Science, Service, Stewardship

Agenda Item H.1.b
Supplemental IEA PowerPoint
November 2011

California Current INTEGRATED ECOSYSTEM ASSESSMENT

PFMC Meeting, Costa Mesa

November 6, 2011

NOAA FISHERIES SERVICE

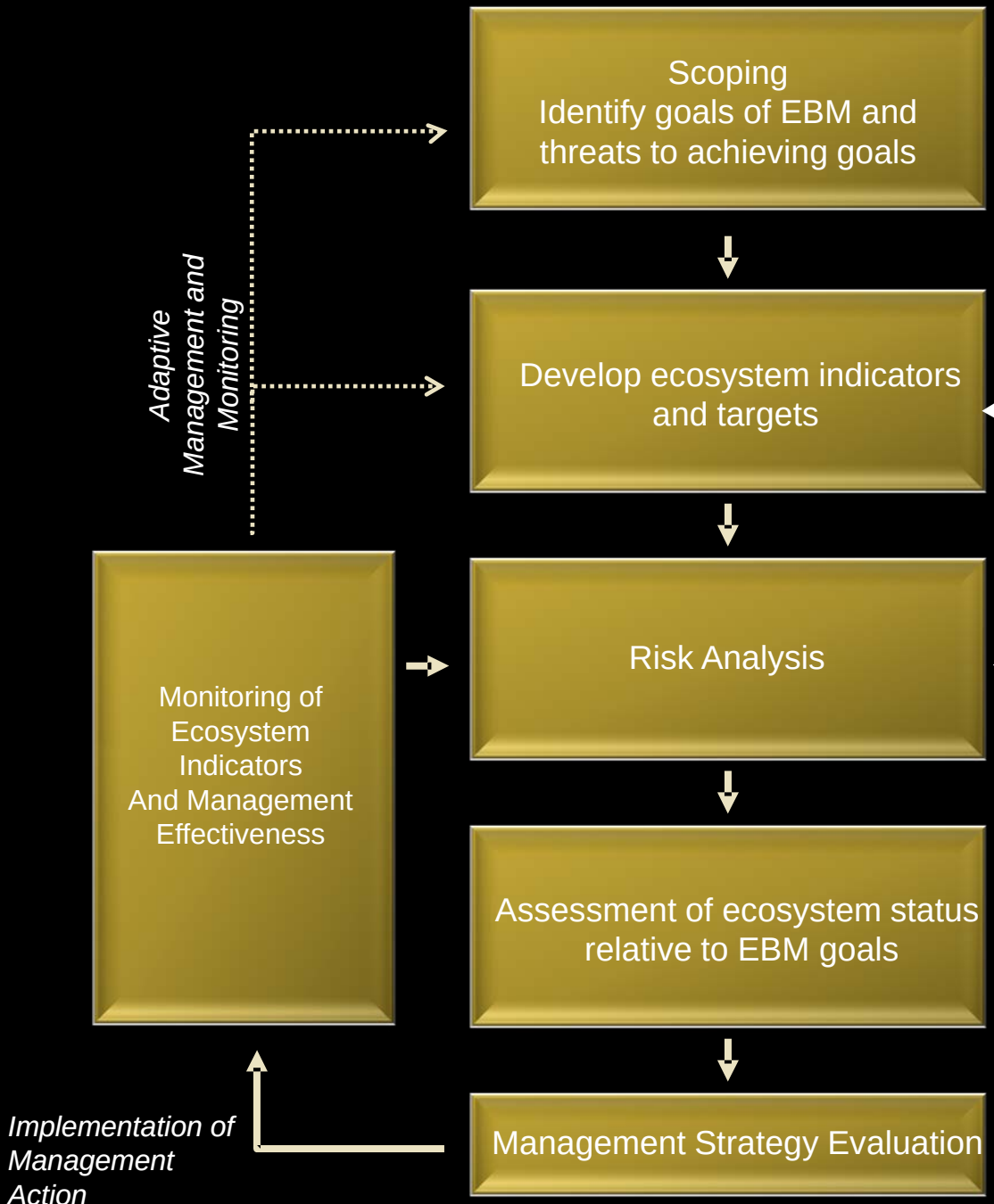
Integrated Ecosystem Assessment

A process for implementation of EBM

An IEA is a synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives.


WE NEED TO ENHANCE OUR SECTOR-RELEVANT SUPPORT FOR A SUITE OF INTEGRATED RISK ASSESSMENT TOOLS.
Dilbert.com DilbertCartoonist@gmail.com
DO YOU UNDER-STAND?
MAYBE. IS YOUR POINT THAT YOU DON'T KNOW HOW TO COMMUNI-CATE?
9-8-11 ©2011 Scott Adams, Inc./Dist. by Universal Uclick
NO.
OH. THEN I DIDN'T GET IT.

Integrated Ecosystem Assessment



Focus of 2010 CCIEA Efforts (NOAA Tech. Memo)

Current focus of CCIEA

Levin et al. PLoS Biology 2009

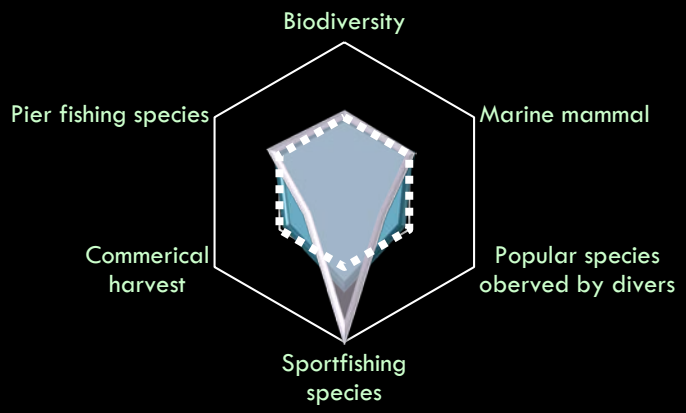
Inspired by the work of Sainsbury, Smith and probably others

CCIEA -- Ecosystem Considerations in FMPs

Overarching IEA: The ecosystem from the ecosystem perspective

"How do fishery practices affect the ecosystem?"

1. Indicator/Target
2. Status
3. Risk
4. MSE



PFMC Focus: The ecosystem from the fish's perspective

" How can information on the ecosystem be used to improve fishery practices?"

1. Climate
2. Ecological interactions
3. Non-fisheries threats
4. Other factors as needed

Presentation to Council SSC – Nov 2nd

PACIFIC FISHERY MANAGEMENT COUNCIL

GROUNDFISH SALMON PACIFIC HALIBUT HIGHLY MIGRATORY S

HABITAT AND COMMUNITIES ECOSYSTEM-BASED MANAGEMENT C

CURRENTS

- Archive of Council Newsletters
- Briefing Book Archive
- Council Meeting Decisions
- Control Dates
- Groundfish
- Salmon
- Highly Migratory Species
- Coastal Pelagic Species

Briefing Book Ar

November 2011 Briefin

The Council meeting propose
for the November 2011 Cour

- A. Call to Order
- B. Open Comment
- C. Salmon Management
- D. Pacific Halibut Manage
- E. Groundfish Managem
- F. Coastal Pelagic Species Management
- G. Habitat
- H. Ecosystem Based Management
- I. Highly Migratory Species Management

DISCUSSION DOCUMENT:

DEVELOPMENT OF AN ANNUAL REPORT ON CONDITIONS IN THE CALIFORNIA CURRENT ECOSYSTEM

PART I. INTRODUCTION AND SUMMARY

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Brian Wells, Southwest Fisheries Science Center (salmon) brian.wells@noaa.gov

INTRODUCTION

The Pacific Fishery Management Council (Council) has recognized the need for an understanding of the physical, ecological, socioeconomic and management components of the California Current Large Marine Ecosystem (CCLME). The Ecosystem Plan Development Team (EPDT) noted that an integrated ecosystem approach to fishery management can 1) promote sustainable human uses of the CCLME, 2) allow for a coordinated evaluation of ecosystem health, 3) aid in identifying critical data gaps and common ground within and between current FMPs, and 4) allow for evaluation of tradeoffs among fishery sectors or among fisheries and other ecosystem objectives. (EPDT Agenda Item J.1.c Attachment 1, March 2011).

The EPDT envisioned a two-step process to bring ecosystem science into the Council process. First, the EPDT promotes the incorporation of ecosystem science into current Council-related products. Secondly, they advocate a holistic, integrated assessment of the CCLME. This advice is echoed in two SSC recommendations in September 2010:

"... that a subset of stock assessments be expanded to include ecosystem considerations...The SSC's Ecosystem-Based Management subcommittee should develop guidelines for how ecosystem considerations can be included in stock assessments." (H.1.c., Supplemental SSC Report)

"...The Council should request NMFS to initiate development of an annual report on conditions in the California Current ecosystem. The SSC can provide guidance on the content, review and

In this document, we focus on the first part of this process – providing ecosystem information that could inform stock assessments and single-species management. In their March 2011 report (Agenda Item J.1.c Attachment 1), the EPDT proposed that NMFS invest time to develop a format for and contents of a Council-focused ecosystem considerations report. They then suggested that the NMFS team work iteratively with the Council and its advisory bodies to refine the format and contents of the document. This document represents the outputs of NMFS' initial investment in this process.

Based on discussion with the EPDT, NMFS opted to focus on a limited number of stocks across three FMPs. These are: hake, sablefish, canary rockfish, bocaccio, Chinook salmon, and sardine. This document focuses on the four groundfish (hake, sablefish, canary rockfish, bocaccio) suggested by the EPDT as pilot species.

HOW THIS DOCUMENT IS ORGANIZED

This document is organized around three basic questions:

1) What are the status and trends of key climate/ocean drivers that influence hake, sablefish, canary rockfish, bocaccio, and Sacramento River Chinook salmon?
2) What are the status and trends of important predators and prey that may influence hake, sablefish, canary rockfish, bocaccio, and Sacramento River Chinook salmon?
3) What are the status and trends of non-fisheries pressures that may influence productivity of hake, sablefish, canary rockfish, bocaccio, and Sacramento River Chinook salmon?

Answering these questions required NMFS staff to answer a number of basic questions about the ecology of the focal species. For example, in order to report the status and trends of key climate drivers, it is necessary to understand the relationship between climate and productivity of focal species. Similarly, documenting status and trends of the forage base c… know… focal s… non-fi… what … specie… repor… also p… analys… inform…

Chapt… online…

Ecosystem considerations relevant for single-species management

Integrated Ecosystem Assessment of the California Current

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Discussion Document:
Focus on hake, sablefish, canary rockfish, bocaccio, and Sacramento River Chinook salmon

Status and trends of:

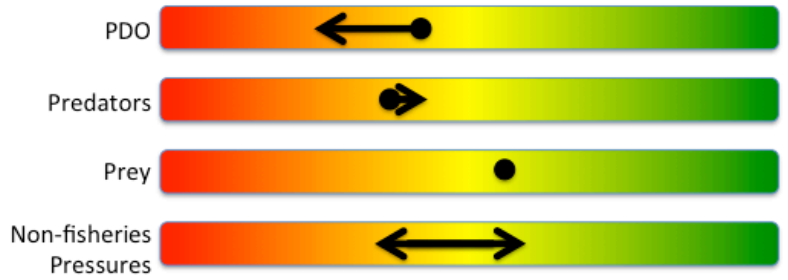
- Key **climate/ocean drivers** that influence these stocks
- Important **predators and prey** that influence these stocks
- **Non-fisheries pressures**

Costa Mesa Discussions

- Presented to SSC, CPS Panels, EAS, Habitat Committee
- Previously presented to EPDT

Examples of Analyses

SABLEFISH



PHYSICAL FORCING

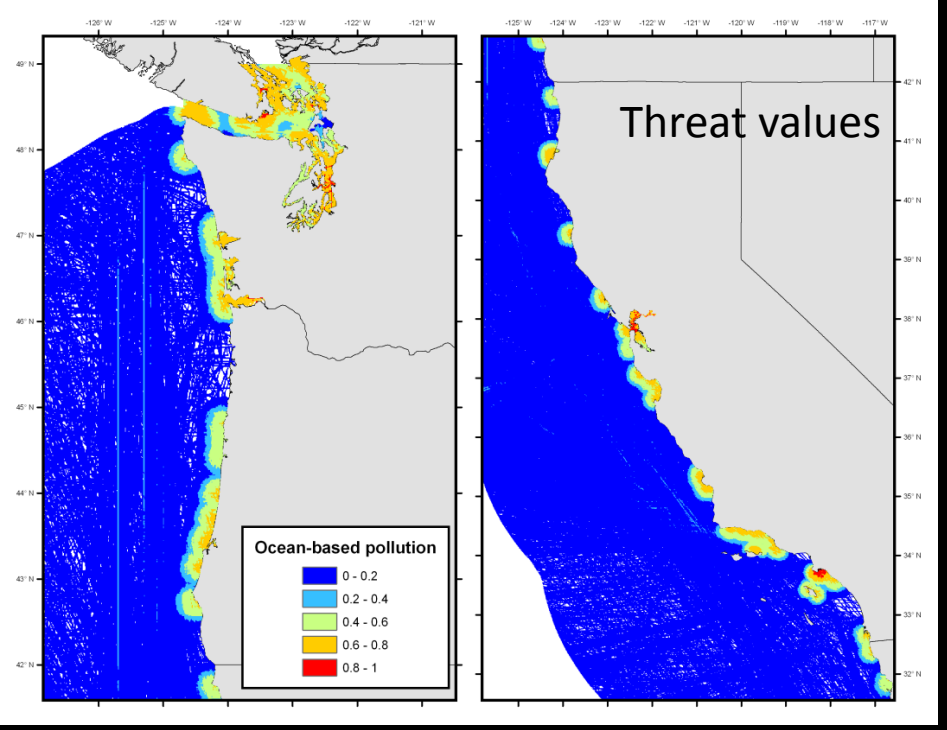
Strong sablefish year classes occur during periods of more intensive Aleutian Low Pressure and after extended periods of below average SST switched to periods of above average temperatures. ENSO effects on sablefish biomass and abundance are weak. Biomass and occurrence of adult sablefish is positively correlated with PDO. Thus, the recent shift to a cool PDO period (past five years) may yield poorer ocean conditions for sablefish. Long-term warming is hypothesized to yield declines in sablefish populations in the southern CC due to reduced spring productivity and copepod production.

TROPHIC INTERACTIONS

Recent densities of sablefish prey are greater than long term mean but may be declining in recent years. Predators on sablefish include pinnipeds, pelagic sharks, large skates, and bocaccio rockfish. Predator abundance is high, but predator biomass appears to be declining in recent years. However, the trends were within historic norms (but the recent decline of predators is just under one s.d. of the long term mean). The sablefish prey index has shown substantial variation through time with a peak in the mid-2000's. (Note that deposit feeders and cephalopods are not included in the prey index and pelagic sharks and bocaccio are absent from the predator index due to lack of data)..

NON-FISHERIES PRESSURES

The status of most of the 19 non-fisheries pressures on sablefish is average with no evidence of improving or declining trends. Some non-fisheries pressures are improving (e.g. nutrient inputs), while others (e.g. coastal engineering) are declining. However, in general the highest risk threats, (e.g., atmospheric deposition of pollutants and increases in sediment runoff) show no trend. When placed in context with climate change pressures (e.g. sea surface temperature), most other non-fisheries pressures pose limited risk to the focal species.



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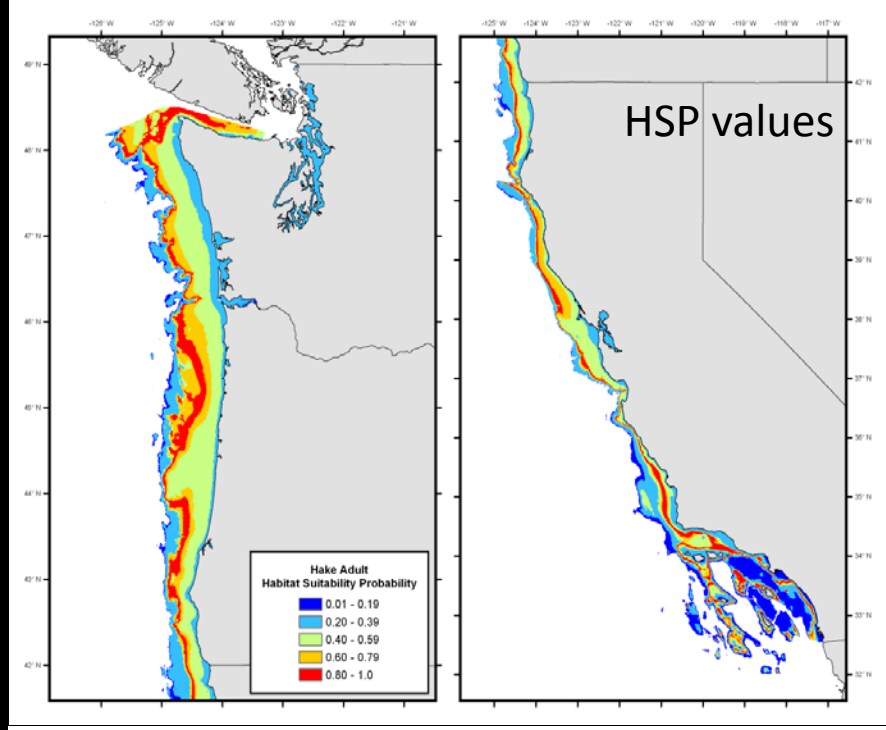

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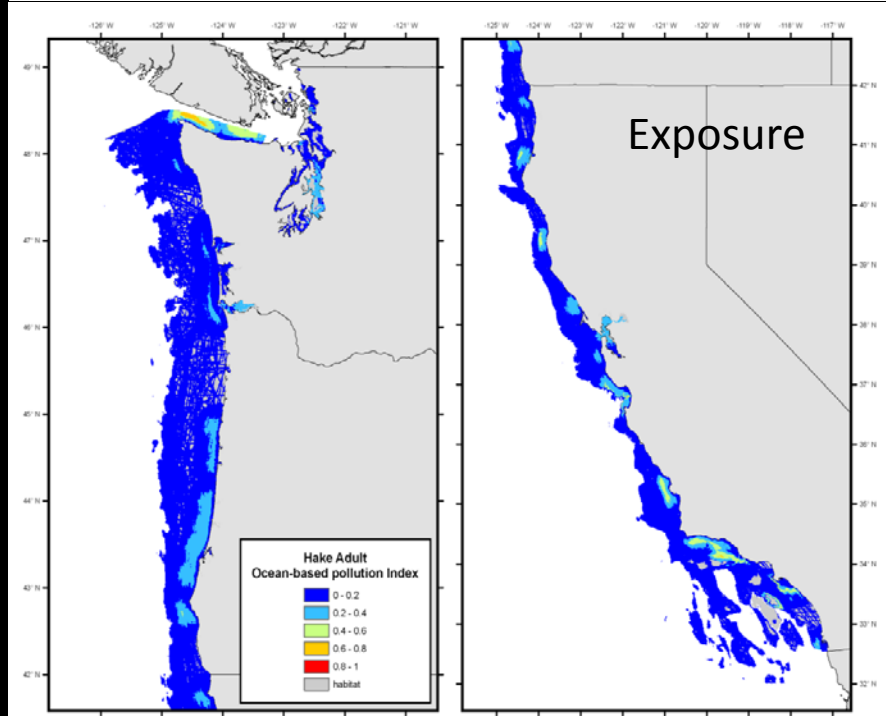
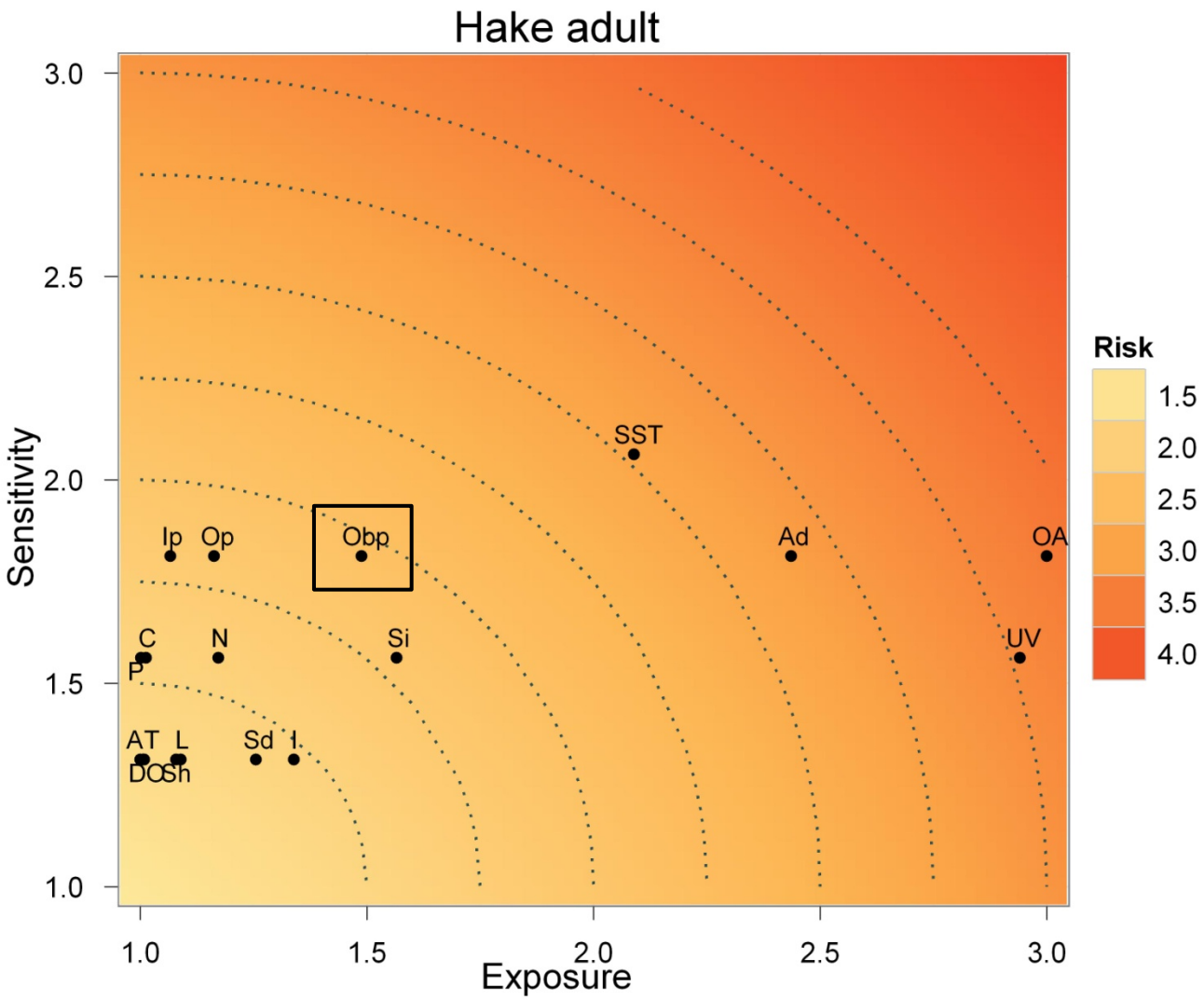


Calculating Risk

Exposure = Threat * HSP

Sensitivity = Life history + R&R factors

Risk from non-fisheries threats: Hake



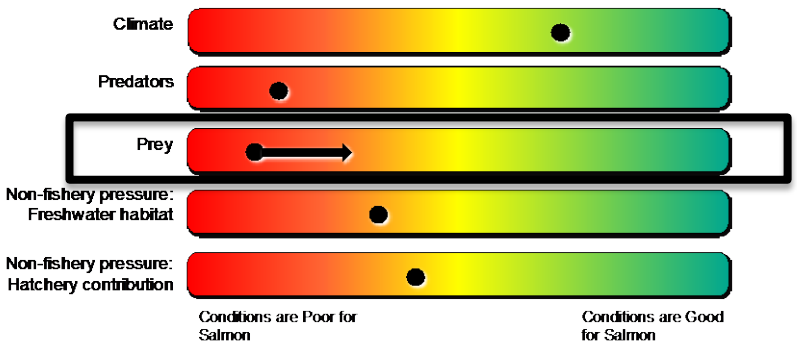
Non-fisheries threats

A – Aquaculture
Ad – Atmospheric deposition
C – Coastal engineering
D – Direct human impacts
Ip – Inorganic pollution
L – Light pollution
N – Nutrient input
Obp – Ocean based pollution
Op – Organic pollution
O – Oil rigs
P – Power plants
Sd – Sediment decrease
Si – Sediment increase
Sh – Shipping activity
I – Species invasions
T – Trash
OA – Ocean Acidification
SST – Sea Surface Temp
UV – UV Radiation

*Spatially expansive threats (high exposure) overshadow point source threats as sensitivity scores among groundfish are similar.

The salmon ecosystem

SACRAMENTO RIVER CHINOOK SALMON



PHYSICAL FORCING

The ocean condition has been generally in a good state for promoting ecosystem and salmon production. Wells et al 2008 (*Marine Ecology Progress Series* 364:15-29) developed an index of ecosystem productivity based on environmental variables (e.g. wind, temperature) and biological productivity. This index tracked, without modification, the abundance of Chinook salmon 1990-2008. This index can be used as an approximation of the ocean conditions in central California; the region wherein recruitment of salmon juveniles to the adult population is determined.

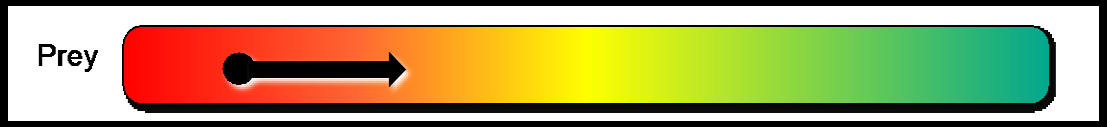
TROPHIC INTERACTIONS

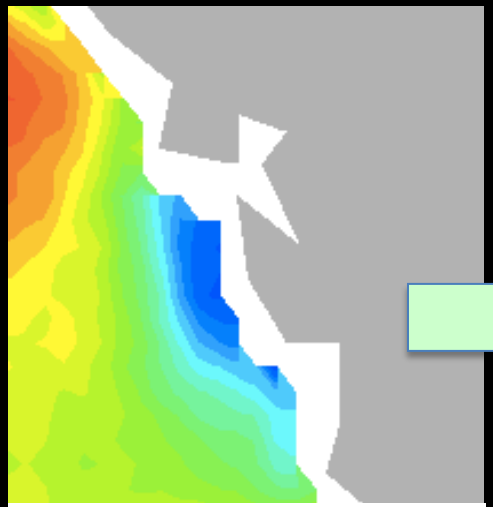
The forage base for Sacramento River salmon has been restricted in recent years with an increasing trend apparent. We represent forage as the the abundance of krill in the Gulf of the Farallones. As of 2005, the population of California sea lion, a primary predator, was at carrying capacity. Research has shown that California sea lions remove salmon from fishing gear at a rate as great as 30%; the greater the loss to depredation the greater is the true harvest as fish are replaced in the fishery.

NON-FISHERIES PRESSURES

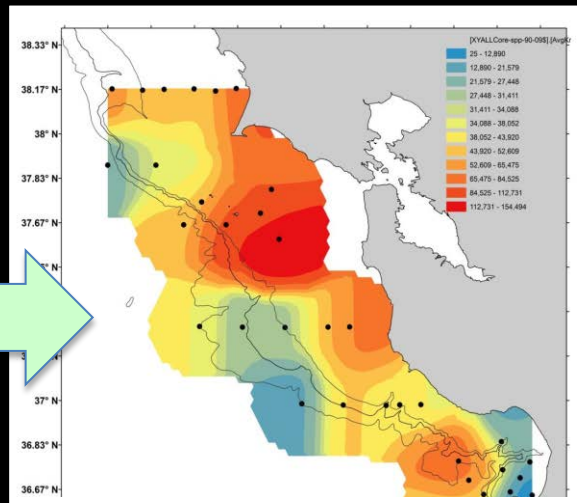
Freshwater habitat: River discharge has been less than optimal for salmon health and productivity. Freshwater flow has been shown to relate to the survival and condition of salmon living in the freshwater environment and moving into the ocean. Hatchery contribution: In the last five years hatchery contribution to the Sacramento River Fall Run Chinook salmon has been approximately 31% with no recent trend. Hatchery contribution represents the proportion of the spawning populations that returns to hatcheries

The salmon ecosystem

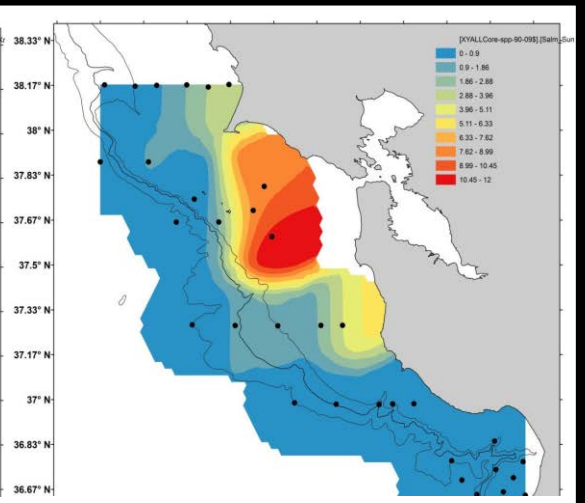




Offshore transport

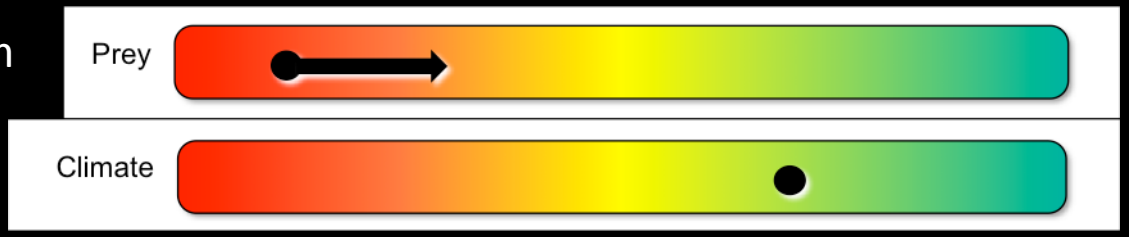


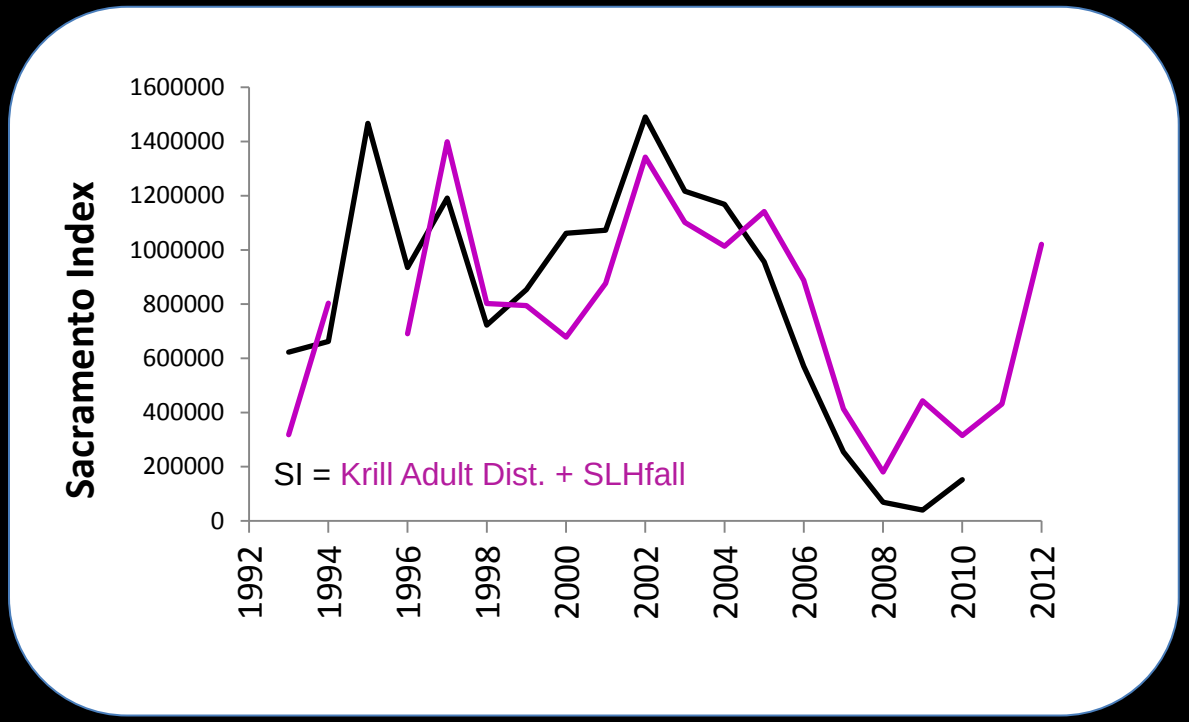
Krill abundance



Juvenile salmon abundance

The salmon ecosystem





Next Steps

Discussion Document: Questions

- Chapter 1: Physical forcing
  1. Are there other important sources of ocean-climate variability?
  2. What literature is missing from this review?
- Chapter 2: Predators and prey
  1. Which time series should be included?
  2. Do we need a more complex analysis for time series data?
  3. What are the correct weights (predators/prey)?
- Chapter 3: Non-fisheries threats
  1. Calculation of risk score: euclidean distance or something else
  2. Exposure intensity score: 1) sum then standardize or 2) standardize then average
  3. Sensitivity criteria: Average of 4 life-history traits or use each independently
  4. Behavior/physiological response scoring (*Sensitivity*)
  5. Threat time series data: a) use all data? b) different proxies?
- Chapter 4: Central California Chinook Salmon
  1. What time series lengths should we use?
  2. Which stocks should we include?
  3. How should we include the whole life cycle?

Future Directions

- Additional FMP species: Sardine, albacore, additional salmon stocks
- Develop organized working relationships with PFMC
- IEA focused analyses: Cruise data, forage dynamics and environmental drivers, MSEs
- Proposing to hold an IEA sponsored workshop with Council participation

IEA Workshop Proposed Goals

- Assess where ecosystem considerations could be included in current management models
- Review current IEA analytical approaches and products, including data used
- Examine potential of new models that include ecosystem considerations for use by PFMC
- Discuss additional IEA products that would be useful to PFMC