

WRONG PLACE, WRONG
TIME: RECENT MISMATCHES IN
FOOD AVAILABILITY TO SALMON
AND SEABIRDS IN CALIFORNIA

William J. Sydeman and Steven J. Bograd

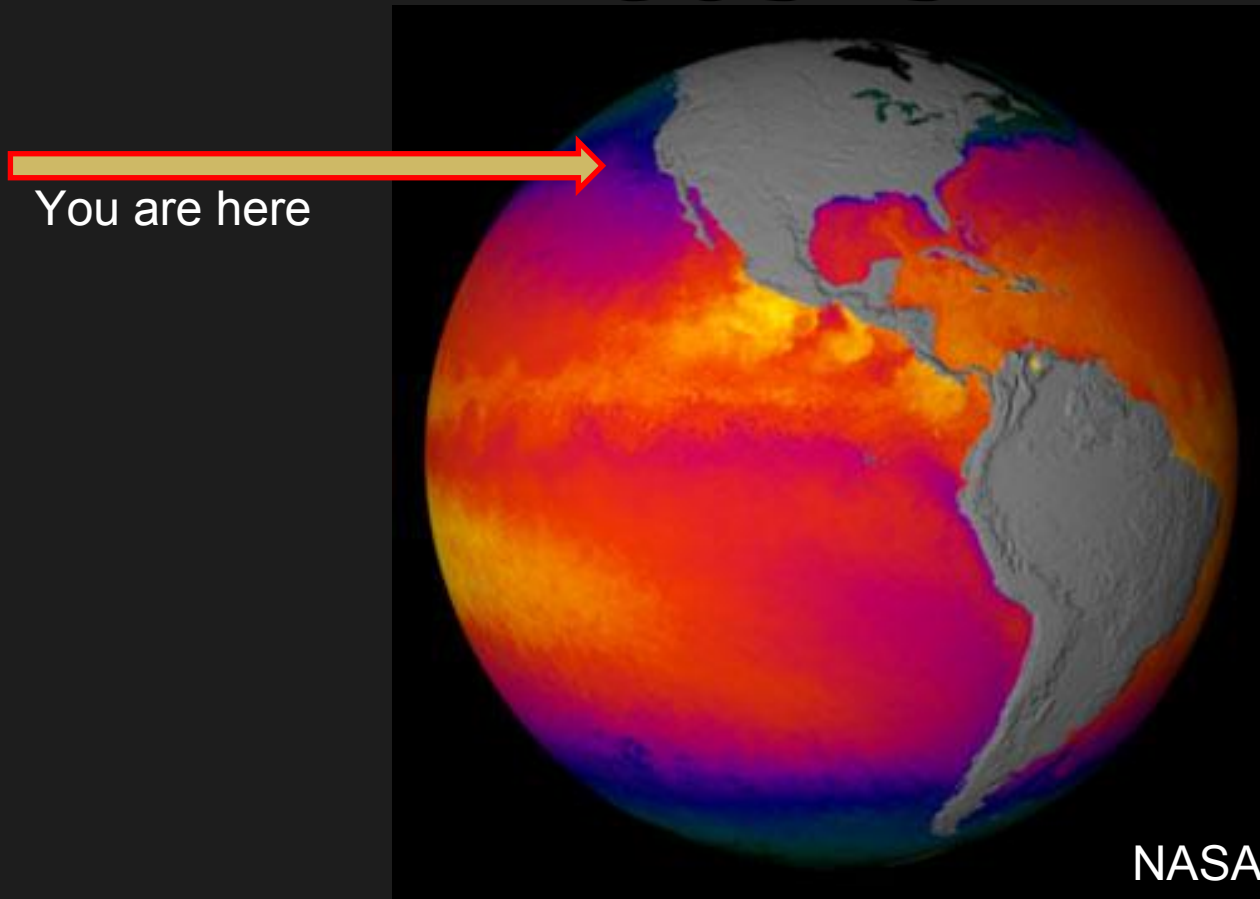


PRESENTATION OUTLINE

1. Problem: system 'health' is in question – bird and fish (salmon, rockfish) failures, variability increasing
2. Explanations? What have we learned (OPC ENV-07)?
 - changes in plankton (“krill”) – spatial mismatch
 - changes in oceanography (currents) linked to climate (...plankton “go with the flow”)
3. What next? Climate Change, Fish, Fisheries

BACKGROUND

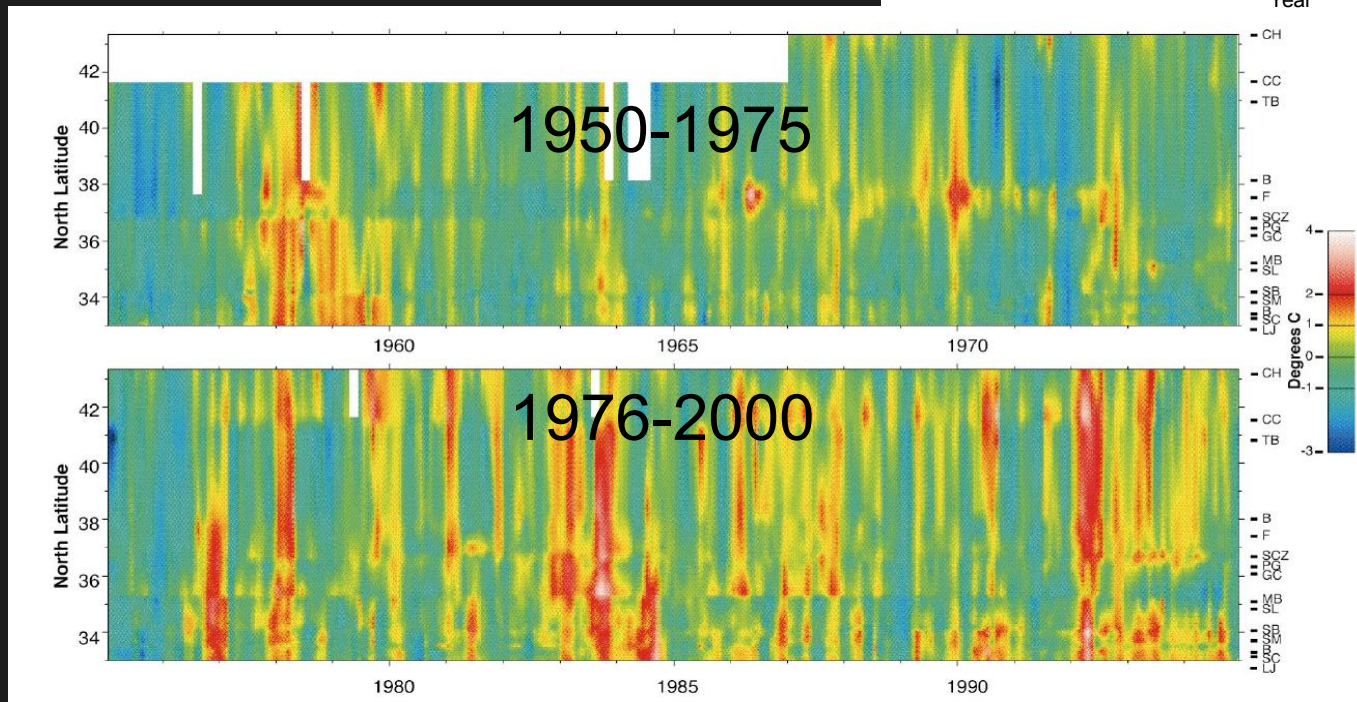
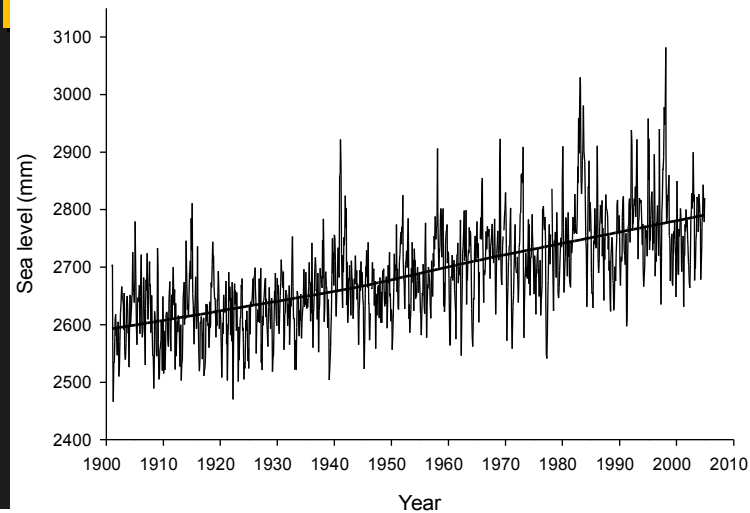
CALIFORNIA IS A COLD-WATER ECOSYSTEM



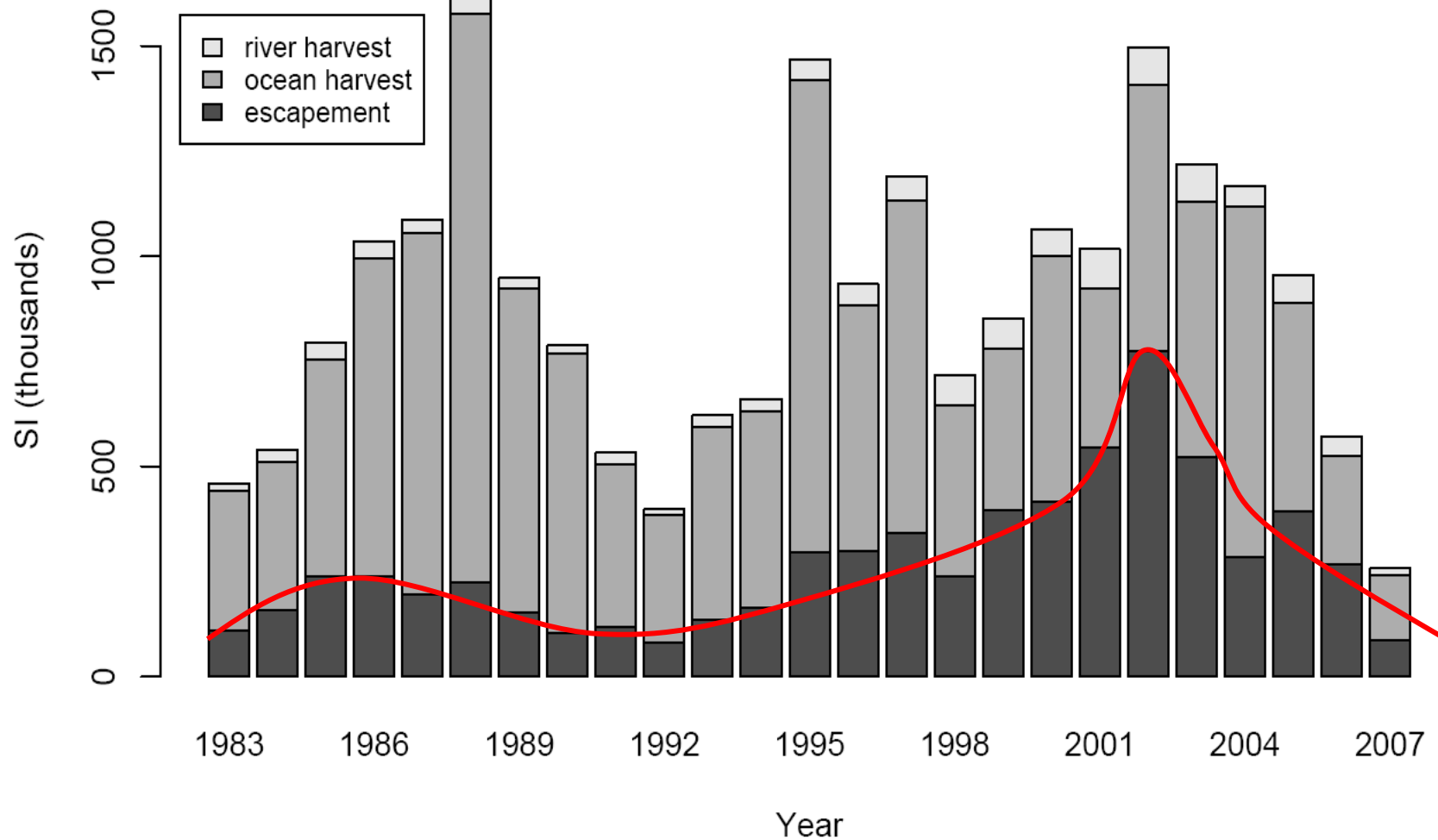
Warm colors (reds) = warm water; cold colors (blues) = cold “subarctic” water

OCEAN CLIMATE CHANGE IN CALIFORNIA

1. Ocean warming
2. Sea level rise
3. Surface waters 'more stratified' = harder to mix
4. Upwelling and currents are changing



CHINOOK SALMON POPULATION



RETURNS (NO. FISH)

2002 - 800,000

...

2007 - 90,000

2008 - 60,000

2009 - ? (better)

2010 - ?

**SIMILAR PATTERNS ACROSS SALMON
POPULATIONS, AND WITH SEABIRDS...**

**...SUGGEST LARGE-SCALE
(CLIMATE-OCEAN)
FACTORS AT PLAY**



Black-footed Albatross

**(GIVEN LONG-STANDING RIVER
DEGRADATION, DECREASE IN STOCK
RESILIENCY)**

TACKLING CLIMATE CHANGE AND ECOLOGICAL COMPLEXITY (OPC ENV-07)

WJ Sydeman and SJ Bograd - Principle Investigators

JA Santora, ID Schroeder - Post-Doctoral Research Associates
(Farallon Inst. and NOAA-ERD)

JD Dorman (Z Powell, prof) - PhD Trainee (UCB)

KL Mills, SA Thompson - Staff Biologists (Farallon)

B Black and RM Suryan - Collaborators (OSU)

JC Field, S Ralston - Collaborators (NMFS)

**WHAT HAVE WE
LEARNED?**

**PREDATORS NEED FOOD AT THE
RIGHT PLACE AND TIME TO THRIVE
AND SURVIVE**



BLUE WHALE/KRILL

KRILL - RIGHT PLACE AND RIGHT TIME= BETTER SURVIVAL AND REPRODUCTIVE SUCCESS..



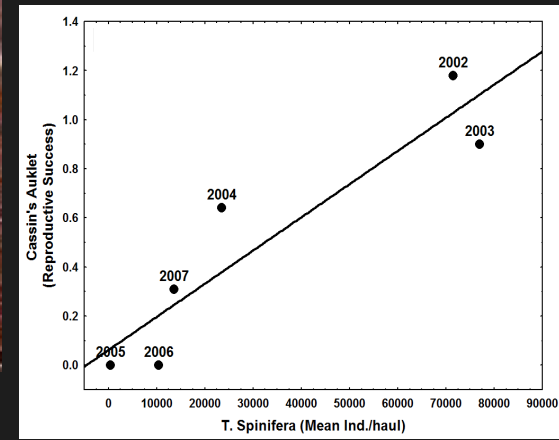
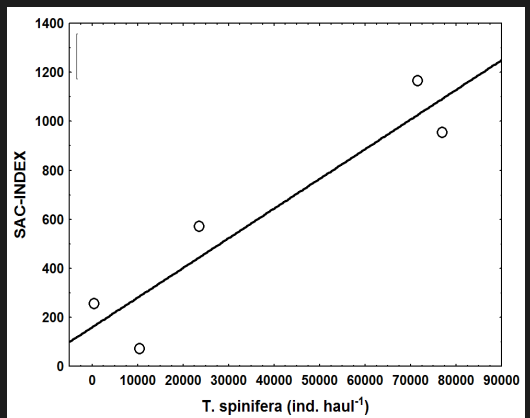
Chinook Salmon



Cassin's Auklet

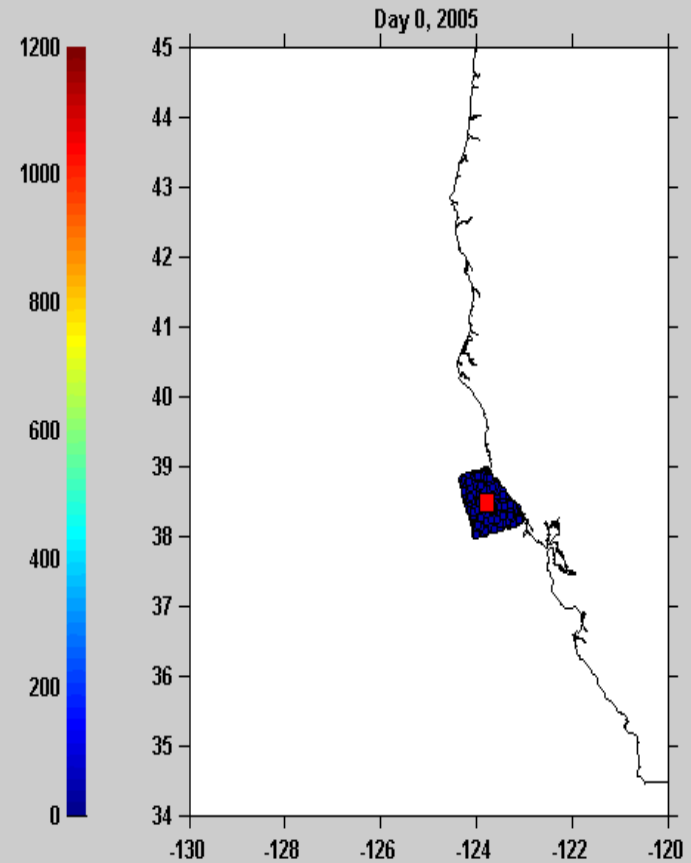
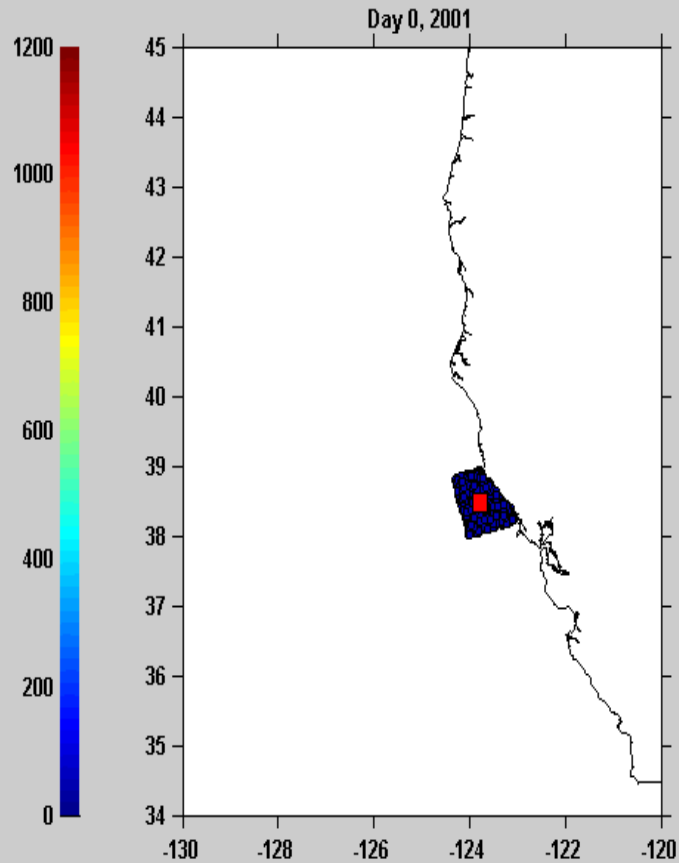


"krill"



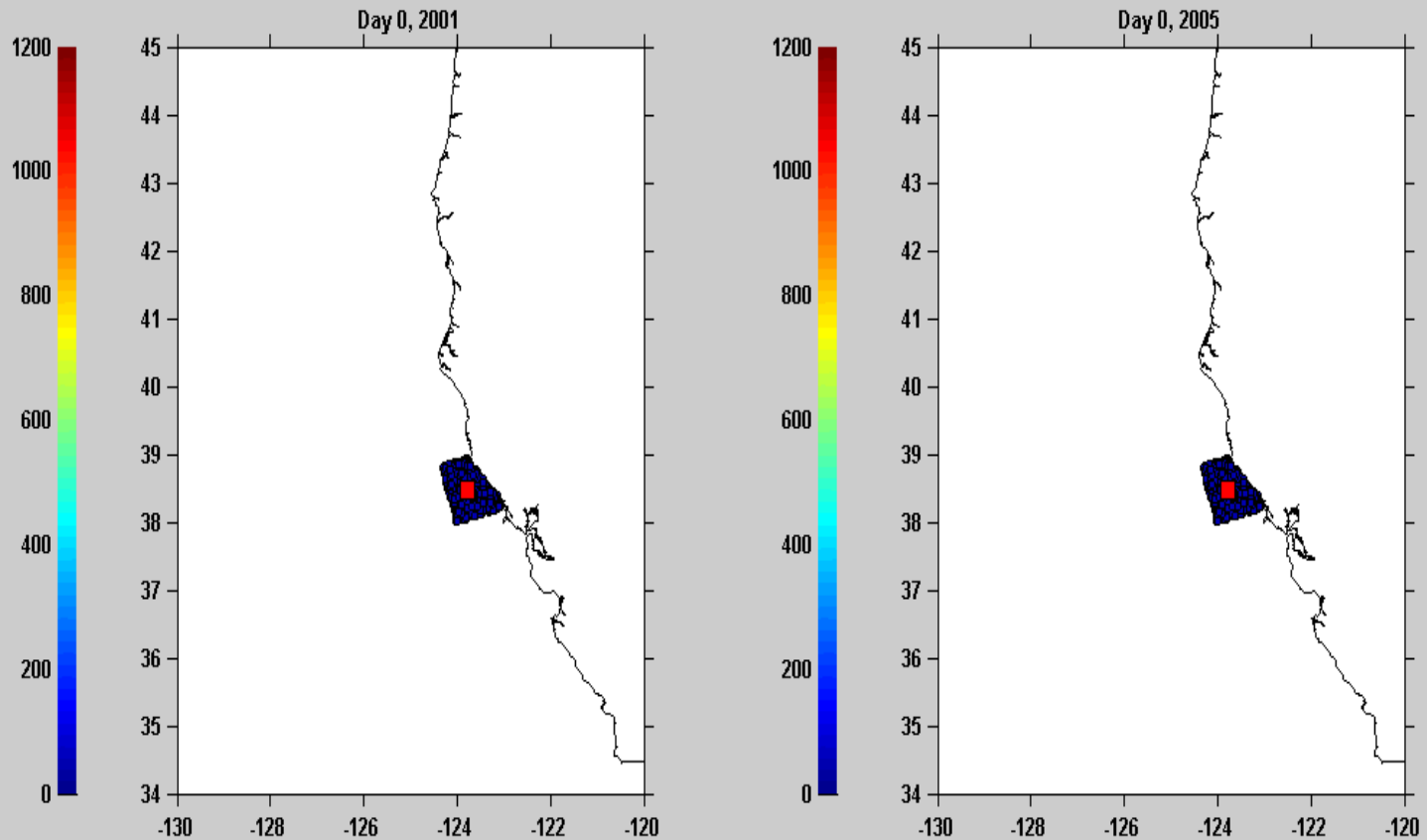
WHAT HAVE WE LEARNED? THE CLIMATE CONNECTION

CLIMATE IMPACTS VIA CURRENTS?



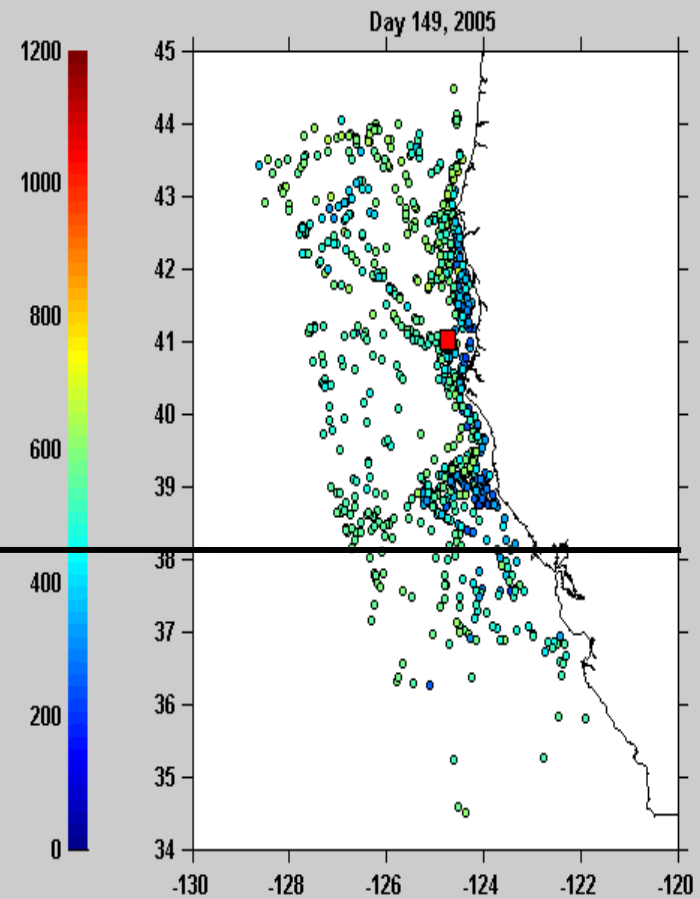
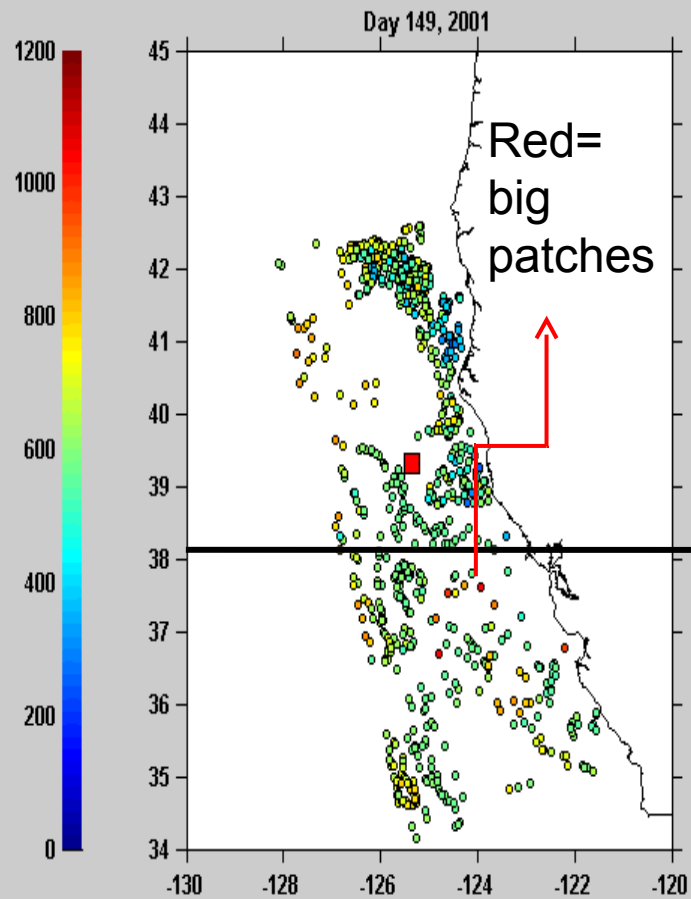
Jeff Dorman et al. unpublished

HOW? COUPLE REGIONAL OCEAN MODEL WITH KRILL POPULATION MODEL (WINDS – CIRCULATION – PRIMARY PRODUCTIVITY – KRILL DIST'N)



Jeff Dorman et al. unpublished

MODEL RESULTS: GOOD VS. BAD YEAR....

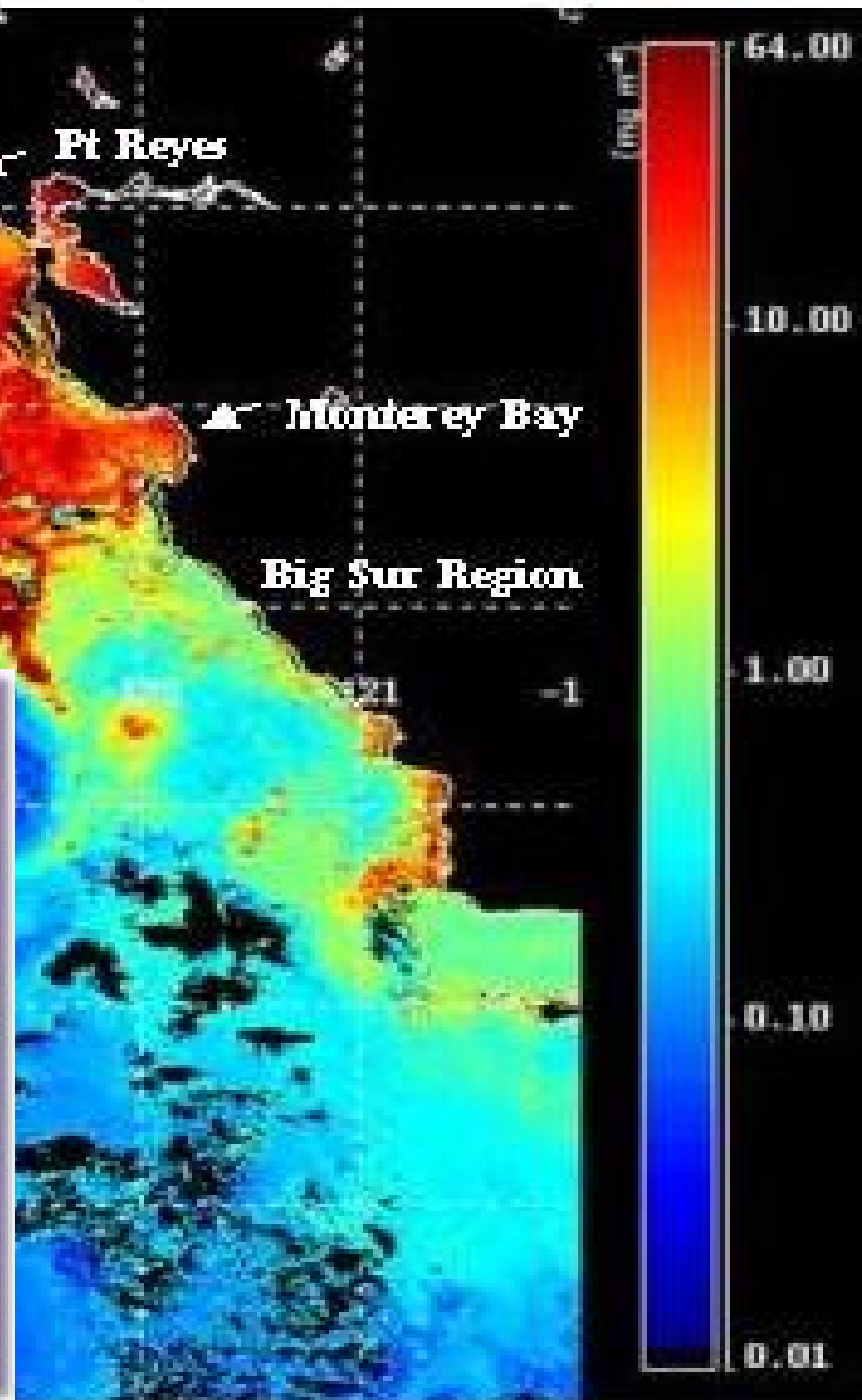


A large school of small, silvery fish, likely rainbow trout or similar species, swimming in clear water. The fish are densely packed and moving in various directions, creating a dynamic scene. The water is a light blue-grey color, and the fish have a metallic sheen.

CONCLUSIONS

First, a small fish story...

**SECOND,
LOCATION,
LOCATION,
LOCATION...**

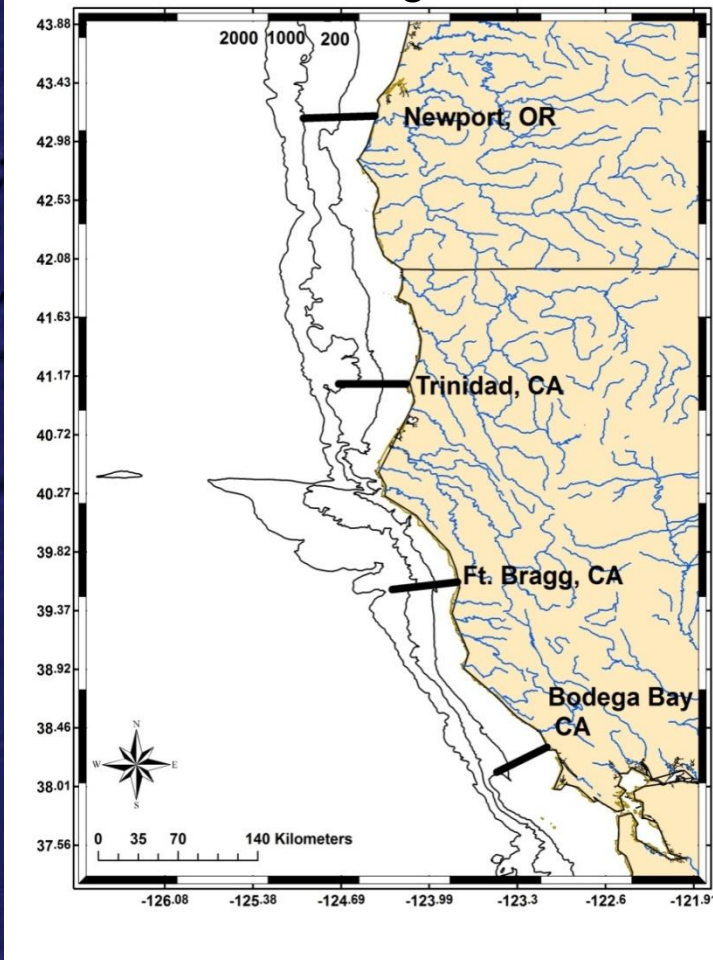


THIRD, MANAGEMENT/POLICY IMPLICATIONS

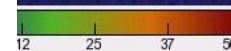
- OCEAN CLIMATE IMPACTS HERE AND NOW
- FOOD (RIGHT PLACE, RIGHT TIME) IMPORTANT TO
JUVENILE SALMON SURVIVAL = RUN HEALTH YEARS
LATER
- ~30M SMOLTS PRODUCED IN CALIFORNIA'S
HATCHERIES...
- CAN WE RELEASE AT DIFFERENT TIMES OF YEAR
TO INCREASE RESILIENCY?

INTEGRATED OCEAN OBSERVING (PHYSICS AND BIOLOGY)

North Coast Program - Plankton



WEST COAST SURFACE CURRENTS MAPPING PROGRAM (COCMP)



THANK YOU!

