Changing Ocean Conditions: Understanding El Niño's Impacts on California's Living Marine Resources Through Ocean Observations

Workshop Summary

Hosted by the Ocean Protection Council and UCSD's Scripps Institution for Oceanography
September 22, 2015
California State Library, Sacramento, CA 95812

Agenda (PDF)
Link to Workshop Audio and Video Archive (WMV file)

Speakers

- **Dr. Dave Checkley**, Director of CalCOFI and Professor of Oceanography, Scripps Institution of Oceanography, UC San Diego
- **Dr. Dan Rudnick**, Professor of Oceanography, Scripps Institution of Oceanography, UC San Diego
- **Dr. Cheryl Peach**, Director, Scripps Educational Alliances, Scripps Institution of Oceanography, UC San Diego
- **Dr. Laura Rogers-Bennett**, California Department of Fish and Wildlife Service and CalCOFI Committee Member
- **Dr. Emmanis Dorval**, National Oceanic and Atmospheric Administration National Marine Fisheries Service, La Jolla Laboratory
- **Dr. Nate Mantua**, National Oceanic and Atmospheric Administration National Marine Fisheries Service, Santa Cruz Laboratory
- **Anna Holder**, California Department of Fish and Wildlife, Coastal Pelagic/Highly Migratory Species Project

Overview

In California, it is nearly impossible for a day to pass without hearing about the upcoming El Niño and how much of an influence it will have on our weather and climate this winter. Across the United States, but particularly in California, we are consumed with predicting and understanding the precipitation and temperature outlook for this season. And rightfully so; the National Oceanic and Atmospheric Administration (NOAA) has assessed that a major El Niño event is occurring and will continue well into Spring 2016 . These conditions indicate that there will likely be weather and climate conditions on par with the strong El Niño event of 1997-1998. This potentially means storms, flooding, sea level rise, and continued temperature anomalies. It also means persistent unseasonably warm waters up and down the California coast that have a direct impact on the fisheries and living marine resources we are working to manage in a sustainable and resilient manner each and every day.

In collaboration with UC San Diego's Scripps Institution of Oceanography (Scripps), the California Ocean Protection Council (OPC) hosted a workshop to further explore these less discussed effects of El Niño – the impacts on living marine ecosystems such as our commercial and recreational fisheries – and to hone in on what we can learn from this year's conditions to better understand and plan for future warm water years. It has been an interesting past couple years in our California Current with the phenomenon labeled 'the Blob', a persistent pooling of warm water in the North Pacific. OPC and Scripps were curious to explore how an additional overlay of warm water – and an enhanced deviation in temperature from the seasonal average – and changing ocean

conditions would further shift the ecosystem structure and species' distribution, vitality, and abundance. We have already seen that these El Niño-like conditions caused by 'the Blob' cause warm-water species of ocean fish and invertebrates to be found farther north than normal. For example, ocean sunfish were observed for the first time off Alaska. In early October, thousands of pelagic red crabs washed ashore in Monterey though they are usually found off the coast of Baja California, Mexico. Forage for sea lions and sea birds is less available. And such changing ocean conditions combined with the drought have the potential to affect salmon.

Given that California's coastal and ocean resources are valued at more than $22 billion annually[1] and its commercial fisheries alone are more than $250 million[2], OPC and Scripps felt it timely and imperative to bring together some of the brightest minds on this topic spanning state and federal government and academia to address and plan for these effects. The driving question throughout the discussion was how we best assess these anomalies[3] to provide the environmental intelligence needed to inform decisions and the public throughout California.

Opening Remarks

Catherine Kuhlman
Deputy Secretary for Ocean and Coastal Policy, California Natural Resources Agency
Executive Director, California Ocean Protection Council

Cat Kuhlman welcomed those in the room and the many that were participating by phone, thanked the distinguished panel, and introduced Secretary Laird who has served as a passionate advocate for the ocean and has specifically been a leader in making our statewide MPA network an organized program and guiding OPC on our work related to changing ocean conditions including warming and ocean acidification. His work and vision particularly on our changing ocean conditions has provided the foundation for our strategy and unifying framework at OPC.

The Honorable John Laird
Secretary, California Natural Resources Agency
Chair, California Ocean Protection Council

Secretary Laird acknowledged the topical nature of the workshop. In today's media, everybody is focusing on El Niño, but focusing on El Niño not for the reason we are here today. El Niño conversation is held up in academic circles, and we need to continue to ask these important questions, reach new audiences, stakeholders, and decision-makers and relay impacts. Secretary Laird further urged the need to ensure the state structure works with scientists to improve how the public is educated. It is the challenge of academics and scientists moving forward to make those in state structure a closer partner and work together to get the information in the public's hands.

Panel Discussion

Dr. Checkley provided an overview of the physics of El Niño, walked through the past impacts on California's living marine resources during El Niño events and the role of ocean observing and CalCOFI (California Cooperative Oceanic Fisheries Investigations) in documenting long-term changes and collecting long-term coupled data about the physics, chemistry and biology of our oceans and how these shape the patterns of our fisheries. He emphasized that it is key to qualify and characterize what happens before, during, and after an El Niño to our fisheries and, therefore, ecosystem structure.

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[1] National Ocean Economics Program
[2] 2013 Landings, California Department of Fish and Wildlife
[3] An anomaly is a single value in time minus the long-term average for that value.

In addition to looking at the previous historic El Niño events of 1982-83 and 1997-98 and exploring how much this year's El Niño will continue to grow and identifying uncertainties, Dr. Checkley emphasized the core characteristics of El Niño years, such as warmer ocean temperatures, decreased upwelling and primary productivity, increased storms (meaning both wind and rain), and shifts in distributions of mobile populations. He also provided a brief summary on potential winners and losers of these anomalous ocean conditions, setting the stage for the Panelists discussions on the effects seen on our state's highest-value fisheries.

CalCOFI combined with other ocean observing, such as NOAA vessel surveys, local and regional observations, provides the environmental intelligence needed to inform the State, including decision makers and the public. CalCOFI provides a historical (climatological) perspective to evaluate conditions off central and southern California as well as a seasonal resolution. Moorings, gliders, satellites and other platforms each contribute to the mosaic of observing across these scales. Anna Holder of the California Department of Fish and Wildlife explored how these observations inform the management of both state and federally managed fisheries. Not only did she detail the management frameworks of key fisheries, such as groundfish, coastal pelagic species, market squid, but there was discussion on how environmental data are used to adaptively manage California's fisheries as mandated by both state and federal law.

Dr. Laura Rogers-Bennett, Dr. Emmanis Dorval, and Dr. Nathan Mantua explored the impacts of El Niño on specific high-value species, namely Dungeness crab, spiny lobster, red abalone, market squid, and salmon. As California's largest commercial fisheries, particularly Dungeness crab and market squid, it is especially critical to understand the impact of El Niño and changing ocean conditions on these high-value species and explore how science can help ensure the effective management of these and other key fisheries.

Dr. Rogers-Bennett highlighted changes to crab and spiny lobster landings during warm El Niño conditions. Both fisheries have been fished for over 80 years, and California's invertebrate fisheries make up about 80% of the total value of fisheries. With datasets like CalCOFI, we are able to go back to the archives and match up landings with ocean conditions and temperatures. This means data collection networks like CalCOFI, which spans six strong El Niño events, coupled with other long-term, multiple-parameter monitoring systems, is poised to collect data that directly speaks to which fisheries will be winners or losers in El Niño-like years. This information (i.e., larval time series or sea surface temperatures) can then be used in management dialogues when projecting whether it will be a good or bad year for a given fishery. Further, by incorporating the data, we can develop novel ecosystem indicators, such has been already been done for market squid, spiny lobster, and is in the process for Dungeness crab.

Dr. Dorval highlighted that given the life cycle of market squid, characterized by fast growth rates and a short life span, this species is very sensitive to El Niño conditions, but the stock can quickly rebuild after an El Niño year. Current efforts are focused on improving the forecasting of squid to better inform fishery management. For salmon, however, it is a slightly different story, as Dr. Mantua discussed. Salmon habitat is extremely sensitive to changing climate conditions. Water flow and temperature are critical climate pressure points in freshwater habitats and healthy ocean conditions and marine food webs are critical for growth and survival. For salmon, California is already at the southern end of its range so how the El Niño plays out in its zone is important. This is especially so when we also consider the land use changes that are making salmon populations increasingly sensitive and vulnerable to weather and climate. How they may respond to other species typically dominant in southern California and Baja and now in their range and habitats is unknown.

Key Questions Answered…and Next Steps

Dr. Peach briefly emphasized how public education can and should be a part of what CalCOFI and other long-term observation networks bring to the management and policy table. Now that we have everyone's attention about the looming influence of this year's El Niño, and in light of the fact that the discussion is dominated by

precipitation projections, we have an opportunity to increase awareness about other effects.

Dr. Rudnick threaded the entirety of the conversation into a series of key questions and summary statements listed below.

What is El Niño and what about this year?

- El Niño involves changes in the equatorial Pacific including warming of the ocean's surface.
- El Niño's effects are felt across the Pacific Ocean and especially in the waters off California.
- The strongest El Niño events of the past several decades were in 1982-83 and 1997-98.
- The last El Niño, in 2009-10, was a moderate one.
- We currently have El Niño conditions at the equator. Models overwhelmingly forecast that El Niño conditions will persist through the winter. In short, El Niño is extremely likely to stick with us.

What are the effects of El Niño for California's ocean?

- Warmer waters. The reason they are warmer is because there is less upwelling of cold water.
- When there is less upwelling of cold water, there is less biological productivity.
- Changes in species distributions, including tuna, further north. Sardines are closer to shore, there are fewer market squid, sea lions are hungry. Overall, there will be winners and losers.
- Managers use the information about El Niño to monitor and assess various fisheries.
- Most changes to fisheries caused by El Niño are likely to be back to normal within a few years.

What about precipitation?

- The strong El Niño events of 1982-83 and 1997-98 brought heavy precipitation to California.
- In general, there is not a strong correlation between El Niño and precipitation.
- The current forecast is for a strong El Niño, so we will see what the year will bring.
- Strong stream flow is good for salmon, but considering the recent warmth and drought, again we will have to see what happens.

And finally, CalCOFI and other sustained baseline observing put California in an excellent position to understand and respond to El Niño's effects.

- The looming El Niño brings both challenges and opportunities.
- We must enhance observations of the El Niño so that we react appropriately now in and the future.
- We need to improve analyses to address changes to physical environment and living resources.
- We need to increase communication of scientific results to inform management and policy.

California is arguably the best observed region in the United States from physics to fish. This means we have a continued opportunity, if not responsibility, to do something in response to this El Niño and future El Niño years in order to more fully understand these phenomena in the context of a changing climate and other anomalies such as the 'The Blob'. It is time to take our research and observations one step further and enhance our use of observations and analysis in statewide and federal management decisions. This opportunity presents itself particularly at a time when the public is interested in the potential impacts of this El Niño and we can reach a broader audience. OPC and Scripps will continue coordination throughout this winter so state managers and decision-makers are getting the best and fastest access to relevant science – and in a clear and useful way – so that, together across the state, we iteratively build on what we observe in our oceans and respond appropriately to impacts on our economically and ecologically significant fisheries.

We encourage you to visit our websites frequently (www.opc.ca.gov and https://scripps.ucsd.edu/news/el-nino) and watch and listen to the workshop discussion.