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UK PELAGIC HABITATS EXPERT GROUP

NCEA Natural Capital and Ecosystem Assessment

Image courtesy Claire Widdicombe, PML

Harmful Algal Blooms — challenges and options for policymakers

Impacts from HABs

- **Harmful Algal Blooms (HABs) can negatively affect human health, society, ecosystems, and industries**
- **Some HAB species produce toxins that accumulate in shellfish, posing serious risks to human health if consumed**
- **HABs can kill marine life through toxins or deoxygenation caused as blooms decompose**
- **In the UK, they often lead to the closure of shellfish harvesting areas and have caused significant fish farm mortalities**
- **Costs include economic losses from closures in the fish and shellfish industries and medical expenses from food poisoning**
- **Eutrophication and other factors can drive HAB events, but complex links can make it hard to identify universal indicators**

Harmful Algal Blooms (HABs) can affect many elements of our coastal and marine systems and there is an urgent need to know more about what drives these impacts

Marine plankton provide substantial economic benefits through the provision of ecosystem services, such as food that supports fisheries and aquaculture. However, when some plankton — usually specific types of microscopic algae (phytoplankton) — grow in excessive numbers, it can incur serious economic costs, including medical expenses from food poisoning and losses caused by closures in the fish and shellfish industries.

A harmful algal bloom (HAB) is defined as an algal bloom that can have a (potential) negative impact on human health, society, the aquatic ecosystem, or associated industries. 'HAB' is not a biological term as the grouping is based on a 'negative impact', and these blooms contain a variety of planktonic organisms, behaving and responding to the environment in a variety of different ways.

What do they do and why should we worry?

HABs can negatively impact human health, society, ecosystems, and industries. In the UK, they frequently lead to the closure of shellfish harvesting areas, and have caused significant fish farm mortalities.

A range of phytoplankton species in UK waters produce toxins that can accumulate within the flesh of filter-feeding shellfish such oysters, scallops and mussels. Consumption of contaminated seafood can cause several shellfish poisoning syndromes, and, as a result, the detection of toxin concentrations above regulatory thresholds can lead to the closure of harvesting areas to protect public health. HABs can also kill farmed fish through toxins or the deoxygenation caused as blooms decompose.

Current UK assessments lack a dedicated HAB indicator due to the diversity and complexity of species and impacts. Eutrophication and other factors can drive HAB events, but these are not always linked, complicating the identification of universal indicators. Management should focus on early warning systems and mitigation measures to reduce the impact from HABs.

Climate change and ocean acidification further complicate HAB impact identification. New technologies, including automated imaging and molecular methods, offer potential improvements in early warning and detection systems to reduce HAB impacts.

Types of harmful algal blooms

HAB genus	High/low biomass	Mechanism of impact	Negative impact
Alexandrium spp.	Low biomass	Paralytic shellfish toxins (PSTs)	• Closure of shellfish harvesting areas to protect human health • Negative impacts on higher trophic levels
Dinophysis spp.	Low biomass	Diarrhetic shellfish toxins (DSTs)	• Closure of shellfish harvesting areas to protect human health • Negative impacts on higher trophic levels
Azadinium spp.	Low biomass	Azaspiracid shellfish toxin (AZAs)	• Closure of shellfish harvesting areas to protect human health • Negative impacts on higher trophic levels
Pseudo-nitzschia spp.	High biomass	Amnesic shellfish toxins (ASTs)	• Closure of shellfish harvesting areas to protect human health • Negative impacts on higher trophic levels
Karenia mikimotoi	High biomass	'Ichthyotoxins' Increased DO demand	• Mortalities/welfare impacts on benthos and farmed fish and shellfish
Flagellate 'X', • *Heterosigma akashiwo*	High biomass	Ichthyotoxins	• Mortality of farmed fish
Diatoms (e.g.): • *Chaetoceros* • *Thalassiosira* spp. • *Pseudo-nitzschia*	High biomass	Physical abrasion DO demand	• Irritation of gills of farmed fish with potential mortalities
Dinoflagellates (e.g.): • *Kryptoperidinium triquetrum**	High Biomass	DO demand	• Mortality of farmed fish
Noctiluca scintillans	High biomass	Water discolouration Ammonia production	• Negative impact on tourism; skin irritation on swimmers and divers
Haptophytes • (*Phaeocystis*)	High biomass	DO demand	• Farmed fish mortalities, foam production, negative impact on tourism
Cyanobacteria (e.g.): • *Microcystis*	High biomass	Water discolouration Microcystin toxins	• Washed into coastal harbours from intensive blooms in freshwater systems e.g. Lough Neagh, risk of cyanotoxin exposure

*Formerly *Heterocapsa triquerta*

Conclusions and way forward

The UK has an active HAB (harmful algal blooms) monitoring community, which has significantly improved understanding of pelagic habitat changes and HAB dynamics. New technologies such as automated imaging, molecular methods, remote sensing, and advanced modeling are increasingly enhancing HAB insights and forecasts. However, benthic HABs remain under-studied, with recent findings of toxin-producing species along the French Atlantic coast highlighting the need for further research. Offshore wind structures around the UK may impact water column dynamics and HAB species composition, but dedicated and comprehensive studies are still lacking.

Dealing with HABs will require a joined-up, interdisciplinary approach to address complex issues with consensus across policy, ecological impacts, monitoring strategies, and the need to address human health protection while dealing with local water quality issues effectively. Resolution around the concepts of different HAB types, including their ecological roles, and the delineation between the status of HABs and their potential negative impacts, will help inform future mitigation strategies and monitoring initiatives.