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Summary report of the Joint FAO-IOC-IAEA Expert Meeting on Marine Biotoxins and Harmful Algal Bloom Monitoring

6–9 October 2025 – Rome, Italy
SUMMARY AND CONCLUSIONS
Issued October 2025

Harmful algal blooms (HABs) are naturally occurring phenomena that can severely impact aquatic ecosystems and aquaculture operations. Certain HAB species produce potent toxins that can pose serious risks to human health through the consumption of contaminated seafood, especially bivalve molluscs. A variety of gastrointestinal and neurological illnesses (paralytic shellfish poisoning, amnesic shellfish poisoning, diarrhoeic shellfish poisoning, neurotoxic shellfish poisoning and azaspiracid shellfish poisoning) associated with these seafood products have been reported.

The main purpose of the Joint Expert Meeting on Marine Biotoxins and Harmful Algal Blooms Monitoring was to develop the Joint FAO-IOC-IAEA guidance on monitoring of algal toxins in bivalve molluscs.

This initiative builds on previous collaborative efforts and responds to a request from the FAO Subcommittee on Fish Trade to fill a critical gap with regard to the provision of technical guidance.

FAO and WHO developed technical guidance for the development of the growing area aspects of bivalve mollusc sanitation programmes, published in 2018 and updated in 2021, focusing on general requirements and microbiological hazards. Toxic HABs and toxins were not included in that guidance; as such, this expert meeting addressed this gap. By enhancing monitoring and forecasting capabilities, this work aims to manage food-safety risks, support sustainable aquaculture, and contribute to global food security.

This guidance is intended to support the development of sampling, analysis, and management approaches for harvesting and production areas to determine the level of toxins in bivalve molluscs and the occurrence of toxic microalgae, and to comply with market requirements. The approach in developing the guidance was based on existing monitoring programs, available guidelines, the Codex Alimentarius Code of Practice for Fish and Fishery Products, and current legislation on this matter in a variety of countries.

This guidance, developed through the Expert Meeting, can be used as a roadmap by regional and national authorities and institutions to establish and implement monitoring and management programmes for marine toxins and HABs, or to expand or enhance existing systems. The guidance also covers aspects related to pre-harvest monitoring or post-harvest batch testing. Additionally, it includes monitoring of microalgae, which can help in managing the risk of toxins contaminating bivalve molluscs intended for human consumption.

The Expert Meeting identified certain data and research gaps and issued a series of recommendations, summarized below.

1. **Gap**: Current toxicity equivalency factors (TEFs) are based on lethality in animal assays that do not necessarily reflect the molecular mode of action in humans. **Recommendation**: Further research is needed to clarify the toxicodynamics and toxicokinetics of most algal toxin groups. This new information will be useful in refining the use of TEFs for analytical methods.

2. **Gap**: Cyanotoxins may contaminate bivalve molluscs. While a few regions do conduct limited periodic monitoring of classified harvesting areas for selected targeted cyanotoxins, there is not enough data available at this point to facilitate the generation of guidance on effective monitoring and management of these toxins. **Recommendation**: More data needs to be generated to conduct robust scientific evaluation, enabling the establishment of human-health risks from cyanotoxin-contaminated bivalve molluscs and their likely potential impacts on food safety.

3. **Gap:** The risk of the accumulation of regulated shellfish toxins in fish, crustaceans, and other marine organisms has been insufficiently evaluated, and strategies for managing the risk are lacking. Although there are studies showing high levels of amnesic shellfish toxins and paralytic shellfish toxins in certain fish species, as well as the trophic uptake of such toxins into grazing organisms (including gastropods, certain echinoderms, and tunicates), as well as predating organisms such as crustaceans and cephalopods, there is a need for more comprehensive research. There is not enough data to firmly establish relationships between toxin levels in causative microalgae and those in other non-bivalve species, nor indeed to explain the kinetics of toxin uptake and depuration in these organisms. **Recommendation**: Guidance should be developed by national and regional authorities regarding establishing approaches for monitoring toxin hazards in non-bivalve species. In addition, regulators should take a case-by-case approach to risk monitoring for other seafood products, and the need for more data to be generated to allow communities to develop their own approaches.

4. **Gap**: There are multiple examples of toxins not regulated in shellfish being identified in mollusc samples around the world. For some of these, there is evidence to suggest potential human-health impacts. Furthermore, there is no evidence confirming the likely ongoing prevalence and toxicity of these toxins in future years. Nevertheless, there are significant risks to human health that remain unaccounted for in most global monitoring programmes. **Recommendation**: Scientific evaluation, legislation and global/regional health standards are urgently required where serious human health risks have been identified. Notably, this should be conducted for the neurotoxic tetrodotoxins reported in many regions across the world in bivalve molluscs. It is recommended that FAO and WHO conduct a risk assessment for tetrodotoxins in bivalve molluscs.

5. **Gap**: While numerous toxicological studies have been conducted over the years for dietary exposure of marine toxins by humans, there is a continued lack of complete data accurately describing long-term, repeated exposure in humans for a wide number of known toxins. **Recommendation**: Conduct studies on long-term exposure and assess its effects in humans to obtain more accurate toxicological information for further risk assessment.

6. **Gap:** Limited availability of rapid tests and lack of scientific evidence for the performance of some commercial pre-harvest and end-product testing kits, which the industry can utilize for effective rapid toxin determination in bivalve molluscs as part of their risk-management obligations. **Recommendation**: More commercial assays are needed, and suppliers of rapid test kits should provide robust scientific data describing their intralaboratory and interlaboratory validation status and fitness for purpose.

Meeting participants are listed in Annex 1 of this summary report.

More information on this work is available at:

http://www.fao.org/food-safety/en/
https://www.fao.org/fishery-aquaculture/en
https://hab.ioc-unesco.org/publications/
and
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Annex 1. Meeting participants

EXPERTS

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