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Submission to the Senate Inquiry on Algal blooms in South Australia

1. Introduction and summary

The Australian Marine Sciences Association (AMSA) is Australia's largest professional association of marine scientists, with members across research agencies, universities, Indigenous organisations, museums, government departments, and industry. For over 60 years, AMSA has provided science-based advice on marine issues and contributed to national marine policy.

This submission has been prepared in accordance with the AMSA position paper on climate change, and the broad recommendations from this paper apply to the current submission (Attachment A).

We submit this statement in response to the unprecedented harmful algal bloom (HAB) affecting South Australian coastal and marine environments since March 2025. This crisis, spanning over 4,000 km² and causing mass mortalities across more than 450 marine species, is one of the most severe and persistent HAB events recorded globally.

AMSA urges immediate, coordinated action to:

- Fund rapid, coordinated environmental data collection while the bloom persists
- Establish a national research program to address HAB knowledge gaps and future priorities
- Strengthen Australia's capacity to forecast, prevent, and respond to future marine mortality events and provide robust scientific advice to all stakeholder groups

2. Response to Terms of Reference

(a) Contributing environmental, land management or water quality factors

South Australia is currently experiencing an unprecedented global-scale HAB event impacting marine life, water quality, marine industries and coastal communities. The HAB has been present since at least March 2025 and, to date, has spread to cover over 4,000 km² of South Australian waters and coastline, spanning approximately 30% of the state's coastline.

The persistence and expansion of the bloom is suggested to have been caused by multiple potential drivers:

- A marine heatwave linked to climate change that maintained sea surface temperatures up to 2.5 °C above the long-term average throughout the 2024/2025 summer
- Prolonged summer conditions until May 2025, including calm marine conditions with minimal vertical mixing, creating stratified marine waters that benefit algal growth
- Large nutrient inputs including recent cold-water upwelling and from land-based runoff, in particular the 2022-2023 Murray River floodwaters, and exacerbated by long-term land clearing, and agricultural and urban sources

- Altered hydrodynamics and storm events that have fragmented and dispersed the bloom to new area
- Natural circulation patterns within South Australia's gulfs that can trap nutrient-rich waters

However, due to the lack of long-term standardised monitoring in the region, it is difficult to attribute specific causation to the event or characterise environmental conditions leading up to the HAB.

Despite initial expectations that the bloom might dissipate in winter, recent models suggest it may persist well into next summer and spread further into Spencer Gulf (Kaempf, 2025 - *under review*).

The scale, duration and impact of this HAB is rare by global standards. Most HAB's are relatively short lived (weeks) (Tominack et al., 2020) and restricted spatially to bays or areas of obvious increased coastal pollution (Anderson et al., 2021). For comparison, a large-scale HAB of *Karenia selliformis* off the coast of southeastern Japan in 2021 lasted just over a month and was considered an extreme event (Takagi et al., 2022). At the time of writing this submission, the South Australian HAB has lasted at least five months and is showing no signs of abatement. The current South Australian HAB with its severe impacts across many species is disrupting ecosystem function and is the worst witnessed across the South Australian marine estate to date.

(b) Ecological, economic, cultural and social impacts

(i) Tourism, commercial and recreational fishing industries

Precautionary closures have been implemented for oyster aquaculture on the Yorke and Eyre Peninsula, including Stansbury, Port Vincent, and Franklin Harbour. There are risks to key fisheries species such as snapper, shellfish and giant cuttlefish, as well as to aquaculture and marine tourism. The impact on marine-dependent industries presents a reputational risk for South Australia and its progression towards a "Clean and Green" future.

(ii) Regional and coastal communities

Mental health issues arising from natural disasters are well-documented, and climate-related 'ecoanxiety' is increasingly recognised among the general community (Cullen, 2025). The South Australian HAB may have negative effects on the mental health of scientists as they witness the decline of ecosystems they have studied and to which they feel both personal and professional connections (Lamont, 2020). Researchers in climate-related careers and young people seem to be particularly vulnerable to climate-related anxiety and other wellbeing issues during such events (Patrick et al., 2022, Cianconi et al., 2023).

(iii) Marine biodiversity and ecosystem health

Since mid-March 2025 unprecedented mass-mortalities have been recorded from South Australian beaches. Affected areas of ecological significance include marine protected areas, the Great Southern Reef, the Adelaide International Bird Sanctuary, and the Coorong Ramsar site. Over 470 impacted marine animal species from >31,500 observations have been documented by researchers and over 800 community citizen scientists[1]. Species observed to be impacted include ecologically keystone, iconic, recreational and commercial fisheries species including sharks, sea dragons, cuttlefish, shellfish, snapper and marine mammals.

[1] SA Citizen Science iNaturalist project, 21 August 2025, https://www.inaturalist.org/projects/sa-marine-mortality-events-2025

Sessile (non-mobile) and benthic (bottom dwelling) invertebrates that are essential to their ecosystems are also washing up on beaches.

It is expected that the thousands of animals washing onto shorelines represent a small fraction of total mortalities and species affected. Limited underwater surveys conducted by Flinders University and the Institute for Marine and Antarctic Studies have confirmed degradation of benthic habitats. They observed less than half of the species normally found on rocky reefs and changes to the bacterial and viral communities in the water column of affected areas. This could have subsequent impacts on biodiversity and ecosystem health. From these limited underwater surveys conducted, it is clear the bloom has degraded benthic habitats including - shellfish, sponges, ascidians, macroalgae reefs and seagrass meadows. Those complex habitats, along with providing water filtration and nutrient cycling are often valuable fish habitats, and can take decades to recover (Kendrick et al., 2019). Information measuring the HAB impacts on other marine habitats such as ocean beaches, soft sediment habitats, mangroves, saltmarshes, benthic habitats and estuaries to the open oceanic water column are unclear, however there is little reason to suspect these areas will be immune from any impact. The significant HAB impacts to animal populations, habitats, trophic ecology, and functions risk destabilising the resilience of South Australia's marine system. Ongoing and future HABs may further erode this resilience, risking the ecological services and industries dependent on South Australia's marine waters. For example, the annual spawning aggregation of giant cuttlefish (*Sepia apama*) at Whyalla and Stony Point in the Spencer Gulf is a natural phenomenon and tourism drawcard. The giant cuttlefish has declined in abundance over the past couple of decades (Steer et al., 2013; Prowse et al., 2015), and there is concern the HAB event could further impact breeding aggregations.

(c) Cultural and economic impacts on Indigenous communities

While comprehensive assessments are lacking, the HAB has had a significant impact on Indigenous communities who have strong cultural connection to Sea Country. Similar impacts to Indigenous communities have been identified after other marine extreme events (e.g., Sinclair et al., 2024). Indigenous-led monitoring and recovery planning should be prioritised to ensure cultural and economic impacts are understood and addressed.

(d) Coordination of state and federal government responses

Precautionary aquaculture closures and some interagency coordination have been implemented; however, gaps remain in:

- Rapid, coordinated mobilisation of scientific response teams
- Integration of citizen science data into official monitoring and impact assessments
- Clear delineation of roles and responsibilities for responding to large-scale marine mortality events
- Consistent, transparent public and industry communication

(e) Current support and recovery arrangements

AMSA commends the decision of an initial $28 million algal bloom support package by the Federal government and SA government to be used for industry support, science and research, communications, community support and clean up. AMSA is encouraged to see support for coastal monitoring, new laboratory testing facilities, rapid assessments, citizen science and response planning.

This HAB event should be used as an opportunity to identify the national policies and capacity needed to build rapid response capabilities to unexpected natural disasters. Participants in the Harmful Algal Bloom Science Forum, held in June 2025[2], consider it likely that 'this HAB event will recur in the future', facilitated by increasing occurrences of marine heatwave and flood events. Similar large-scale disturbances, though not necessarily from the same causes, are likely to occur elsewhere in Australia as climatic conditions continue to change (Hague et al., 2024; Hobday et al., 2024; Champion and Coleman, 2025).

A first step is to ensure policies are in place, to sustain ongoing scientific capacity for understanding local ecosystem processes as a bedrock of information and specialist knowledge. This has been identified in the draft Sustainable Ocean Plan under the focus priority 'Climate Action', as well as in the draft National Marine Science Strategy white papers under the themes 'Australia's changing oceans: Building knowledge for actionable outcomes' and 'Biodiversity and Ecosystem health'.

The second step is to explicitly plan for building local research capacity, drawing on national capabilities and international connections to develop effective management strategies that prioritise resources and enable rapid and cohesive responses to future marine mortality events across multidisciplinary agencies and specialists. AMSA therefore recommends that a national legislative and policy framework is established to recognising large-scale marine mortality events, such as those caused by HABs or severe marine heatwaves, as eligible for a coordinated national response.

(iii) Research, monitoring and restoration efforts

Close to 60 participants in the Harmful Algal Bloom Science Forum from State and Federal government agencies, national research institutes, universities, and the private sector identified seven key knowledge gaps, 16 key needs, and a key action to '**facilitate the prioritisation of research needs and the development of a Science Program aimed at addressing research gaps and future priorities'**[1]**.** This current HAB event provides a critical opportunity to collect as much data as possible on the bloom and its short- and long-term impacts. This will enable the science community and decision makers to be better equipped at responding to and managing future HAB events.

A significant amount of monitoring to date on the HAB has been conducted through voluntary efforts by scientists and citizen scientists. The initial commitment of the $28 million support package can build upon these efforts and help to provide coordination on where best to direct further monitoring efforts during and after the bloom. AMSA also calls for increased investment in habitat restoration and resilience-building in affected areas, together with research into practical pathways for reducing nutrient inputs from catchments to marine receiving environments. These efforts should be guided by Indigenous leadership and include active community participation where appropriate.

In addition to the key needs and priorities identified in the Science Forum, AMSA also calls for**:**

1) **Immediate and coordinated information-gathering about the current South Australian HAB.**

There must be an immediate, coordinated effort to collect information on the current HAB, involving local researchers, Traditional Owners and community. Funding for this work should

[2] Harmful Algal Bloom Science Forum, 3 June 2025, https://pir.sa.gov.au/__data/assets/pdf_file/0010/482095/harmful-algal-bloom-science-forum-summary.pdf

be prioritised and rapidly deployed, as speed for data collection is critical while the bloom persists. It is known from ecological theory that the larger a disturbed area, the longer it will take to recover (Palumbi et al., 2008). Data on the spatial scale of impacts caused by the HAB are thus urgently needed to detect whether breeding source populations for recolonisation still exist, forecast how long recovery may take, and whether active restoration (e.g. translocations) could be feasible to facilitate recovery. Such studies will be essential to guide future management. Given the uncertainty around managing current and future HAB events, investing in novel monitoring and characterisation approaches offers valuable long-term potential for marine environmental disasters. Funding in the immediate term will help contain overall costs while maximising timely data collection.

2) **Special research initiatives to develop capacity to deal with this and future HAB across Australia.**

A dedicated national program, such as an Australian Research Council (ARC) Special Research Initiative, should be established to build Australia's capacity to respond to HABs. This would bring the issue to national prominence, while fostering national and international collaboration, at the same time supporting local research into ecosystem impacts to document and allow learning from the current HAB. Similar mechanisms through the National Health and Medical Research Council (NHMRC) could target the human health dimensions of HABs, ensuring coordinated investment in both environmental and health research. Funding multidisciplinary projects that integrate biological, physical, social, and medical sciences could develop practical tools, strategies, and knowledge to improve preparedness and response to HABs across Australia.

(f) *Adequacy of long-term monitoring, forecasting and prevention strategies*

South Australia benefits from national programs such as IMOS and targeted fisheries surveys, but these lack the spatial and temporal coverage needed for early HAB detection. Investing into these existing programs while developing complementary programs to address gaps will help strengthen long-term monitoring, forecasting and prevention strategies.

3. Conclusion

AMSA would welcome the opportunity to present evidence to the Inquiry but urges that immediate funding for coordinated data collection and analysis be made available while the bloom persists. This HAB event underscores the urgent need for long-term investment in marine science capacity and world-class monitoring platforms to prepare for, and respond to, future large-scale marine mortality events that exacerbate the cumulative pressures already facing our marine ecosystems.

Learning from the current emergency to build enduring capacity to monitor, mitigate, and prepare for future events is essential to protect Australia's marine ecosystems, cultural heritage and industries.

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Attachment A: Recommendations from AMSA Position Paper on Climate Change

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