

Marine Heatwave Response Plan 2023/24

To guide the actions required at each stage of the marine heatwave cycle

November 2023



Background

The NSW marine estate occurs within the south-east Australian climate change hotspot, where ocean warming is occurring at a rate that is approximately three times faster than the global average. Ocean warming trends are further punctuated by shorter-term marine heatwaves. To date, no marine heatwave plan exists for temperate marine ecosystems, despite recent significant marine heatwaves in Western Australia and Tasmania.

These extreme events are defined as a “prolonged discrete anomalously warm water event that sufficiently exceed the long-term ocean temperature average for a specific region.” Analogous to how other extreme climatic events (e.g., cyclones) are described, marine heatwaves are associated with a formalised classification system ranging between category 1 (moderate) and category 4 (extreme) events.

Marine heatwaves are becoming more frequent and intense under climate change and are increasingly recognised as having major impacts on biological systems, especially already at-risk species, and seafood industries. A variety of impacts have been associated with marine heatwaves, including shifts in the geographic distribution of marine biodiversity and entire marine ecosystems, local extinctions, sub-lethal effects such as long-term changes to species fecundity and fitness and economic impacts on commercial and recreational fisheries, aquaculture and tourism sectors.

For example, the severe 2011 marine heatwave off Western Australia where ocean temperatures were 4-5°C warmer than the long-term average caused sustained range contractions and decline of kelp forests, loss of seagrass recruitment failure in lobster stocks, closure of the scallop and blue swimmer crab fisheries, mass mortalities of abalone, invasion of new species and breeding impacts to penguins. Similarly, the 2015/2016 Tasman Sea marine heatwave that was characterised by ocean temperatures up to 2°C warmer than usual for several months, was linked to the introduction of Pacific Oyster Mortality Syndrome and the closure of oyster hatcheries, reduced performance of salmon and mortalities of abalone.

Such biological responses to marine heatwave events can produce large socio-economic impacts and long-term change to the ecosystem goods and services provided by our marine environment. While impacts associated with marine heatwaves have largely been negative, opportunities may also arise, such as emerging or increased fishing opportunities for some subtropical fish species where range extensions have resulted in these species being pushed further within the NSW marine environment. Marine heatwaves may also provide a catalyst for engaging the public on the effects of marine climate change and learning to prepare, respond and build resilience for future events.

A marine heatwave response plan for NSW

Ocean temperature forecasts provide a strong indication that elevated ocean temperatures are likely to be experienced off eastern Australia in the over the 2023/24 summer and autumn (Bureau of Meteorology). These forecasts can signal a heightened risk of marine heatwave events developing in the near-term. Moreover, a marine heatwave forecasting tool is imminently available, which will allow prediction of these extreme events on time scales relevant to marine managers and stakeholders. These tools mean we can develop proactive strategic responses to marine heatwave events, which can be guided by a response plan.

Several response plans for extreme thermal events exist that have informed the development of this plan. The Great Barrier Reef Marine Park Authority (GBRMPA) Coral Bleaching Response Plan and the National Oceanic and Atmospheric Administration (NOAA) Coral Reef Information System provide excellent structures to guide this plan. Further, elements of this plan have been guided by multi-institutional marine heatwave planning groups and forums of collaborators across academia and state government agencies.

This plan is being develop using several unique metrics and frameworks for responding to marine heatwaves adapted to the NSW marine estate. This plan is considered a living document to maintain a flexible approach to evolving and emerging challenges. NSW DPI will continue to monitor the effectiveness of associated policies and programs and adjust as necessary to ensure effective and efficient development and implementation.

Structure of the Plan

The plan will have four components that will provide for a robust and strategic approach to assessing the threat of and responding to marine heatwaves in the NSW Marine Estate.

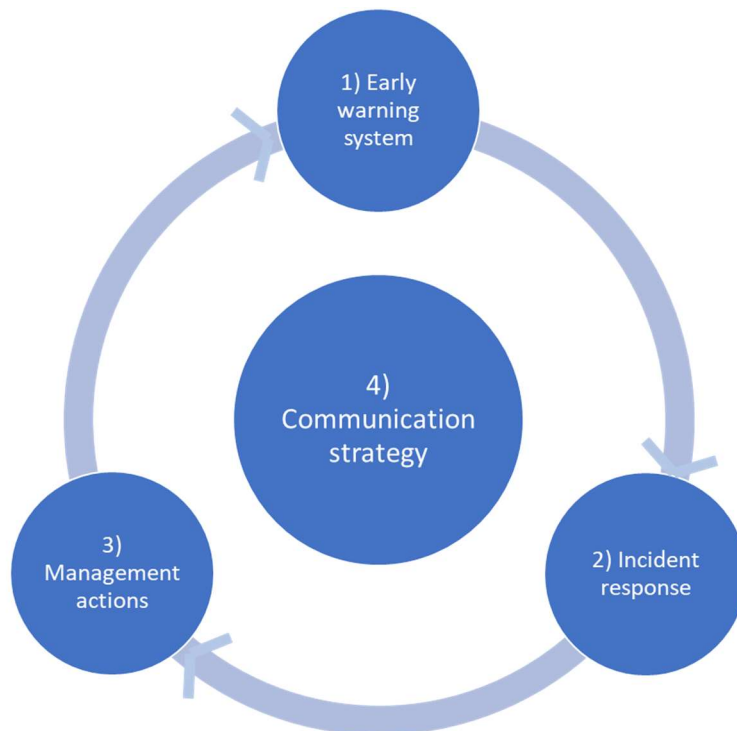


Figure 1: Four key components to the NSW Marine Heatwave Response Pan

1) Prepare early warning system

Early warning of the likelihood of marine heatwave development and associated impacts will be vital to inform the need for a response. The early warning system involves a combination of annual monitoring and communication of ocean environmental conditions, including marine heatwave tracking, through online tools and biological monitoring to detect impacts.

The occurrence of marine heatwaves can be anticipated through monitoring of ocean environmental data and forecasting tools. Tools available through the [Marine Heatwave Tracker](#) and [Bureau of Meteorology](#) are available to track ocean temperature anomalies and will be routinely monitored by marine estate managers and scientists. Real-time monitors are also used by the aquaculture industry in estuaries and bays in NSW under the NSW Shellfish Program for food safety. An early season “report card” will be produced and distributed to provide a forecast of how ocean temperatures are tracking for the upcoming summer and the early likelihood of a marine heatwave event developing. This will include links to forecasting websites so that stakeholders can self-monitor changes throughout the summer. Through the summer period, briefings from the Bureau of Meteorology and the CSIRO will be regularly attended to ensure all new information is considered and to ensure that our response plan aligns with other relevant agencies.

The onset of anomalous warm water combined with existing or new on-ground monitoring can enable early warning signs of biological impacts. Potential early impacts of a marine heatwave will be detected through existing or new monitoring programs or mobilisation of citizen science groups [Redmap](#) and [Reef Life Survey](#), commercial and recreational fishers, aquaculture farmers, cultural fishers and Traditional Owners, and other partnerships (e.g. Great Southern Reef Research Partnership). Existing monitoring can be adjusted in scale, timing or location to assess early impacts and existing citizen science programs can be mobilised or adapted to detect impacts if ocean temperatures are forecast to be unusually warm. Example methods and metrics that could be used to measure impacts will be developed and suggested in this plan.

Broad prioritisation of taxa, habitats, populations or locations that may be most impacted by marine heatwaves will be undertaken based on knowledge of previous marine heatwave impacts, existing and updated vulnerability assessments, including focus on existing threatened species, the exposure of marine species to any predicted marine heatwave event and understanding of the relative sensitivity of marine species to elevated ocean temperatures through research. This prioritization will inform strategic monitoring programs (species, locations) as well as the potential need for management actions.

A severity scale (integrating marine heatwave severity, extent and any emergent biological impacts) will be developed to inform the need for an incident response. A potential response will be defined as the occurrence of both an active marine heatwave and associated biological impact(s). If a significant impact is detected through monitoring or observations following the onset of a marine heatwave, then an incident response plan is triggered.

2) Response

Different severity of marine heatwaves and impacts will trigger different response levels. To accurately assess the level of impact, a comprehensive assessment of biological impacts will be done through monitoring of key habitats and species, ecological function and ecosystem change, and social and economic impacts.

An assessment and monitoring framework will be developed to include a comprehensive assessment of the spatial and temporal extent of marine heatwave impacts and their ecological

implications through methods such as water, aerial or video surveys, biological sampling and citizen science and industry observations. Observations will be validated with scientific surveys.

Assessment and monitoring of impacts will be additional to, or expansions of, the early warning system. The assessment of impacts may require rapid diversion of staff, funds and resources to conduct surveys at required spatial and temporal scales. It will also be vital to engage and mobilise trained groups, such as the Indigenous Rangers and trained citizen scientists, to conduct robust surveys. Rapid assessment and communication of impacts will be vital for informing management actions and scope of an incident response that is required.

Once the need for an incident response is deemed necessary, the Governance structure in this plan sets out the organisational structure in place to deal with a response and coordinates the financial, governance, planning and reporting process to measure the extent and severity of impact and implementation of a response. The Plan will be consistent with DPI incident management and the Australasian Inter-service Incident Management System (AIIMS) which includes management by functions including Control, Planning, Operations, Logistics/Finance and Public information (DPI Incident Management).

3) Possible Management actions

Management actions during and following marine heatwave impacts can help support the resilience of the marine estate and promote recovery. The cultural significance of species for Aboriginal people and agility of different industries (e.g. commercial, recreational fishing and aquaculture) that may potentially be directly impacted need to be considered. This plan will evolve to outline potential management actions that could boost resilience and recovery. Potential management actions may include accounting for marine heatwave impacts through the following example options, noting this is not an exhaustive list of examples:

- Total Allowable Catch setting or review processes, both in advance and retrospectively,
- Application of spatial or temporal closures to provide additional stock and habitat protection,
- Amending size, possession or bag limits temporarily or in the longer term,
- Translocation programs to minimize impacts to threatened and at-risk species or boost stock levels in impacted areas,
- Develop and safeguard public water areas to relay aquaculture stock in emergencies,
- Monitor habitat impacts and implement translocation/conservation programs for benthic species (i.e., corals, kelp) that are highly susceptible heatwave impacts,
- Prioritising stock enhancement and/or conservation breeding programs for high-risk species,
- Industry or other sectoral engagement to identify and assess potential impacts, management and training options,
- Industry engagement to promote adaptive harvest and aquaculture systems,
- Conduct pro-active vulnerability assessments for populations and ecological communities that are at risk from climate change and prioritize research and development activities that can help build resilience into these populations and ecological communities.

The severity of the marine heatwave impact and the habitats, populations and species impacted will determine what actions are appropriate. Because in many instances there are limited actions that can prevent heatwave impacts, a key component of management actions will be investment in and

undertaking of enhanced strategic biological monitoring to measure heatwave impacts and strategies to boost resilience and track recovery after heatwaves occur.

In support of this plan, Marine Estate Management Strategy (MEMS) project management team are in the process of developing a risk management plan for the predicted impacts of El Nino (marine heatwaves included) to the delivery of 100 MEMS project across multiple Marine Estate Management Authority (MEMA) affiliated agencies. This is living document and Initiative leads and projects staff will have the opportunity to provide input into the plan as it develops. The plan, with treatments proposed, will be provided to Marine Estate Steering Committee (MASC) and MEMA as sponsors of the MEMS program, to ensure they are aware of the risks to delivery in 2023/24. This follows the same approach taken during COVID 19 and post flood events, to ensure management is proactive in risk management (and communication) where possible.

4) Communications strategy

The communication strategy connects the whole plan at all stages, with early and regular communication essential for effective implementation. The communication strategy provides key messages, communication at all levels from internal stakeholders, executives and ministers to external stakeholders.

The communication strategy ensures consistent, credible and accurate information is communicated about the likelihood, potential impacts and declaration of marine heatwave events, responses and management actions that we undertake and subsequent recovery. This plan will outline suggested timing, triggers, level and types of communications that could be used.

The communications strategy includes advising stakeholders as soon as possible via:

1. A media release,
2. Social media on all DPI social channels, stakeholder briefing sessions, newsletters and other communication channels

Key messages include:

- Marine heatwaves are expected across the south-eastern coast of Australia in the coming months, with sea temperatures forecast by the Bureau of Meteorology to be up to 2.5°C warmer than normal this spring.
- Extreme weather events, such as the marine heatwaves, have the potential to make the future effects of climate change a reality in the near-term.
- Understanding, monitoring and managing the impacts of marine heatwaves will be a priority for the DPI Fisheries over the coming months and years.
- The NSW Government, in collaboration with key agencies and stakeholders, has developed a response plan that includes increased marine monitoring, in an effort to better detect and understand the impact of such events on our fisheries
- Seafood industries need to prepare for potential impacts and this may include adopting new systems and practices to manage heat stress
- We know our oceans are warming, but it's not just an increase in mean ocean temperatures that we need to be concerned about, we also need to plan and prepare for the frequency of temperature extremes.

- Marine heatwaves can negatively impact a range of species but sessile species (e.g. abalone) and key habitats (e.g., kelp, corals and seagrass) that can't escape the warmer temperatures are likely to be among the most heavily impacted
- The response plan will include:
 - **Early Warning System** - monitoring to detect physical and biological impacts and the onset of heatwaves;
 - **Response** - establishing a structure to implement a response and coordinate the processes;
 - **Management Actions** – activities that could be used to boost resilience and promote recovery; and,
 - **Communication Strategy** - early and regular communication to ensure consistent, credible and accurate information is communicated about events, responses and recovery.
- To prepare for climate change, a range of research programs as well as climate vulnerability assessments and adaptation strategies are currently underway through the DPI Strategic Plan and Planning for Climate Change (Initiative 3) of the Marine Estate Management Strategy.
- NSW DPI Fisheries will work closely with the CSIRO, the Bureau other state governments, universities and our key stakeholders including cultural fishers and traditional owners to monitor and respond to marine heatwaves and to engage fishers and the citizen science community.
- A new project agreement with the Fisheries Research and Development Cooperation (FRDC) and QLD Government has also been put into place, will enable us to update climate vulnerability assessments for priority transboundary fish stocks and other marine species shared across State borders.