

Rosy rockfish, corals, sponges and anemones on Cordell Bank. (Rick Starr, NOAA)

# Questions?

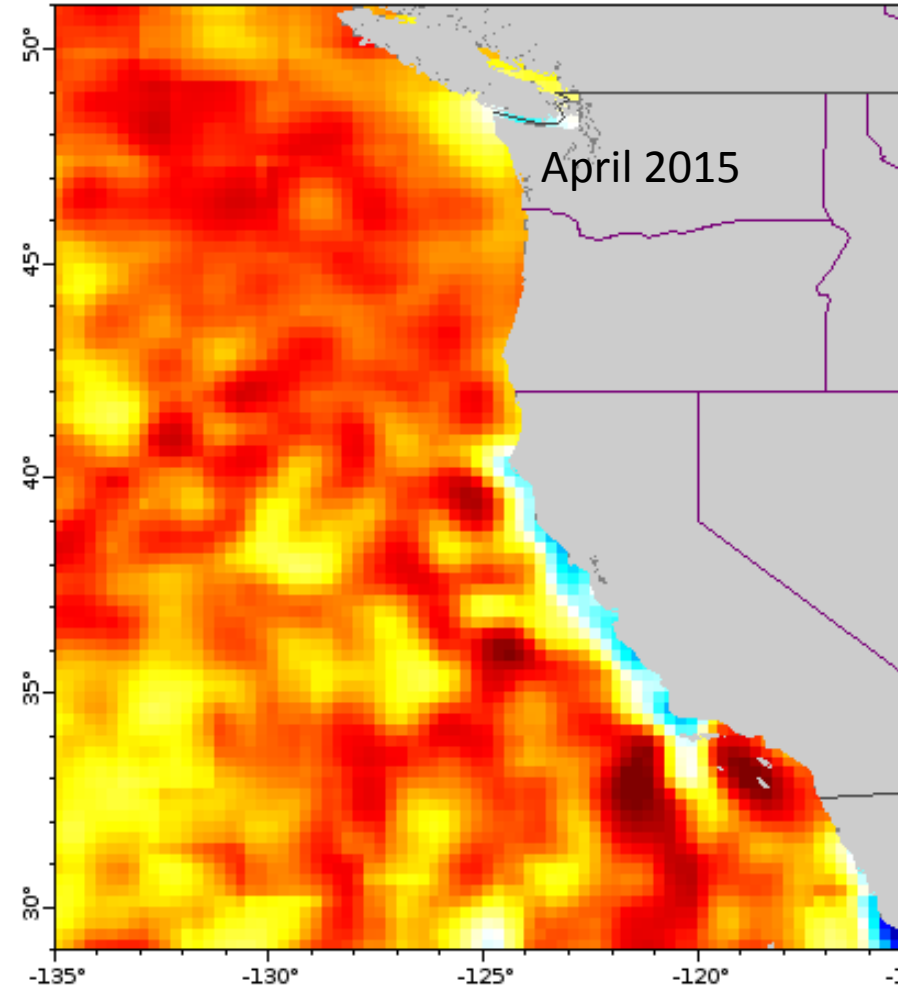
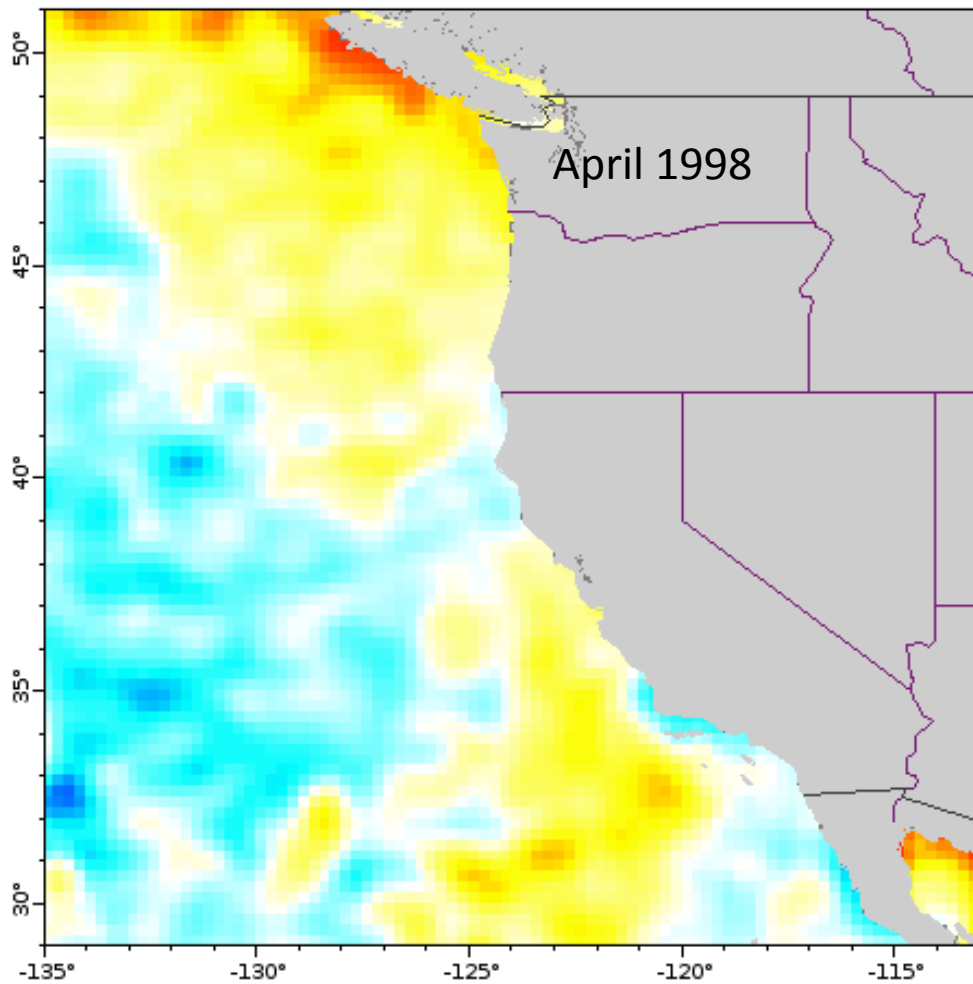



Emaciated California sea lion pup, San Nicolas Island, early 2015 (photo: Sharon Melin, NOAA)

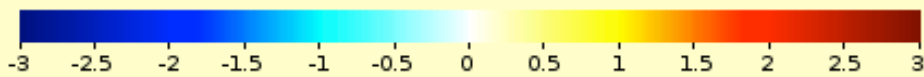


Sea surface temperature anomalies, Sept. 1, 2014 (NOAA National Climate Data Center)



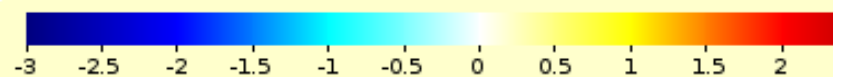


 NOAA CoastWatch



**SST Anomaly, Blended, Optimum Interpolation (OI), Ver. 2, NCDC AVHRR,  
0.25 degree, Global  
(degree C) 1998-04-15  
Data courtesy of NOAA NCDC**

 NOAA CoastWatch



**SST Anomaly, Blended, Optimum Interpolation (OI), Ver. 2, NCDC AVHRR,  
0.25 degree, Global  
(degree C) 2015-04-15  
Data courtesy of NOAA NCDC**