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.

Toby Garfield
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

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

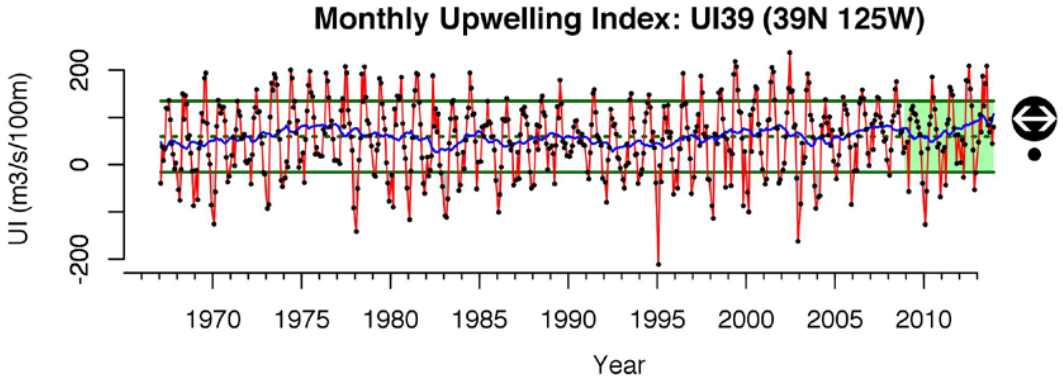
	#indices	#plots
Physical, Chemical and Climate Indicators	13	31
Additional Physical, Chemical and Climate Indicators	4	13
Fishery-related Anthropogenic Activities	28	28
Non-Fishery Related Anthropogenic Activities	20	21
Abundance of pelagic forage	13	20
Salmon	16	16
Groundfish	30	30
Ecological Integrity	40	40
Totals:	164	199

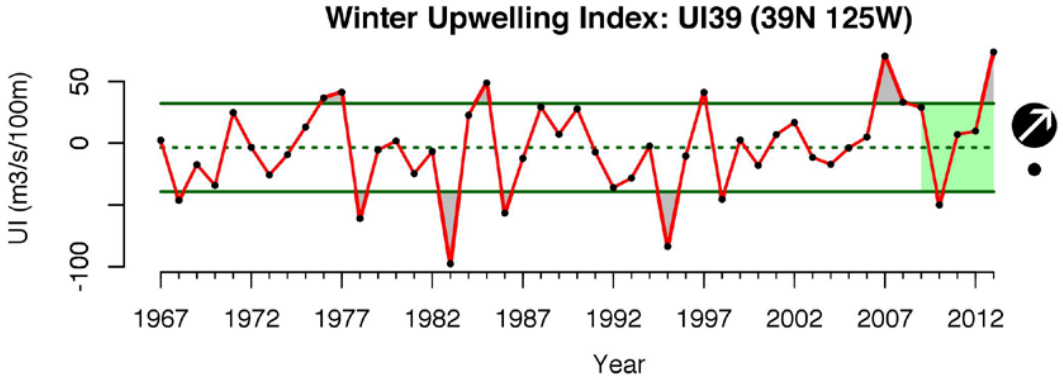
Physical, Chemical and Climate Indicators

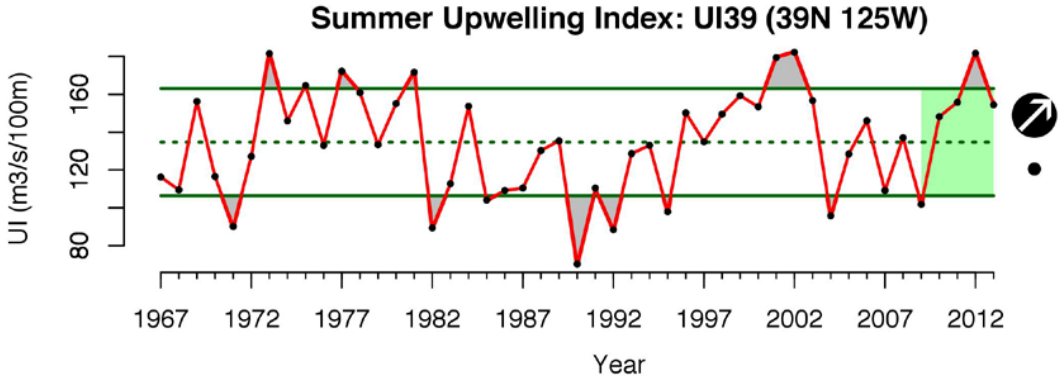
Indicator	Site	Monthly Trend	Status	Winter Trend	Status	Summer Trend	Status
Multivariate El Nino Index	basin-scale	↔	●	↔	●	↔	●
Northern Oscillation Index	basin-scale	↔	●	↗	●	↔	●
North Pacific Gyre Oscillation	basin-scale	↔	+	↔	●	↔	●
Pacific Decadal Oscillation	basin-scale	↔	●	↔	●	↔	●
Eddy Kinetic Energy	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







There will be explanatory text alongside each plot.

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

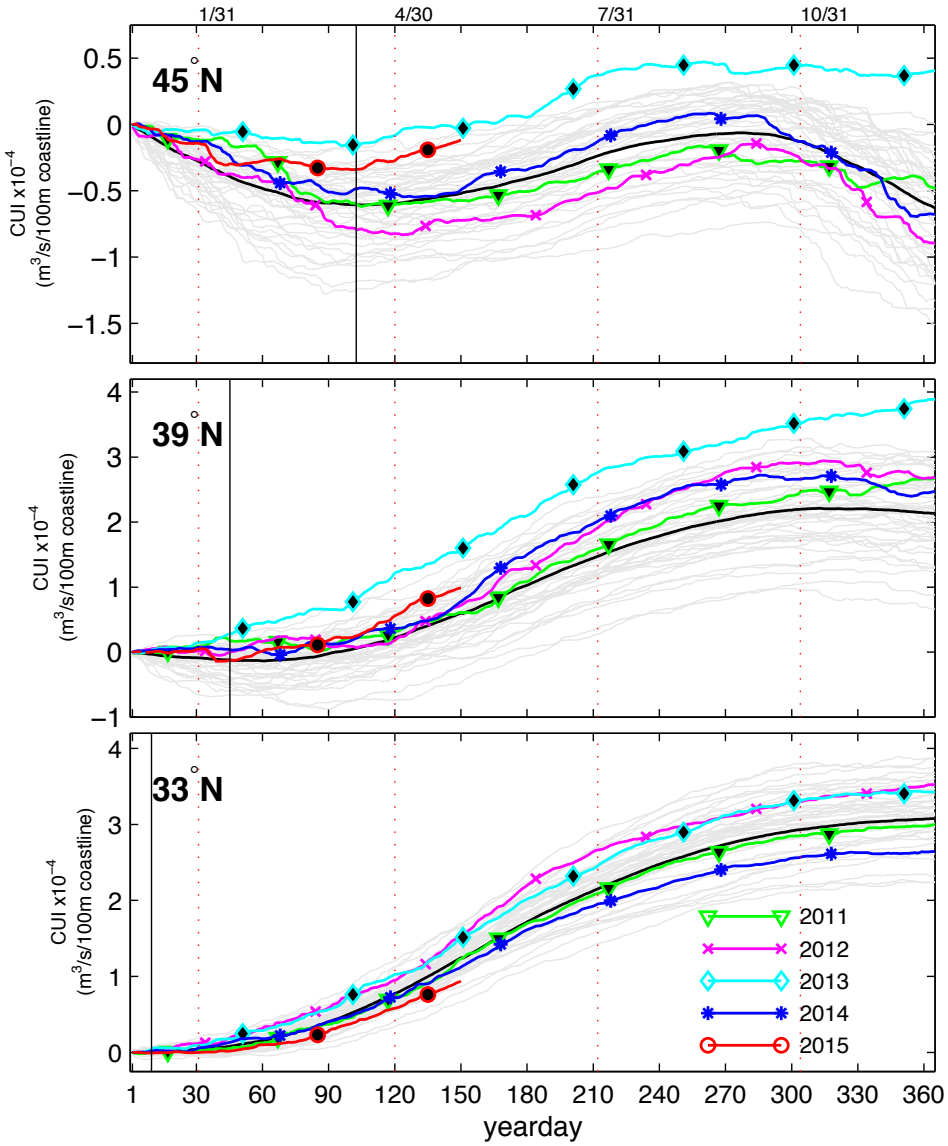
Bakun Cumulative Upwelling Index at 45°N, 39°N & 33°N provides local influence

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.

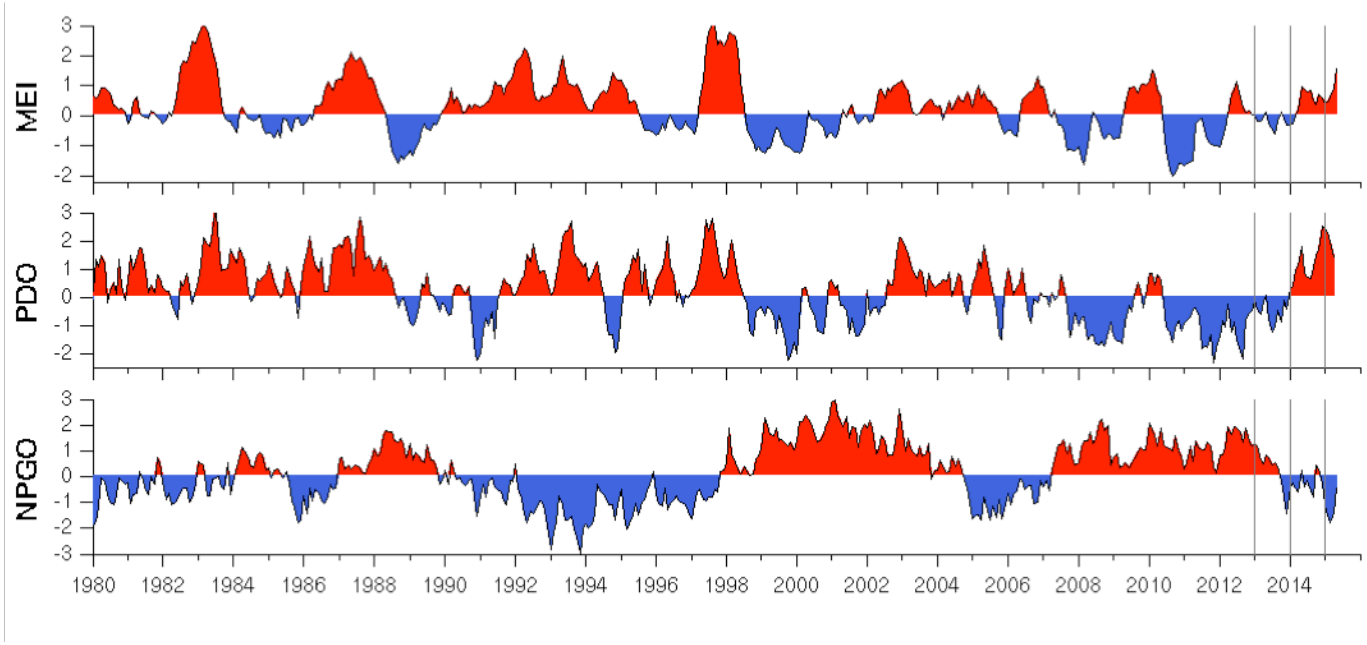
Upwelling impacts the nutrient supply, the oxygen concentation and the ocean acidity.

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



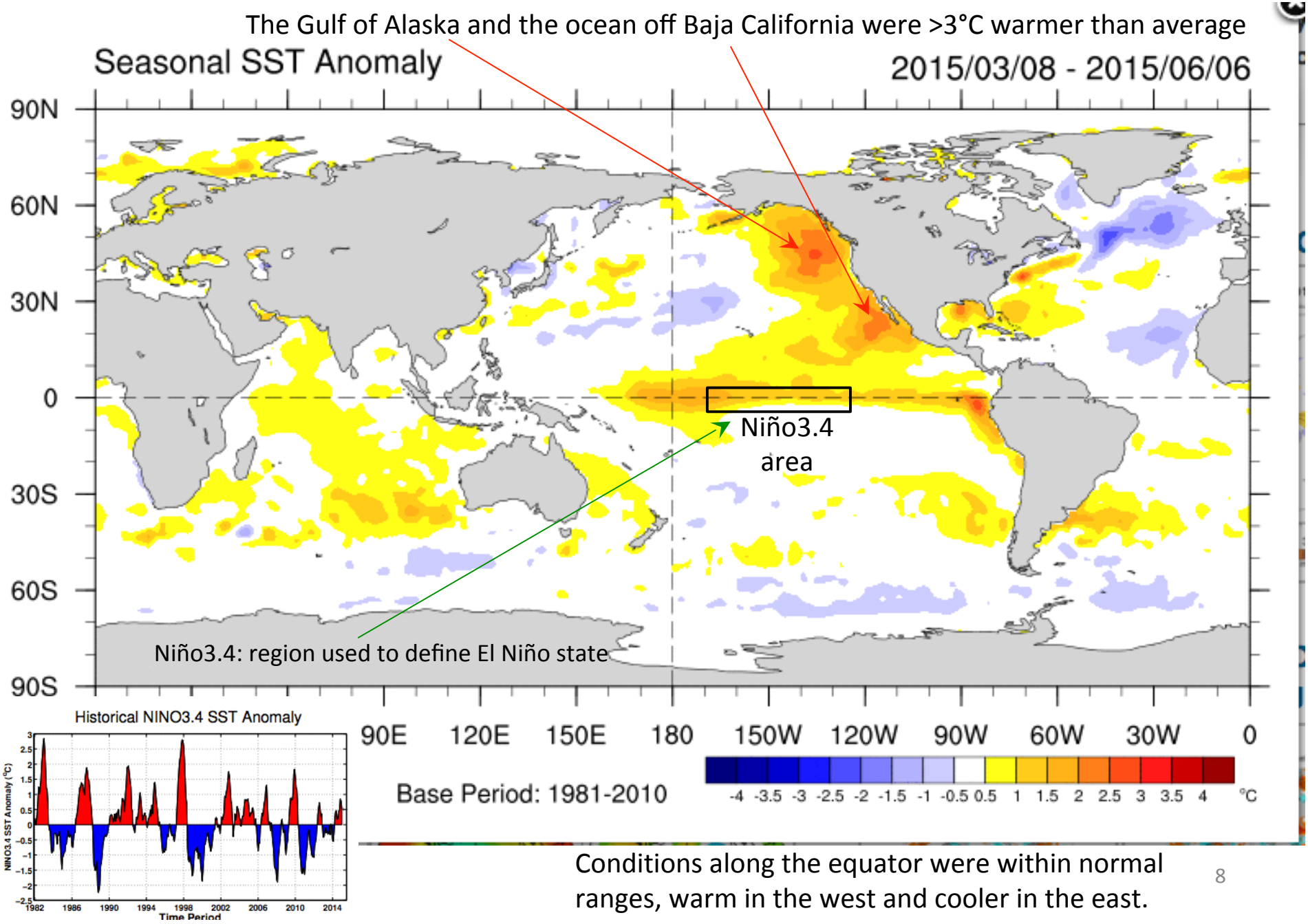
The “basin-scale” indices are all pointing to warmer, less productive condition sin the California Current System.

That said, some species take advantage of these conditions.



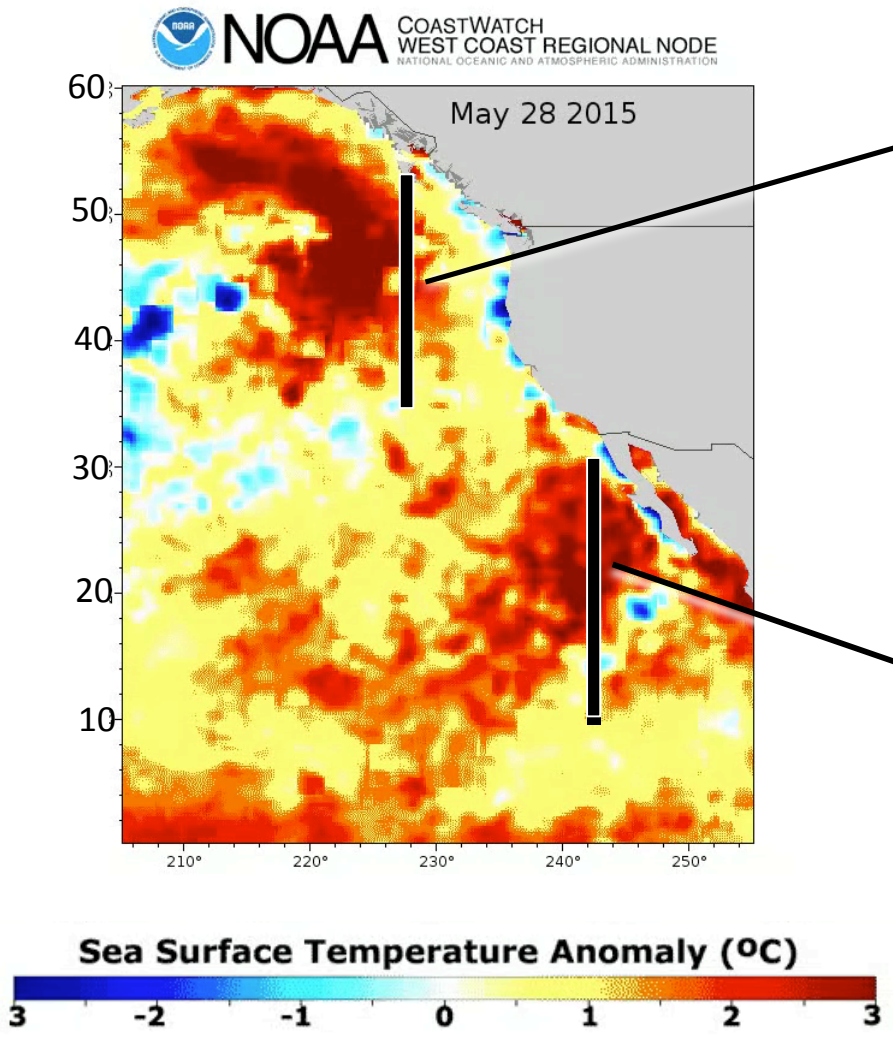
Positive MEI & PDO and negative NPGO all suggest warmer and less productive activity in the CCS.

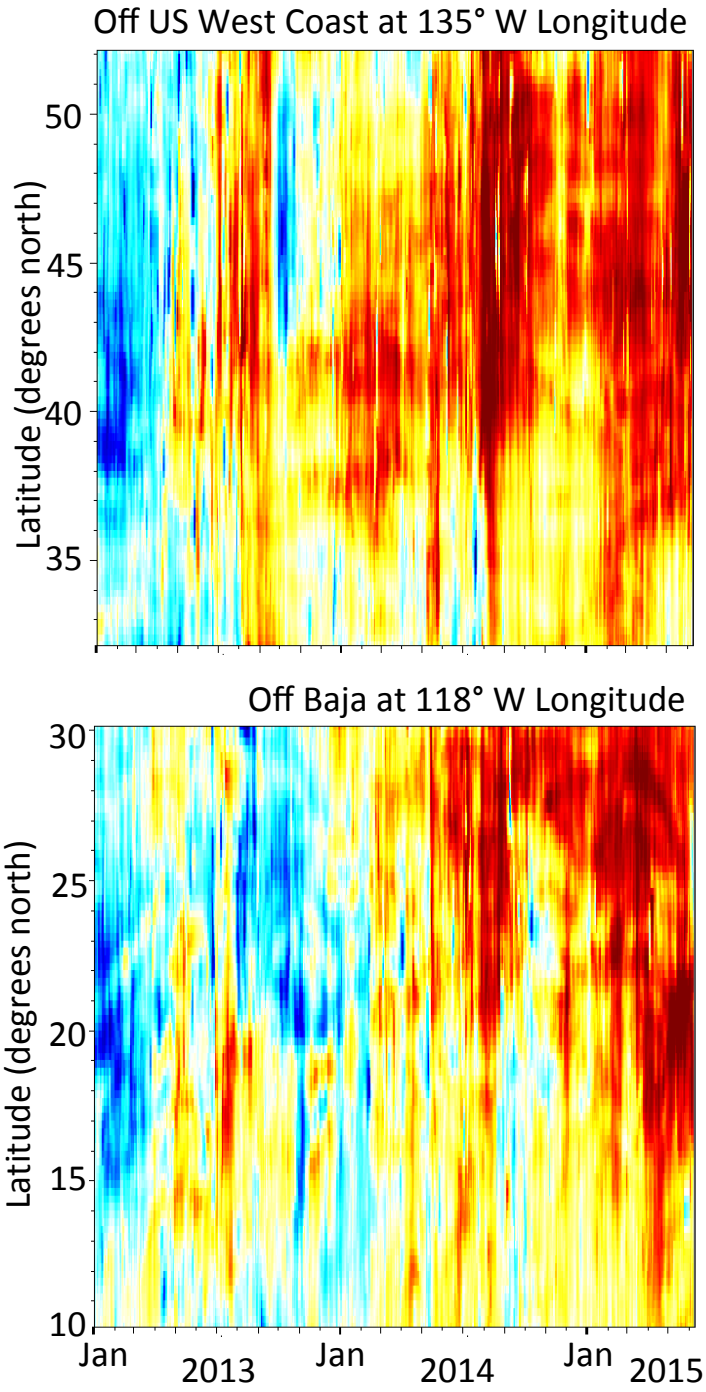
Eastern Pacific sea surface temperatures (SST) were (and are) anomalously warm in 2014-2015



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

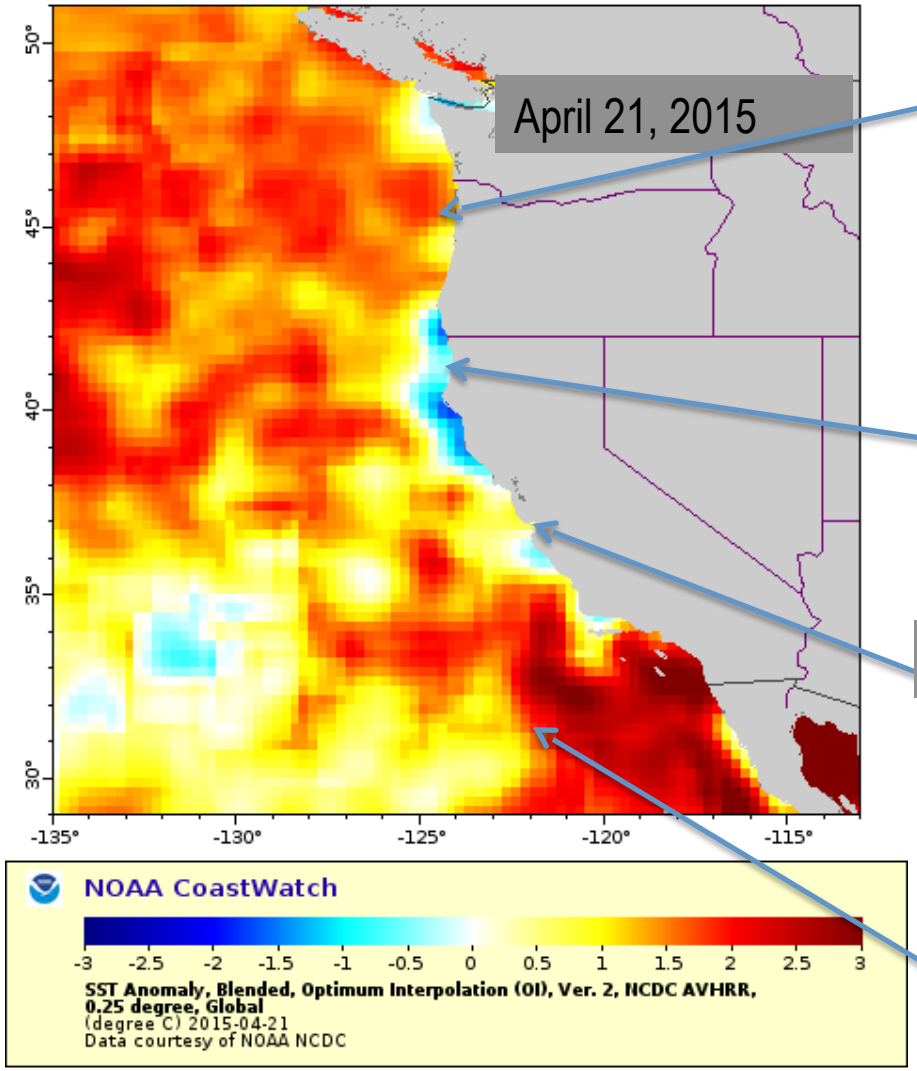
Capturing the two warm anomalies

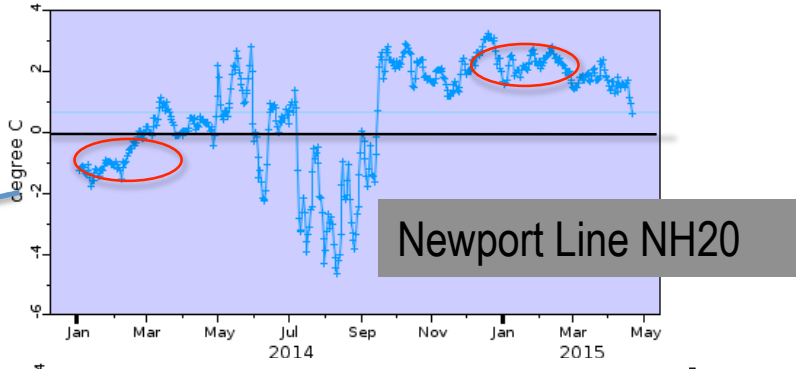


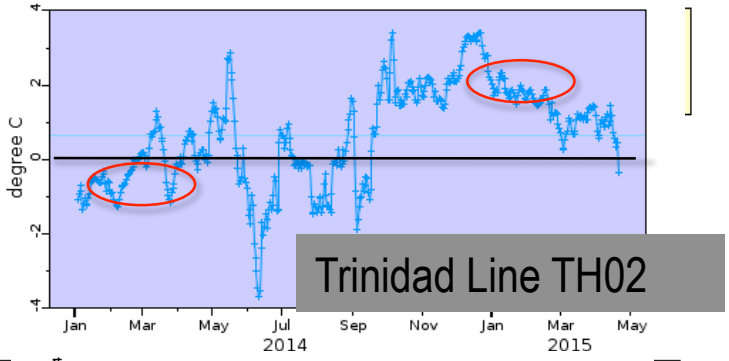


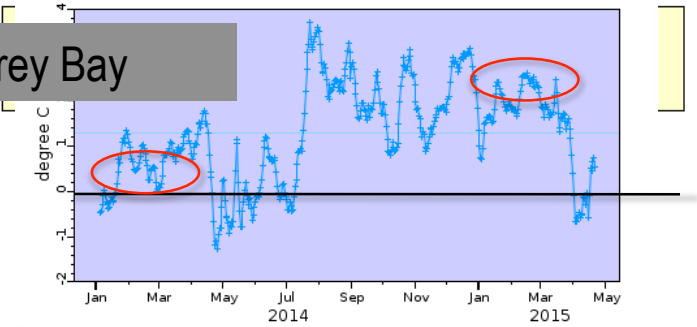
Powered by ERDDAP. Image by Dale Robinson, NOAA CoastWatch.

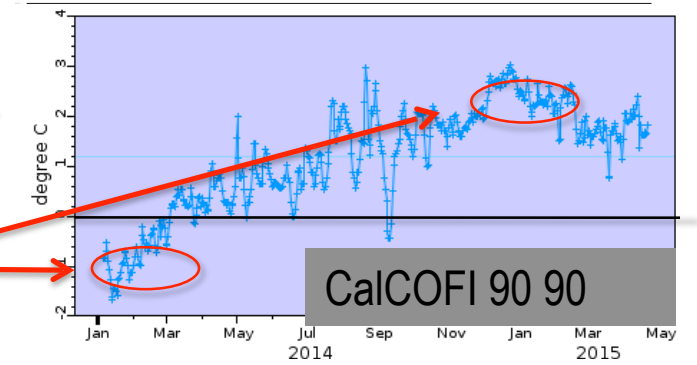
2014/15 SST anomaly











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

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.

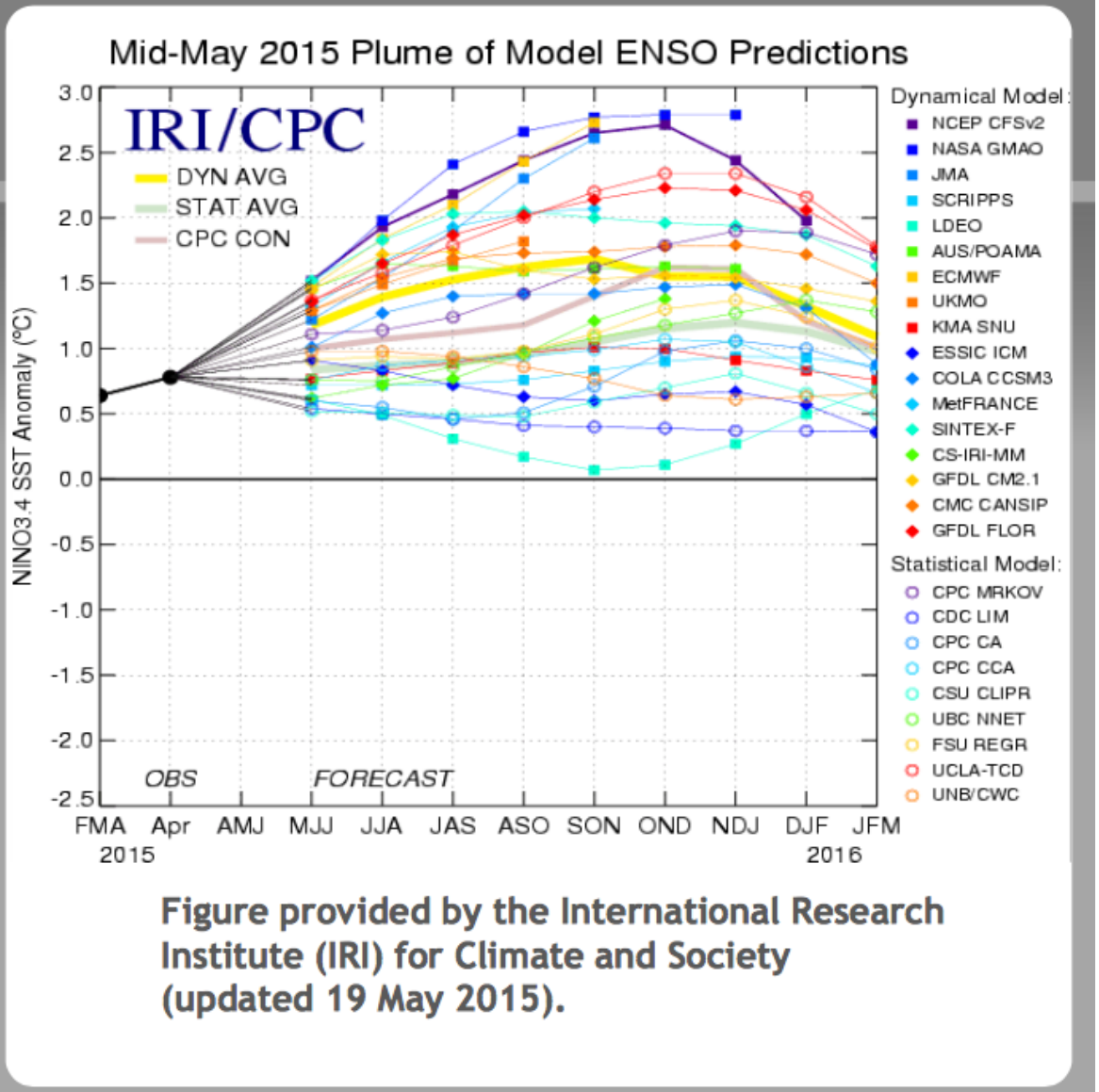
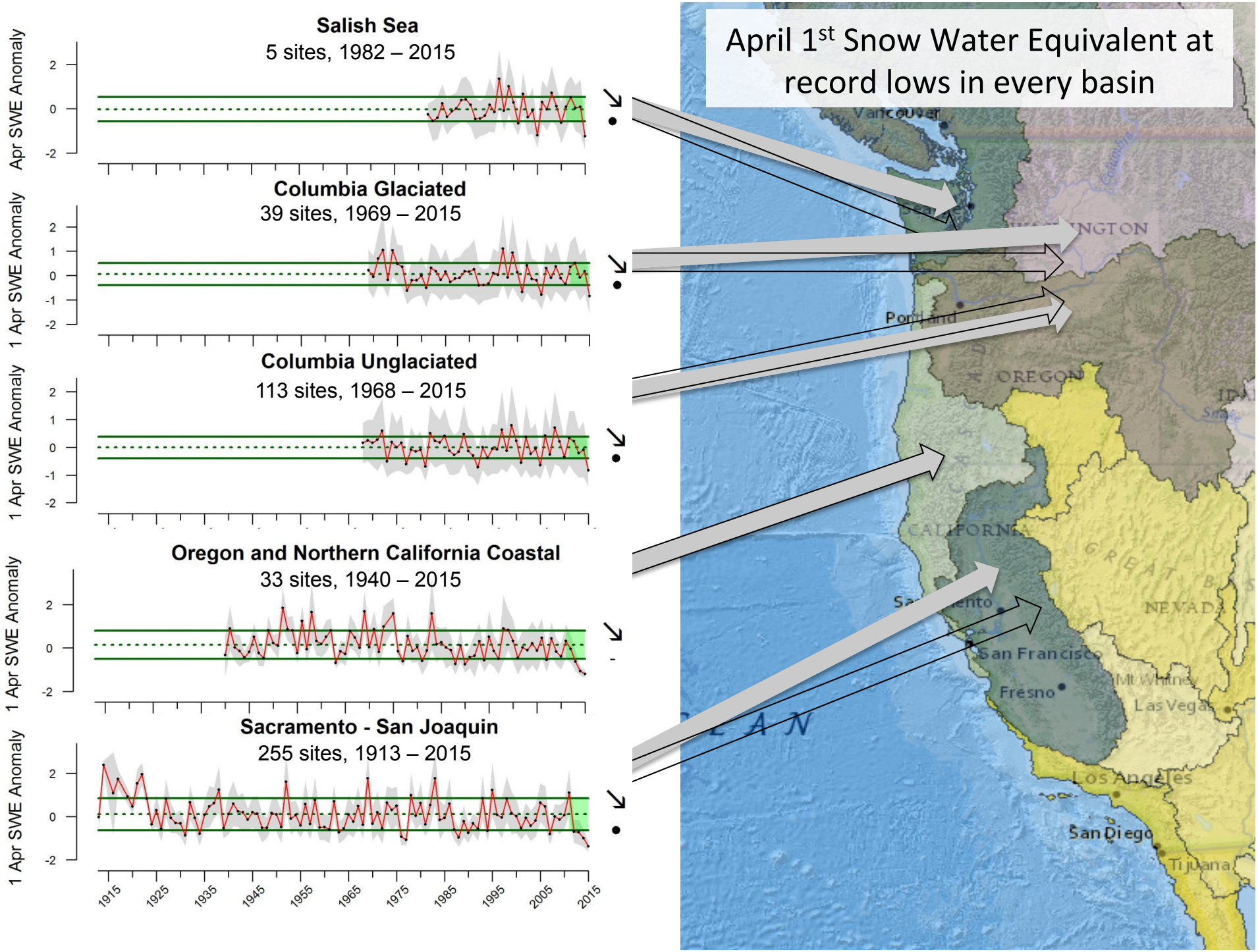


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 May 2015).

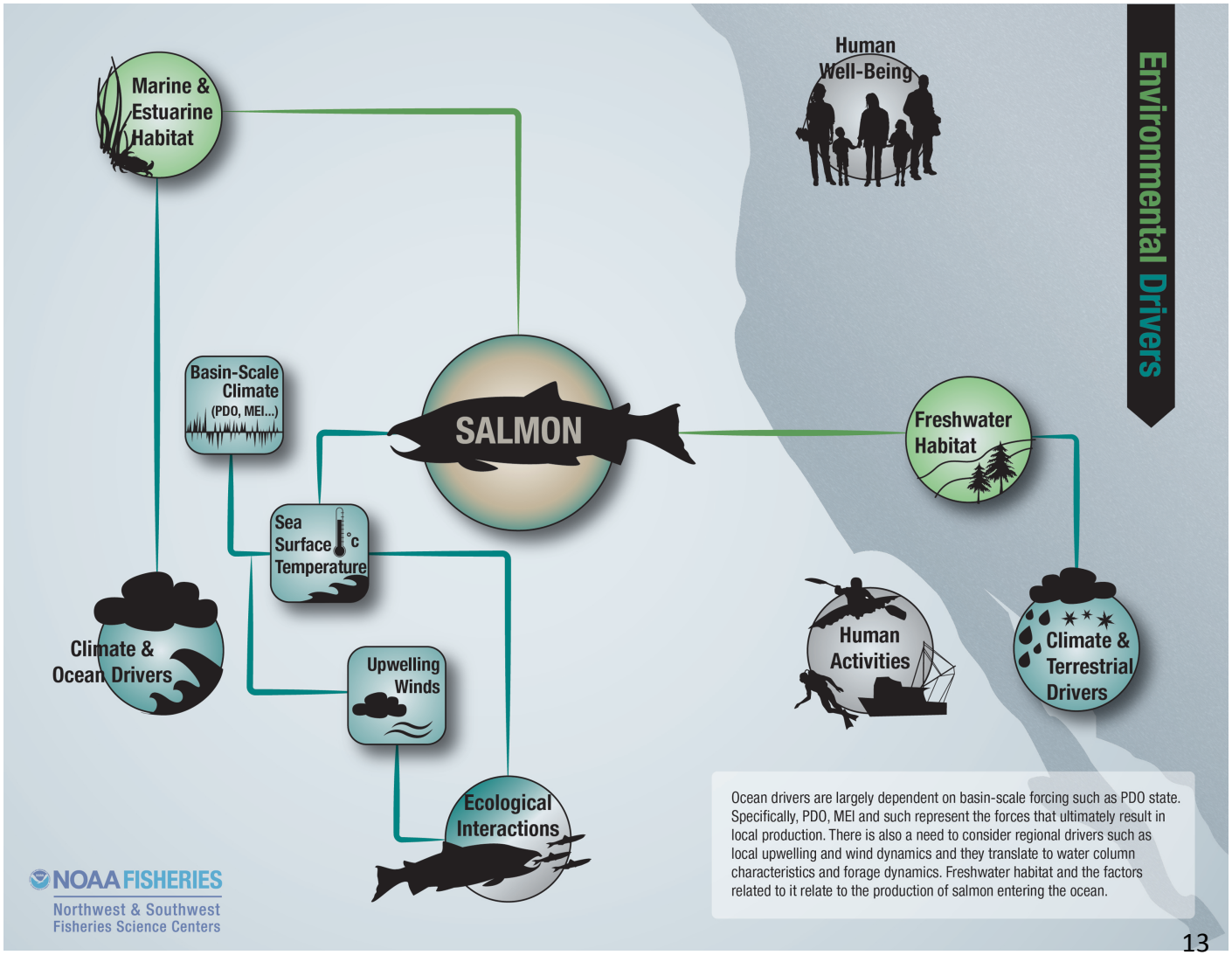
The majority of the models predict El Niño conditions continuing until winter 2016


Salish Sea
5 sites, 1982 – 2015
Columbia Glaciated
39 sites, 1969 – 2015
Columbia Unglaciated
113 sites, 1968 – 2015
Oregon and Northern California Coastal
33 sites, 1940 – 2015
Sacramento - San Joaquin
255 sites, 1913 – 2015
1 Apr SWE Anomaly
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
April 1st Snow Water Equivalent at record lows in every basin
Vancouver
Portland
OREGON
NEVADA
San Francisco
Fresno
Las Vegas
Los Angeles
San Diego
Tijuana

How do these anomalies affect us?

(case study: salmon)

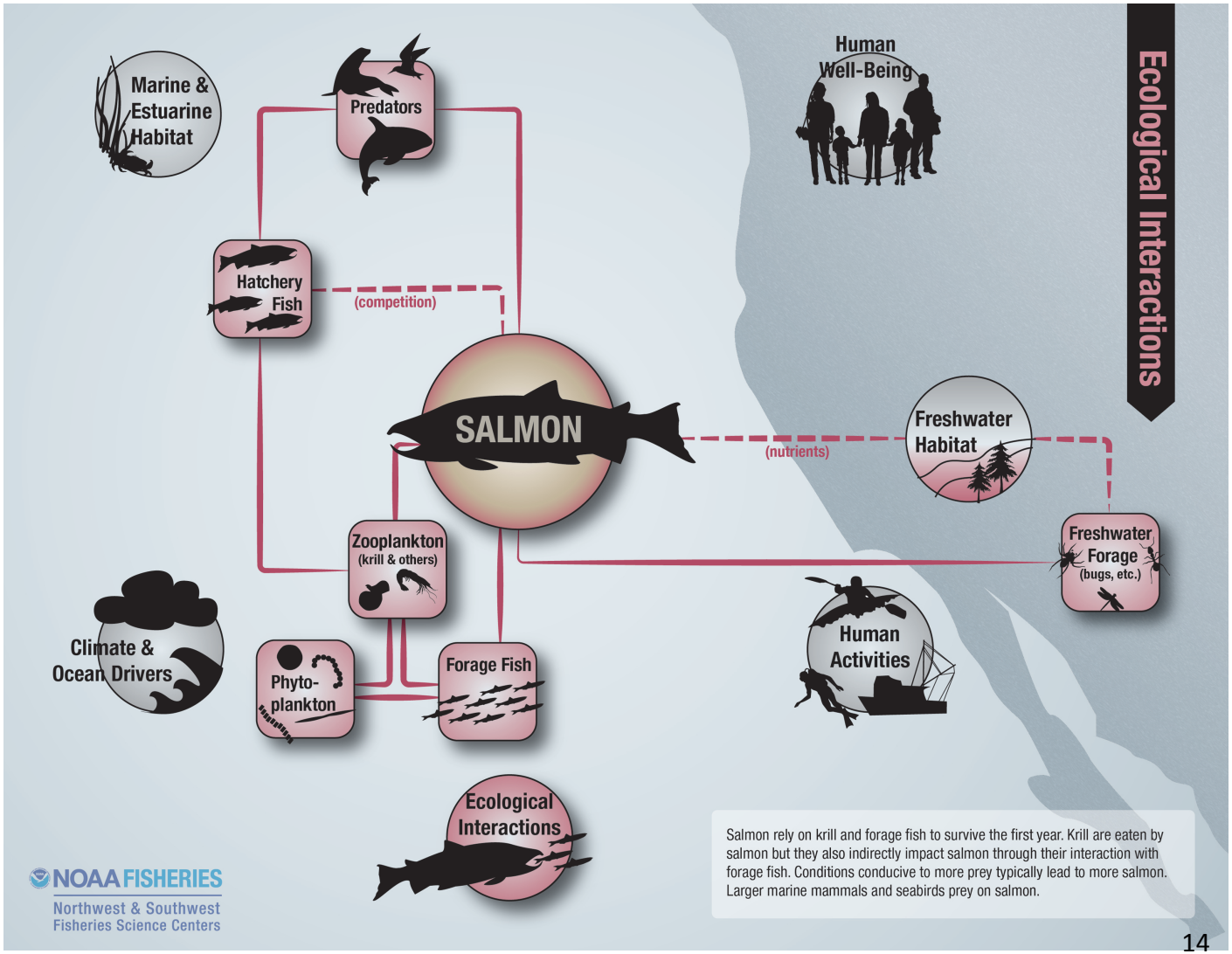
Environmental Drivers



How do these anomalies affect us?

(case study: salmon)

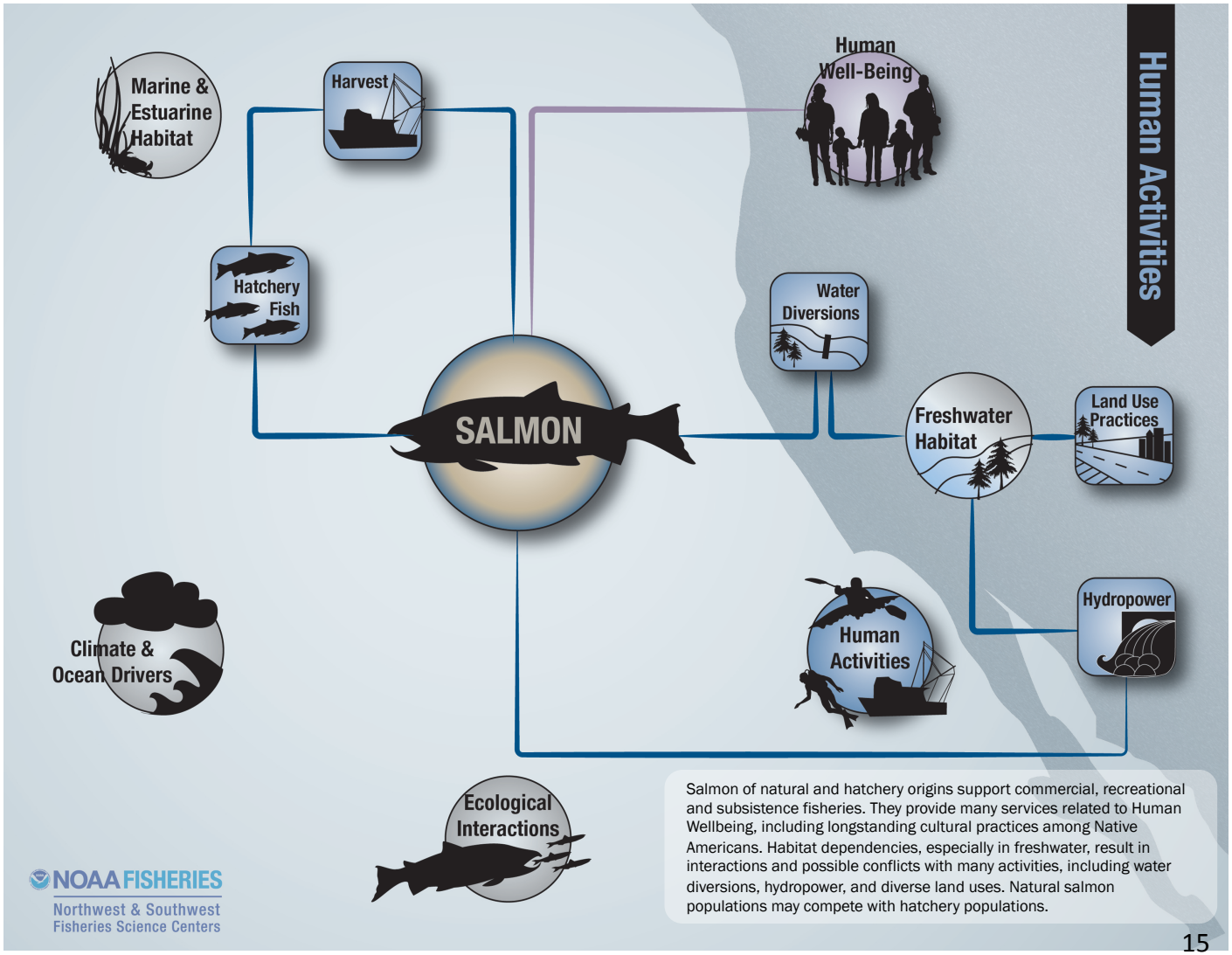
Ecological Interactions



How do these anomalies affect us?

(case study: salmon)

Human Activities

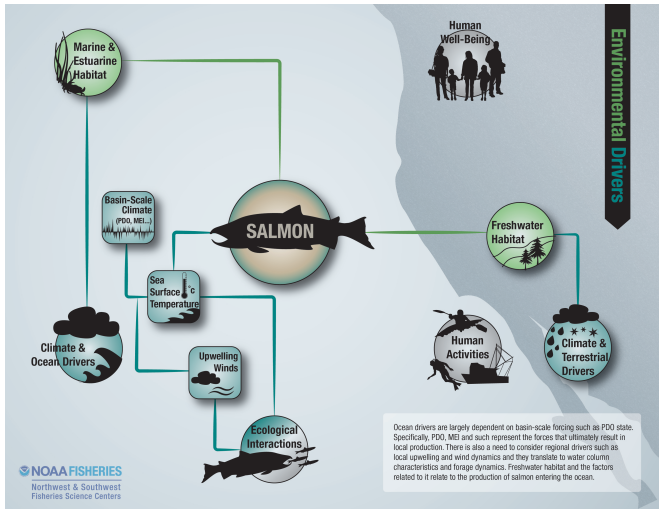


How do these anomalies affect us?

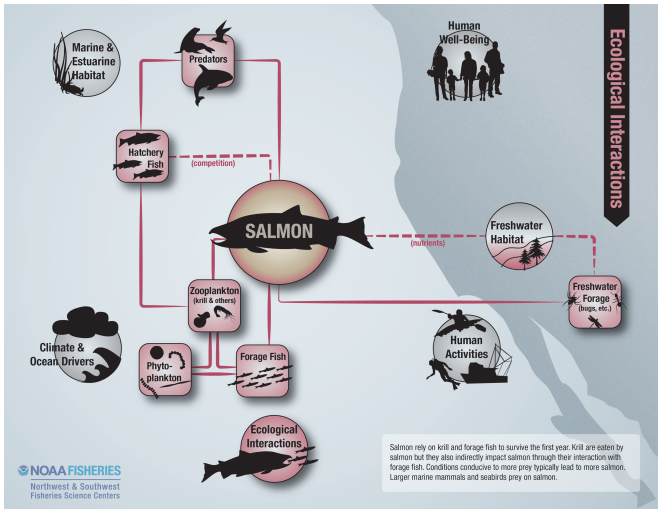
(case study: salmon)

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

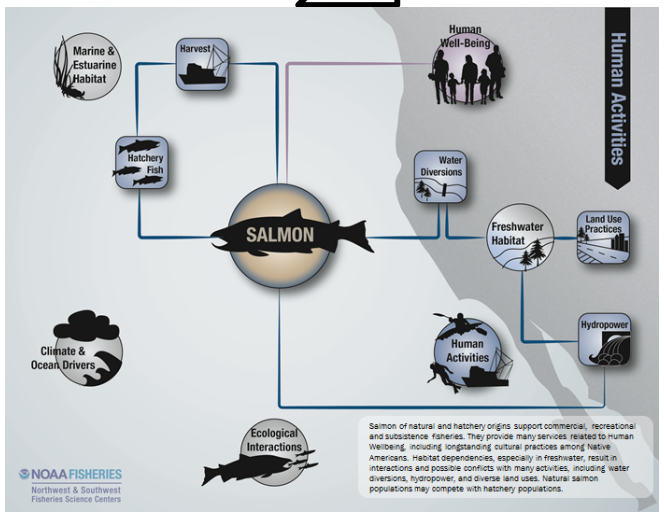
Environmental Drivers



Ecological Interactions

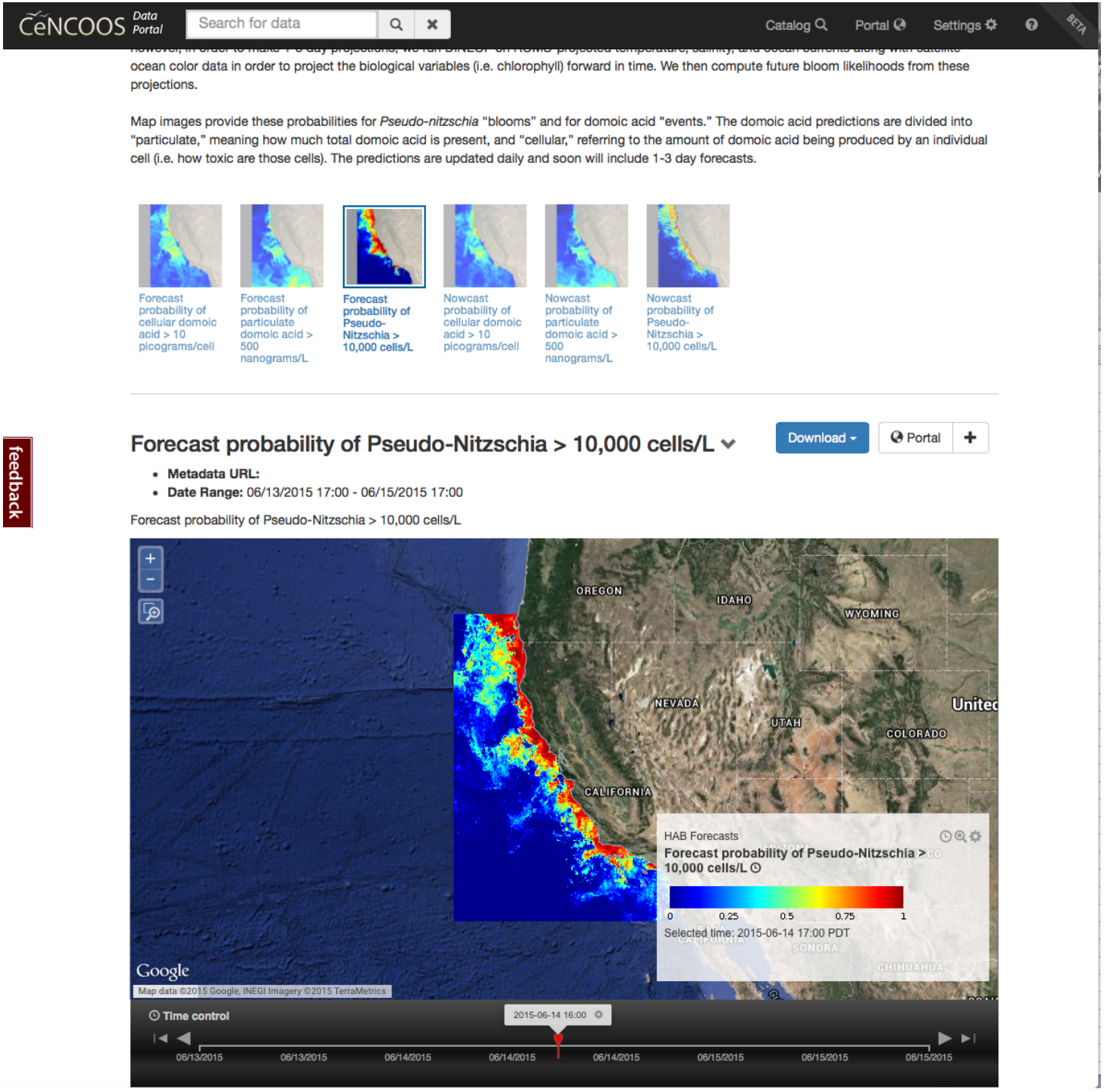


Human Activities



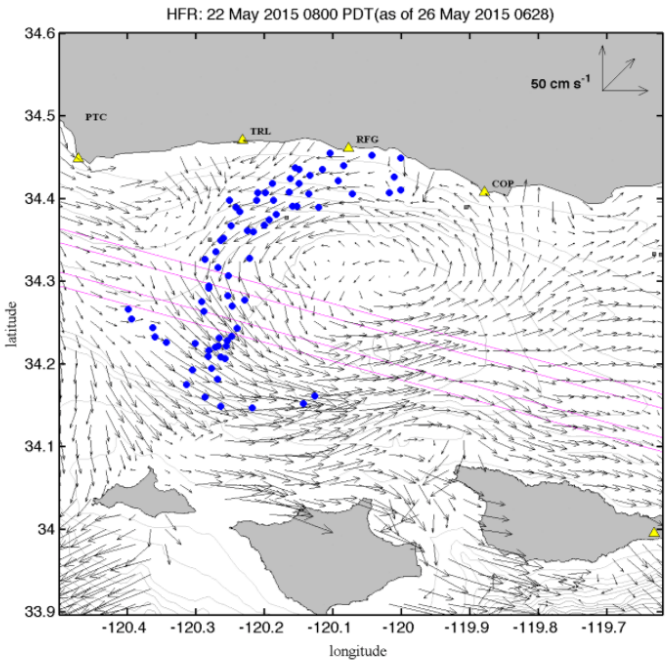
In the 2013 report HABs were listed as a new biological concern.

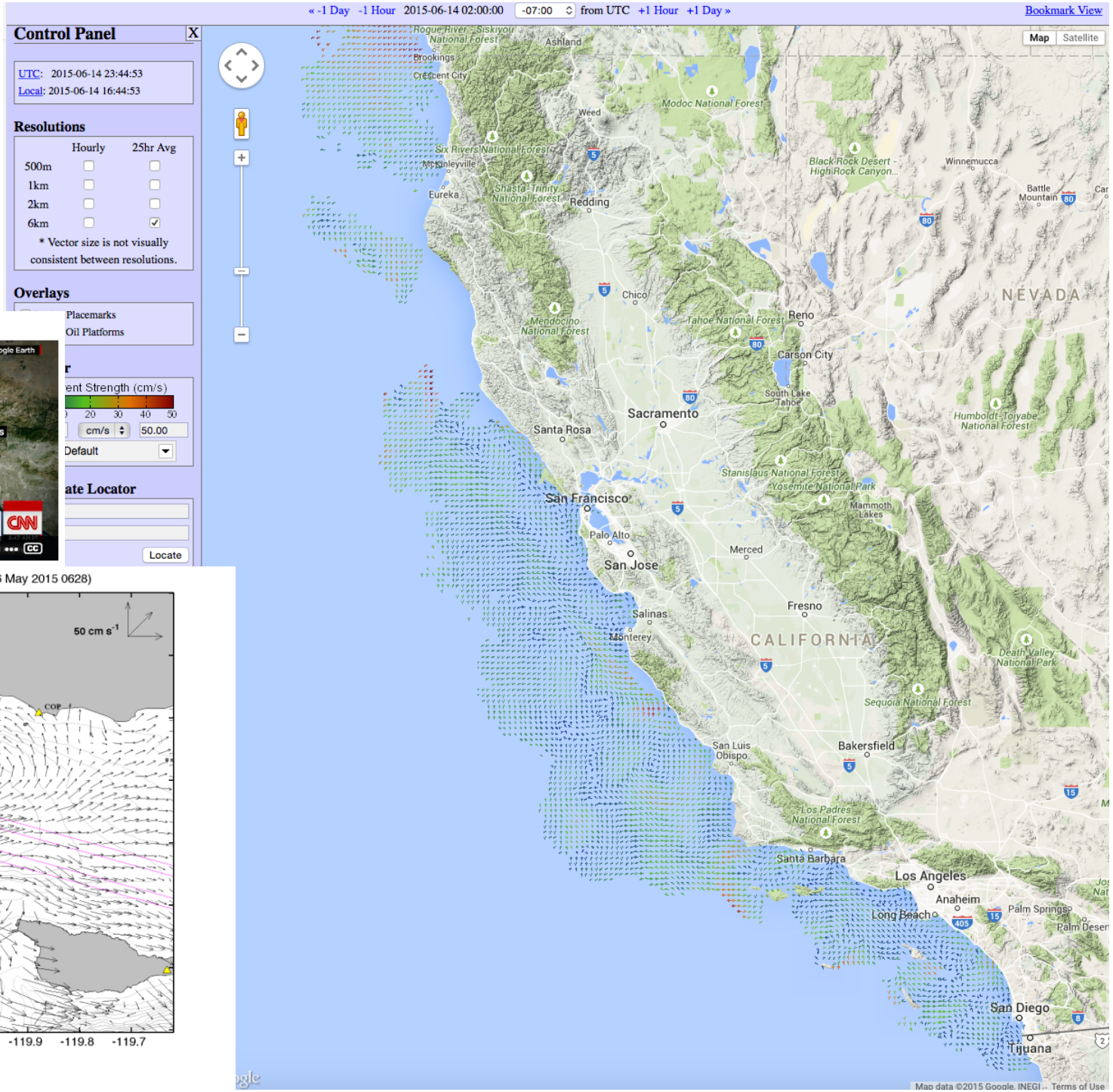
That concern is real.



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

CNN - California oil spill

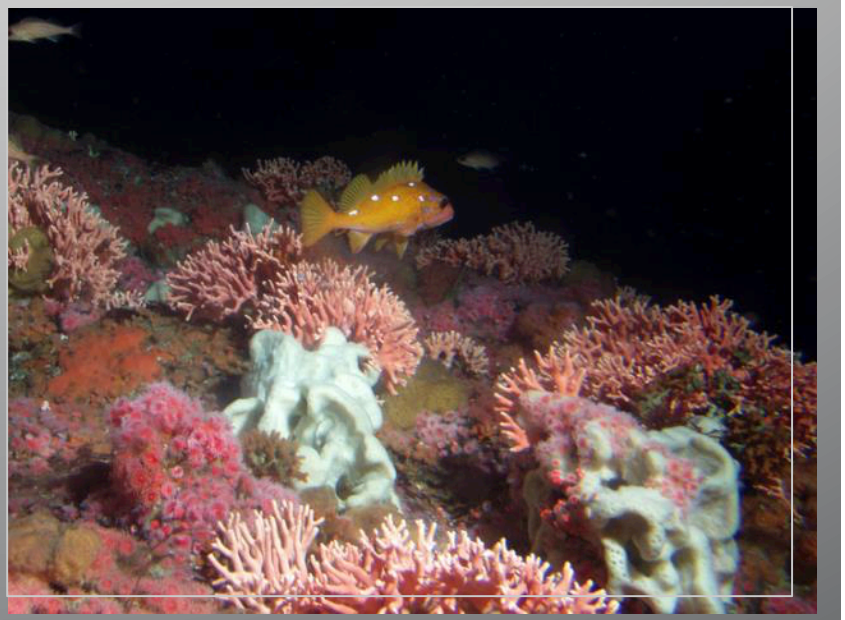




Indicators in the 2013 report

- Ocean Acidification
- Depth of the O_2 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

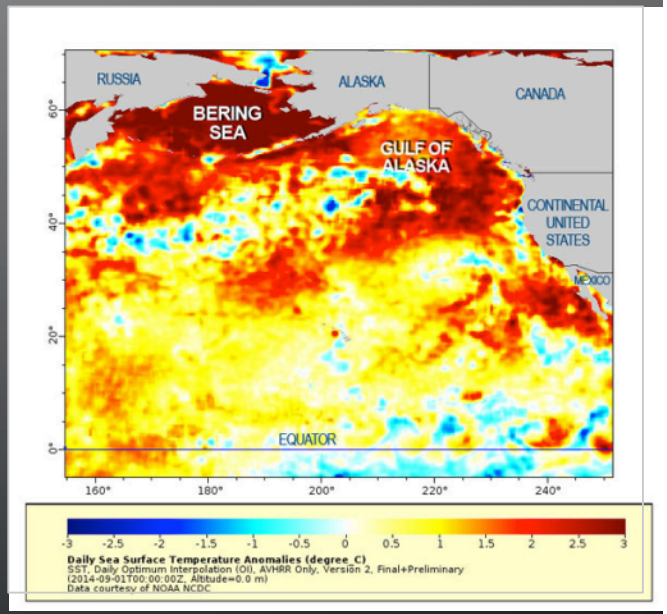
Commercial albacore fishing off Oregon. (Helena Aryafar, NOAA)



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

Questions?

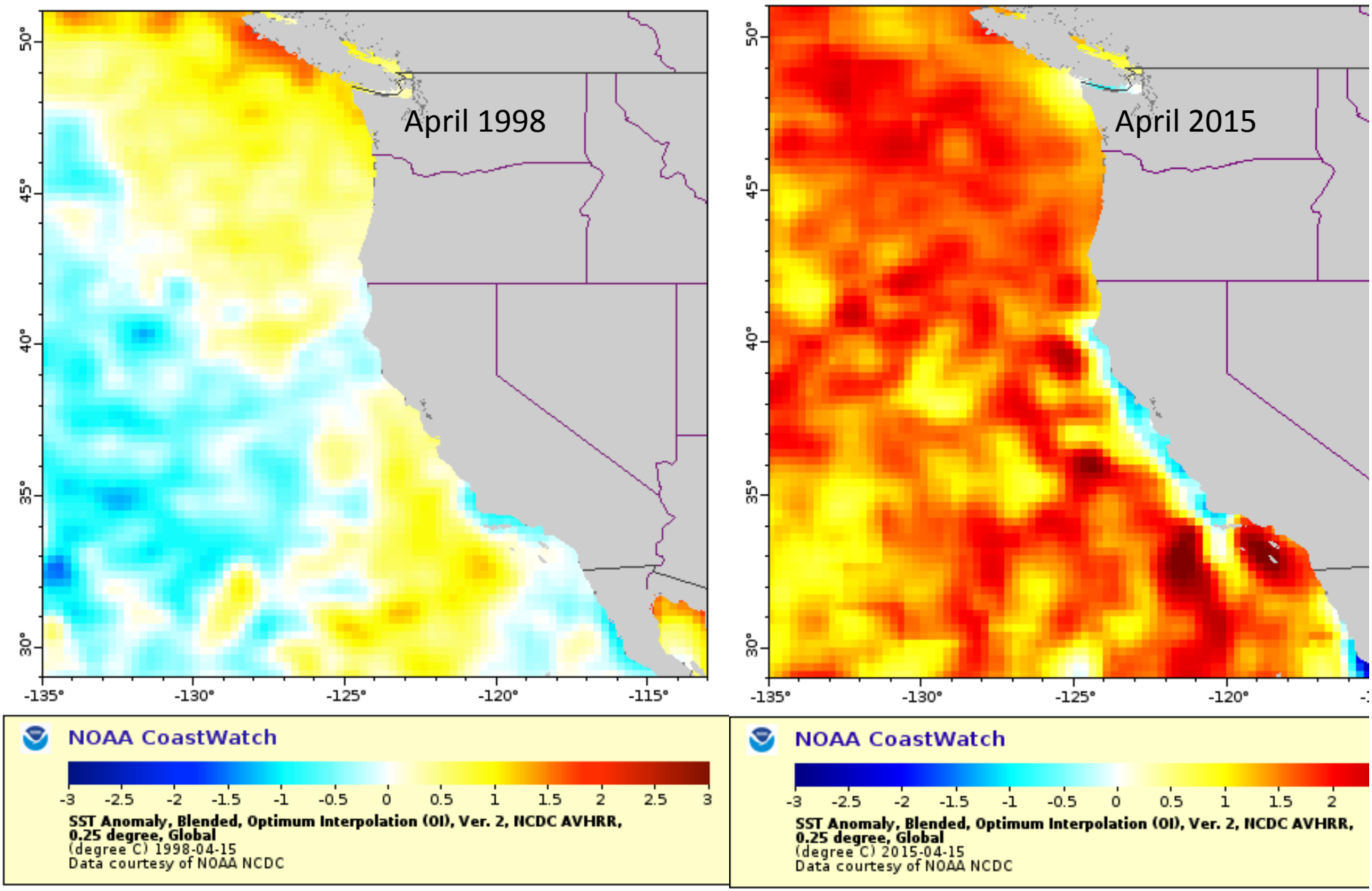
Emaciated California sea lion pup, San Nicolas Island, early 2015 (photo: Sharon Melin, NOAA)



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

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

IEA
INTEGRATED ECOSYSTEM ASSESSMENT


April 1998
April 2015
50°
45°
40°
35°
30°
-135°
-130°
-125°
-120°
-115°
NOAA CoastWatch
-3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3
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
-3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2
SST Anomaly, Blended, Optimum Interpolation (OI), Ver. 2, NCDC AVHRR, 0.25 degree, Global
(degree C) 2015-04-15
Data courtesy of NOAA NCDC