Cordell Bank National Marine Sanctuary
Climate Change

Management Issue

Within the region of Cordell Bank National Marine Sanctuary (CBNMS or Sanctuary), there is limited information on how atmospheric and oceanographic conditions vary on multiple temporal scales and how these forcing mechanisms influence distribution and abundance patterns of Sanctuary living resources.

Description

Due to its location offshore, the Sanctuary is strongly influenced by oceanic forcing as opposed to terrestrial inputs. Located within the California Current System, the Sanctuary is exposed to strong seasonal variation in atmospheric and oceanographic conditions, defined by upwelling, relaxation, and winter storm conditions. Longer-term climatic phenomena influencing the region include El Niño-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and global climate change, processes which operate on different spatial and temporal scales. There is a need to understand smaller scale shifts in climate as well as global climate change and to determine how these changes may impact sanctuary resources.

The hydrocoral Stylaster californicus is one species of importance on Cordell Bank that could be strongly impacted by climate change including ocean acidification and warming ocean temperatures. Photo Credit: Rick Starr/CBNMS

Questions and Information Needs

1) What habitats are most at risk from changing climate?

2) Which species will be most affected by various climate change drivers?

3) How will ocean acidification impact the Sanctuary and directly affect various species, including deep water corals, larval fish and crustaceans, krill and other calcifying invertebrates?

4) How will changes in upwelling intensity and timing impact krill populations and larval dispersal and recruitment of rockfishes and invertebrates?

5) How do patterns of jumbo squid abundance and distribution vary with changing ocean conditions and what are the ecological implications of a resident jumbo squid population?

6) How will changes in the depth of the Oxygen Minimum Zone impact Cordell Bank communities?

Scientific Approach and Actions

- Create an atmospheric and oceanographic climatology report to provide a summary of how the conditions within the Sanctuary vary seasonally; this would provide a framework upon which to understand interannual variation in conditions
- Analyze oceanographic buoy data and monthly and seasonal monitoring data to provide a means to understand how conditions within the Sanctuary vary over different time scales as well as how these patterns relate to regional oceanographic dynamics
- Develop a climate change site scenario to identify climate change drivers and regional impacts
- Resume a benthic monitoring effort that will provide data to assess changes in the distribution and abundance of invertebrates and fishes as it relates to climate change

Scientific Approach and Actions *(continued)*

- Create a coupled bio-physical model to understand the dynamics of larval dispersal in the Cordell Bank region and assess variations due to changes in upwelling intensity and timing
- Assess the patterns of dispersal and residency of jumbo squid associated with Cordell Bank as related to changing ocean conditions and conduct targeted trophic study of jumbo squid inhabiting slope depths west of Cordell Bank
- Develop sampling protocol to identify and track Oxygen Minimum Zone west of Cordell Bank
- Develop and implement a regional ocean acidification monitoring effort
- Initiate deep water habitat classification effort to identify areas that may support deep coral communities
- Conduct studies to quantify deep coral distribution and abundance in the region

Potential Key Partners and Information Sources

University of California-Bodega Marine Lab, San Francisco State University Romberg-Tiburon Lab, Moss Landing Marine Lab, Partnership for Interdisciplinary Studies of Coastal Oceans, NOAA Fisheries Santa Cruz Laboratory, NOAA Pacific Marine Environmental Lab, Monterey Bay Aquarium Research Institute.

Management Support Products

- Climatology report
- Paper summarizing relationships between physical drivers and biological populations on Cordell Bank
- Ecological model integrating jumbo squid into the trophic structure of the Cordell Bank ecosystem
- Model illustrating the migration of the Oxygen Minimum Zone (OMZ) into shallower shelf waters with implications of increased hypoxic events over the Bank
- Annual report of regional ocean acidification monitoring effort
- Habitat maps and maps depicting deep coral abundance and distribution
- Model to better understand relationship between rockfish and invertebrate larval recruitment and upwelling

Planned Use of Products and Actions

- Use climatology to understand variations in local oceanography driven by climate change
- Reduce stressors on sensitive deep water communities susceptible to climate change
- Information on deep coral communities will inform permitting decisions
- Information from monitoring the Oxygen Minimum Zone and ocean acidification will help us to identify sources responsible for changes in ocean communities
- Information will be provided to the larger ocean community to encourage ocean conservation

Program References

CBNMS Management Plan

- Conservation Science Action Plan, strategy CS-1, CS-2, CS-7, CS-8, CS-10

CBNMS Condition Report

- Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality (question 1)
- Status of key species (question12)
- Condition or health of key species (question 13)

ONMS Performance Measures

- Number of sites in which habitat, based on long-term monitoring data, is being maintained or improved
- Number of sites in which select living marine resources, based on long-term monitoring data, are being maintained or improved