



The Annual California Current Ecosystem Status Report: Background and physical oceanography indicators



Dense schools of fishes form over a coral and sponge community in the Cordell Bank National Marine Sanctuary. (NOAA)

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With support from NOAA's California Current IEA Team

January 12, 2016

#1 of 5 IEA Webinars to the PFMC

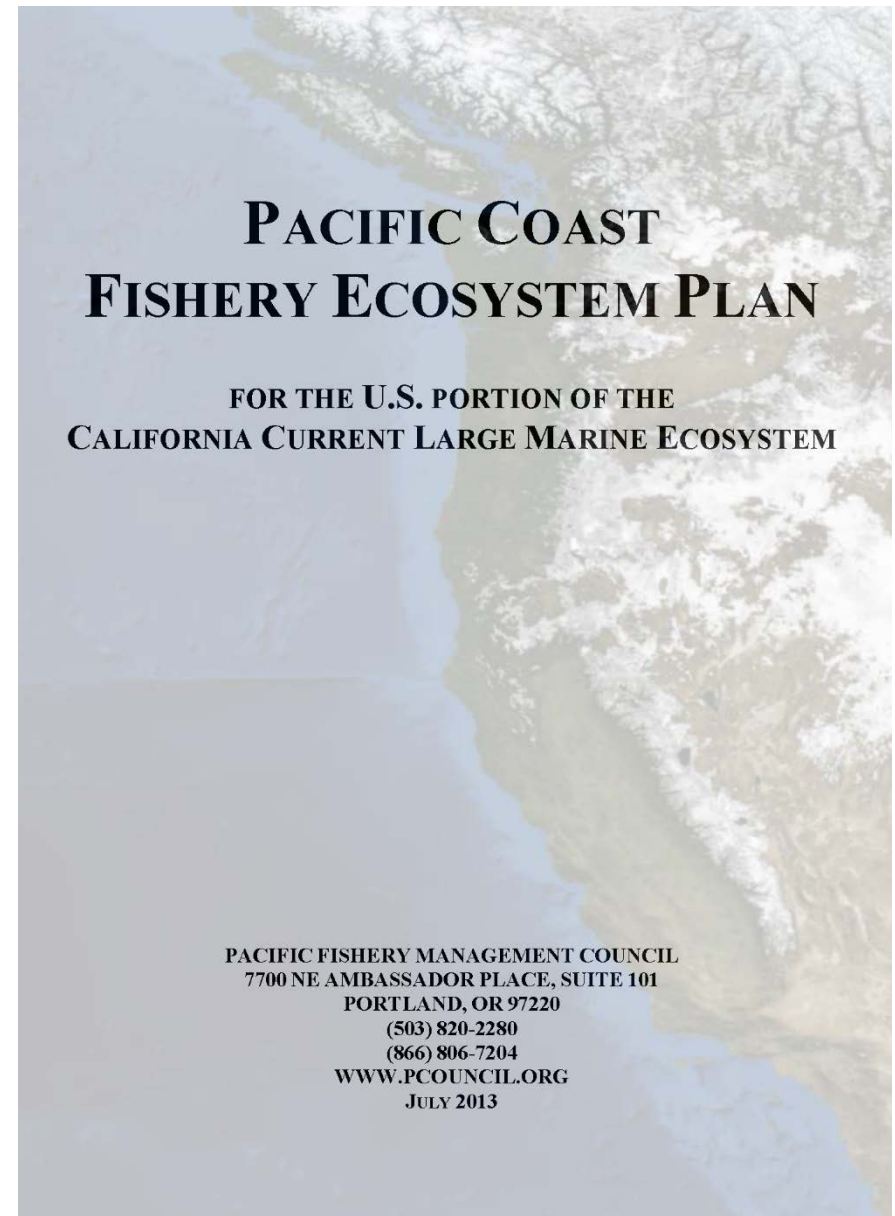




State-of-the-Ecosystem Reporting:

Council requests an annual Ecosystem Status Report at each of its March meetings.

The Report is to provide indicators that improve understanding of status and function of the ecosystem parameters relevant to Council decision-making process.



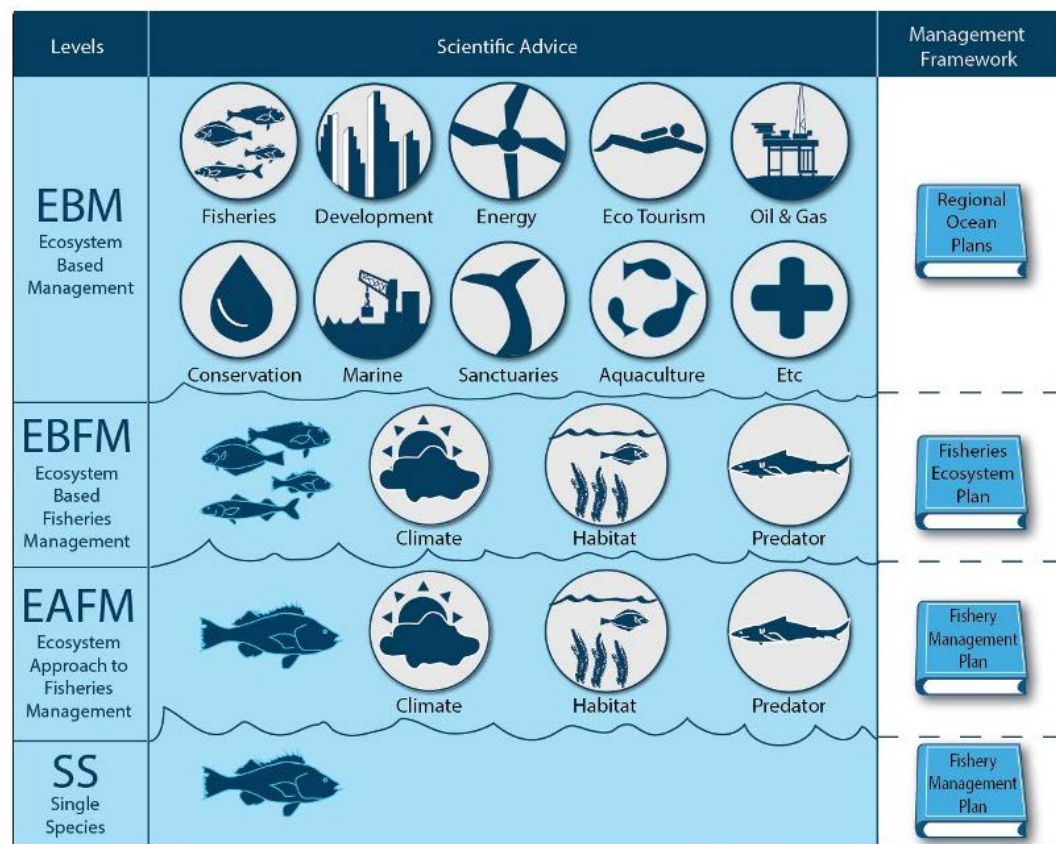
Why Develop an Integrated Ecosystem Assessment (IEA)?

To enable **Ecosystem Based Management (EBM)**

EBM: The IEA integrates **socio-economic factors** into any management testing scenarios.

EBFM: The IEA provides the tools for multi-species management decisions.

EAFM: Regional Fishery Management Councils including “**Fishery Ecosystem Plans**” based on regional IEA



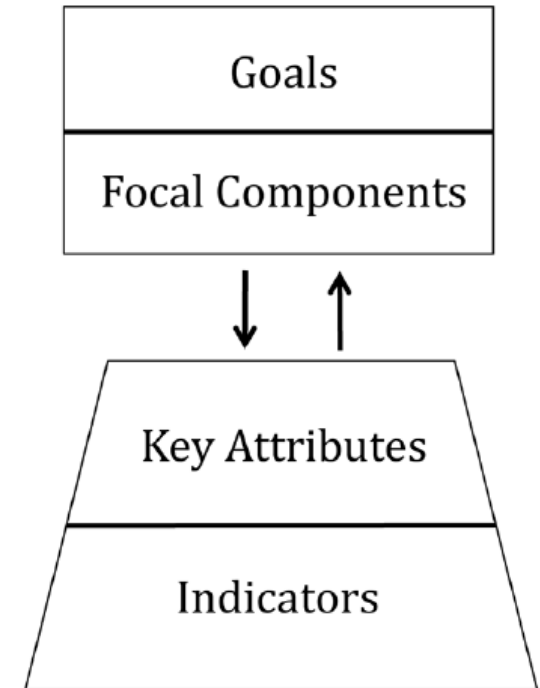
NOAA FISHERIES



Indicators:

To be managed, it must be measured

- o Need to select those indicators that best inform **the defined management goals**.
- o Ecosystem indicators are quantitative
- o Indicators should be:
 - directly observable
 - based on well-defined theory
 - understandable to the general public
 - cost-effective to measure
 - supported by historical time series
 - sensitive and responsive to changes in ecosystem state (and management efforts)



From Kershner et al., 2011

The California Current Large Marine Ecosystem (CCLME) is driven from below by ecosystem variability and from above by anthropogenic pressures. EBM (PFMC) goals must balance pressures from both below and above.

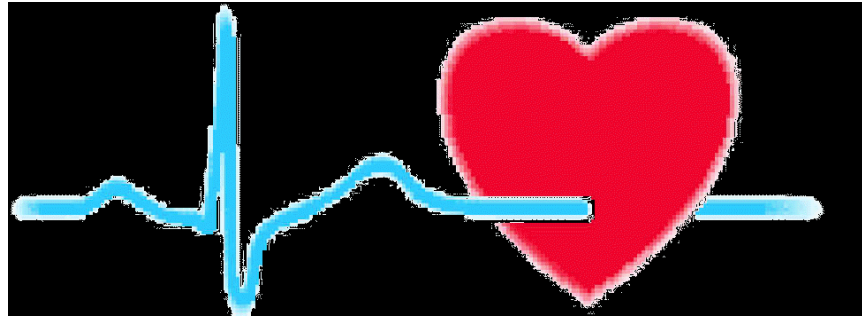


Key attribute

- *Key attributes* are the characteristics that define the structure, composition, and function of focal ecosystem components
 - Harwell, M. A., V. Myers, et al. (1999). "A framework for an ecosystem integrity report card." Bioscience **49**(7): 543-556.

Indicator

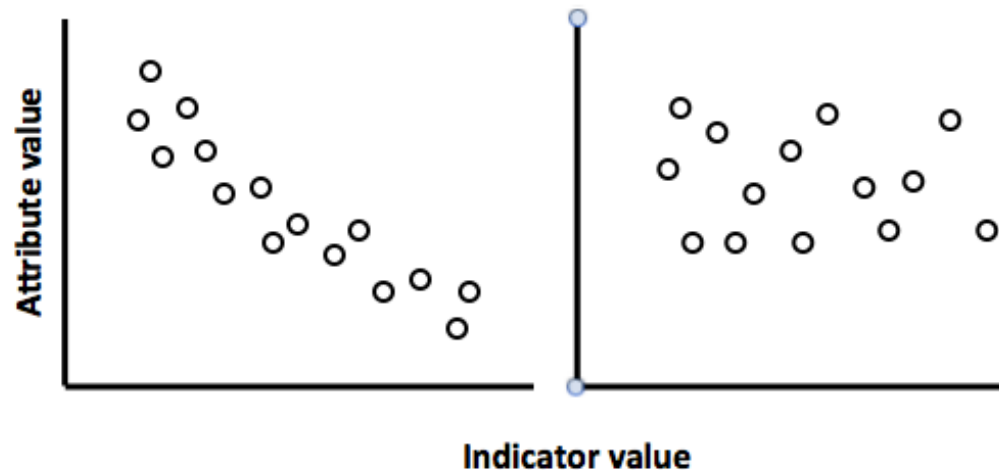
- *Quantitative measurements that serve as proxies for characterizing key attributes of natural and socioeconomic systems*
 - Heinz Center (2008). The State of the Nation's Ecosystems 2008: Measuring the Lands, Waters, and Living Resources of the United States, Island Press.



Cholesterol is one indicator
of human (heart) health

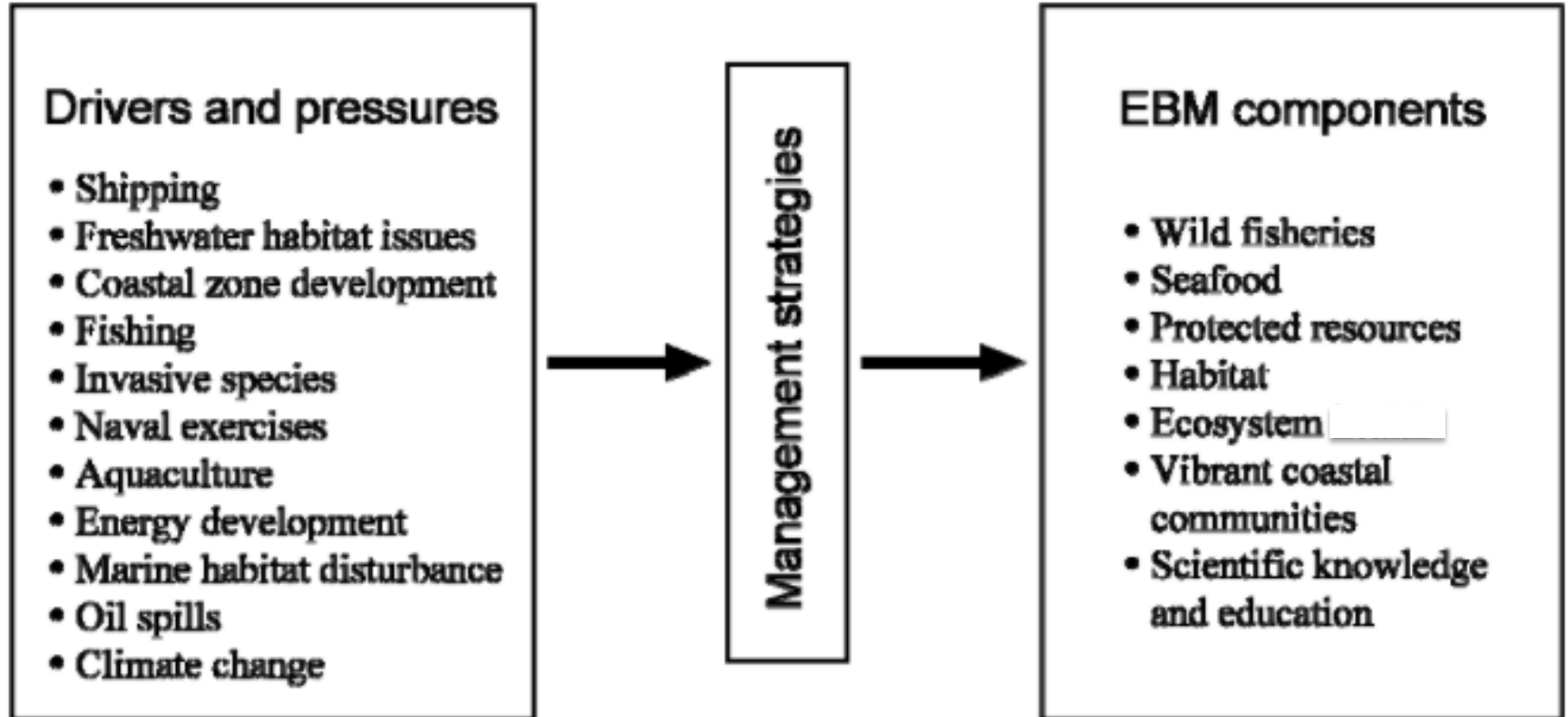
Informative indicator

Uninformative

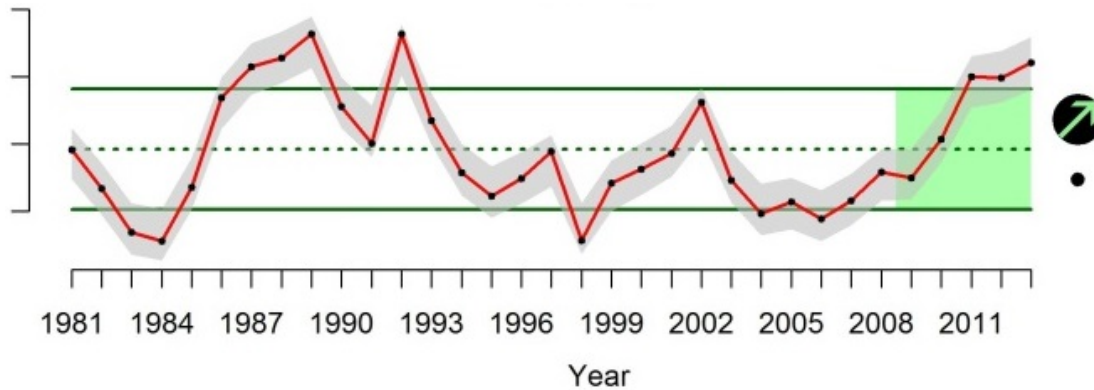




Drivers and Pressures



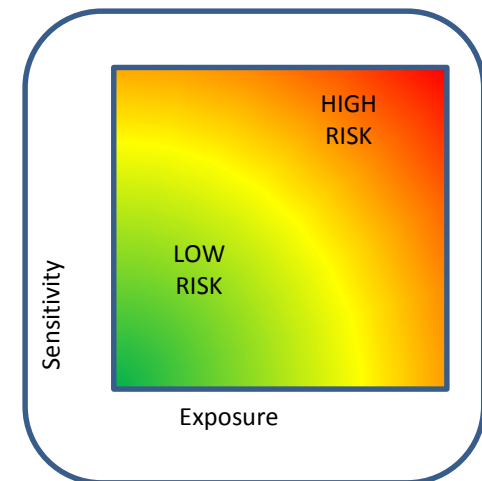
Presenting the indices



Status and trend plots



Conceptual models and risk analyses





Indicators in CCIEA 2015 ecosystem status report:

1. Climate and Ocean Drivers
 1. Basin-scale climate indicators
 2. Regional Climate indicators
2. Focal Components of Ecological Integrity
 1. Northern copepod anomaly
 2. Regional forage availability
 3. Salmon: Chinook salmon abundance
 4. Groundfish
 5. Marine Mammals
 6. Seabirds
3. Human Activities
 1. Total landings by major fisheries
 2. Aquaculture production and seafood demand
 3. Trends in shipping activity, nutrient input and offshore oil and gas activity
4. Human Wellbeing
 1. Fleet diversity indicators
 2. Coastal community vulnerability indicators
 3. Vessel safety in the fixed gear sablefish fleet

New indicators being added for 2016:

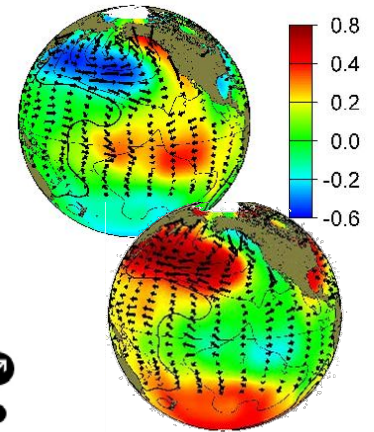
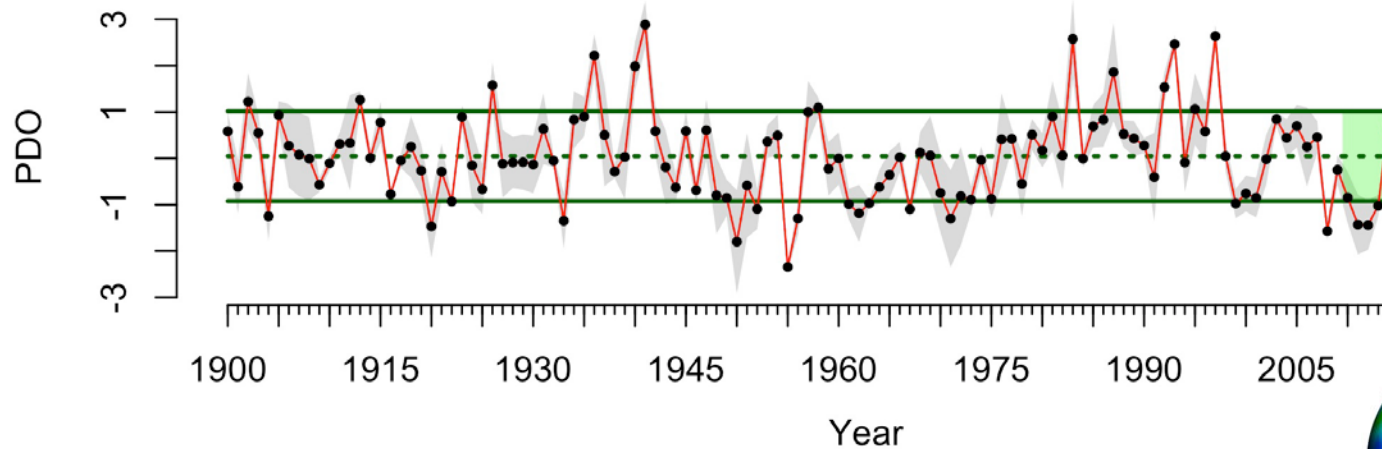
- **Habitat Indicators**
- **Risk Assessments**



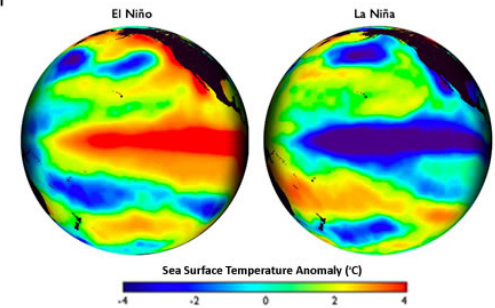
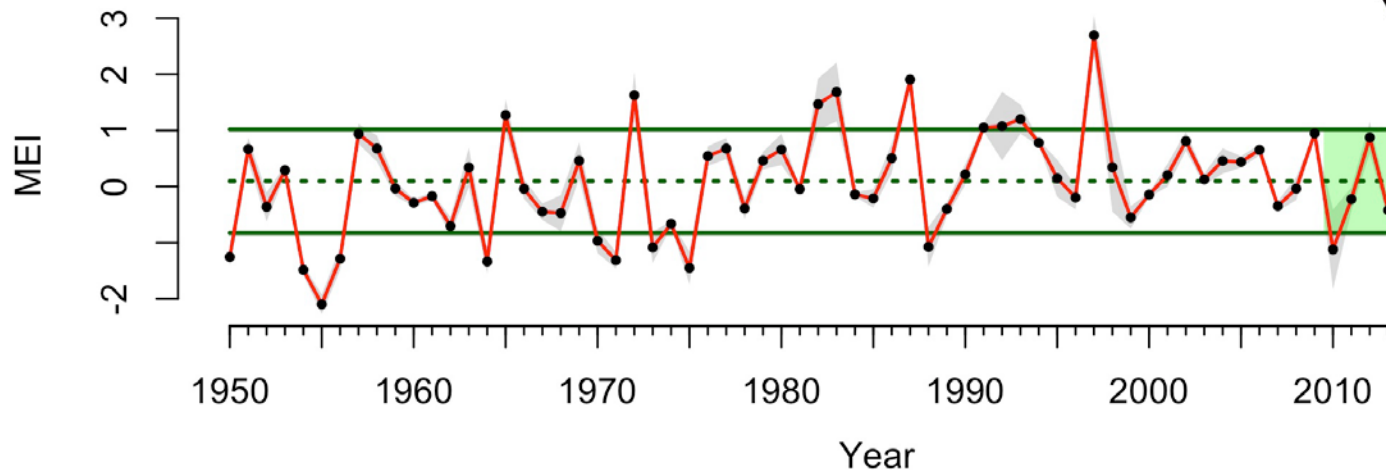
Basin Scale Indicators

Pacific Decadal Oscillation (PDO) and
Multivariate ENSO Index (MEI)

Summer PDO



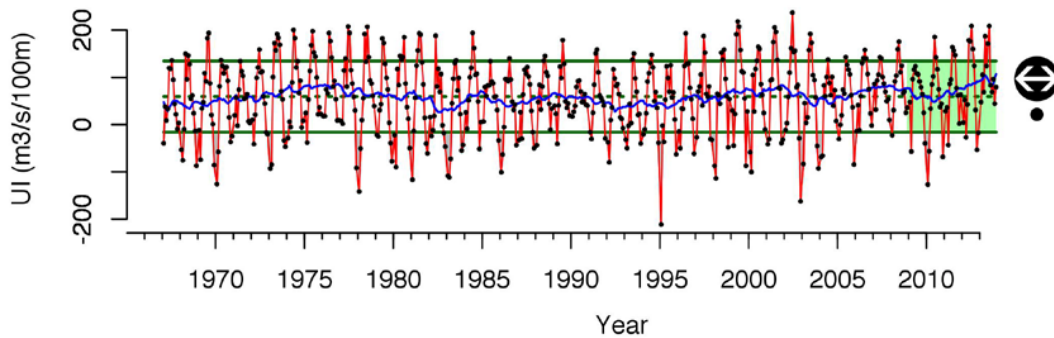
Summer MEI



Upwelling is the dominant local forcing

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

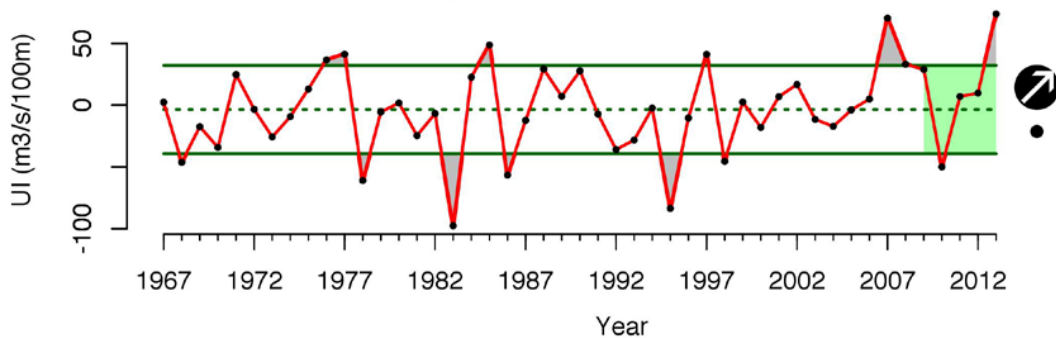
Monthly Upwelling Index: UI39 (39N 125W)



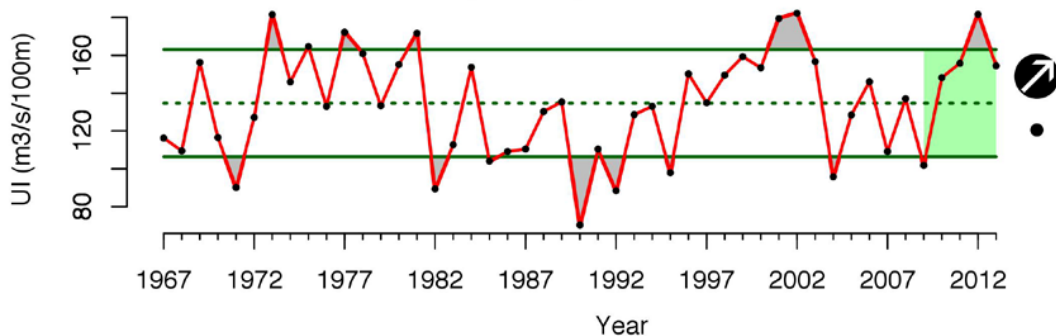
Text goes here

There is explanatory text alongside each plot.

Winter Upwelling Index: UI39 (39N 125W)



Summer Upwelling Index: UI39 (39N 125W)



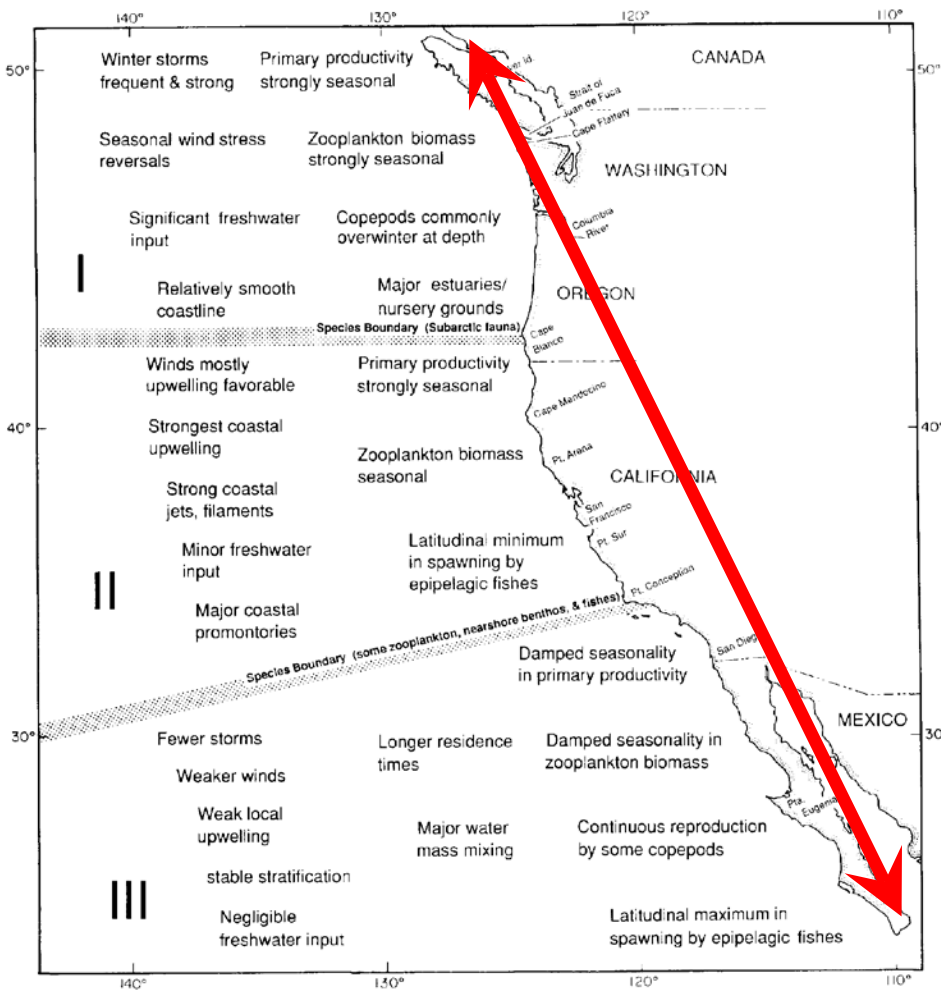
The user is able to customize any plot.

[link to custom plotting](#)

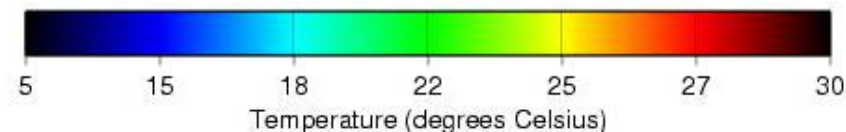
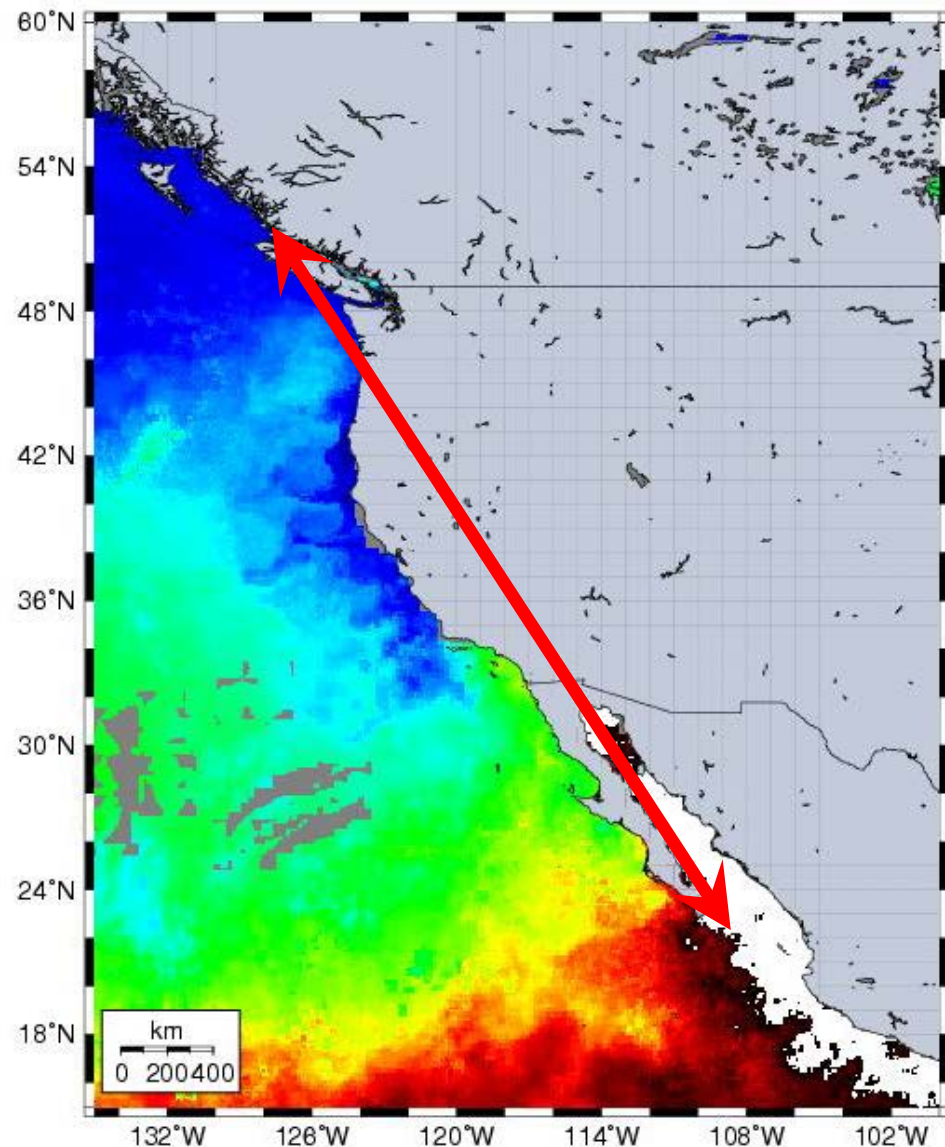


CCLME from BC to BC:

Three regions dominated by bottom up forcing



AVHRR-GAC SST from 16 Jul 2006 to 18 Jul 2006



Adapted from King et al., 2011



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

	#indicators	#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

Indices included in the 2013 report:	Totals	164	199
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Obviously, the indicator list needs to be reduced to a smaller independent set that captures the management goals for the CCLME!



Ranking Indicators

Categories used to develop indicator rankings:

1. Ecosystem Condition
2. Ecosystem Risk Assessment
3. Primary Considerations
4. Data Considerations
5. Other Considerations

Overview of the five webinars



Present content of the Annual California Current Ecosystem Status Report:

- Tuesday, January 12: Physical oceanographic indicators
- Thursday, January 14: Biological indicators
- Tuesday January 26: Human dimensions indicators

Added content for the 2016 Report:

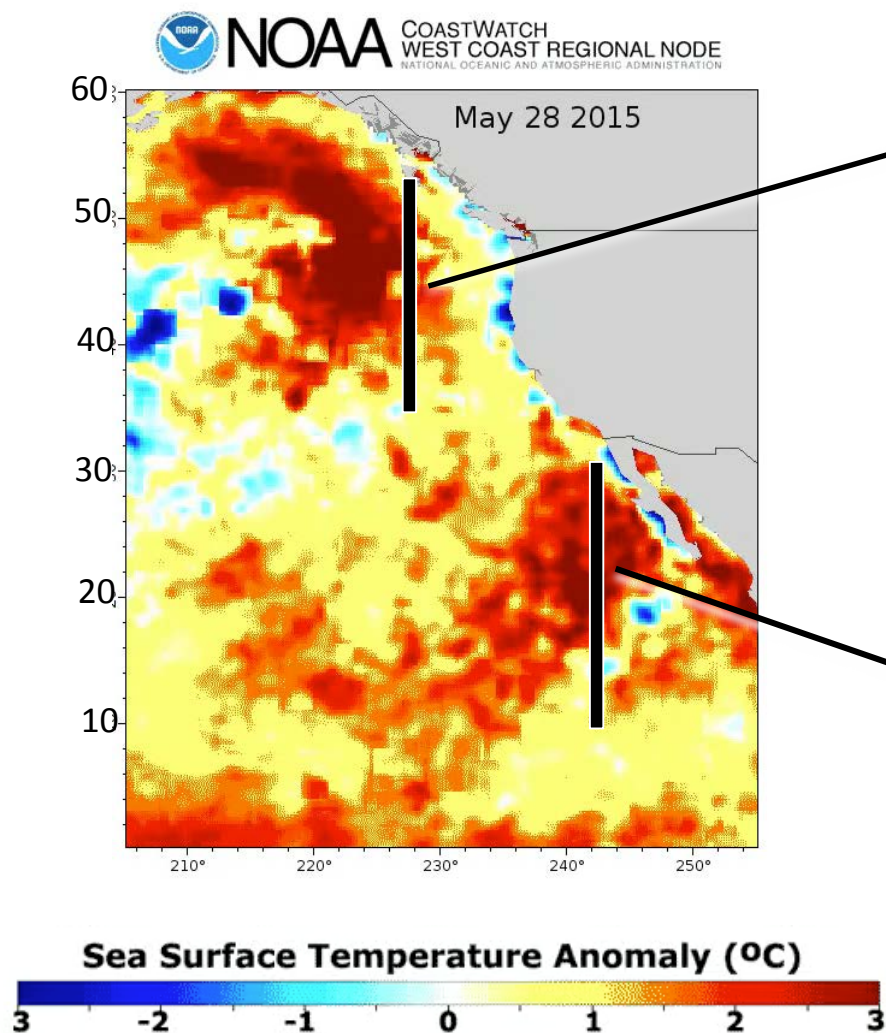
- Thursday, January 28: Habitat indicators
- Tuesday, February 2: Risk assessments and application of indicators to decision making



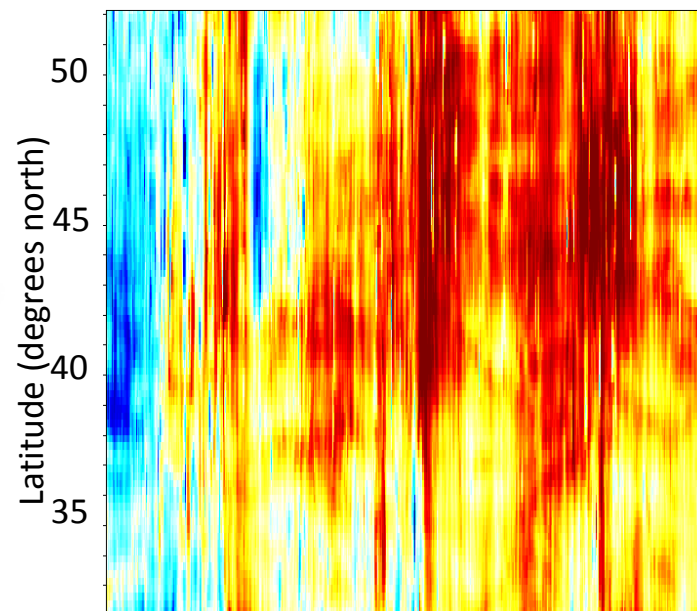
The unprecedented climate variability over the last two years requires emphasizing indices not included in the original list.

1. Warm anomalies (blob)
2. Snow Water Equivalent at record lows
3. Harmful Algal Blooms (HABs) an increasing biological concern

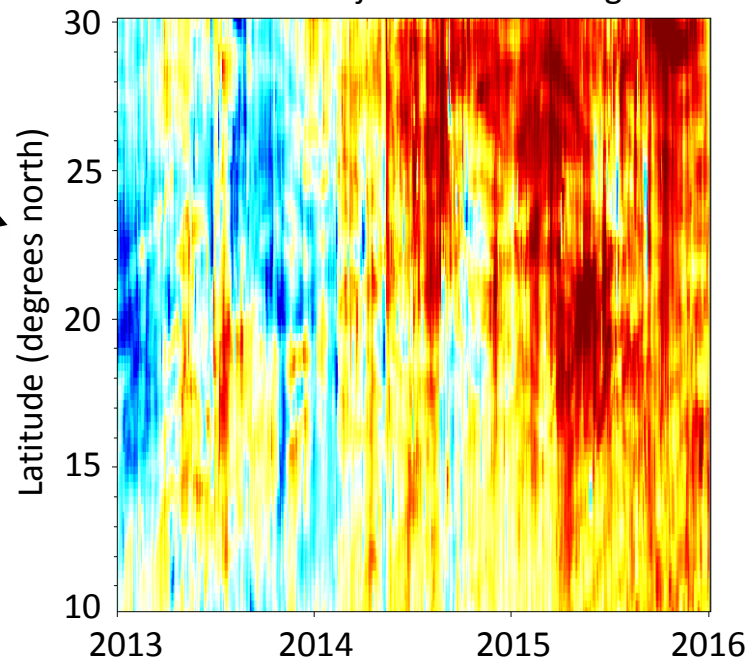
Capturing the two warm anomalies



Off US West Coast at 135° W Longitude

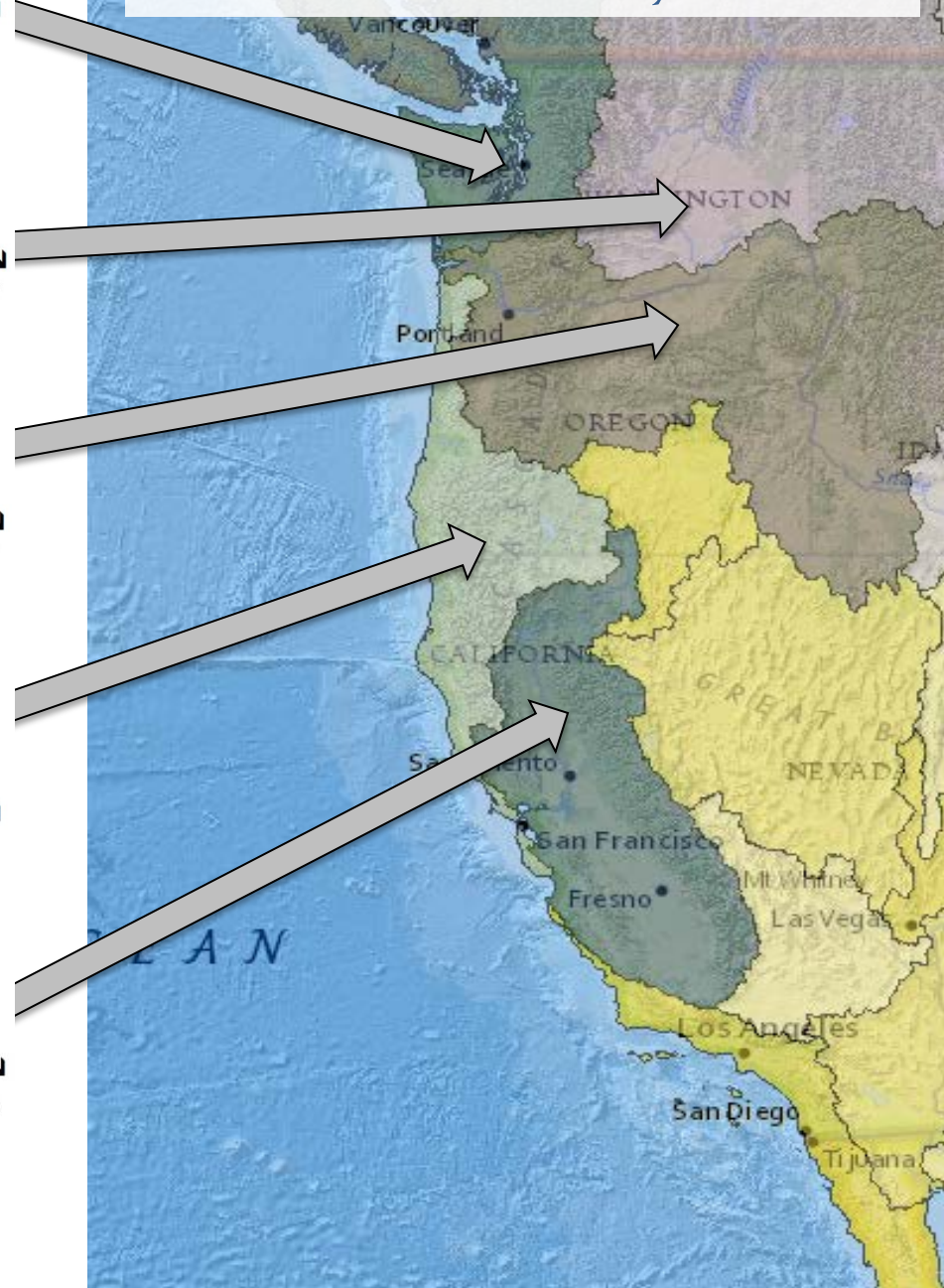
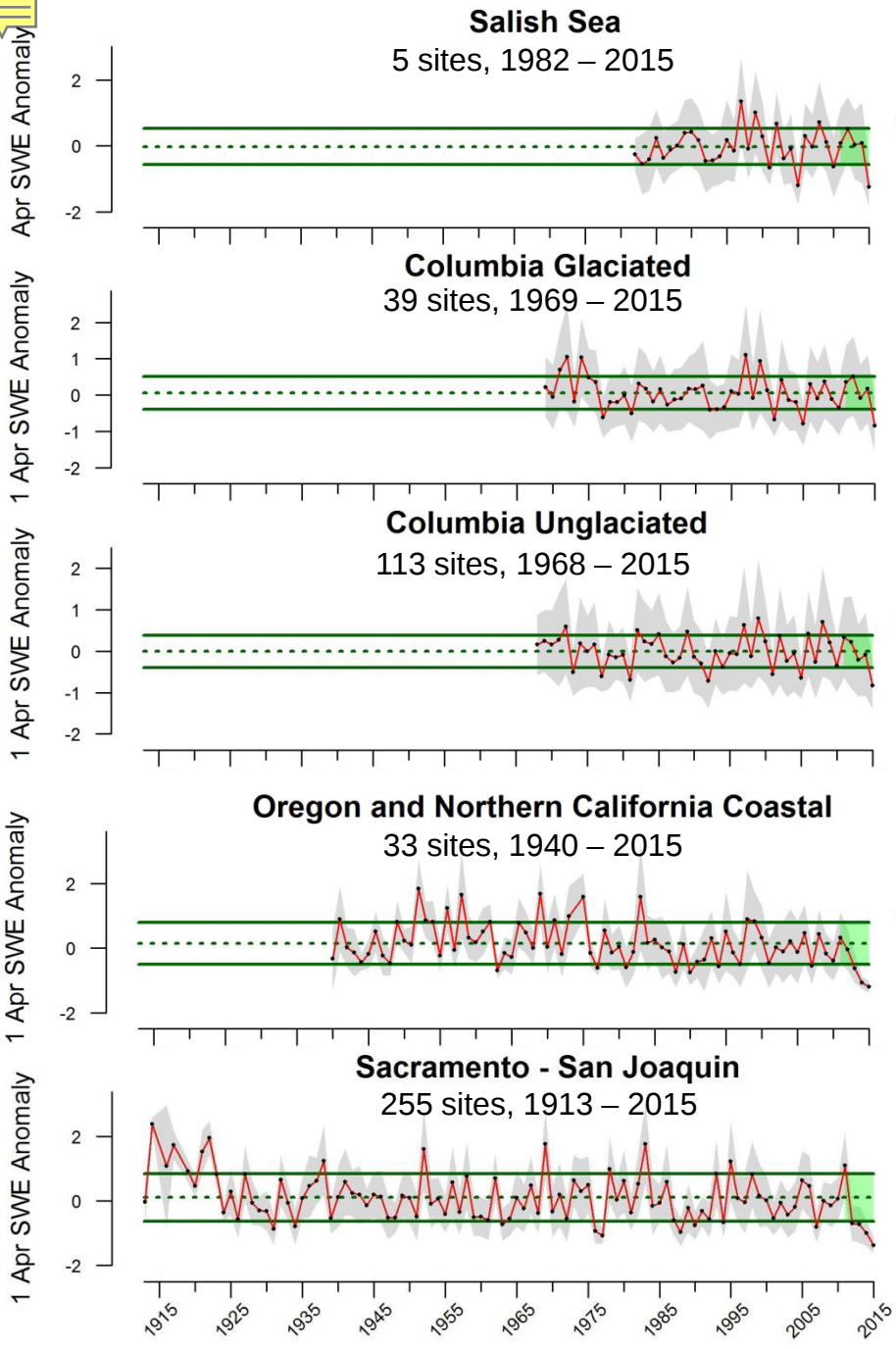


Off Baja at 118° W Longitude



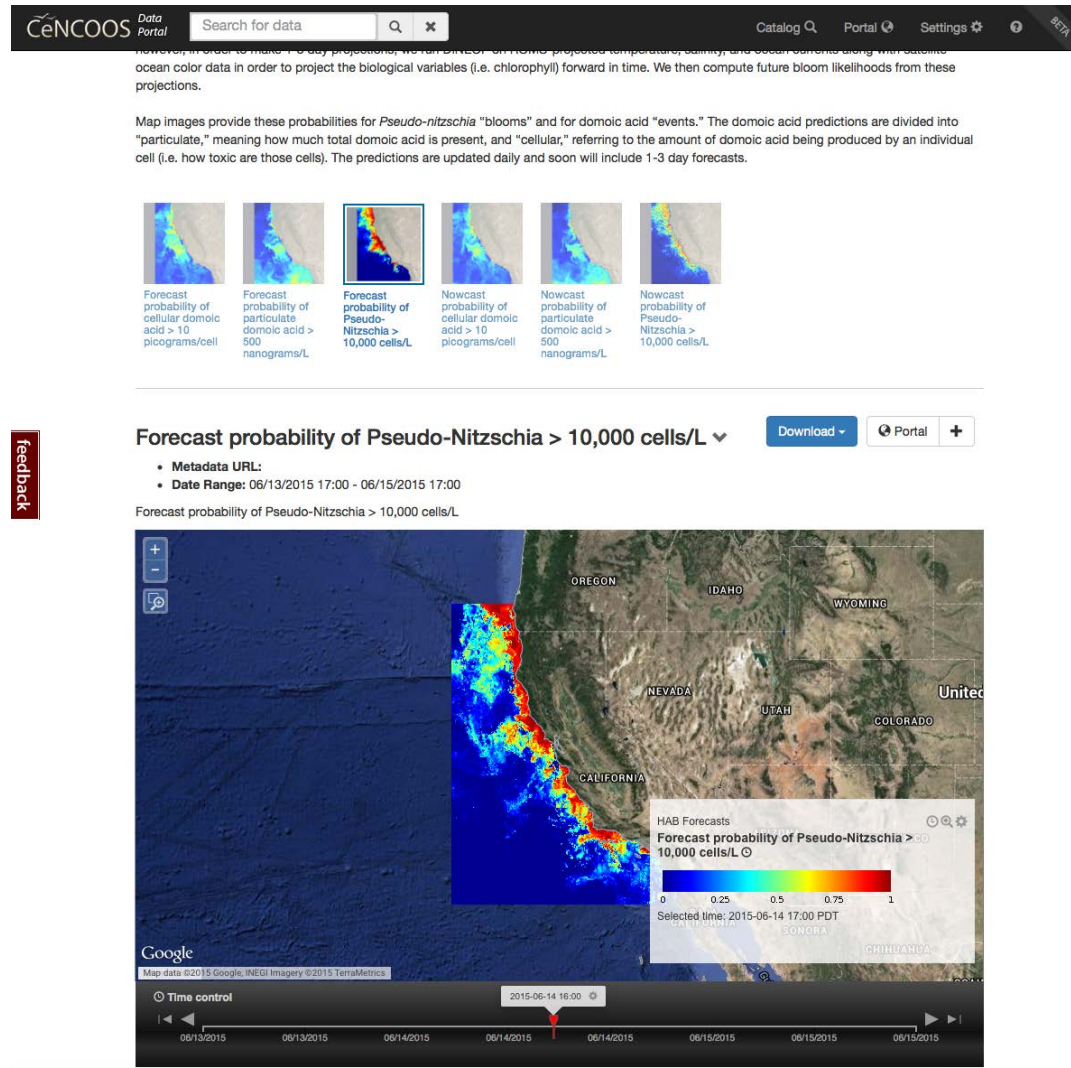


April 1st Snow Water Equivalent at record lows in every basin



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

That concern proved real!





These three events (blob, snow-water equivalent and HABs) point out the need for regular assessment of the indices used to describe ecosystem health and change

Discussion

