# Development of a Bleaching Response Plan

**Purpose:**
Pre-planning before a bleaching event allows managers to quickly respond when bleaching happens. It is critical to plan ahead for staffing, funding, communications, monitoring, etc. Having a plan in place may also help managers gain credibility and political support with reef users and decision-makers.

**Instructions:**
Use the following worksheet to help you develop a Bleaching Response Plan for a coral reef area under your management or in partnership with an agency or community responsible for management.

**This worksheet will help you think about how you will:**

- Predict mass bleaching events
- Monitor pre-and post-bleaching to identify resilient reef areas
- Set thresholds for declaring mass bleaching
- Assess the ecological impacts of mass bleaching
- Assess the socio-economic impacts of mass bleaching
- Communicate about mass bleaching before, during and after the event
- Implement management interventions to increase coral survival during events
- Incorporate responses to other stressors (disease, crown of thorns, invasive species)
- Fund and staff activities called for in the plan
- Gain support for the plan

**NOTE:** There are several models of response plans. Depending on your site and organizational capacity, you should design the appropriate scale of plan for your site. Additionally, if a current bleaching response plan exists, revisit your plan and consider opportunities to update the plan by integrating information you learned in the online course.

**OUTPUT:** Key components of a Bleaching Response Plan for your site

## Step 1. Objectives

**Determine the objectives of the Bleaching Response Plan.**

**Think about the following questions:**

1. What is the site or areas that will be covered by the Bleaching Response Plan?
2. Who will be involved in the development of this plan? What other agencies, institutions and communities must be consulted with?
3. Who will be involved in the implementation of the plan? Is it the same as those who have been involved in the development? If not, how will those responsible for implementation be engaged?
4. What current monitoring plans or programs are in place at this site?
5. Are there other objectives that could be paired with the plan efforts, such as coral disease or invasive species response?

Example Objectives:

- Develop a bleaching response plan for Molokini MPA
- Engage community partners in bleaching monitoring and response on the island of Rota

**List three priority objectives for the plan:**

## Step 2. Monitoring

### *Step 2a. Early Warning Systems*

**Fill out the following table to decide which Early Warning Systems are appropriate for your site:**

| Early Monitoring Systems | Are they applicable or useful for your plan? | Are you signed up to use this system? Or does a group exist? | Who will be responsible for monitoring the early warning systems? |
|---|---|---|---|
| NOAA Seasonal Bleaching Outlook | | | |
| NOAA Hotspot and DHW maps on web | | | |
| Weekly weather summary (NOAA NWS air temp, cloud cover and wind) | | | |
| Coral Reef Watch Email Bleaching Alerts | | | |
| Local temperature loggers | | | |
| Virtual Stations | | | |
| Citizen monitoring system | | | |

### *Step 2b. Routine and Responsive Monitoring Task Lists*

Routine tasks take place on a regular schedule as part of a monitoring protocol. Responsive tasks will be undertaken in the case of a bleaching event.

**Answer the following questions:**

1. Is there an existing monitoring program in place (disease, invasive species) that these efforts can be paired with?
2. If not, is it possible to identify and monitor resilient sites ahead of time?
3. How will the extra monitoring be paid for, or can it be part of regular monitoring?
4. Who will be responsible for monitoring the extent and severity of bleaching? Who will coordinate monitoring?

5. Who will analyze monitoring data to look for resilient areas or places that are more vulnerable to bleaching?
6. Is there existing capacity for outreach/communication within your organization? If not, is there a possibility to partner with other institutions to help with communication efforts?
7. Are there financial, equipment, or staffing resources for follow-up surveys to assess mortality (i.e., months after the bleaching event) or to conduct post-bleaching communications?

**Fill in the following table to create a basic chart of routine and responsive tasks for your plan. Edit the activities and add more details as appropriate for your site:**

| Routine Tasks: | | |
|---|---|---|
| **Activity** | **Frequency** | **Person or agency responsible** |
| Monitor appropriate Early Warning Systems (Insert here) | | |
| Brief public/management team/media/community members (select appropriate groups) on weather and heating conditions | | |
| Conduct regular monitoring of sites (include list of sites here and details on monitoring methods) | | |
| Other:<br>Example: citizen monitoring program | | |
| Responsive Tasks: | | |
| Brief public/management team/media/community (select appropriate groups) on bleaching events and extent of bleaching | | |
| Release Media Statement | | |
| Coordinate monitoring surveys at bleaching sites | | |

| | | |
|---|---|---|
| Alert relevant partners and agencies | | |
| Other: | | |

## Thresholds that trigger bleaching monitoring and response

It is important to determine what would trigger a shift from routine to responsive bleaching monitoring and response. Fill in the following table with corresponding routine and responsive tasks that will be conducted according to the stress level of your reef sites as predicted by Coral Reef Watch (CRW). Please note that although CRW products have been very successful in detecting and monitoring the thermal stress that causes coral bleaching, it is important to fine-tune the information for your site. For example with regular monitoring you might find that corals in your specific site do not bleach during a Bleaching Alert Level 1, but do bleach when CRW notes Bleaching Alert Level 2 for your area. If you notice this is a pattern for your area you can then adjust your triggers table to reflect those variations.

When determining the routine and responsive activities for your site consider some of the following questions:

1. At what severity level do you encourage your citizen monitoring program to start monitoring (if one exists)
2. At what severity level do you engage with more volunteers to further increase monitoring efforts?
3. At what severity do you begin to monitor specific sites and compare them with satellite based measurements to better hone in on threshold temperatures?
4. When do you deploy your scientific monitoring team and to what sites?

Please edit the following table as necessary to make it relevant to your site.

| **Trigger/ stress level from Coral Reef Watch** | **Potential Bleaching Intensity** | **EXAMPLE: Activities Routine/Response** | **Activities Routine/Response** *(fill in the activities that will be performed under each scenario--routine and/or responsive--generated in Step 2b)* |
|---|---|---|---|
| No stress (HotSpot <= 0) | No Bleaching | *Example: continue to monitor CRW early warning system* | |
| Bleaching Watch (0 < HotSpot < 1) | No Bleaching | *Example: continue to monitor sites and check CRW daily* | |
| Bleaching Warning (1 <= HotSpot and 0 < DHW < 4) | Possible Bleaching | *Example: release a media statement warning of potential bleaching, brief management team, etc.* | |
| Bleaching Alert Level 1 (1 <= HotSpot and 4 <= DHW < 8) | Bleaching Likely | *Example: close all sites within MPA to fishing and resource use, etc.* | |
| Bleaching Alert Level 2 (1 <= HotSpot and 8 <= DHW) | Mortality likely | *Example: work with local communities to discuss coral mortality and what this means for their resource use.* | |

Other:
If there are other triggers that your program would like to consider write them below:
*Example: reports from citizen based monitoring programs.*

## Step 3. Communication Strategy

Communication is a critical part of any bleaching response plan. It is important to consider which stakeholder should be communicated with, how best to do it, and what messages to convey.

**Answer the following questions:**

1. How can you do pro-active communication before bleaching occurs (e.g., briefing decision-makers or media) so that these groups will be ready to assist if a bleaching event does happen?
2. What groups (local fishers, dive operators, researchers, etc.) should be contacted at the beginning of the bleaching season?
3. What groups or individuals should be contacted if severe bleaching occurs?
4. What messages do you want to convey to each group? What is the best way to convey those messages (email, press release, website announcement, newsletter, phone call, etc.)?

**Fill out the following table following these instructions:**

- **Choose two priority stakeholder groups for communication (**these could include senior management, the governor, other elected officials, local communities, the press etc.)
- **Fill in the corresponding categories on the table** (examples of messages for high bleaching risk, during a moderate bleaching or severe bleaching event, and methods of communication)

| Category | Priority Stakeholder 1<br><br>Fill in group here_____ | Priority Stakeholder 2<br><br>Fill in group here_____ |
|---|---|---|
| **Examples of messages for possible bleaching/bleaching warning bleaching risk (tailor to your own site):** | | |
| **Examples of messages during a bleaching likely/bleaching Alert Level 1 bleaching event (tailor to your own site):** | | |
| **Examples of messages during a Mortality Likely/bleaching alert level 2 bleaching event (tailor to your own site):** | | |
| **Methods of communication during mortality likely/bleaching Alert Level 2 bleaching events:** | | |

## Step 4. Socioeconomic Impacts

It is important to consider the impacts of climate change and coral bleaching on human users of coral reefs. These will have both direct impacts, from bleaching or subsequent coral mortality caused by bleaching, and indirect impacts from management measures intended to protect the reefs.

**Answer the following questions:**

1. What might be the socioeconomic impacts of a moderate bleaching event?
2. What might be the socioeconomic impacts of a severe bleaching event with significant coral mortality?
3. What populations would be affected by a moderate bleaching event?
4. What actions might lessen the impacts of a moderate bleaching event?
5. What populations would be affected by a severe bleaching event with coral mortality?
6. What actions might lessen the impact of a severe bleaching event?
7. What user groups would be affected by a change in fishing regulations? How?

## Step 5. Implementation of the Bleaching Response Plan

**Answer the following questions:**

1. Who is responsible for implementation of the bleaching response plan?
2. Have the responsible parties agreed to implement the plan? Are all critical partners engaged and in agreement of roles and responsibilities?
3. What next steps are necessary to ensure effective plan implementation?
4. Please list the steps that are needed to implement the plan along with a simple timeline.

### Step 6. Management Actions

During a bleaching event, or when SST are highly elevated, corals are more vulnerable to disease and other stressors. Therefore, it is critical for managers to prevent further damage to the reef system. Temporary closures of reefs to fishing and tourism during times of stress are potential management actions to help reduce stress on corals.

**Answer the following questions:**

1. What steps must be taken to close or restrict access to areas used for fishing or recreational purposes (e.g., tourism)?
2. What alert levels will trigger any potential management actions?
3. What agencies need to be involved if an area must be closed or have restricted access?
4. What coastal zone/land-based activities need to be addressed to minimize bleaching damage?
5. What other management actions could be taking to reduce further stress to vulnerable areas?

## Step 7. Funding and Support

**Answer the following questions**

1. Is there sufficient capacity and available resources to implement the bleaching response plan effectively?
2. If not, what is specifically needed for effective implementation (funding, training, equipment, stakeholder buy-in?)
3. Provide a list of needs and approximate costs.

## *Resources*

Great Barrier Reef Marine Park Authority Bleaching Response Plan: http://www.gbrmpa.gov.au/__data/assets/pdf_file/0019/4285/gbrmpa_CoralBleachingResPlan2011.pdf

Maynard, J.A., J.E. Johnson, P.A. Marshall, C.M. Eakin, G. Goby, H. Schuttenberg, and C.M. Spillman. A Strategic Framework for Responding to Coral Bleaching Events in a Changing Climate. *Environmental Management* DOI 10.1007/s00267-009-9295-7.

Woodley, C.M., Bruckner, A.W., McLenon, A.L., Higgins, J.L., Galloway, S.B. and Nicholson, J.H. 2008. *Field Manual for Investigating Coral Disease Outbreaks*. NOAA Technical Memorandum NOS NCCOS 80 and CRCP 6. National Oceanic and Atmospheric Administration, Silver Spring, MD 85pp.

 