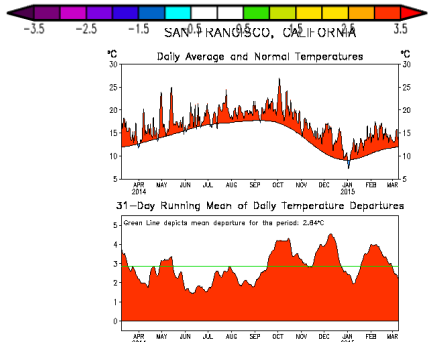
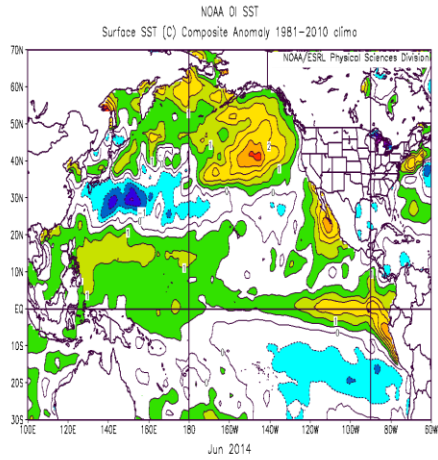


Conveying the 2014-2015 warm
anomaly environmental and
ecological conditions to fishers,
regulators, legislative staffers and
federal employees

Toby Garfield, Chris Harvey and the
CCIEA Team

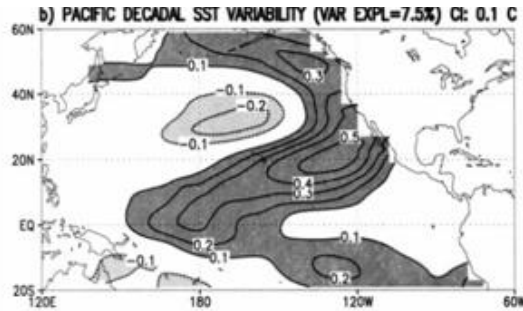
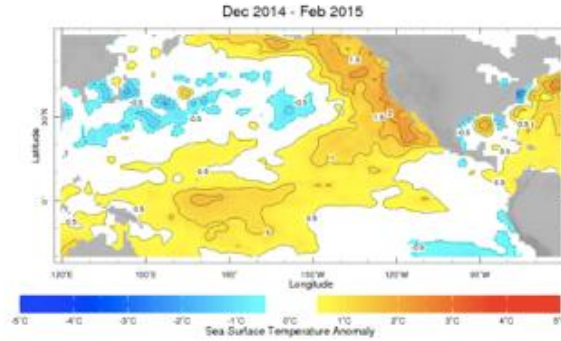
SIO Blob meeting, 6 May 2015

Historic "warm blob"



A very unusual year

Mild El Niño



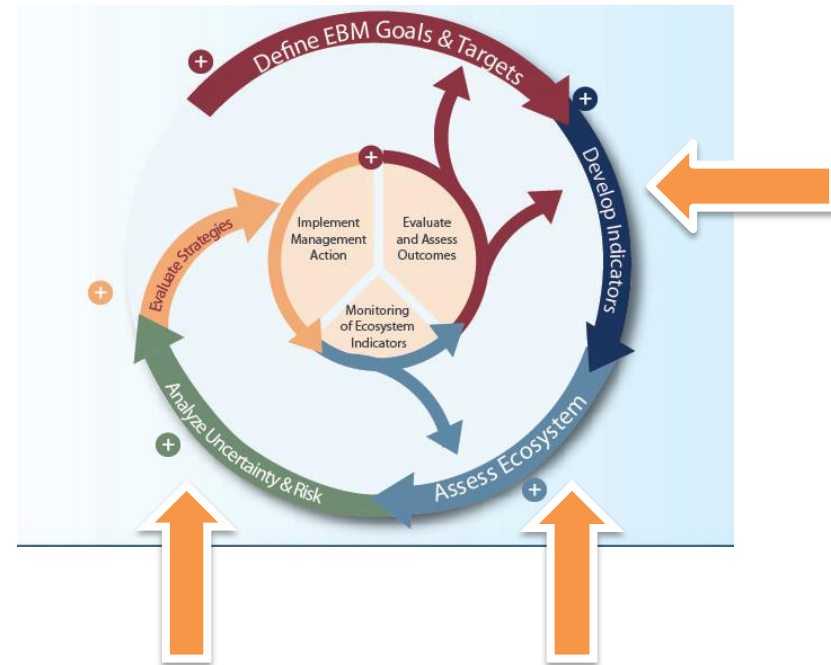
Historic warmth and low snowpack



CALIFORNIA CURRENT ECOSYSTEM

- Climate
- Energy
- Water quality
- Ship traffic
- Fisheries
- Economy
- Vibrant coastal communities

(IEA)



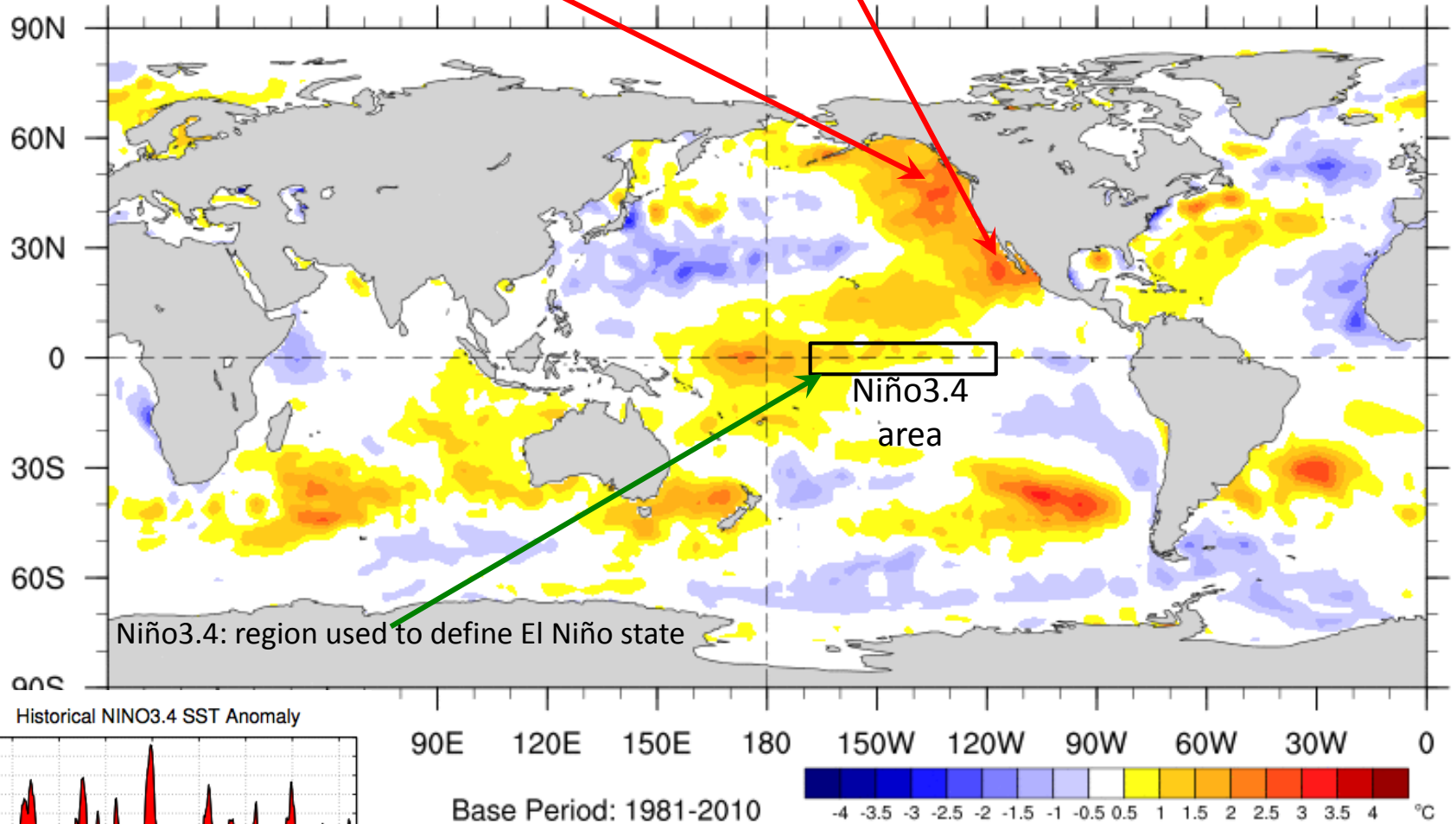
Integrated Ecosystem Assessment
Ecosystem-Based Management

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

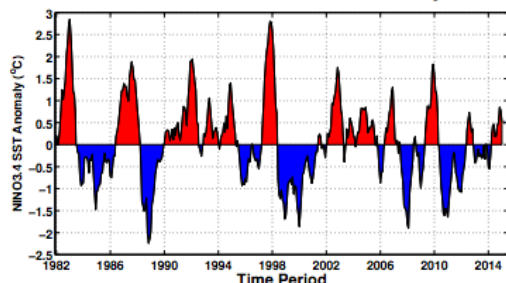
The Gulf of Alaska and the ocean off Baja California were $>3^{\circ}\text{C}$ warmer than average

Weekly SST Anomaly

2015/02/22 - 2015/02/28



Historical NINO3.4 SST Anomaly



El Niño, ENSO, MEI, Niño3.4, ONI

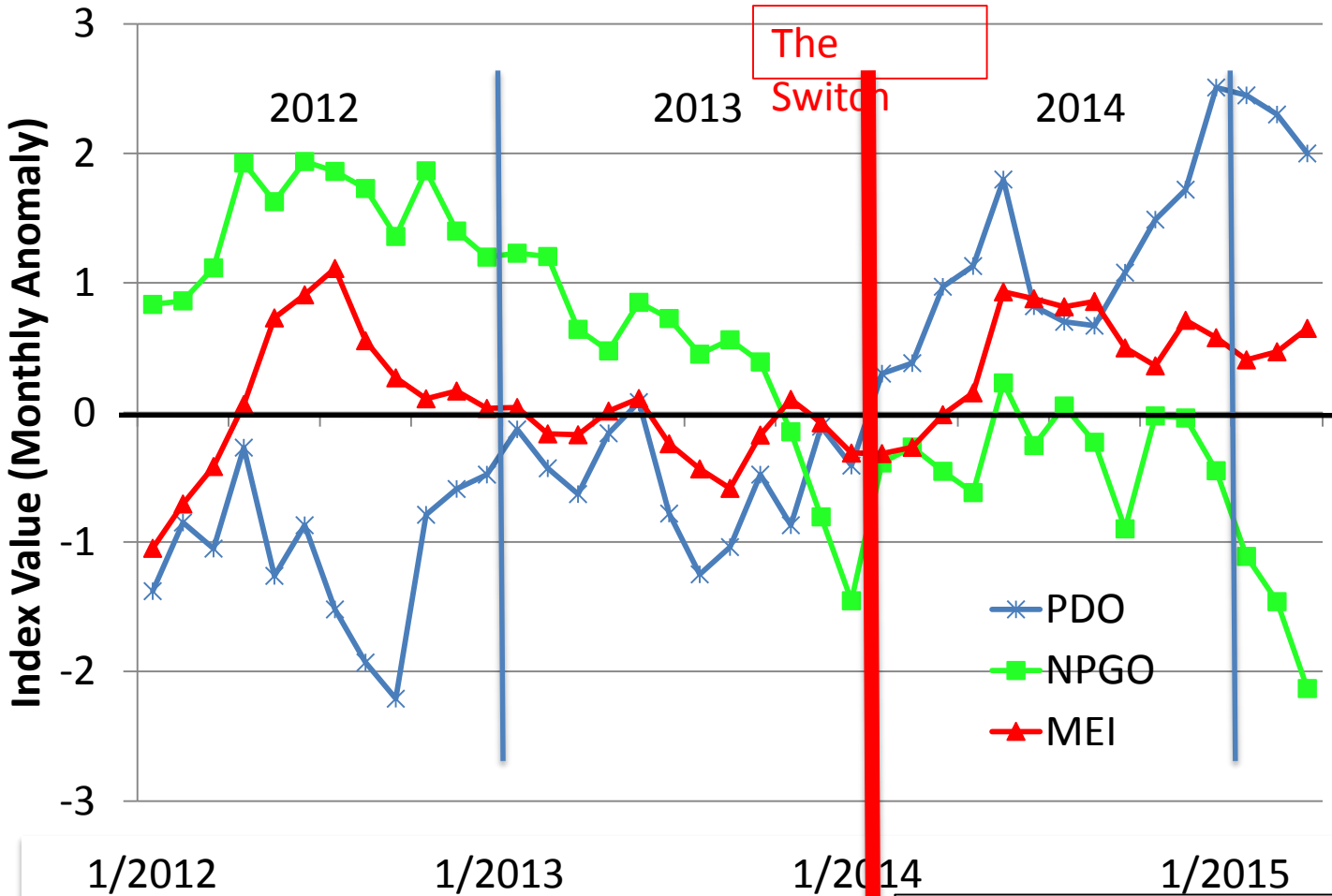
Basin Scale Indicators for the last 3 yrs:

PDO: Pacific Decadal Oscillation index indicating long term temperature shifts,

NPGO: North Pacific Gyre Oscillation Index indicating strength or volume of gyre flow,

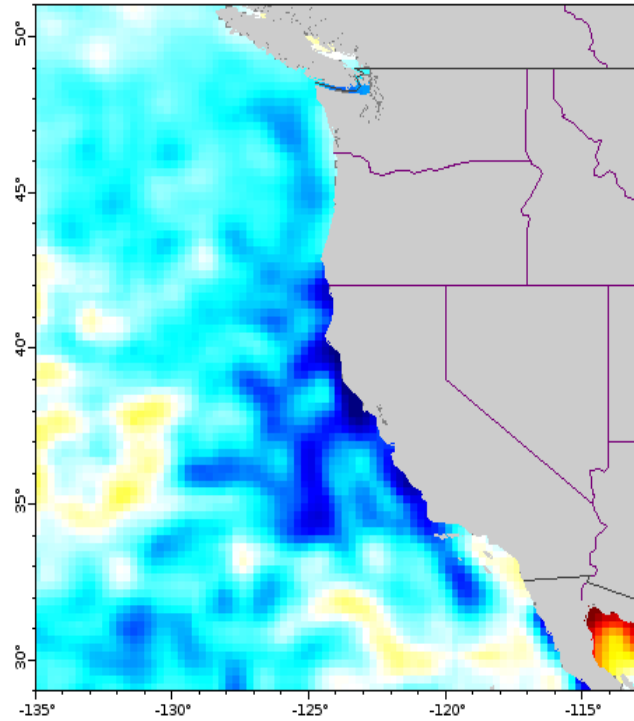
MEI: Multivariate El Niño Index indicating interannual variability of temperature

The three indices are suggesting that at the end of 2013 there occurred a transition from favorable productivity conditions to generally low productivity conditions!

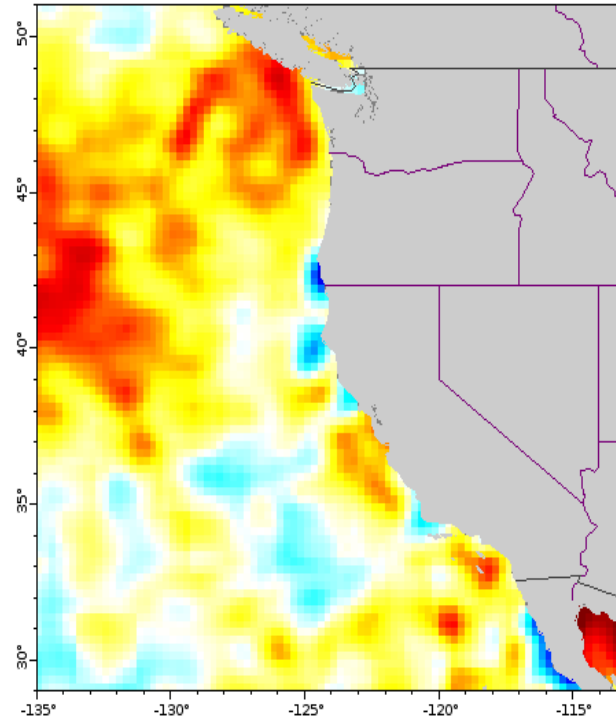


Sea Surface Temperature anomalies (SSTa) for April 2013, 2014, 2015

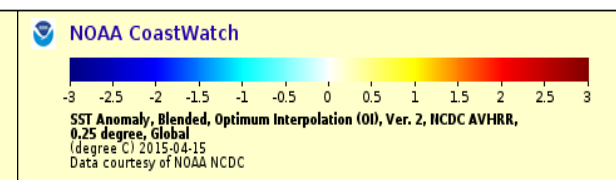
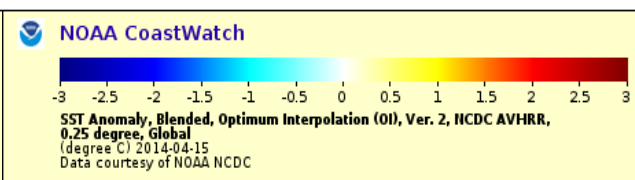
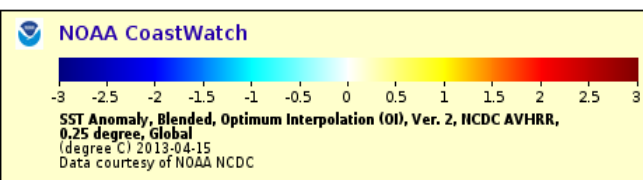
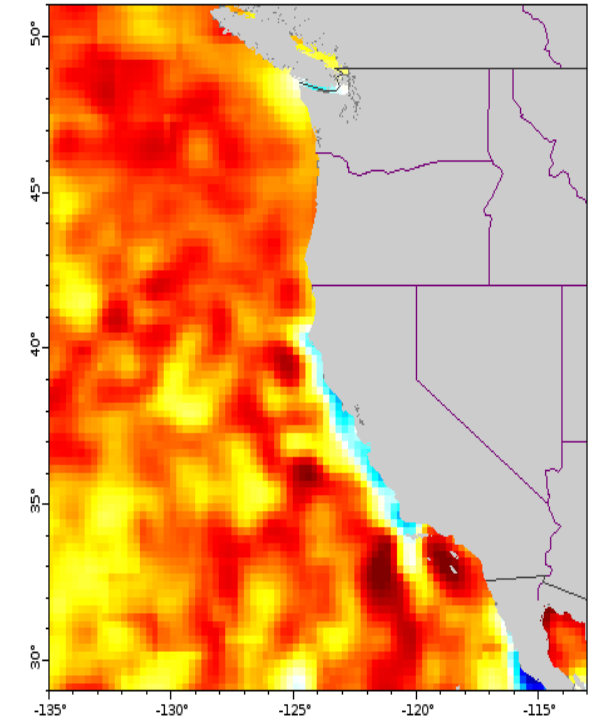
2013



2014



2015



2013: record upwelling

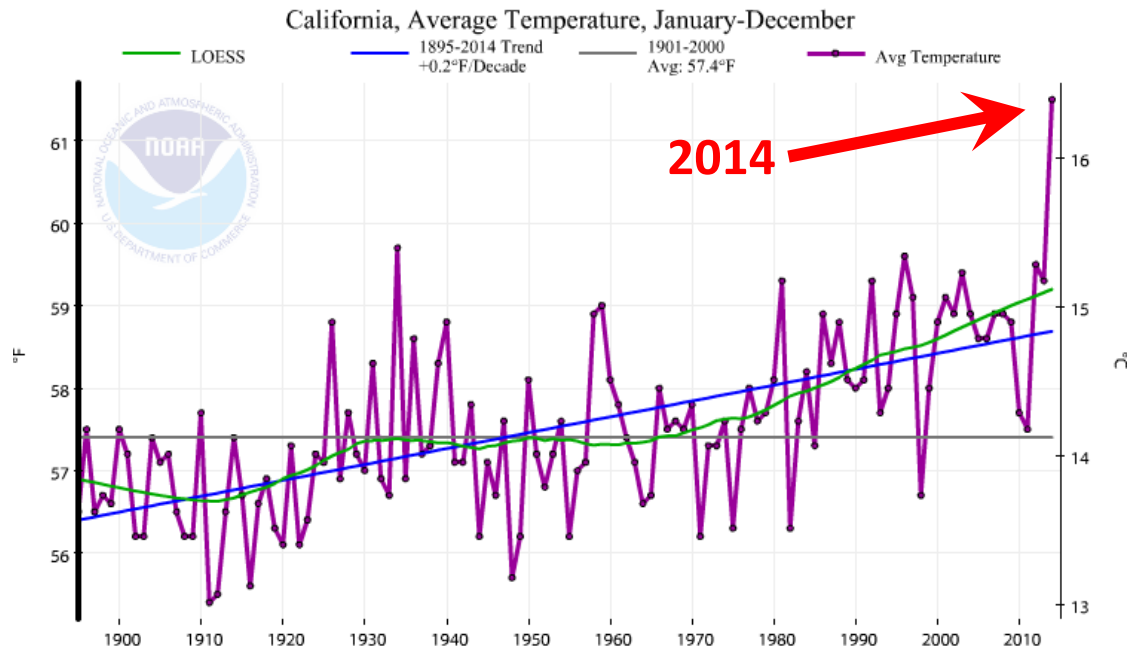
2014: alongshore gradient

2015:???

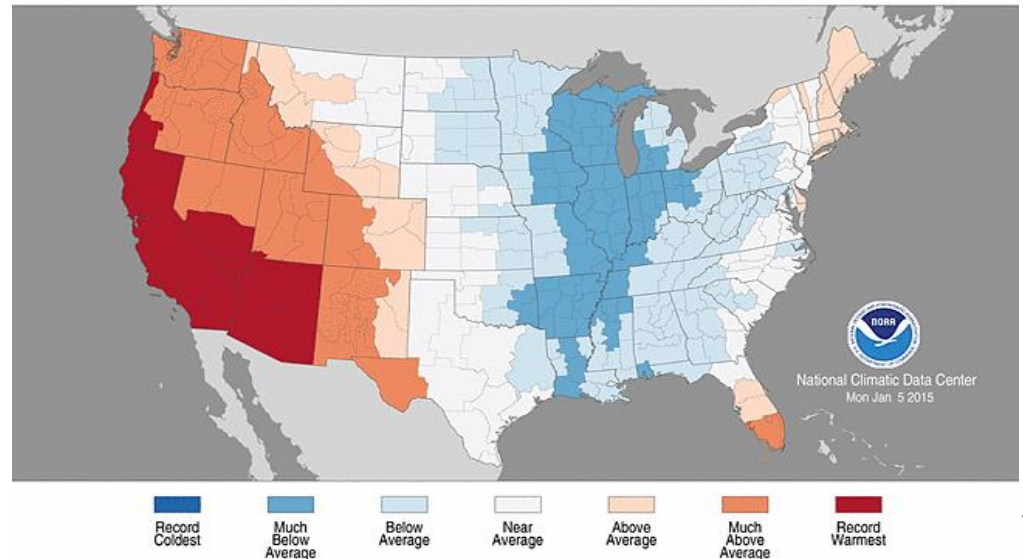
It wasn't just the ocean that was warm.

In California, 2014 weather was not only dry, but it was also extraordinarily hot

- Surface air temperature record was almost off the charts, ~ 1 °C warmer than the previous record
- Extraordinary warmth was confined to the southwest, centered in California

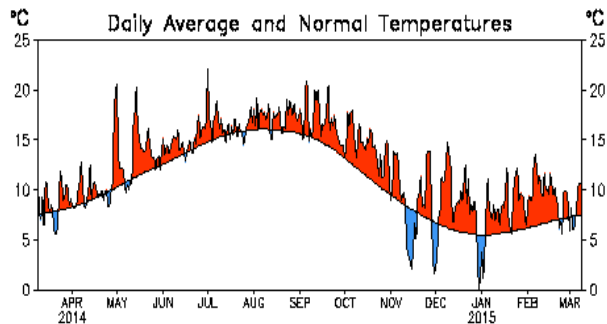


Divisional Average Temperature Ranks
January-December 2014
Period: 1895-2014

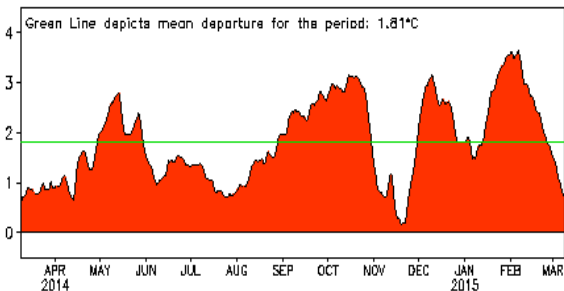


Almost every day in the last year was warmer than average at most West Coast locations

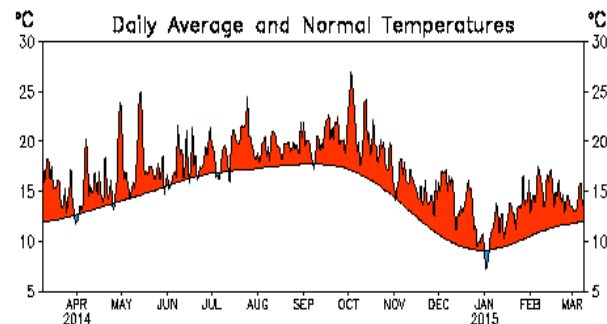
ASTORIA, OREGON



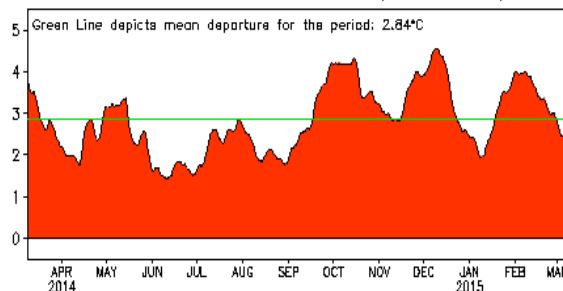
31-Day Running Mean of Daily Temperature Departures



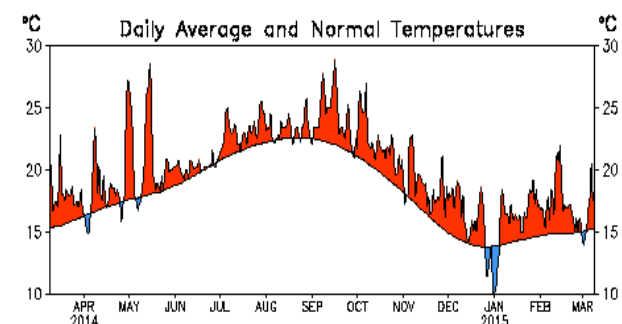
SAN FRANCISCO, CALIFORNIA



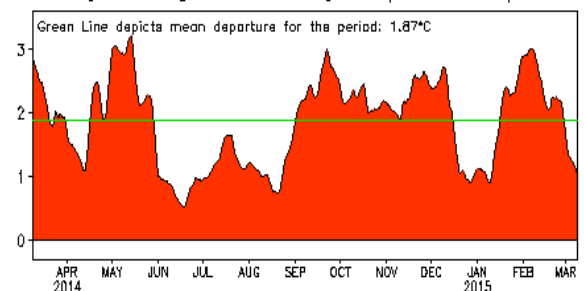
31-Day Running Mean of Daily Temperature Departures



SAN DIEGO/LINDBERGH, CALIFORNIA

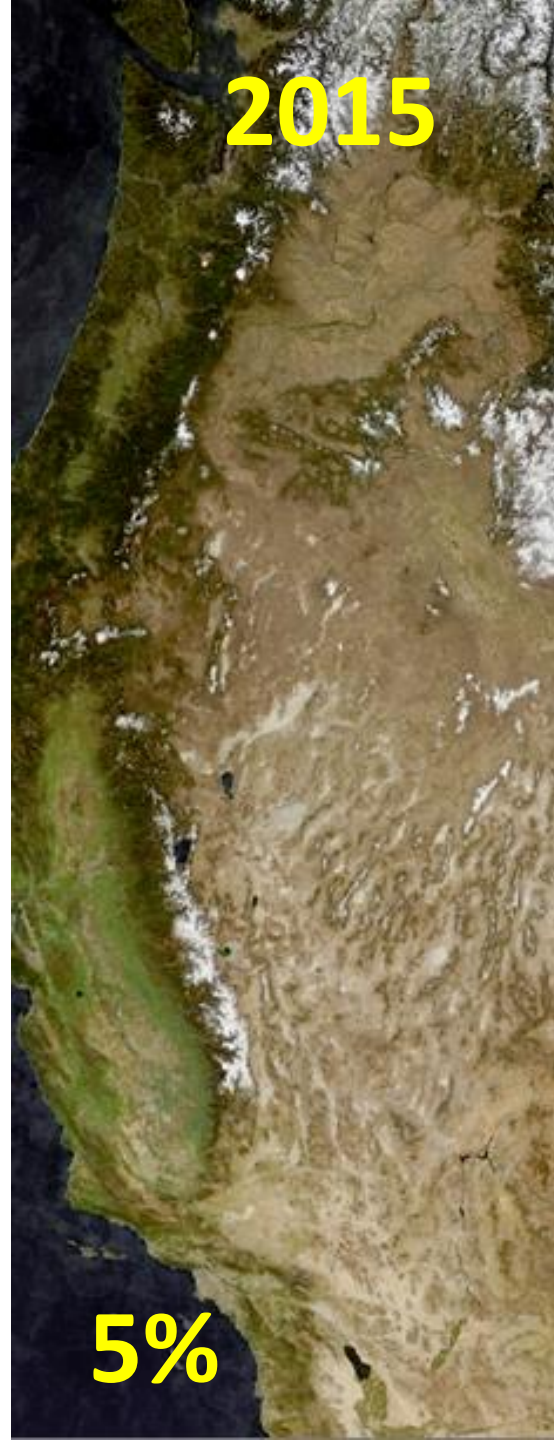
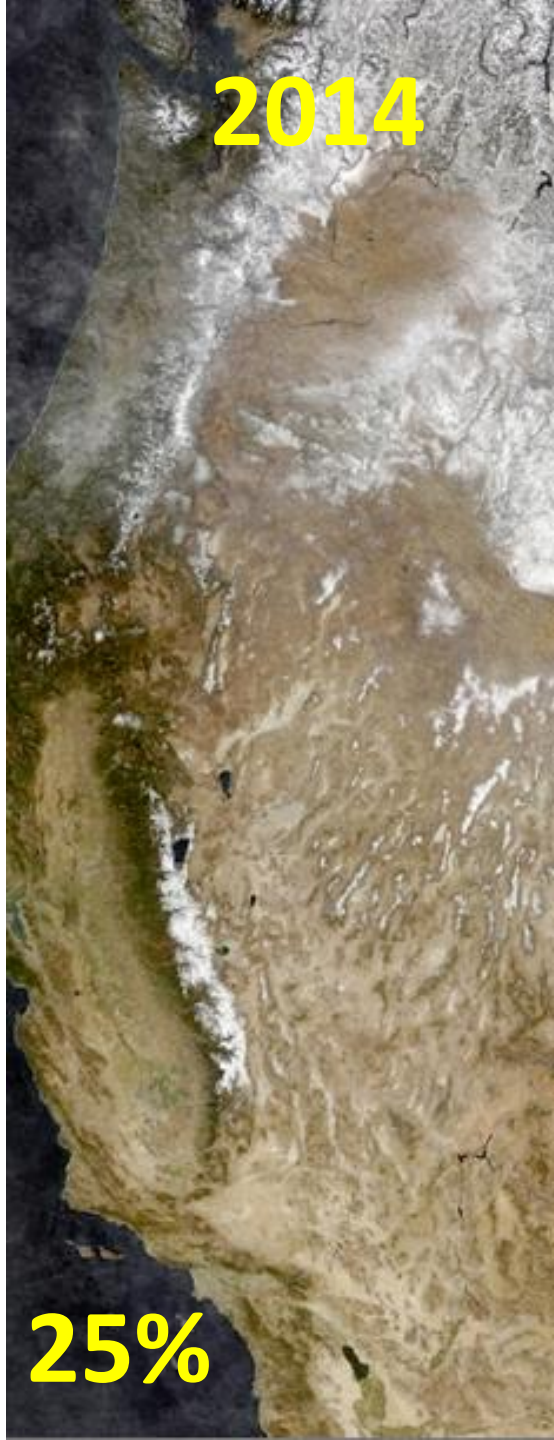
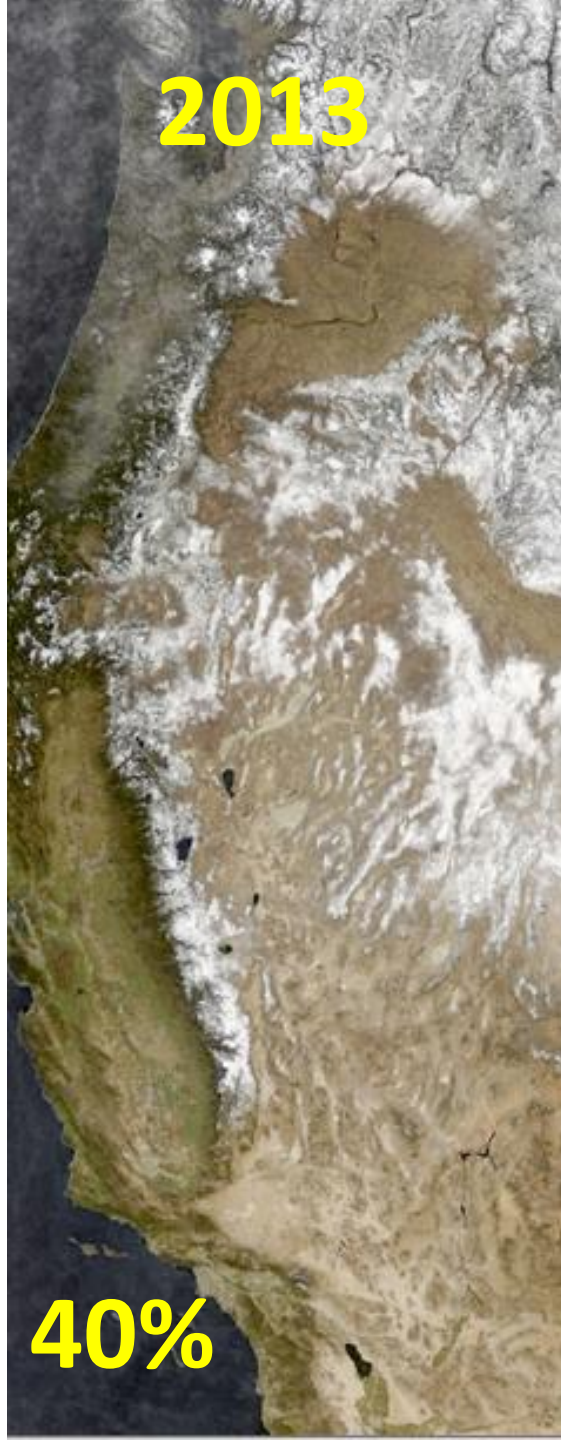


31-Day Running Mean of Daily Temperature Departures



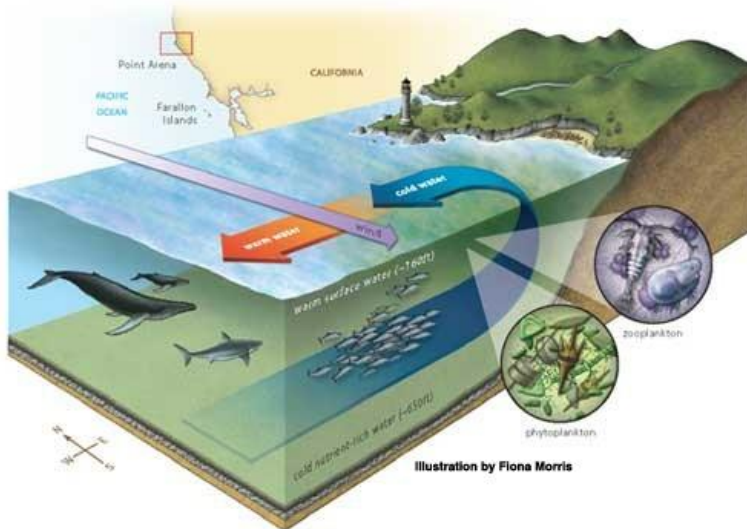
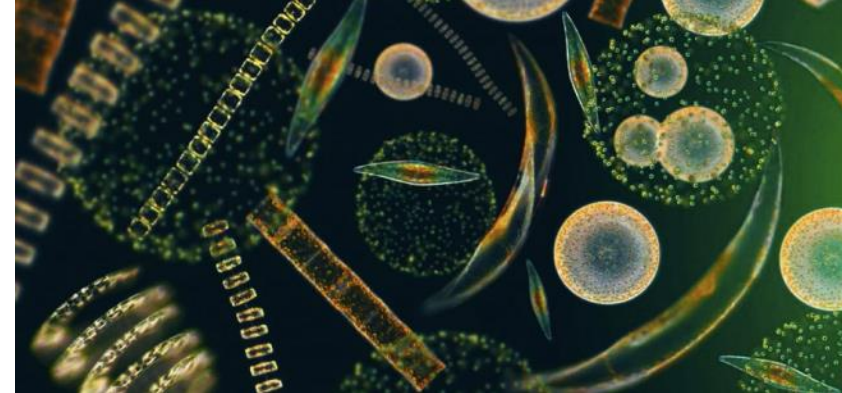
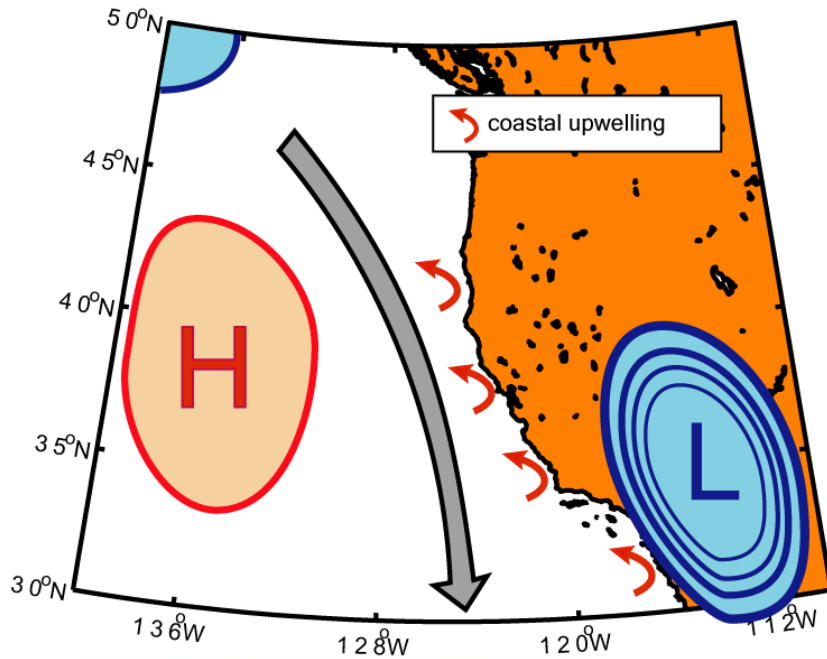
http://www.cpc.ncep.noaa.gov/products/global_monitoring/temperature/global_temp_accum.shtml

http://www.nytimes.com/interactive/2015/03/05/us/one-giant-picture-of-all-the-snow-across-the-us.html?smid=tw-share&_r=0

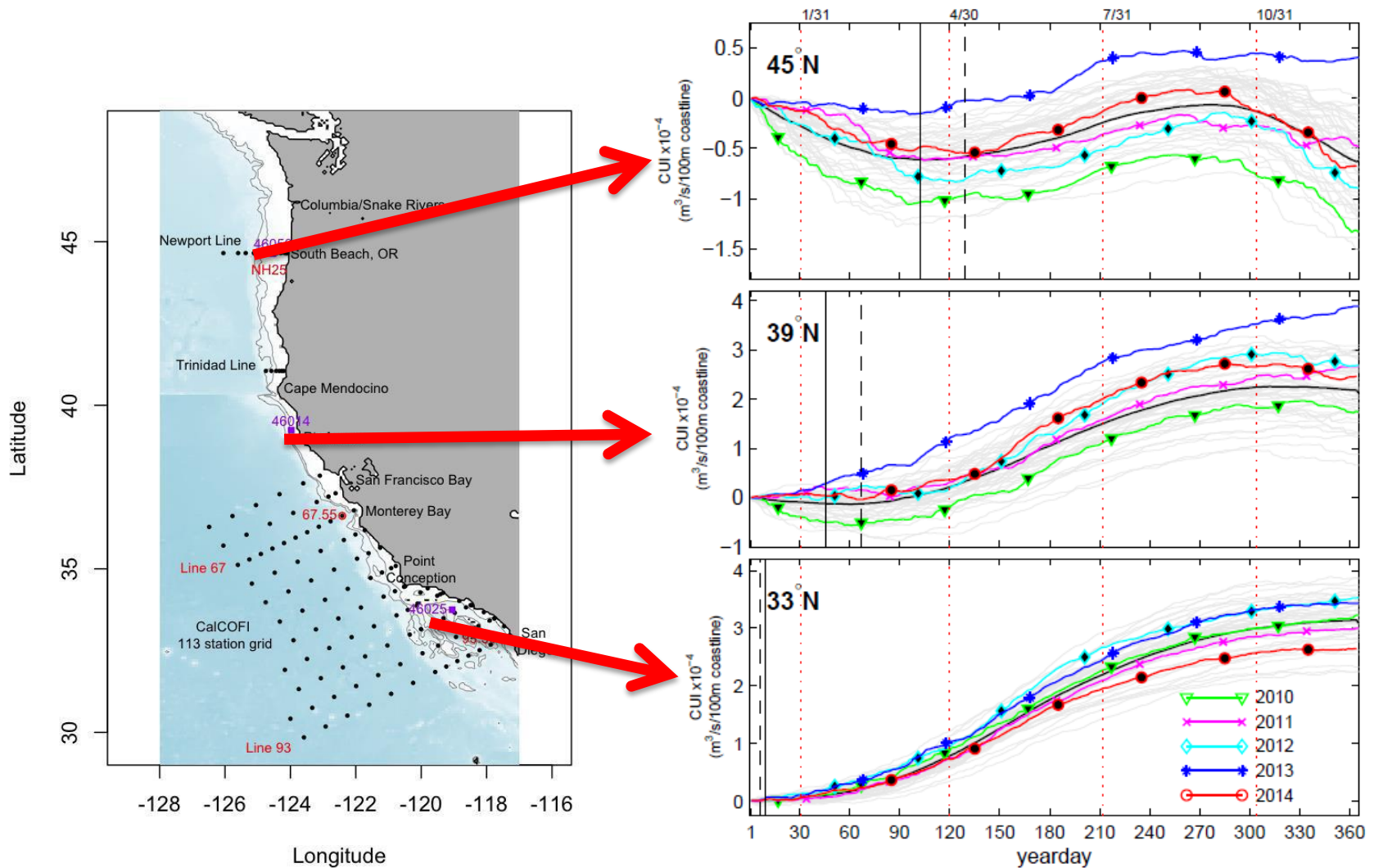


CALIFORNIA CURRENT FOOD WEB DEPENDS ON UPWELLING

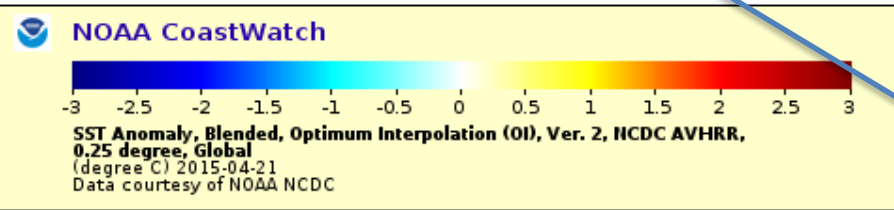
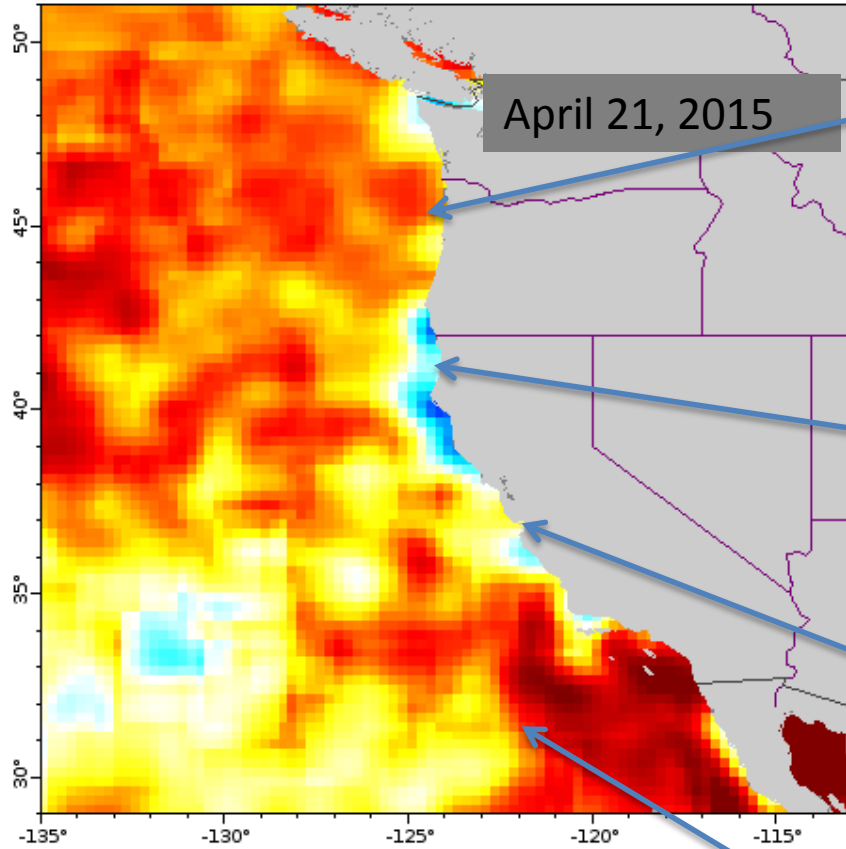
The source waters and upwelling strength determine the primary productivity



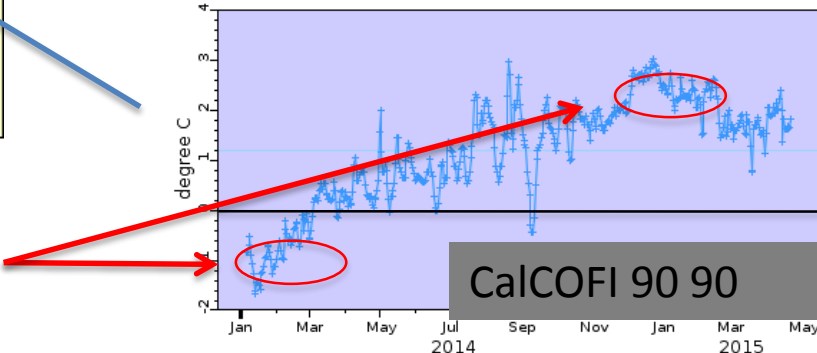
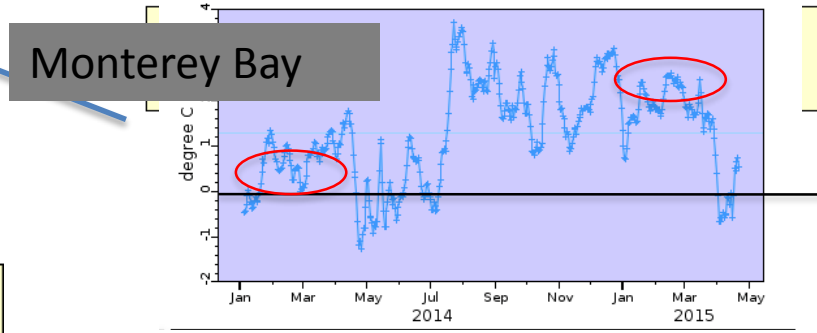
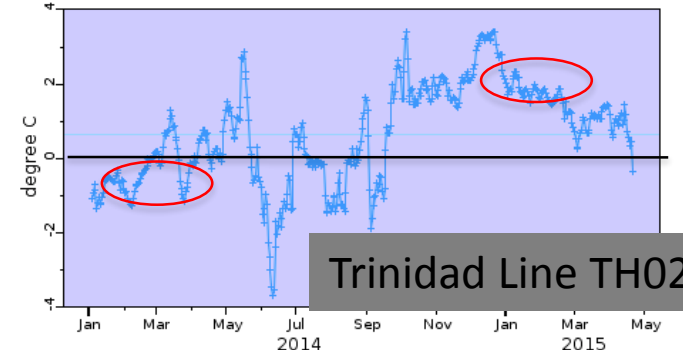
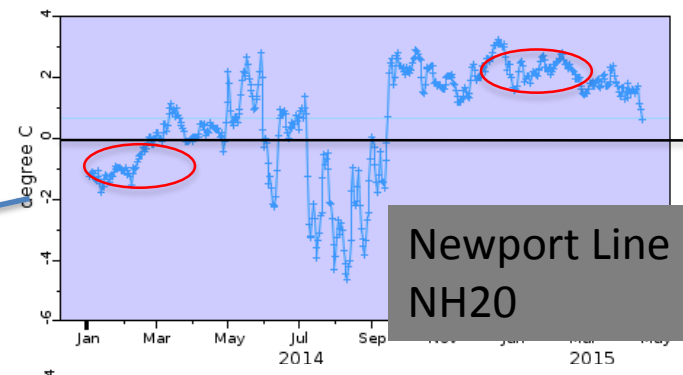
Regional Indicator: Cumulative Upwelling



2014/15 SST anomaly



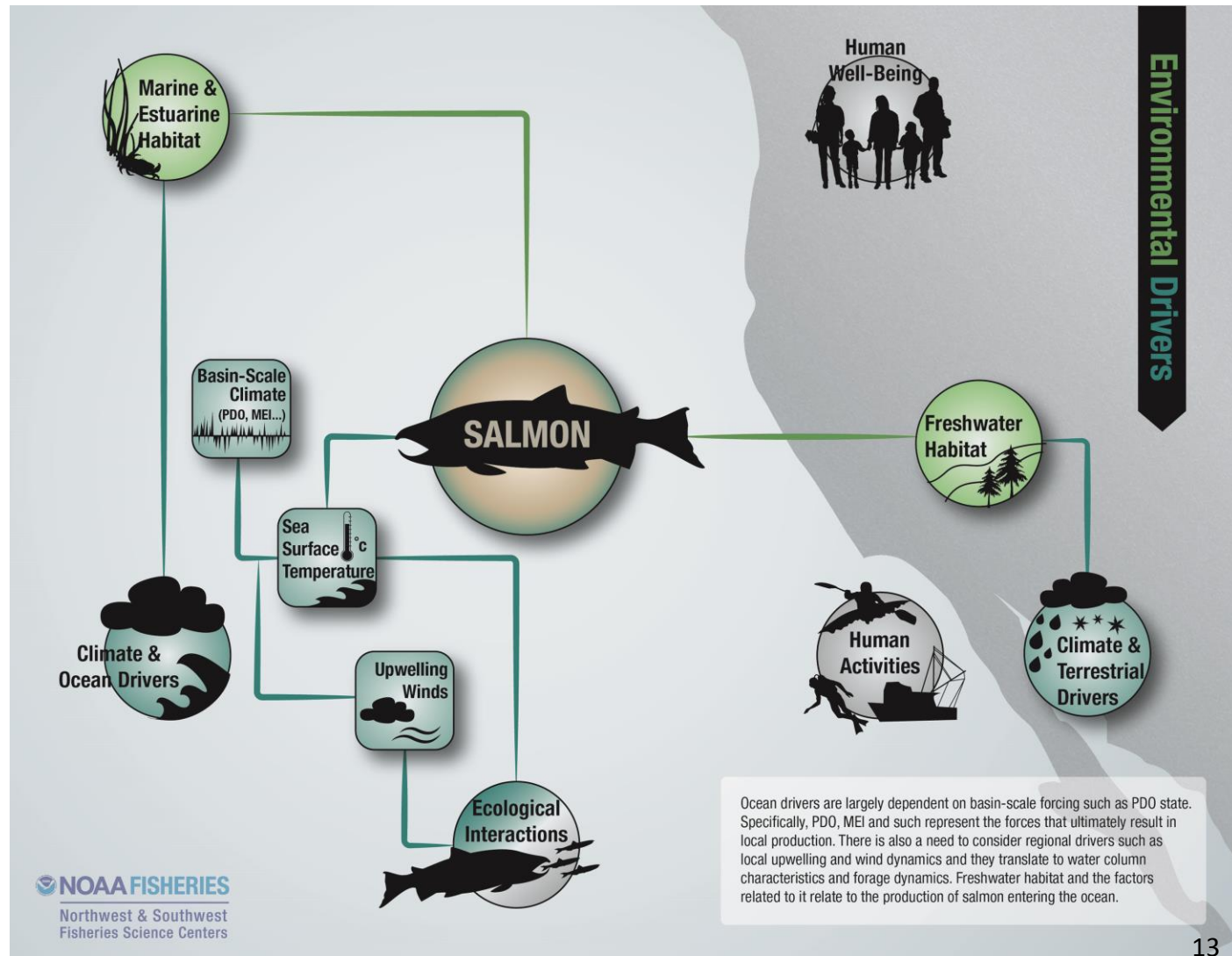
It's early to describe this spring's upwelling, but the winter ocean was much warmer.



How do these anomalies affect us?

(case study: salmon)

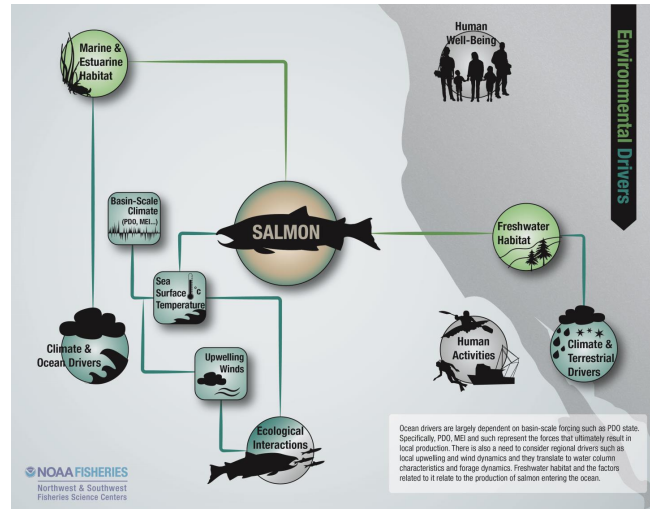
Environmental Drivers



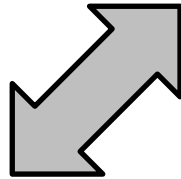
How do these anomalies affect us?

(case study: the outlook for salmon 2-3 year out it grim)

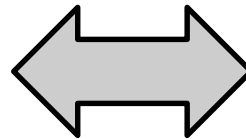
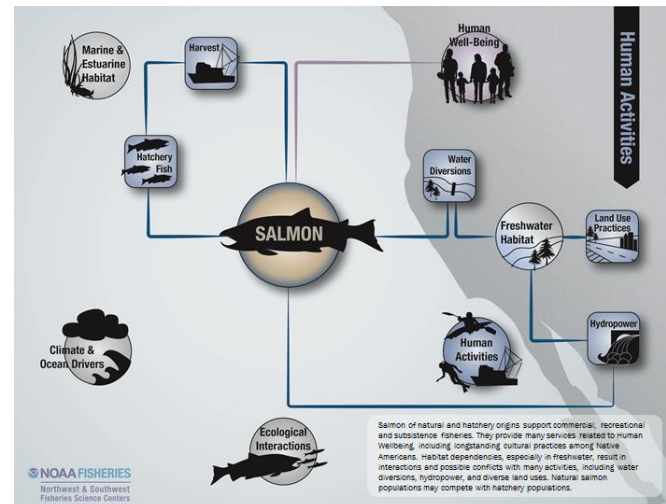
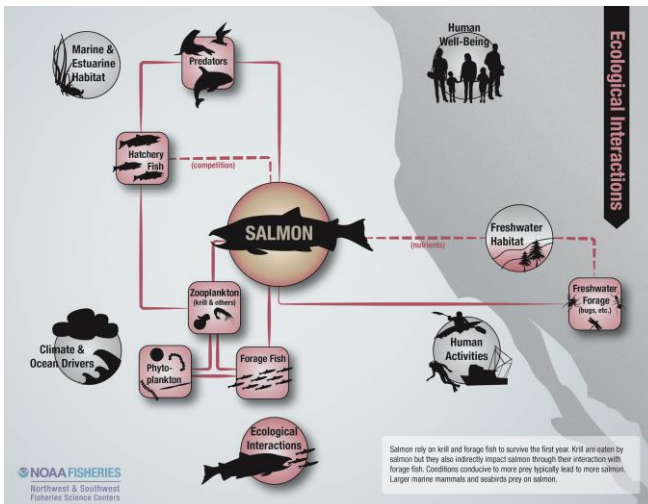
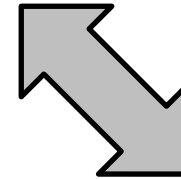
Environmental Drivers



Ecological Interactions

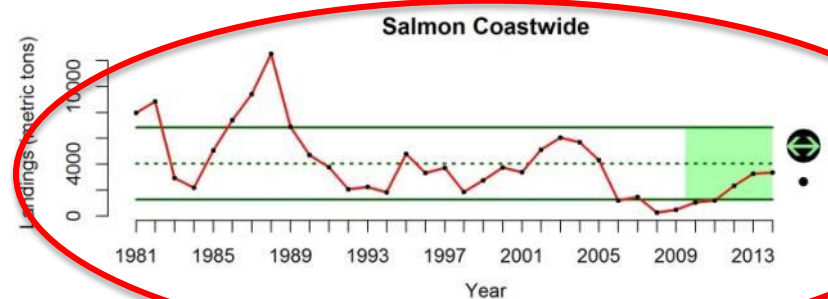
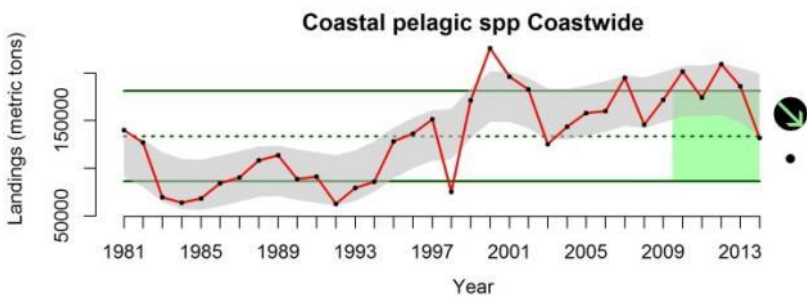
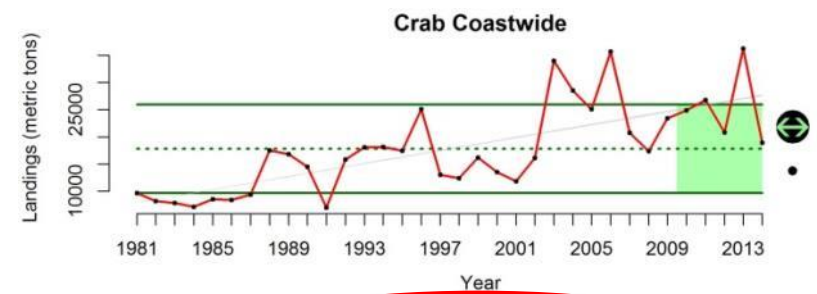
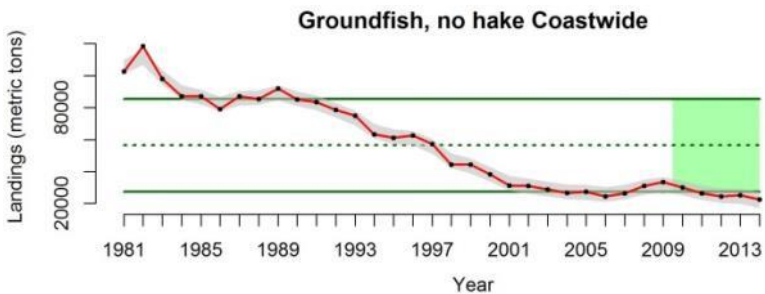
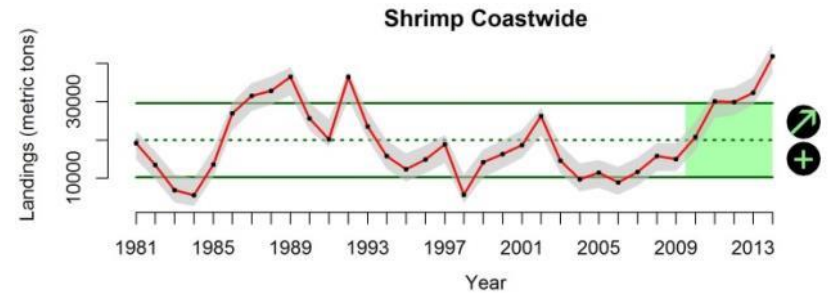
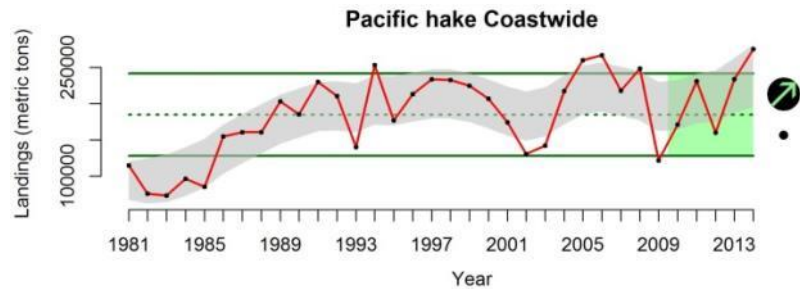
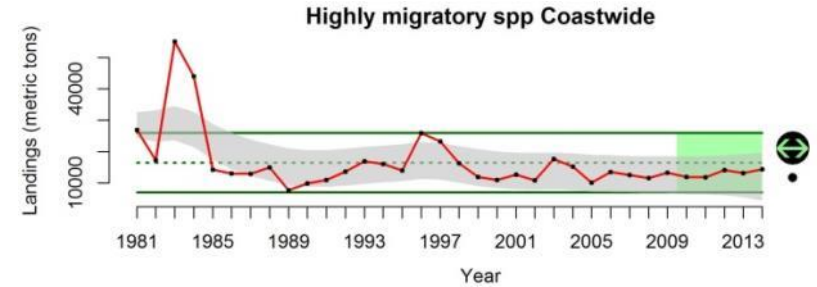
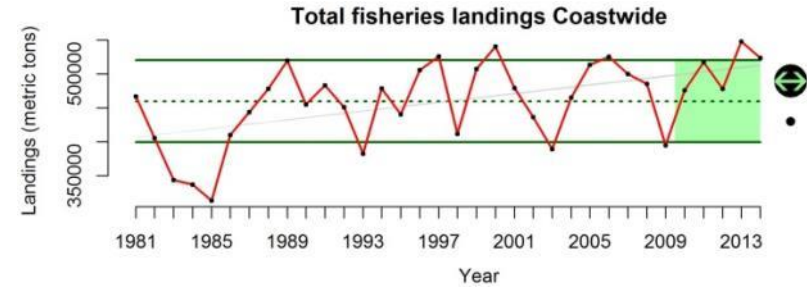


Human Activities



Coastwide U.S. commercial fishery landings

- Total landings just updated; 1981 to 2014



Other human activities

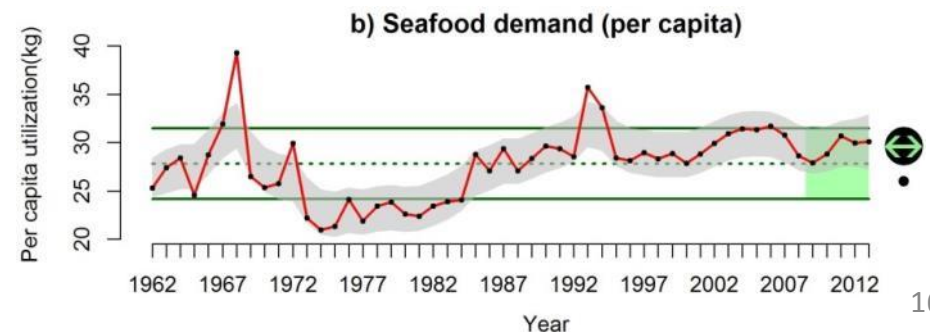
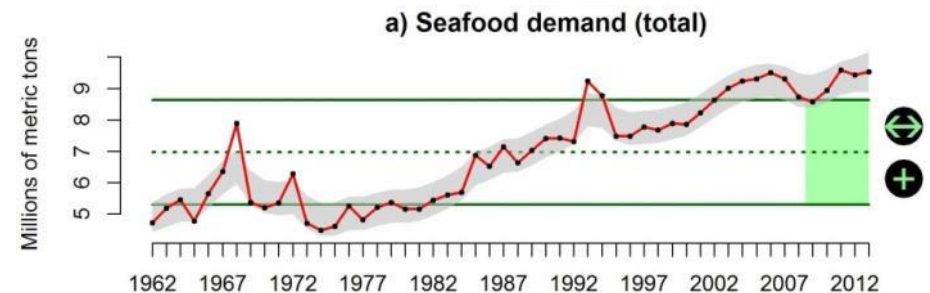
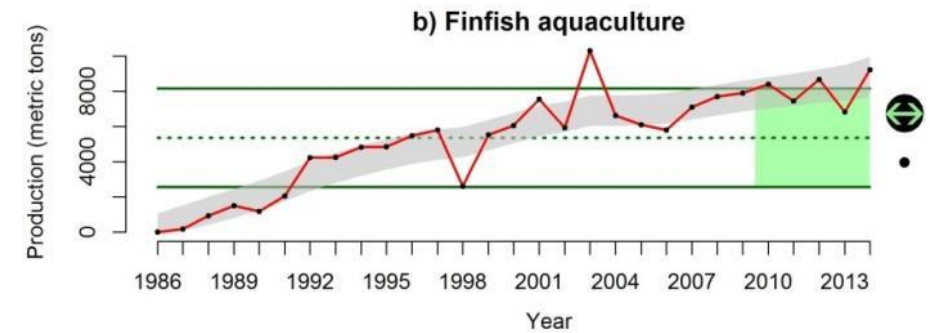
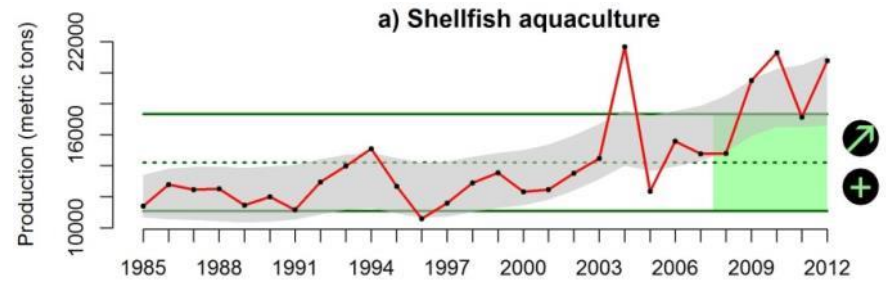
- **Sectors related to fisheries:**

- West Coast shellfish aquaculture (through 2012)
- West Coast finfish aquaculture (through 2014)
- U.S. total seafood demand (through 2013)

- **Per capita U.S. seafood demand remains flat**

- **IEA is monitoring other human activities as well**

- Shipping
- Energy extraction
- Coastal development
- Pollution

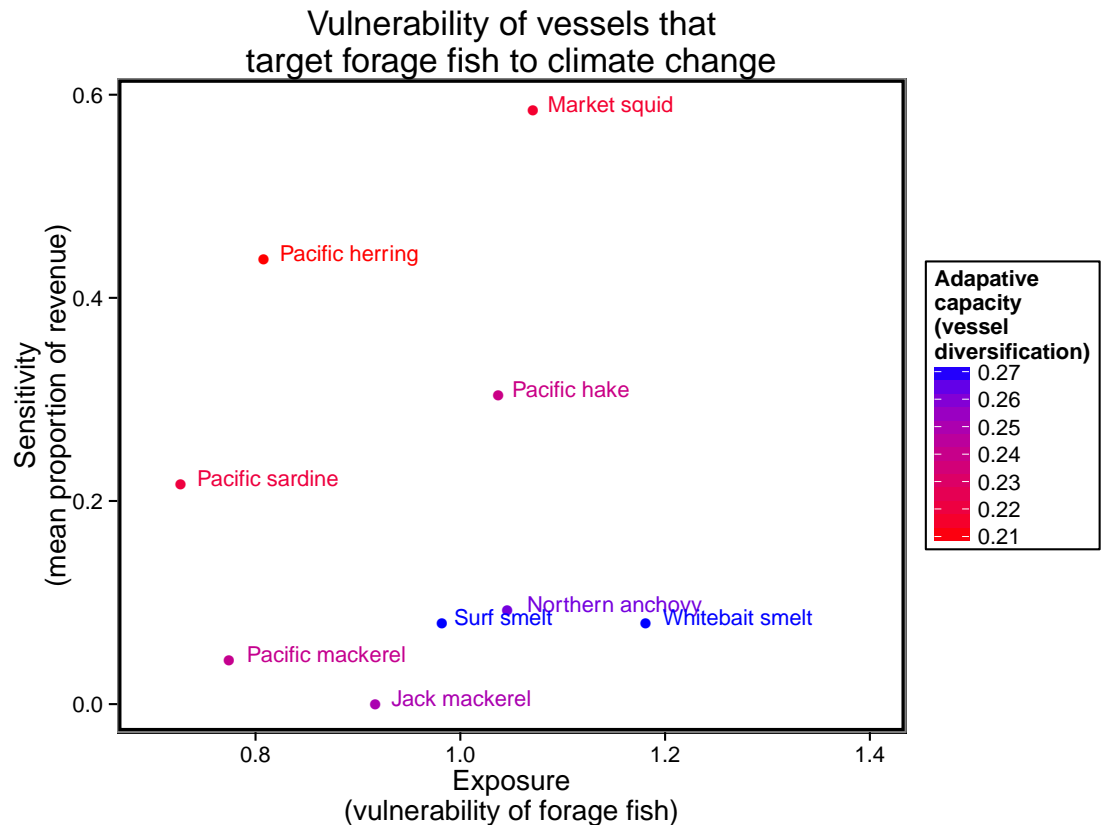




VULNERABILITY OF *PEOPLE* TO CLIMATE CHANGE

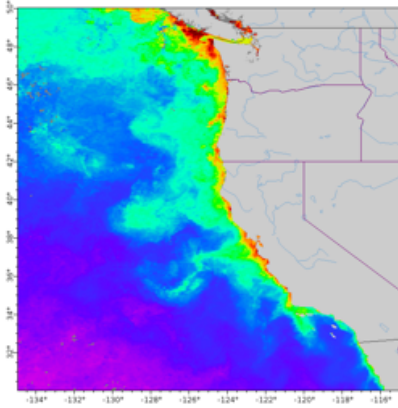
Is a vulnerable fish a vulnerable fishery?

Premise: increased vulnerability of marine resources to expected climatic change, and reduced resilience in human communities
→ increased vulnerability





Providing near real-time satellite data for the coastal ocean



Environmental Data

View and download over 800 regional and global datasets, including satellite data, model output, and in situ measurements from field sensors.

[Data Catalog](#)

ERDDAP Data Server

The ERDDAP data server provides a simple, consistent way to subset and download environmental datasets in common file formats with options to make graphs and maps.

[Features](#)

[Get Data](#)

Software

The Environmental Data Connector (EDC) and Xtractomatic data extraction scripts make it easy to discover and extract data from online servers and download them directly into ArcGIS, R, MatLab, and Excel.

[EDC](#)

[Xtractomatic](#)

News and Events

New CoastWatch website for the West Coast Node unveiled [Posted: Apr 20, 2015](#)

Coming soon: 2015 NOAA Ocean Satellite Data Course [Posted: Apr 1, 2015](#)

VIIRS POC and PIC are now available on ERDDAP [Posted: Aug 26 2014](#)

High-resolution VIIRS SST is now available on ERDDAP [Posted: Nov 5 2014](#)

ERDDAP update - [Version notes](#) and instructions for [downloading and installing](#) are available for ERDDAP [Posted: Mar 12, 2015](#)

Xtractomatic tools update - new versions of [Xtracto for Matlab](#) and [Xtracto for R](#) directly access an expanded number of datasets [Posted: Mar 9, 2015](#)