

Impact of climate variability on the California Current ecosystem and Pacific salmon survival: linkages, ocean condition indicators, forecasting, and management perspectives



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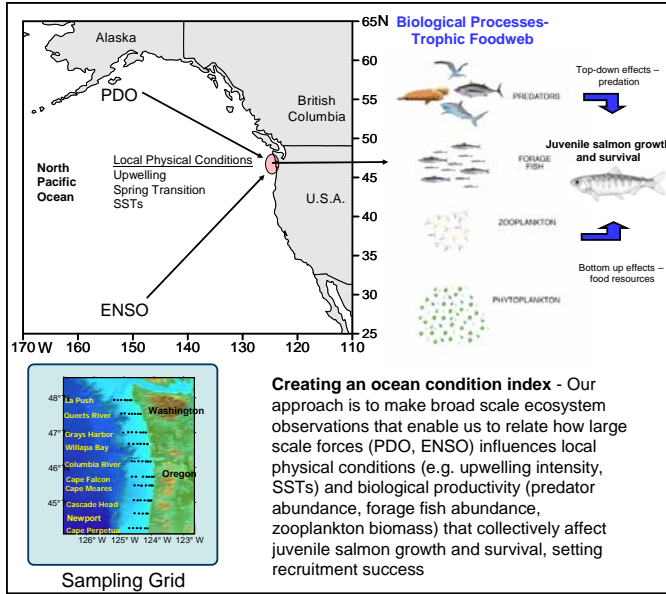
Problem Statement

Issue - Physical and biological elements of the California Current ecosystems appear stable during each long term phase (cool or warm regime) of the Pacific Decadal Oscillation (PDO) that affects the North Pacific ecosystems

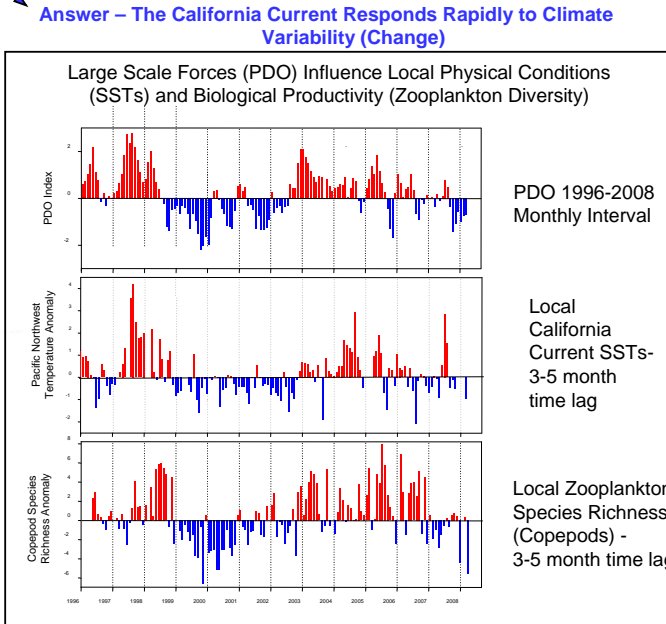
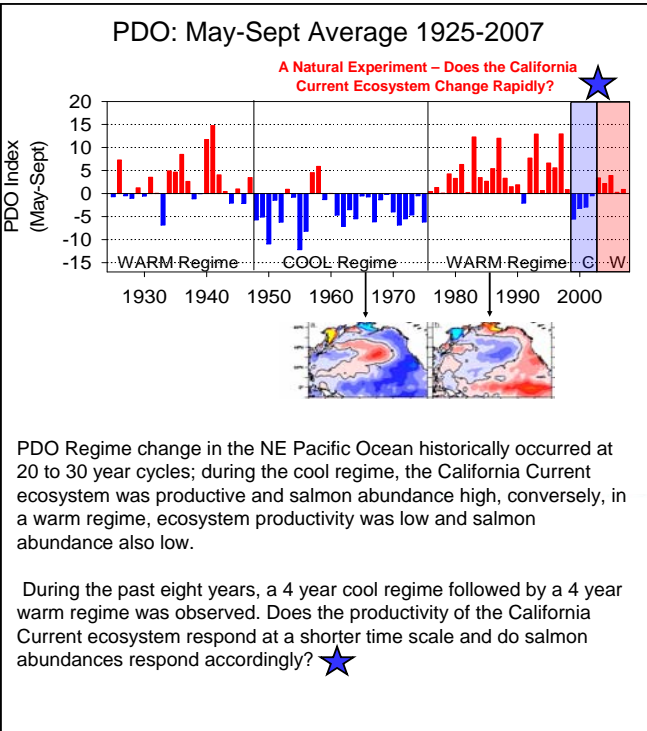
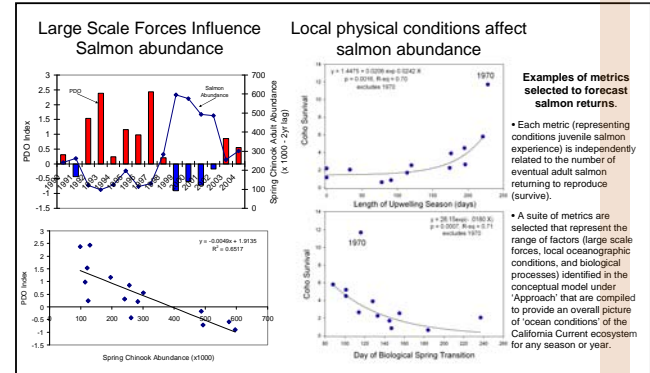
Question - If large scale regime shifts occur at a greater frequency (shorter duration), is the California Current ecosystem able to respond accordingly?

Consequence - Because Global Warming could affect duration and variability in large scale forcing; managers of fishery resources need faster responding forecasting tools!

Approach – Conceptual Model



Results



Ocean Index – Forecasting Future Salmon Returns

www.nwfsc.gov (look for ocean indicator link)

	Juvenile migration year				Forecast of adult returns	
	2000	2005	2006	2007	Coho 2008	Chinook 2009
Large-scale ocean and atmospheric indicators						
PDO	Green	Red	Yellow	Yellow	Yellow	Yellow
MEI	Green	Red	Yellow	Yellow	Green	Green
Local and regional physical indicators						
Sea surface temperature	Green	Red	Yellow	Yellow	Red	Red
Coastal upwelling	Green	Red	Yellow	Yellow	Yellow	Yellow
Physical spring transition	Green	Red	Yellow	Yellow	Green	Green
Deep water temp. & salinity	Green	Red	Yellow	Yellow	Green	Green
Local biological indicators						
Copepod biodiversity	Green	Red	Yellow	Yellow	Yellow	Yellow
Northern copepod anomalies	Green	Red	Yellow	Yellow	Green	Green
Biological spring transition	Green	Red	Yellow	Yellow	Green	Green
Spring Chinook–June	Green	Red	Yellow	Yellow	Green	Green
Coho–September	Green	Red	Yellow	Yellow	Red	Red

Legend: Favorable condition for salmon (Green), Neutral condition for salmon (Yellow), Unfavorable condition for salmon (Red); High Salmon Return (Blue), Average Salmon Return (Yellow), Low Salmon Return (Red)

* Ocean condition metrics rated on a green light-red light scale; the cumulative view provides a forecast of adult salmon returns 1 to 2 years into the future for fisheries managers. Each metric has been shown to independently relate to salmon survival

