Papahānaumokuākea Marine National Monument

Coral Bleaching

Management Issue

One of the impacts of global climate change is increasing sea surface temperatures, which have been well documented to be a driver in mass coral bleaching events. Global models predict that sea surface temperatures will continue to rise and increased occurrences of worldwide mass coral bleaching events are anticipated.

Description

Evidence shows that global temperatures have been on the rise over the last thirty years. The change in global temperatures affects global sea surface temperature, and changes in sea surface temperature have been demonstrated to cause coral bleaching, a process whereby coral colonies lose their color due to the expulsion of symbiotic microscopic algae from most coral tissues. Mass coral bleaching in the Northwestern Hawaiian Islands occurred in 2002, and was most severe in the three northernmost atolls. (Kure, Pearl and Hermes, and Midway) The occurrence of coral bleaching in the cool waters of the Northwestern Hawaiian Islands has been interpreted by some as indicative of climate change (Kenyon et al. 2006).

Close-up of individual coral polyps, which may or may not survive bleaching events, depending on the length and severity of the event. Photo credit: James Watt

Coral habitat of the NWHI provides structure to sustain reef biodiversity, forms the base of the food web, and provides the islands with protection from storm events. Loss of this habitat due to coral bleaching has the potential to severely impact the marine community of these atoll systems. Managers need to understand the drivers for this phenomenon to assess impacts, identify resistant and/or resilient areas, and potentially identify additional management actions that can address coral bleaching issues.

With coral reefs around the world in decline, the Northwestern Hawaiian Islands present a unique opportunity to characterize an intact coral reef ecosystem and to begin to understand the degree of natural variability in an ecosystem relatively free of local anthropogenic influences. Therefore, studying these remote ecosystems may also make an important contribution toward understanding the impacts of global climate change on coral reefs.

Questions and Information Needs

1) What oceanographic characteristics confer resistance or susceptibility to bleaching?

2) What species specific characteristics confer resistance, resilience and susceptibility to bleaching?

3) How widespread are bleaching events in the Monument?

4) How far in advance can bleaching events be predicted using currently available tools?

5) What is the predictability of bleaching events in terms of duration and geographic scope?

6) How do bleaching events affect the ecosystem as a whole?

7) What role do the zooxanthellae play in a bleaching event and in coral recovery?

8) What percent of corals survive mild/moderate/severe bleaching in the Monument?

Scientific Approach and Actions

- Examine the accuracy of predictions using existing tools and data
- Examine existing habitat monitoring data to look for characteristics that have historically conferred resistance and cross reference those with bleaching data
- Assess and prioritize research and monitoring activities by developing and implementing a prioritized research and monitoring plan for the monument
- Coordinate meetings for updates with researchers
- Conduct monitoring to understand ecosystem change over time by assessing monitoring program protocols, formalizing a collaborative regional monitoring program for the Northwestern Hawaiian Islands and continuing to monitor at established sites in shallow-water coral reefs
- Collect, analyze and input research, monitoring and bathymetric data into appropriate databases to inform management decisions

Potential Key Partners and Information Sources

Hawai‘i Institute of Marine Biology; NOAA/NMFS/PIFSC; Native Hawaiian Cultural Practitioners; US Fish and Wildlife Service; State of Hawai‘i Department of Land and Natural Resources

Management Support Products

- Report characterizing the accuracy of bleaching event predictions
- Report describing characteristics that may relate to resistance or susceptibility to bleaching
- Produce scientific papers and reports on the extent, impacts and predictability of bleaching events
- Presentations on research results at conferences, symposia, meetings and workshops
- Maps of particularly sensitive areas

Planned Use of Products and Actions

- Draft a Bleaching Response Plan with information collected during research and monitoring activities
- Contribute to the data record on long term monitoring of coral bleaching in the NWHI
- Communicate results of research and monitoring by coordinating an annual meeting to present current research being conducted in the Northwestern Hawaiian Islands
- Use data collected and analytical results from research expeditions to develop or enhance education and outreach products
- Utilize research results to inform management and implementation of the Marine Conservation Science and Habitat Management and Conservation Action Plans
- Restrict activity in sensitive areas

Program References

PMNM Management Plan

- Action Plan 3.1.1 Marine Conservation Science
  - Strategy MCS-1: Continue and expand research, characterization and monitoring of marine ecosystems for the life of the plan.
- Action Plan 3.2.3 Habitat Management and Conservation
  - Strategy HMC-1: Develop and implement a strategy for restoring the health and biological diversity of shallow reefs and shoals where anthropogenic disturbances changed the ecosystem.
- *Other Action Plans*:
  - 3.5.1 - Agency Coordination
  - 3.6.2 - Information Management
  - 3.6.3 - Coordinated Field Operations

PMNM Condition Report

- Question 1 and 6

Other Documents

- Monument Goals 1, 2, and 5