

# IEA in the California Current

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# INTEGRATED SOCIO-ECOLOGICAL SYSTEM OF THE CALIFORNIA CURRENT

## FOCAL ECOSYSTEM COMPONENTS

### Ecological Integrity

Diversity, Seabirds, Marine mammals, Salmon, Forage species, Groundfish, Species interactions



### Human Wellbeing

Conditions, Connections, Capabilities (e.g., safety, community, livelihood)



## MEDIATING COMPONENTS

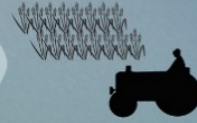
### Habitat

Marine, Estuarine, Freshwater



### Human Activities

(e.g., fishing, farming, mining, recreation, research, education, activism, restoration, management)



## DRIVERS AND PRESSURES

### Climate & Ocean Drivers

(e.g., climate, ocean upwelling)



### Social Drivers

(e.g., population growth and settlement patterns, national and global economic and political systems, historical legacies, dominant cultural values, and class systems)



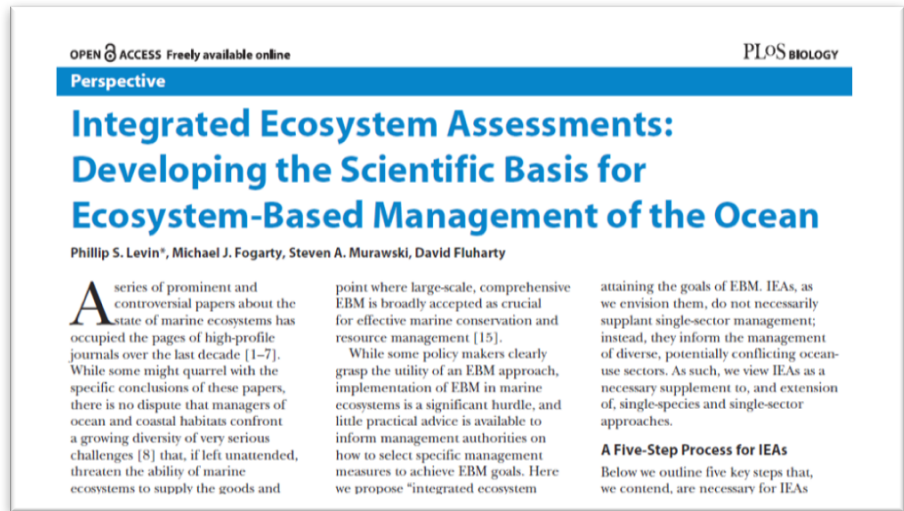
### Local Social Systems

(e.g., laws, policies, economies, institutions, social networks, hierarchies, cultural values, built environment)

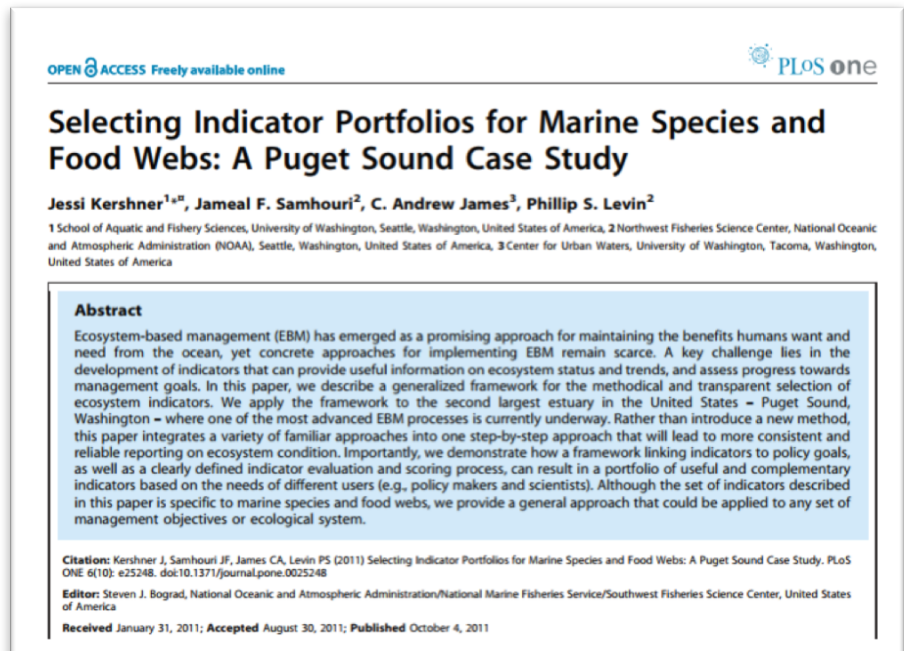


# Brief history of CCIEA

- NOAA IEA development, 2004-2009
- Puget Sound pilot effort, 2008-2010
  - “Small scale” proof of concept
  - Indicator screening process (Kershner et al. 2011, PLoS One)
- **CCIEA, 2010-2011**
  - Initial indicator development on two targeted groups (groundfish, salmon); one protected group (sturgeon); and a broad goal (ecosystem integrity)
  - PFMC engagement
  - Development of models and analytical methods



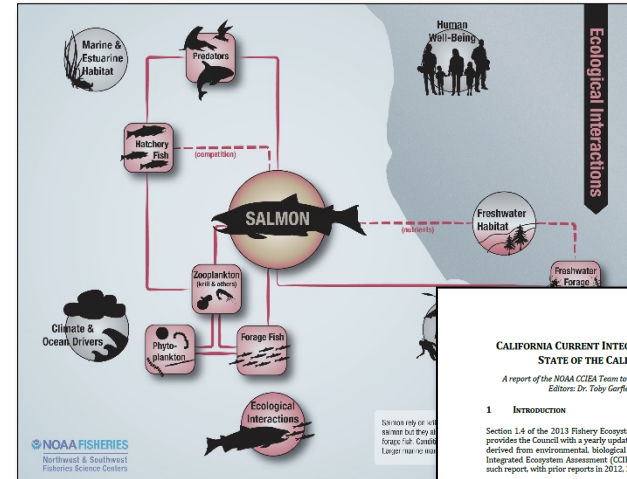
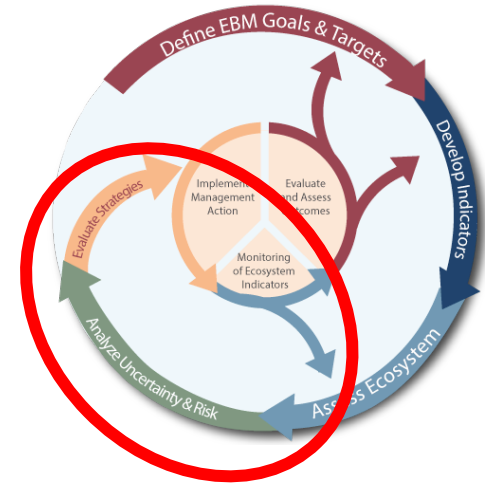
Levin et al., 2009. *PLoS Biology* e1000014



Kershner et al., 2011. *PLoS One* e25248

# Brief history of CCIEA

- **2011-2012**
  - Additional food web and human activities indicators
  - Initial risk assessments and MSEs
- **2013-2014**
  - Developed conceptual models
  - Added habitat and human dimensions indicators
  - More risk assessments and MSEs
  - Began annual ecosystem status reports to PFMC
- **2015-2017**
  - Turned a corner with PFMC
  - Increased partnership with NMFS Protected Resources, National Marine Sanctuaries
  - Streamlined delivery of products



**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 (NWFFSC)

**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 4<sup>th</sup> such report, with prior reports in 2012, 2014 and 2015.

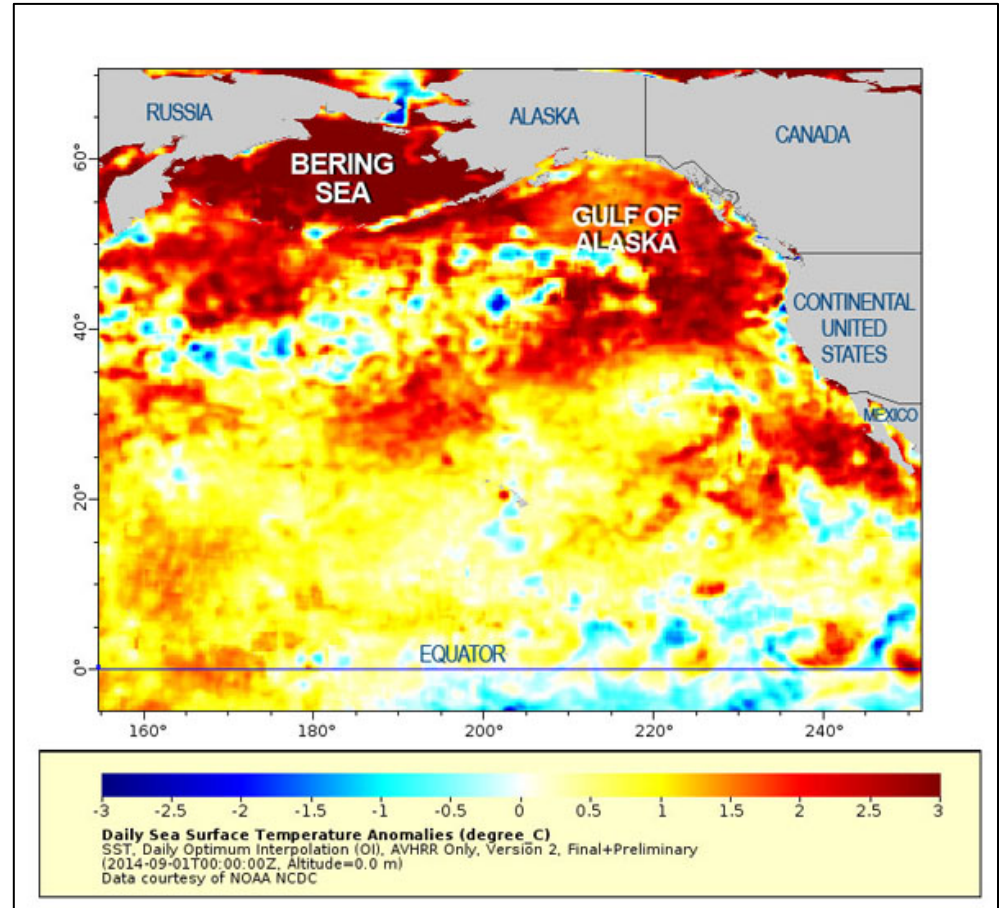
The highlights of this report are summarized in Box 1.1. Sections below provide greater detail. In addition, a list of supplemental materials is provided at the end of this document. In response to previous requests from Council members or the Scientific and Statistical Committee (SSC) to provide additional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

**Box 1.1: Highlights of this report**

- Due to the recent high sea surface temperature anomalies in both the northeast Pacific and the region off Baja California and the development of the third largest El Niño this century, for the 2014 – 2015 period the California Current Ecosystem can be classified as lower productivity at almost every trophic level. Oceanographic conditions, represented by MEL PDI and WFO indices, indicated warmer conditions throughout.
- The northern coopepod index decreased off of Newport, indicating lower energy content for higher trophic levels.
- High energy forage species were at low levels, while forage species with low and intermediate energy content were patchy, catches of young of the year rockfish and market squid were very high South of Cape Mendocino.
- Pacific salmon faced additional stresses due to drought, warm weather, warm streams and 93% 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.
- Newly developed indicators of coastal community vulnerability show that fishery-dependent communities experienced increasing socioeconomic vulnerability from 2000 to 2010.

# “Turning the corner with the PFMC”

- Major climate anomaly in recent years (the “Warm Blob”) with negative impacts on CC LME
- This seriously boosted our microphone
- PFMC engagement with the CCIEA team has been far greater and more proactive since the Blob
  - More interest and interaction
  - Regular meetings with SSC to provide technical review of our work
  - FEP initiative from 2015-2017 to help tailor annual report to PFMC needs



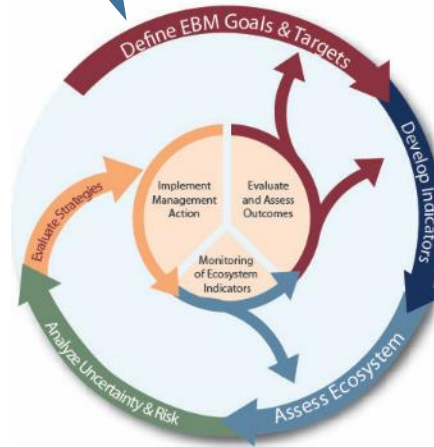
*Sea surface temperature anomalies, Sept. 1, 2014  
(NOAA National Climate Data Center)*

# What's next for the CCIEA

A scenic view of a rocky coastline with waves crashing against the shore, under a clear blue sky. The foreground shows a steep, grassy cliffside overlooking the ocean. The middle ground features a rocky beach with waves breaking on the shore. In the background, a forested hillside rises above the coast.

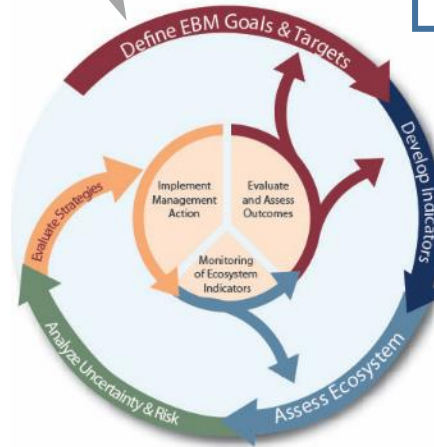
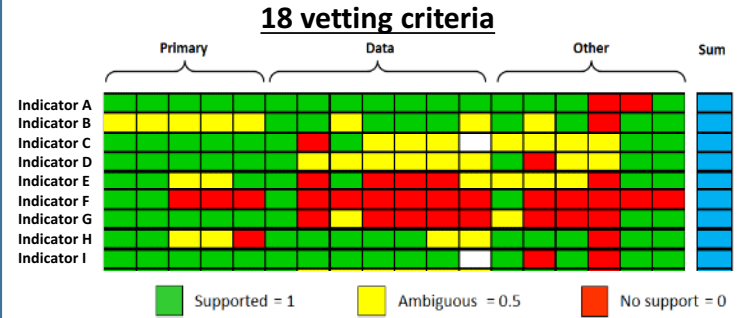
- Supporting PFMC as it undertakes FEP initiative on “climate change and coastal communities”
- Providing science for regional implementation of national NMFS initiatives on EBFM and climate science
- Helping address NMFS chief scientist’s call for “transformative ideas”
- Continuing existing integrative projects on a range of topics
- Improving capacity for prediction, forecasting, nowcasting, and identifying thresholds and tipping points

**What is the role of coastal pelagic species as forage and fisheries in the CCE?**



What is the role of coastal pelagic species as forage and fisheries in the CCE?

## Vet candidate indicators of CPS and potential drivers





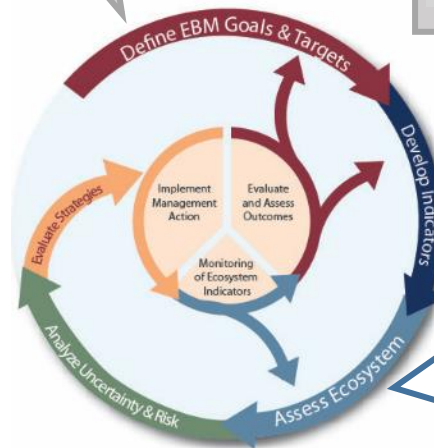
What is the role of coastal pelagic species as forage and fisheries in the CCE?

## Vet candidate indicators of CPS and potential drivers

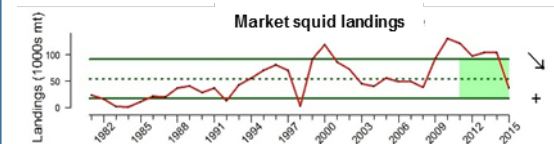
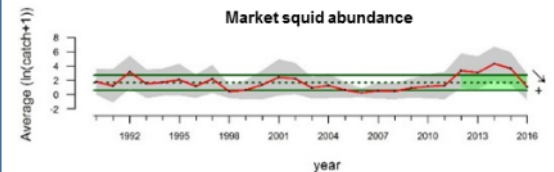
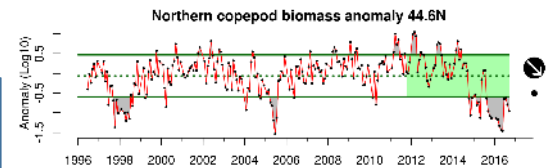
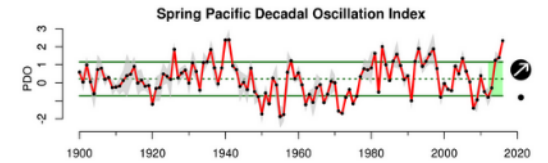
**18 vetting criteria**

	Primary			Data			Other			Sum
Indicator A	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator B	Supported	Ambiguous	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator C	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator D	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator E	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator F	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator G	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator H	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Indicator I	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported

■ Supported = 1    
 ■ Ambiguous = 0.5    
 ■ No support = 0

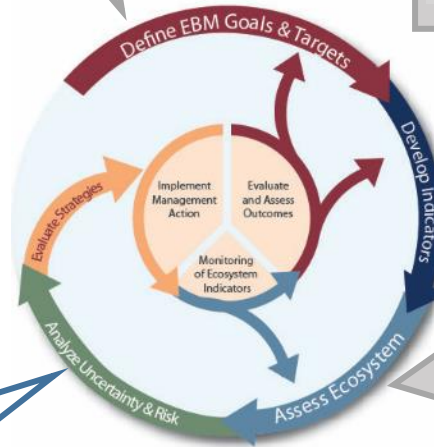
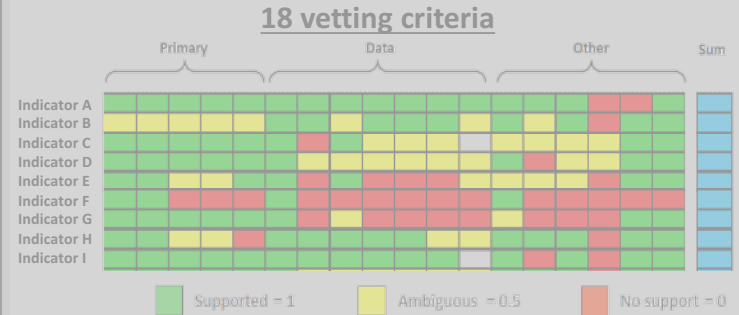


## Assess indicator data

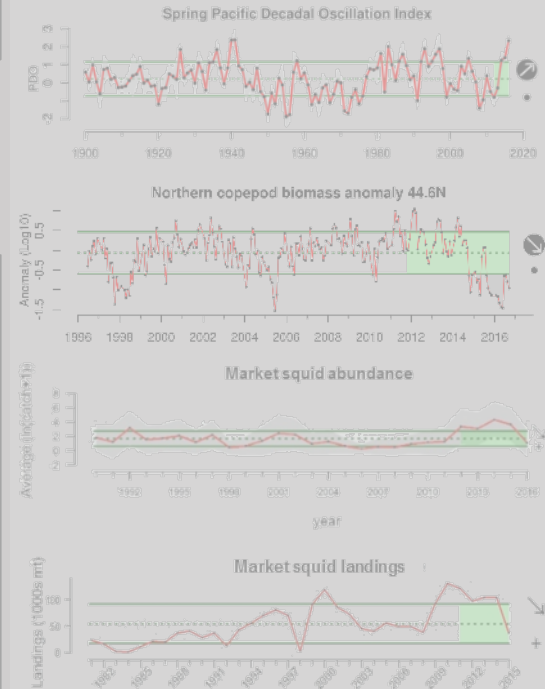


What is the role of coastal pelagic species as forage and fisheries in the CCE?

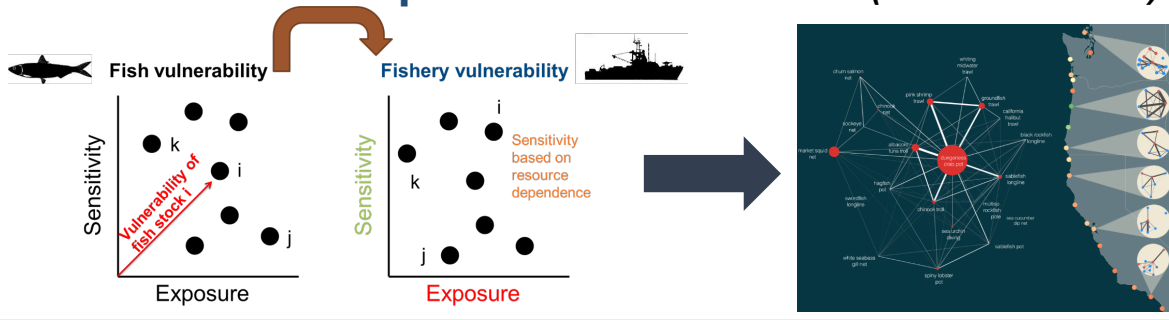
## Vet candidate indicators of CPS and potential drivers



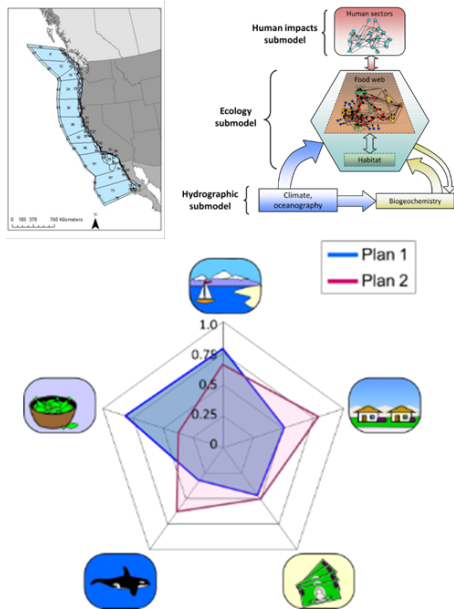
## Assess indicator data



## Assess risk of species and fisheries (Samhuri et al.)

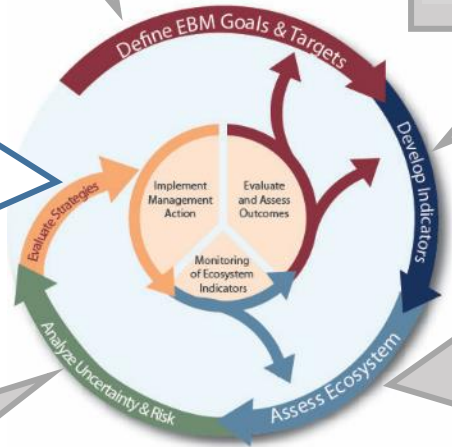
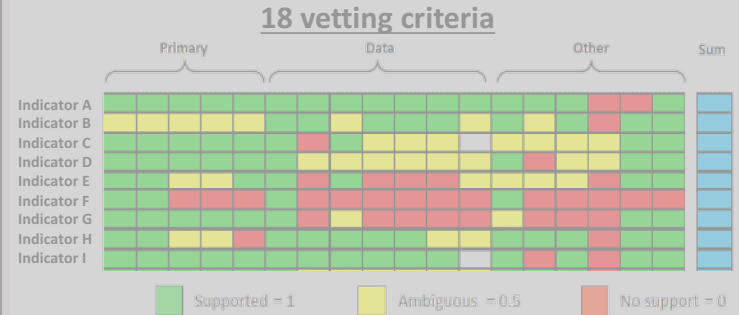


# Test mgmt options, tradeoffs, climate (Kaplan et al.)



What is the role of coastal pelagic species as forage and fisheries in the CCE?

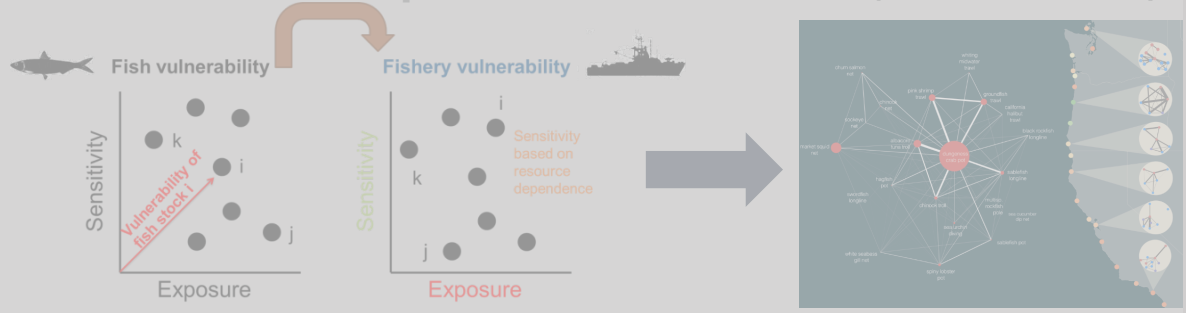
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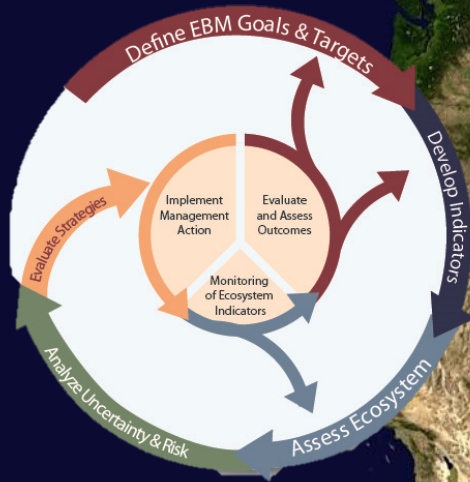
# A few thoughts in retrospect...

- CCIEA team invested a lot of effort early on in tool development, publishing, writing big reports, and establishing credibility with one partner (the PFMC)
- We invested less time in engaging with managers and stakeholders to figure out what the key questions are
- Possibly as a result, tangible management uptake of our products has been slow

(We are having those engagement conversations now, but I have no idea if we would have made more progress if we had done it the other way around...maybe every case is different?)




I'm pretty sure I believe that  
"Integrated Ecosystem Assessment" does *not* mean  
"study the entire system at once"



Rather, it should involve using the IEA framework to address specific management questions and evaluate tradeoffs at relevant scales

 Washington State Marine Spatial Planning

 Linking environmental drivers to target species life histories

 Effects of climate variability on fishery participation

 Vulnerability of pelagic species and fisheries to climate change

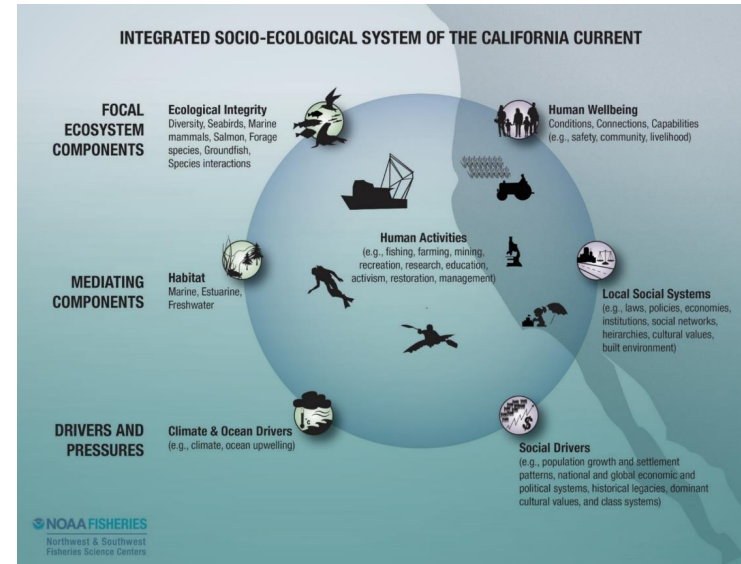
 Improving Sanctuary 5-year condition reports

Dynamic mgmt of bycatch in the swordfish fishery

# Some other lessons learned

- Engagement among scientists, managers and stakeholders
- Good conceptual models help get you all on the same page
  - Helps identify indicators too
- Social scientists are in short supply in NOAA...engage, recruit, fund
- Small-scale “pilot” IEA in Puget Sound was valuable experience
- External, facilitated, expert review is *essential*
- Take advantage of “opportunities”
  - Warm Blob
- Learn to present findings in multiple ways—you’ll have multiple audiences
- Even a small amount of \$ can go a long way
- Incentivize products beyond just publications
  - Models, surveys, communication tools, status reports, short synthesis blurbs
- National and international IEA network is strong...take full advantage

# Thanks!



## Acknowledgements:

- Many dozens of colleagues, past and present, who have done so much work on the California Current IEA
- The NOAA IEA office for many years of generous support, both financial and otherwise

