

2.12: The California Current Integrated Ecosystem Assessment

Toby Garfield On behalf of the ~58 CCIEA contributors

SWFSC Ecosystem Review, April 20, 2016



NOAA
FISHERIES
SWFSC

7 of 8 Terms of Reference questions are addressed through the CCIEA:

- Q1: The CCIEA illustrates the center's clear goal of an ecosystem-related science program.
- Q2: The CCIEA addresses both Regional Office and Fishery Management Council requests.
- Q4: The CCIEA process pinpoints the oceanographic, habitat, climate and ecological data required to fulfill ecosystem-related science needs.
- Q5: The CCIEA framework is engaging modeling at many levels.
- Q6: The CCIEA is addressing the Council's Fishery Ecosystem Plan.
- Q7: All CCIEA products and publications are peer-reviewed.
- Q8: The CCIEA is developing dynamic approaches to communication.

IEA: It's a program and a process

- Science tool for ecosystem based management.
- Promotes sustainable ecosystems and fisheries.
- Requires coordination and cooperation among a wide audience.
- It is an iterative process.



IEA: It's a program and a process

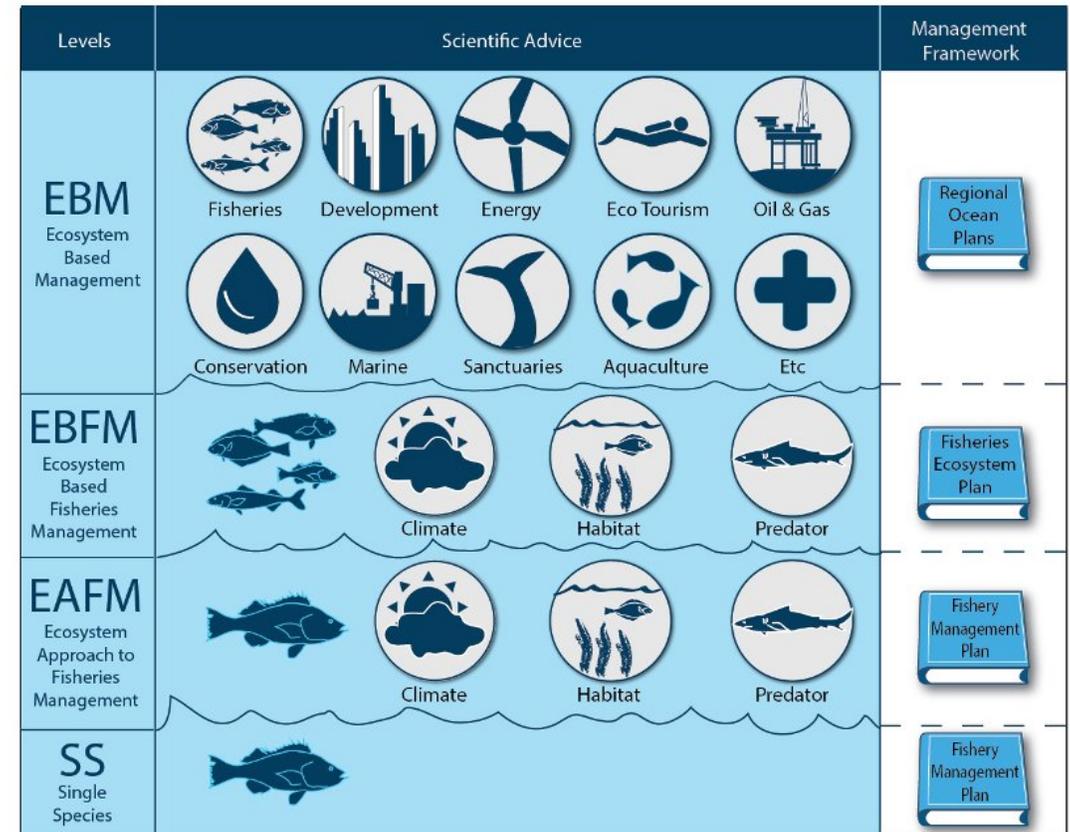


- It's the engine to inform ecosystem-based management by bringing the science to the managers.

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





CALIFORNIA CURRENT INTEGRATED ECOSYSTEM ASSESSMENT (CCIEA) STATE OF THE CALIFORNIA CURRENT REPORT, 2016

A report of the NOAA CCIEA Team to the Pacific Fishery Management Council, March 9, 2016.
Editors: Dr. Toby Garfield (SWFSC) and Dr. Chris Harvey (NWFSC)

1 INTRODUCTION

Section 1.4 of the 2013 Fishery Ecosystem Plan (FEP) outlines a reporting process wherein NOAA provides the Council with a yearly update on the state of the California Current Ecosystem (CCE), as derived from environmental, biological and socio-economic indicators. NOAA's California Current Integrated Ecosystem Assessment (CCIEA) team is responsible for this report. This marks our 4th such report, with prior reports in 2012, 2014 and 2015.

The highlights of this report are summarized in Box 1.1. Sections in addition, a list of supplemental materials is provided at the end of the report in response to previous requests from Council members or the Scientific and Statistical Committee to provide additional information, or to clarify details within this short report.

Box 1.1: Highlights of this report

- Due to the record high sea surface temperature anomalies in the region off Baja California and the development of the thinning of the California Current for the 2014 - 2015 period the California Current Ecosystem productivity at almost every trophic level. Oceanographic conditions, including PDO and NPGO indices, indicated warmer conditions throughout the region.
- The northern copepod index decreased off of Newport, indicating lower productivity at higher trophic levels.
- High energy forage species were at low levels, while forage species at intermediate energy content were patchy; catches of young of the year squid were very high South of Cape Mendocino.
- Pacific salmon faced additional stresses due to drought, with winter 2014-2015 95% below-normal snow-water equivalent storage.
- Unusual mortality events for California sea lions and Guadalupe Fur Seals, as well as an unusually large, coast-wide common murre wreck, are further evidence of overall lower productivity in the California Current Ecosystem.
- Commercial fishing landings remained high, driven mainly by landings of Pacific hake and coastal pelagic species.

SUPPLEMENTARY MATERIALS

TO THE

CURRENT INTEGRATED ECOSYSTEM ASSESSMENT (CCIEA) STATE OF THE CALIFORNIA CURRENT REPORT, 2016

Review of the California Current Integrated Ecosystem Assessment (CCIEA) Program

IEA Steering Committee and Review Team:

Chris Kelble¹ (Chair), Michael Alexander², Kerim Aydin³, Michael Fogarty⁴,
Evan Howell⁵, Joshua Lindsay⁶, Douglas Lipton⁷, Mark Monaco⁸,
Rost Parsons⁹, Becky Shuford⁷,

Southwest Fishery Science Center
La Jolla, California
February 10-12, 2015

Indicators: Seafloor Disturbance by Fishing Gear

eries Human Activities Indicators

tion Indicators for Major West Coast Ports

dicators

toby.garfield@noaa.gov), Josh Lindsay
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CCIEA: It's a process more than a program

Ecological Components

- Ecological Integrity
- CPS/Forage
- Salmon
- HMS
- Groundfish
- Seabirds
- Marine Mammals
- Marine Turtles



Human Dimensions

- Human Wellbeing
- Human Activities

Drivers / Pressures

- Ocean / Climate
- Human Activities



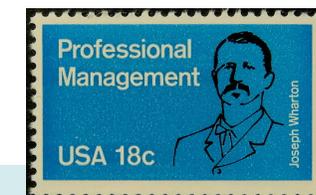
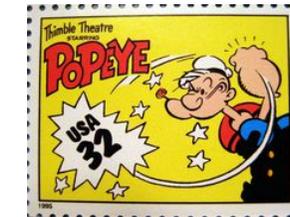
Mediating Components

- Habitat
- Local Social Systems



Analyses

- Risk Assessments
- Scenario Evaluations



2015 CCIEA Review Recommendations:

Overall very positive review of the work accomplished to date: PFMC engagement and product development singled out (20-page report, conceptual models and dynamic web site) .

Review recommendations:

- Focus on integrating existing products and research rather than expanding,
- Focus on end-users and the products they require,
- Develop IEA products to directly inform management decisions,
- Reengage management to strengthen IEA input to management decisions,
- Enhance CCIEA team by building collaborations across the NOAA IEA regions,
- Improve communication with the IEA Steering Committee,
- Fund synthetic, integrated activities focused on advancing the IEA,
- Make the CCIEA toolbox available across the NOAA IEA community,
- Include ecosystem services in conceptual models and other products.

Secondary priorities:

- In addition to toolboxes, develop other examples of improved science-based management
- More engagement with other NOAA line offices
- Move away from voluminous reports. 20-page ecosystem status report and dynamic web site are good starts.

Committee:

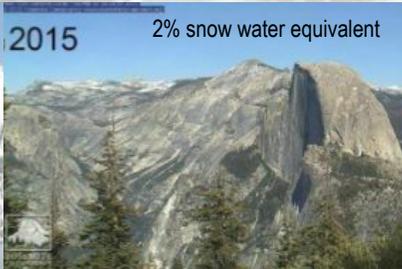
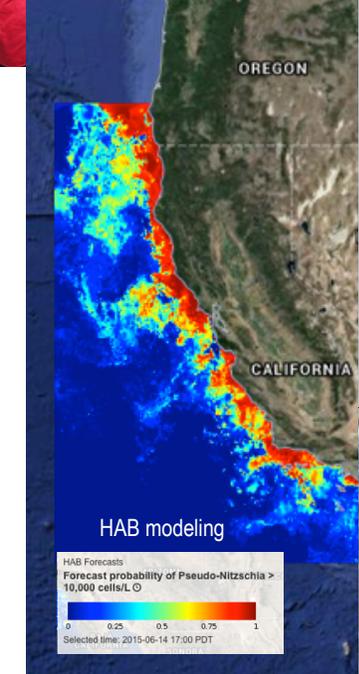
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1.AOML, 2. ESRL, 3. AFSC, 4. NEFSC, 5. PIFSC, 6. WCRO, 7. S&T, 8. CCMA, 9. NESDIS



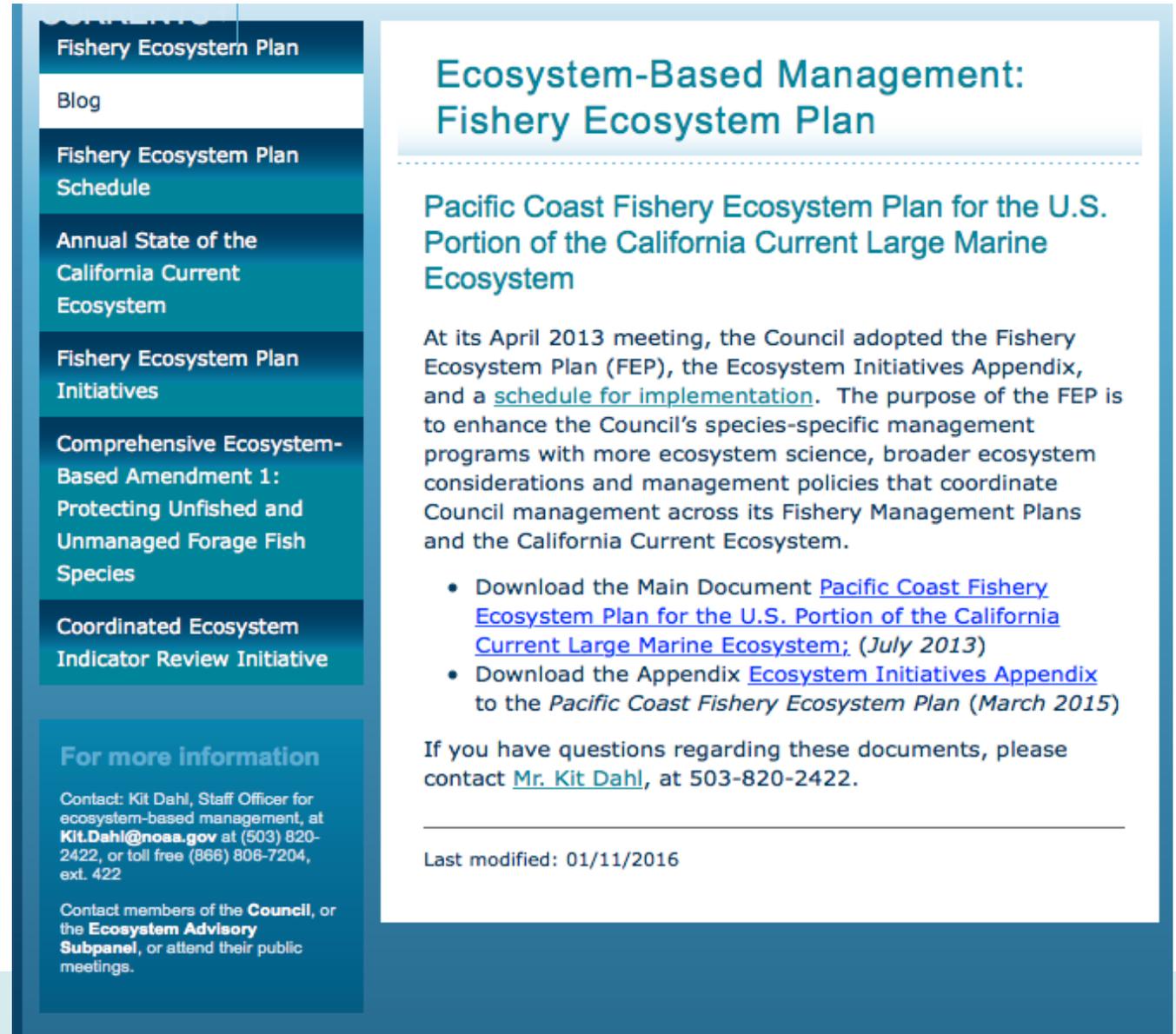
PACIFIC COAST FISHERY ECOSYSTEM PLAN

FOR THE U.S. PORTION OF THE
CALIFORNIA CURRENT LARGE MARINE ECOSYSTEM



Communicating with partners, especially the PFMC

- Three iterations of the comprehensive report.
- 4th Annual (March) presentation to the Council (with 20 page summary).
- Indicator Webinars.
- Semiannual meetings with Council committees and subcommittees.



The screenshot shows a website page with a navigation menu on the left and main content on the right. The navigation menu includes links for 'Fishery Ecosystem Plan', 'Blog', 'Fishery Ecosystem Plan Schedule', 'Annual State of the California Current Ecosystem', 'Fishery Ecosystem Plan Initiatives', 'Comprehensive Ecosystem-Based Amendment 1: Protecting Unfished and Unmanaged Forage Fish Species', and 'Coordinated Ecosystem Indicator Review Initiative'. Below the menu is a 'For more information' section with contact details for Kit Dahl and information about Council and Ecosystem Advisory Subpanel meetings. The main content area features the title 'Ecosystem-Based Management: Fishery Ecosystem Plan', a sub-header 'Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem', a paragraph of text, a bulleted list of links to download documents, and contact information for Mr. Kit Dahl. A footer note indicates the page was last modified on 01/11/2016.

Contents

- Fishery Ecosystem Plan
- Blog
- Fishery Ecosystem Plan Schedule
- Annual State of the California Current Ecosystem
- Fishery Ecosystem Plan Initiatives
- Comprehensive Ecosystem-Based Amendment 1: Protecting Unfished and Unmanaged Forage Fish Species
- Coordinated Ecosystem Indicator Review Initiative

For more information

Contact: Kit Dahl, Staff Officer for ecosystem-based management, at Kit.Dahl@noaa.gov at (503) 820-2422, or toll free (866) 806-7204, ext. 422

Contact members of the **Council**, or the **Ecosystem Advisory Subpanel**, or attend their public meetings.

Ecosystem-Based Management: Fishery Ecosystem Plan

Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem

At its April 2013 meeting, the Council adopted the Fishery Ecosystem Plan (FEP), the Ecosystem Initiatives Appendix, and a [schedule for implementation](#). The purpose of the FEP is to enhance the Council's species-specific management programs with more ecosystem science, broader ecosystem considerations and management policies that coordinate Council management across its Fishery Management Plans and the California Current Ecosystem.

- Download the Main Document [Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem; \(July 2013\)](#)
- Download the Appendix [Ecosystem Initiatives Appendix to the Pacific Coast Fishery Ecosystem Plan \(March 2015\)](#)

If you have questions regarding these documents, please contact [Mr. Kit Dahl](#), at 503-820-2422.

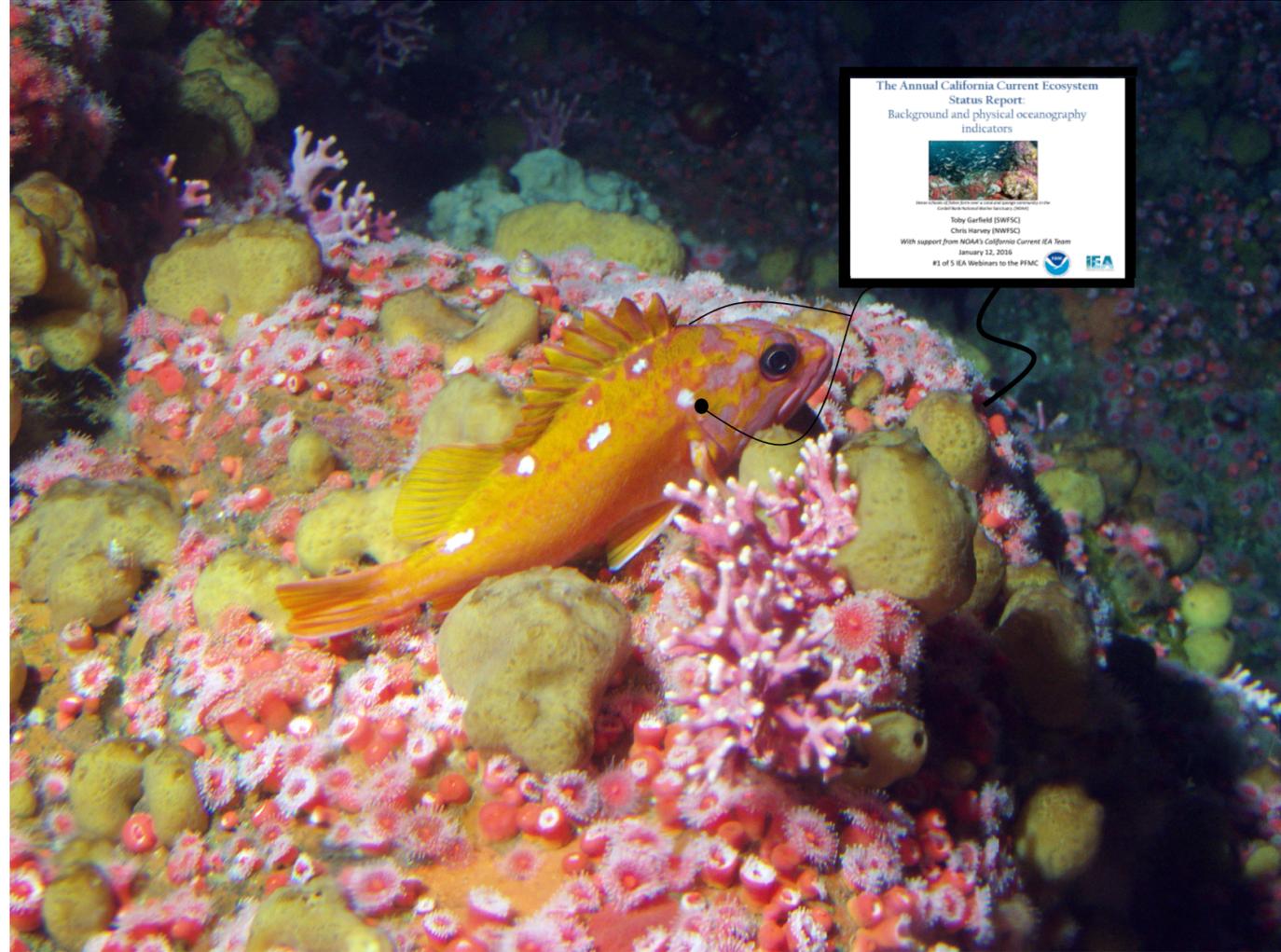
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Engagement with the Pacific Fishery Management Council

Webinar series on indicators:

1. January 12: Physical Oceanography Indicators
2. January 14: Biological Indicators
3. January 26: Human Dimensions Indicators
4. January 28: Freshwater, Estuarine and Marine Habitat Indicators
5. February 2: Risk Assessments and Applications of Indicators to Decision Making

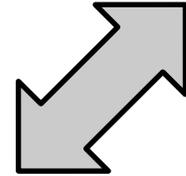
All webinars recorded and available on the Pacific Fishery Management Council web site.



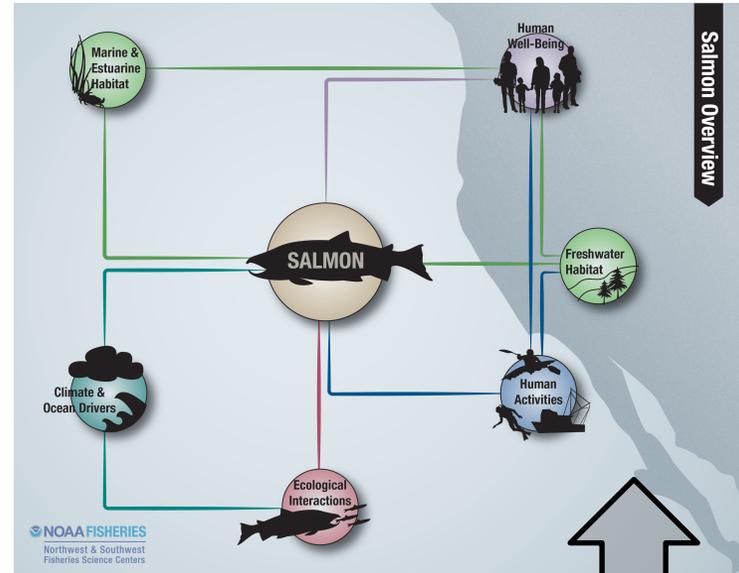
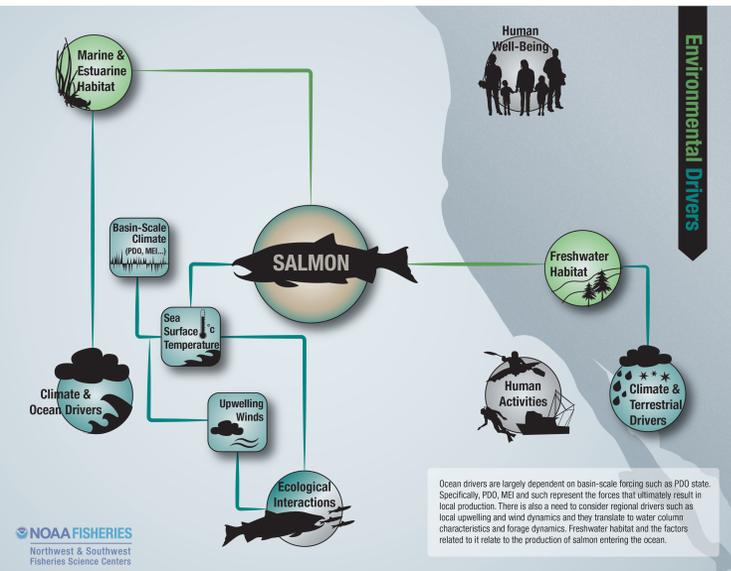
Rosethorn rockfish watching the first webinar

Conceptual models allow linking environmental, ecological and human drivers (example: salmon)

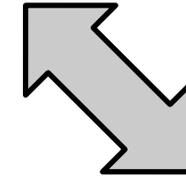
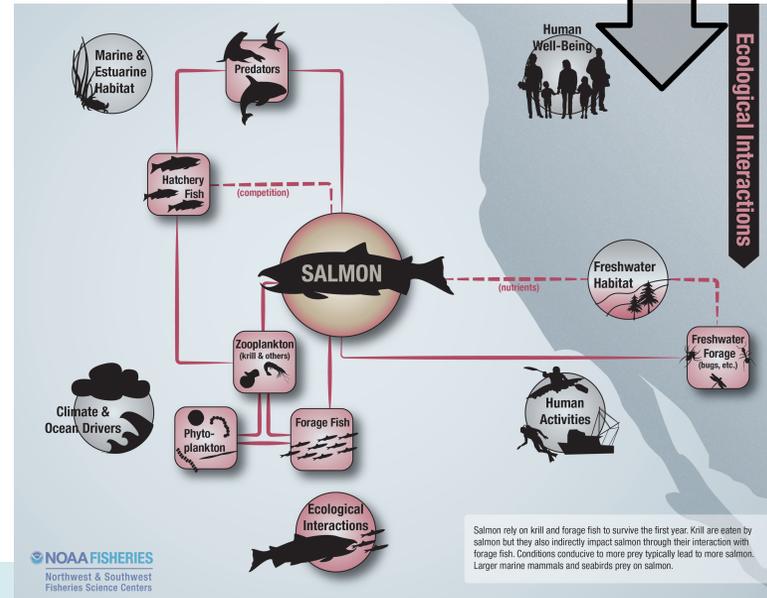
It's necessary to examine all aspects of the ecosystem to determine the impact on the salmon and humans.



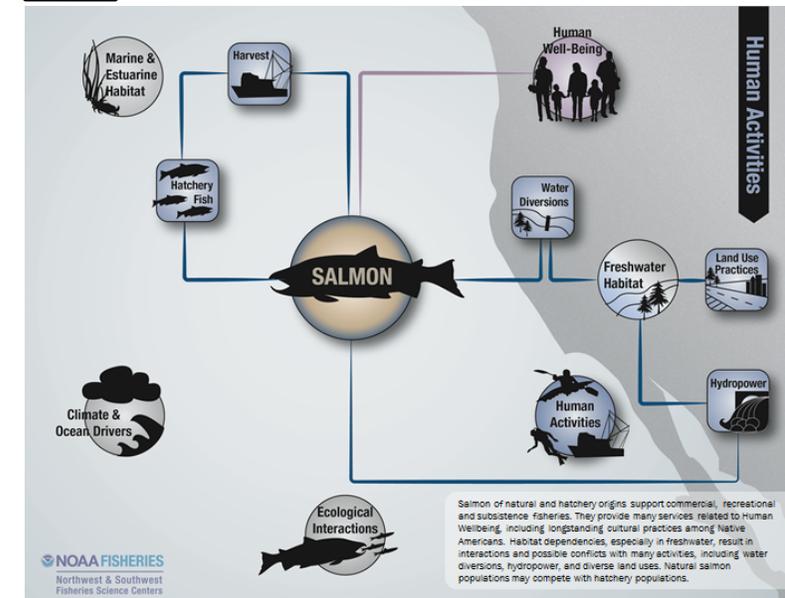
Environmental Drivers



Ecological Interactions



Human Activities

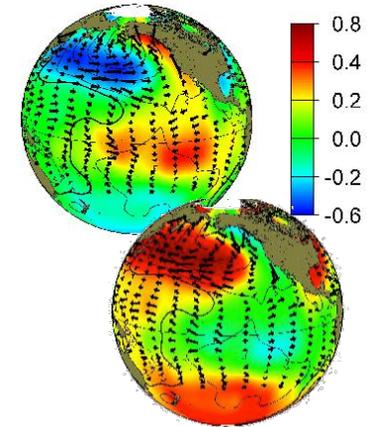
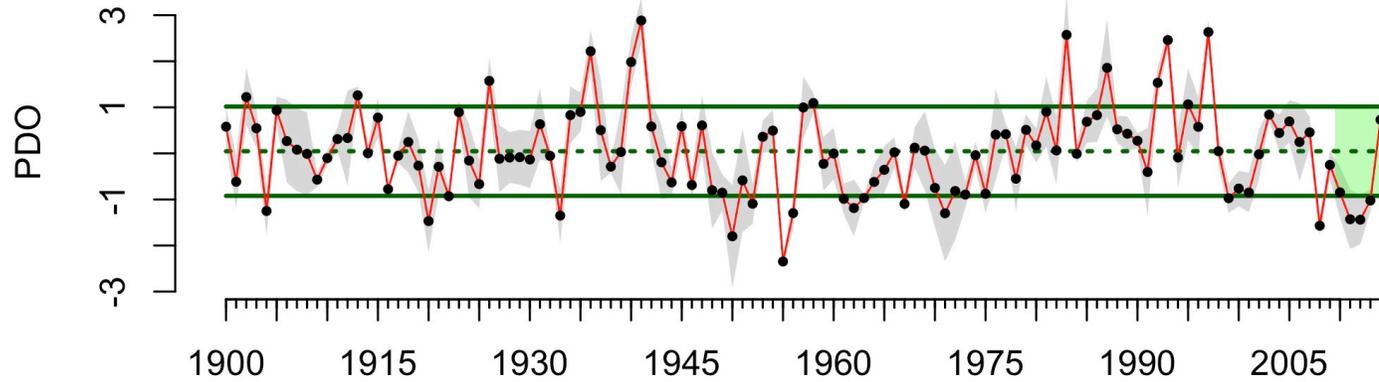


Basin Scale Indicators

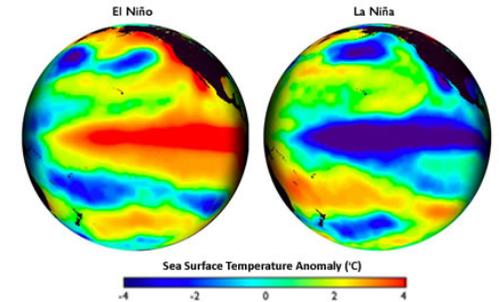
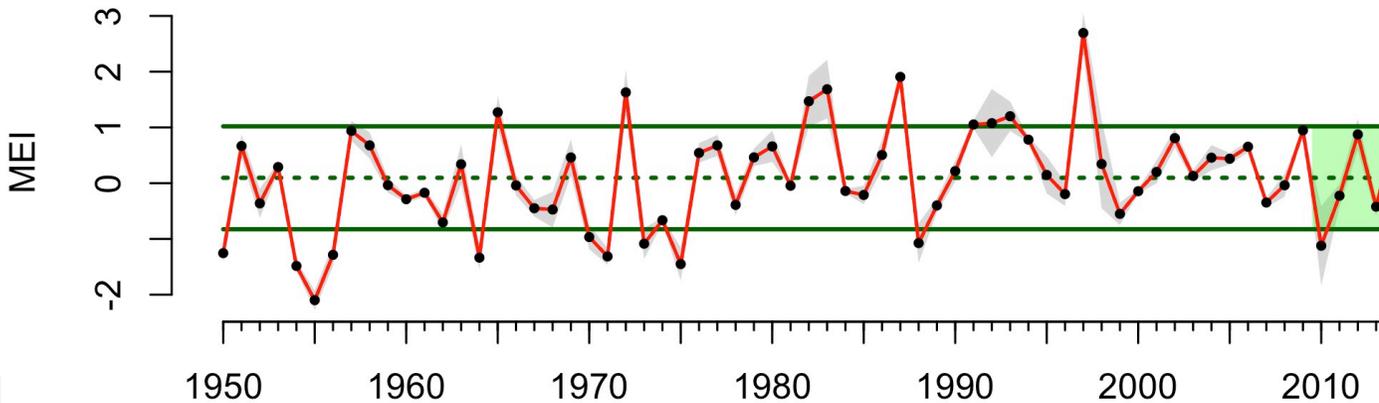
Pacific Decadal Oscillation (PDO) and Multivariate ENSO Index (MEI)



Summer PDO



Summer MEI



Transformation of CCIEA PDF report to truly dynamic web-based report (thanks to ERDDAP)

NPGO

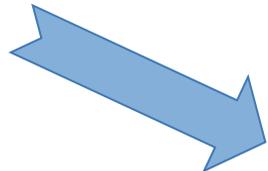
The North Pacific Gyre Oscillation (NPGO) is a low frequency signal in sea surface heights over the Northeast Pacific. Positive (negative) values of the NPGO are linked with increased (decreased) surface salinities, nutrients, and chl-a values in the CCLME (Di Lorenzo et al. 2008). Many NPGO events since 1975 seem to have been more extreme or had a longer duration than those earlier in the time series (Figure OC28). Winter and summer trends were very similar with a broad low from 1991 to 1997 and a peak from 1998 to 2004. Since 2006, values have been increasing with the past 5 years falling around or above 1 standard deviation from the mean. **For 2013, the NPGO remained high and roughly similar to the previous several years. This suggests 2013 should have**

OC-46

CCIEA PHASE III REPORT 2013: DRIVERS AND PRESSURES – OCEAN AND CLIMATE

had high surface salinity, high nutrients, and resulting high chl-a values, further supporting the trends in upwelling strength that 2013 should have been a highly productive year.

- Plots generated dynamically,
- Text snippets stored in a spreadsheet/database, updated semi-automatically,
- Trends and status automatically updated
- Custom plots, websites, value added products



Physical, Chemical and Climate Indicators

Trends and status of physical, chemical and climate indicators in the California Current system. LEGEND

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	↔	+	↔	●	↔	●

North Pacific Gyre Oscillation

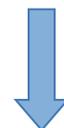
Monthly, winter and summer values of the North Pacific Gyre Oscillation (NPGO) from 1950-2013. The NPGO is a low frequency signal in sea surface heights over the Northeast Pacific. Positive (negative) values of the NPGO are linked with increased (decreased) surface salinities, nutrients, and chl-a values in the CCLME. Monthly values are included to show seasonal cycles and a continuous time series, and the blue line shows a running annual average.

Implications

For 2013 the NPGO remained high and roughly similar to the previous several years. This suggests 2013 should have had high surface salinity, high nutrients, and resulting high chl-a values, further supporting the trends in upwelling strength that 2013 should have been a highly productive year.

Link to custom plotting

<http://oceanview.pfeg.noaa.gov/ceia-table/?opentab=1>



CCIEA 2013 Report
http://www.noaa.gov/iea/Assets/iea/california/Report/pdf/2.Ocean_and_Climate_Drivers_2013.pdf

Shift-share analysis of port-level economic growth

Decompose changes in commercial fishing revenue into

- Coast-wide economic effect: how is port i affected by broad regional economic trends?
- Coast-wide industry effect: how is port i affected by regional trends in commercial fishing?
- Fishery mix effect: how is port i affected by changes in fisheries in which i specializes?

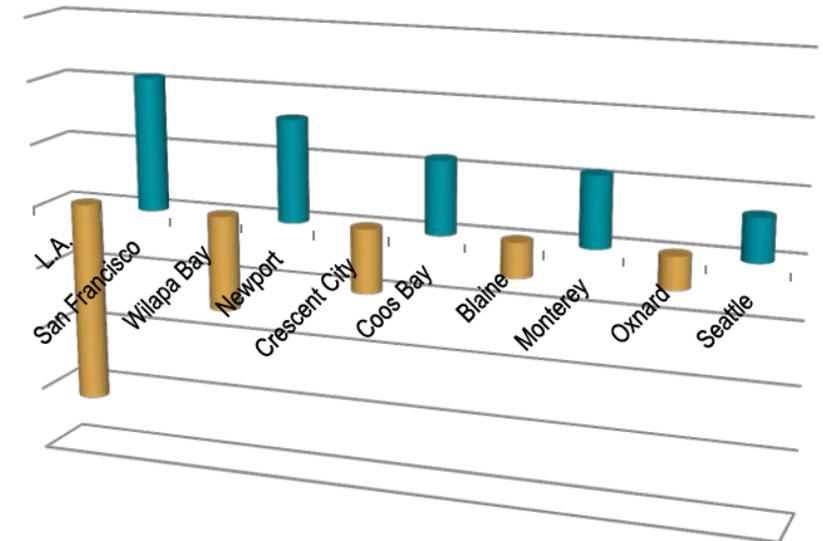
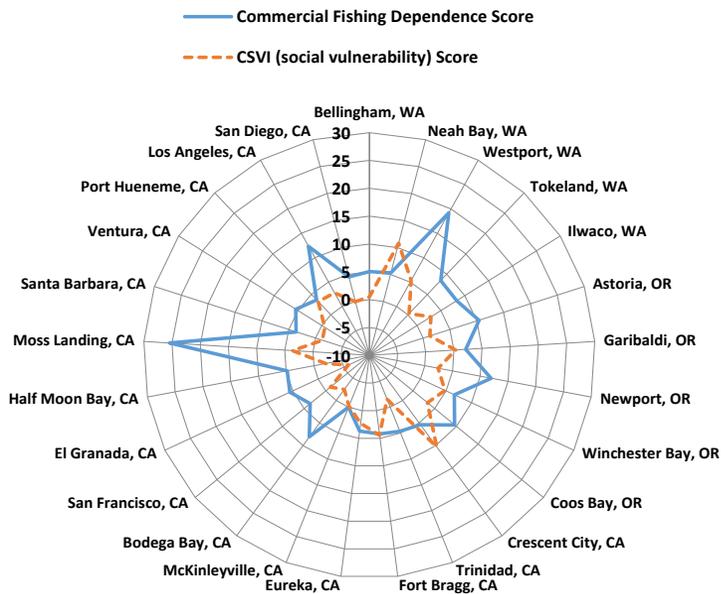
Identifies ports that grew faster or slower than expected given overall regional economic trends, regional industry trends, fishery specific trends, and port specific dependence on specific fisheries.

Shown here:
largest positive and negative departures from expectations, evaluated from 1994-2014.

May identify:

1. ports that have successfully adapted to changing fishing conditions
2. ports that may be susceptible to meta population shifts

Estimates of social vulnerability in Fishery dependent communities



2012-present ocean and weather variability have sharply focused the need for updated environmental information.

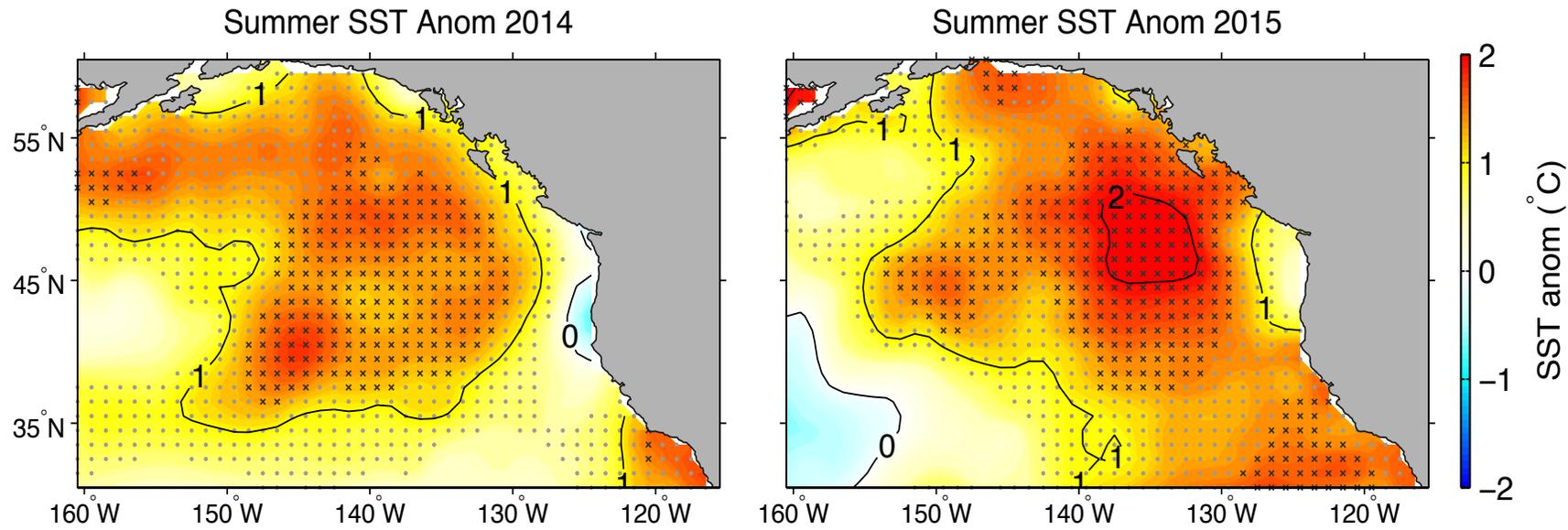


Figure 3.1.2: Sea surface temperature (SST) anomalies for the summer (Jun-Aug) of 2014 and 2015. The time series analyzed at each grid point started in 1982. The large warm anomaly in the upper center in 2014 is the "Warm Blob," with the southern anomaly off Baja California in the lower left. Gray circles mark grid cells where the anomaly was > 1 s.d. above the long-term mean. Black x's mark grid cells where the anomaly was the highest of the time series.

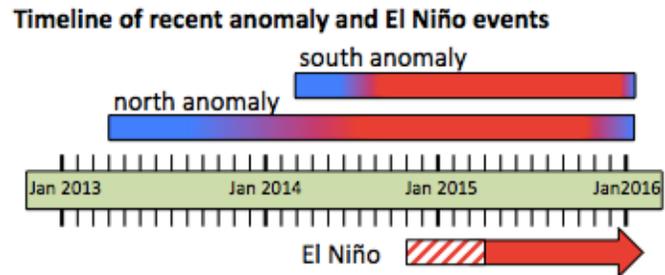
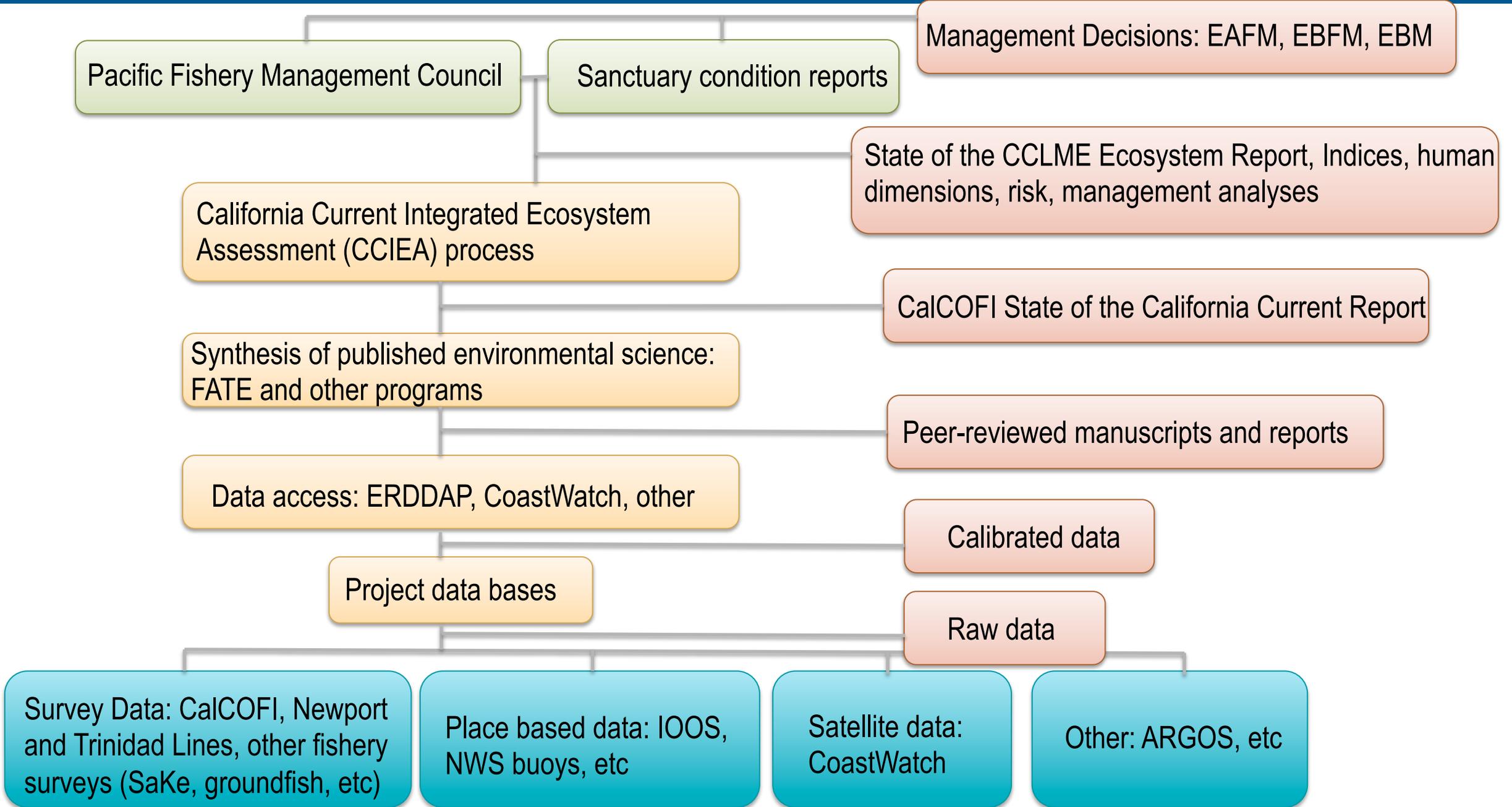


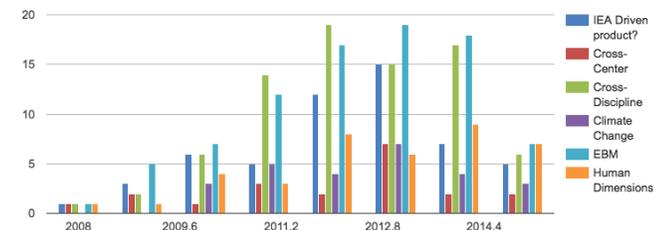
Figure 3.1: Timeline of the warm temperature anomalies in the north (the "Warm Blob") and south of the CCE, and the El Niño event that nearly occurred (hashed bar) and later did occur (solid arrow).

Environmental teams have been applying to the Fisheries and the Environment (FATE) internal funding program to develop approaches to better understand the range of variability seen during the last four years and then develop ecological indices.



Strengths, Challenges, Solutions

- NWFSC & SWFSC have been co-leads and equal partners.
 - Strong support from Center leadership.
- Excellent involvement by WCRO and other NOAA lines (OAR, NOS).
- Have developed a good working relationship with the PFMC.
 - Annual state of the California Current Ecosystem report
 - Working with Council subcommittees on expanding the FEP
 - Developing their methodology for indicator review (5 webinars)
- Expanding our relationship with the five west coast Sanctuaries
- Significant publication output including IEA analyses (124 peer reviewed).



Challenges

- Making useful a 400+ page report (timely and accessible to managers).
- Management input for the IEA process.
- Filling holes in the suite of indicators.
- Bringing human well-being fully into the CCIEA for completed socio-economic management.
- The CCIEA is a labor of love for most participants (1 split FTE, contract labor)

Strategies

- Move to web-based delivery with dynamic plotting.
- Pursue FATE, and other NOAA, funding opportunities to strengthen indicator suite.
- Greater interaction with the PFMC subcommittees and Sanctuary scientists.
- Working relationships with Sanctuary and state agencies on protected resources.
- Stronger partnership with Sea Grant specialists and other “field operators.”
- Continued focused workshops and working groups

Questions?

School of jack mackerel near Catalina (Adam Obaza, NOAA)

