



## Moving beyond BACI:

### What do to when science and reality clash in marine reserve monitoring?

Workshop Held: June 10<sup>th</sup>, 2015

Challenges have arisen when implementing a BACI (Before-After-Control-Impact) sampling design at two of Oregon's Marine Reserve sites. For Cape Perpetua, the main challenge is the lack of appropriate "Control" sites possessing comparable habitats (e.g. deep, isolated reef) and oceanographic conditions (e.g. hypoxia, upwelling). For Cape Falcon, the existing extractive pressure is so low as to render a BACI approach ineffective for tracking change through time.

To address these challenges the Marine Reserves Team held a workshop with experts from Oregon State University (OSU), University of California--Santa Cruz (UCSC), and the Partnership for the Interdisciplinary Study of Coastal Oceans (PISCO) to brainstorm and receive feedback on alternative ecological sampling designs for the Cape Perpetua and Cape Falcon Marine Reserves.

#### Participants

Brittany Huntington (ODFW)  
Dave Fox (ODFW)  
Cristen Don (ODFW)  
Bob Hannah (ODFW)  
Kristen Milligan (PISCO-OSU)

Mark Carr (PISCO-UCSC)  
Jessica Watson (PISCO-ODFW)  
Kirsten Grorud-Colvert (PISCO-OSU)  
Scott Heppell (OSU)  
Selina Heppell (OSU)



# Monitoring Design Workshop Agenda

Overall Goal: Receive expert judgment on BACI design

Develop a sampling strategy for ecological monitoring in Cape Perpetua and Cape Falcon Marine Reserves where control sites (aka comparison areas) are problematic and render a BACI sampling design challenging or inappropriate.

## Meeting Agenda:

10-10:10: Quick introductions

10:10-10:15: Agenda review (two case study problems)

10:15-11:00: Cape Falcon: First 10 minutes, the background material is reviewed by Brittany and Jessica to get everyone on the same page. Discussion of ODFW's proposed approach and brainstorm alternatives.

11:00-11:45: Cape Perpetua: First 10 minutes, the background material is reviewed by Brittany and Jessica to get everyone on the same page.

11:45-Noon: Wrap-up and any next steps.

Noon: Meeting adjourn; lunch provided (get feedback on whether this type of disconnect between reserve monitoring recommendations (aka BACI) and the realities of reserve placement warrant an opinion piece where we can discuss these two case studies specifically--- and the alternatives that we developed in lieu of BACI.



# Monitoring Design Workshop Summary

## Key Outcomes:

1. As a system of multiple reserves, focus comparisons on trajectories of change over time between marine reserves and comparison areas across gradients of fishing pressure.
2. Broad agreement that for Cape Falcon and Cape Perpetua that some focus should be shifted to soft sediment and/or crab research.
3. For monitoring of rocky reef monitoring at Cape Falcon the consensus of this panel was to consider numerous fished patch reefs (including three arch rocks at comparable depths) as comparison sites to the marine reserve.
4. For monitoring of rocky reef monitoring at Cape Perpetua the consensus of this panel was to consider the fished reef at Seal Rock as comparison sites, despite minimal overlap in the depths of rocky reefs in these two areas, to the marine reserve.

## Summary by Topic

### BEFORE AFTER CONTROL IMPACT (BACI):

The meeting began with the clarification that though Oregon Department of Fish and Wildlife (ODFW) has two years of pre-closure monitoring data in the reserves, these two years are too short to establish robust baselines for rocky reef nearshore systems when implementing a true Before-After-Control-Impact (BACI) study design due time needed to refine sampling approaches and limited annual field days to generate needed sample sizes.

Rather than focus on comparing limited 'before' data pre-closure to subsequent monitoring efforts, the Marine Reserve Program's ecological monitoring should adopt an After-Control-Impact (ACI) framework. This entails comparing the relative trajectories of the communities inside vs outside no-take marine reserves through time. In addition, it was noted that fishing pressure adjacent to the reserves differs significantly at each of the five reserve site (often associated with distance from port). Therefore, it is important for the ecological team to recognize and formulate site-specific hypotheses based on the relative fishing pressure at each

site as well as consider the system of reserves as a whole that spans a gradient of fishing pressure.

#### CAPE FALCON:

After a brief presentation describing the characteristics of the Cape Falcon Marine Reserve, the group discussed potential ecological monitoring efforts for Cape Falcon.

With regards to the rocky reef complexes in Cape Falcon, the group suggested that ODFW's fishery independent and visual surveys should be conducted to compare trajectories of change over time in the marine reserve as well as multiple patch reefs north and south of the reserve and/or Three Arch Rocks. Due to the historically low fishing effort in Cape Falcon, it is hypothesized that this reserve will show little change over time while some of these more heavily fished areas are expected to display changes over time. Using numerous fished reefs as the control (comparison) sites for Cape Falcon will enable ODFW to compare the impacts of fishing versus no-take protection on small, rocky reef communities.

It was recommended that ODFW's ecological monitoring team investigate potential drivers influencing reef productivity inside and outside the marine reserve based on preliminary fishery independent results showing that areas with similar habitat structure in similar depth ranges having differing different catch rates. These efforts were suggested to include collection of more visual and oceanographic data sets to identify the drivers that are causing the differences in catch rates between these low catch rates observed in the reserve compared to much higher catch rates observed in similar habitats immediately outside the reserve boundary.

With regards to soft sediment monitoring in Cape Falcon Marine Reserve, it was suggested that ODFW focus on building collaborative relationships with other projects and programs at ODFW and Oregon State University to conducting monitoring efforts on Dungeness crab populations (including fishery independent and life history studies). Potential areas of research include CPUE of crab take inside and outside the marine reserves and monitoring the crab population size structure inside and outside the marine reserve over time. Other potential areas of research that were suggested were investigating and monitoring any ripple scour depressions that occur in the reserve and surrounding areas.

#### CAPE PERPETUA:

After a brief presentation describing the characteristics of the Cape Perpetua Marine Reserve, the group discussed potential ecological monitoring efforts for Cape Perpetua.

Cape Perpetua Marine Reserve stands out as one of the largest areas of the coast that was heavily/regularly crabbed, and is now closed to extraction. Similar to the recommendations for Cape Falcon, rocky reef monitoring the group suggested that ODFW's fishery independent and visual surveys should be conducted to compare trajectories of change over time. It was recommended to compare the deep, isolated, rocky reef in the reserve marine reserve to rocky

reef habitats in heavily fished, Seal Rock, despite the differing depth, size, and structure of these two reef habitats. It was also suggested that due to the unique oceanographic conditions of the Cape Perpetua Marine Reserve, future monitoring efforts for the rocky reef should continue to focus on the impacts of hypoxia and rocky reef fish assemblages as well as further explore the drivers of diversity on this reef compared to other reefs.

With regards to soft sediment monitoring in Cape Perpetua Marine Reserve, it was suggested that ODFW use a similar approach to Cape Falcon and conduct a comparative study on Dungeness crab in both reserves looking at the influence of historical fishing pressure as well as hypoxia to compare crab populations between these two reserve sites. Again, suggested potential areas of research include CPUE of crab take inside and outside the marine reserves and monitoring the crab population size structure inside and outside the marine reserve over time. Other potential areas of research that were suggested included investigating and monitor any ripple scour depressions that occur in the research and surrounding areas.