BI0001 / **BIOLOGICAL / Fisheries and Aquaculture**

Harmful Algal Blooms

Definition

Harmful algal blooms result from noxious and/or toxic algae that cause direct and indirect negative impacts on aquatic ecosystems, coastal resources, and human health (Kudela et al., 2015).

Reference

Kudela, R., E. Berdalet, S. Bernard, M. Burford, L. Fernand, S. Lu, S. Roy, G. Usup, P. Tester, R. Magnien, D. Anderson, A. Cembella, M. Chinain, G. Hallegraeff, B. Reguera, A. Zingone, H. Enevoldsen and E. Urban, 2015. Harmful Algal Blooms. A scientific summary for policy makers. https://unesdoc.unesco.org/ark:/48223/pf0000233419 Accessed 11 October 2020.

Annotations

Synonyms

HABs.

Additional scientific description

Harmful algal blooms (HABs) are present in nearly all aquatic environments (freshwater, brackish, marine), as naturally occurring phenomena (Kudela et al., 2015).

Many HABs are increasing in severity and frequency, and biogeographical range. Causes are complex, but in some cases can be attributed to climate change and human impacts, including eutrophication, habitat modification, and human-mediated introduction of exogenous species (Kudela et al., 2015).

Photosynthetic algae support healthy aquatic ecosystems and form the base of the food web, fixing carbon and producing oxygen. Under certain circumstances, some species can form high-biomass and/or toxic proliferations of cells (or 'blooms'), thereby causing harm to aquatic ecosystems, including plants and animals, and to humans via direct exposure to water-borne toxins or by toxic seafood consumption. Ecosystem damage by high-biomass blooms may include disruption of food webs, fish-killing by gill damage, or contribution to low oxygen 'dead-zones' after bloom degradation. Some HAB species also produce potent natural chemicals (toxins) that can persist in the water or enter the food web, leading to illness or death of aquatic animals and/or human seafood consumers (Kudela et al., 2015).

Even non-toxic algal blooms can have devastating impacts when they lead to kills of fish and invertebrates by generating anoxic conditions. Some algal species, although non-toxic to humans, can produce exudates that cause damage to the delicate gill tissues of fish (such as the raphidophytes Chattonella, Heterosigma, and dinoflagellates Karenia, Karlodinium). Aquaculture stocks (caged fish, molluscs, crustaceans) are trapped and, thus, can suffer devastating mortalities, which could lead to economic and food losses, and may eventually became a food security issue (FAO and WHO, 2020).

Of greatest concern to human society are algal species that produce potent neurotoxins that can find their way through shellfish and fish to human consumers, where they cause a variety of gastrointestinal and neurological illnesses (FAO, 2012).

Metrics and numeric limits

Not available.

Key relevant UN convention / multilateral treaty

None.

Examples of drivers, outcomes and risk management

It is difficult to predict when a HAB will develop. Climatic and environmental conditions such as changes in salinity, rising water temperature, and increased nutrient levels and sunlight can influence population growth for HAB species. In some cases, these changes can be attributed to human impacts, including habitat modification, and human-mediated introduction of exogenous species (NOAA, 2016).

Harmful algal blooms are recognised as one facet of complex ecosystem interactions with human society. Research, monitoring, and management of HABs must be closely integrated with policy decisions that affect the global oceans (Kudela et al., 2015).

There is no plan, and no realistic possibility of eliminating HABs and/or their dependent consequences. Nevertheless, decades of research and monitoring have improved understanding of HAB events, leading to better monitoring and prediction strategies (Kudela et al., 2015).

New technologies and approaches to monitoring, control and management of HABs are now available, highlighting molecular probes for cell detection, rapid and sensitive toxin assays, remote sensing detection and tracking of blooms, bloom control and mitigation strategies, and the use of large-scale physical/biological models to analyse past blooms and forecast future events (Anderson, 2009).

Many islands and countries in arid regions, where freshwater resources are limited, are increasingly dependent on desalination to provide water to rapidly growing coastal populations and to meet the social and economic demands that underpin development in those areas. Evidence is now showing that HABs pose a threat to the desalination industry and to water security in those areas. Studying HABs in the vicinity of desalination plants is an emerging science because there is limited information on the potential problems that toxic blooms may pose (UNESCO, 2015).

The Intergovernmental Oceanographic Commission (IOC-UNESCO) has been a driver in defining the international research agenda on HABs and their impacts, and is now also addressing how to provide solutions applicable to desalination plants (UNESCO, 2015).

Harmful algal blooms are a worldwide phenomenon requiring an international understanding leading ultimately to local and regional solutions. Continued progress in research, management, mitigation, and prediction of HABs benefits from international coordination. In this spirit, the international community has developed programmes sponsored by the IOC and Scientific Committee on Oceanic Research (SCOR) to coordinate international HAB research, framework activities, and capacity building (Kudela et al., 2015).

New initiatives, such as GlobalHAB sponsored by IOC and SCOR, will continue to provide the mechanisms to further understand, predict, and mitigate HABs. Research, management, and mitigation efforts directed towards HABs must be coordinated with other local, national, and international efforts focused on food and water security, human and ecosystem health, ocean observing systems, and climate change (Kudela et al., 2015).

The establishment of national monitoring programmes for marine biotoxins and their source organisms (HABs) is needed. These programmes require continuous update to include new and emerging toxins when necessary and for harvesting area management.

References

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Coordinating agency or organisation

Food and Agriculture Organization of the United Nations.