

## **DRAFT Theme Session G on Human Health Risks and Marine Environmental Quality**

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### **Background**

There are growing demands by researchers and policy makers to address the risks and impact of environmental quality on human health. The goal of Theme Session G was to evaluate and discuss the existing knowledge of all aspects of marine environmental quality that negatively (may) affect human health.

Health risks may be associated with chemical, biological, radioactive, physical and microbiological contamination as well as with fish and shellfish parasites and diseases. Chemical residues in fish and shellfish consumer products such as dioxins, furans and polychlorinated biphenyls (PCBs) and new emerging chemicals in relation to food safety generally require continuous surveillance and remain an ongoing problem in several ICES regions. The same is true for microbiological contamination (by pathogenic bacteria or viruses) of beaches and shellfish products as a result of untreated or partially treated waste water discharges from land-based pipelines or ships. Toxic algae blooms and shellfish poisoning represent continued threats for both swimmers and consumers. Information on the degree of radioactive contamination and their impact on humans, directly or through the food chain, is still sparse.

Contributions to the Theme Session covering relatively new human health threats including genetically modified organisms and their pathogens, the use of antimicrobial drugs in aquaculture, and physical disturbances such as noise and exhaust fumes from vessels or installations were especially welcomed.

### **Presentations**

D. Vethaak opened the Theme Session by welcoming the participants (a maximum of 40 participants in the morning session and 20 in the afternoon session) and by introducing the theme and the objectives of the session. Ten oral presentations were given (based on nine full papers and one extended abstract) and two posters were displayed at the poster session.

The majority of the presentations (seven papers, one poster) focused on anthropogenic contaminants in the marine environment or in seafood. One paper and one poster provided information on fish parasites potentially pathogenic for humans, one paper focused on invasive species and related human health effects and one focused on testing of algal toxins.

Two of the contaminant-related presentations provided data on contaminants in the marine environment without focusing on potential human health effects (G:01 on variation in sediment metal concentrations (lead, copper, manganese, zinc) in the pre- and post-monsoon period in the South China Sea, Malaysia; G:06 on concentrations of PCBs in bivalve species (clams and cockles) from the Galician coast, Spain). From the presentations on 'new' (brominated flame retardants, perfluorinated alkylated compounds) and 'old' toxic contaminants (e.g., DDT, dioxin, PCBs, polycyclic aromatic hydrocarbons (PAHs), toxaphene, organotin compounds, methyl mercury) there is evidence that the concentrations detectable in certain regions of the marine ecosystem are still a matter of concern, both in terms of potential harm to the marine environment and its inhabitants and as risk to human seafood consumers. For instance, in papers G:04 and G:05, data is presented on significantly increasing concentrations of perfluorinated alkylated substances (PFAS) in marine biota since the 1970s, including marine mammals from remote areas. To date, there is only little data on toxicity of these compounds. However, some studies have been carried out on human

exposure to PFAS (e.g., through consumption of sea fish) but the results do not yet allow for any firm conclusions on human health risks. A study on organic contaminants in sediments and fish from the Western Scheldt in the south-west of The Netherlands (G:08) revealed that dioxin concentrations recorded in eel (*Anguilla anguilla*) approach current maximum levels for fish and fishery products according to the EU standards (TEQ: toxic equivalent value) for human food safety (4 pg TEQ/g product) and exceeded the EU action level (3 pg TEQ/g product). Current concentrations of combined dioxin and dioxin-like PCBs in eel and brown shrimp (*Crangon crangon*) will even exceed maximum acceptable food safety levels once the new EU standards (8-12 pg TEQ/g product) have come into effect in November 2006. It was furthermore demonstrated that levels of dioxin and dioxin-like PCBs in food items (e.g., brown shrimp) of the harbour seal (*Phoca vitulina*) exceed established no observed effect concentrations (NOEC) for harbour seal, indicating a risk for the occurrence of health effects. Paper G:02 provided data derived from an EU-funded project carried out in eleven countries on sources, consumer exposure and risks of organotins contamination in seafood, in particular focusing on risks associated to the anti-fouling agent tributyltin (TBT). The study revealed that, in general, 'normal' seafood consumers are not at risk of exceeding the tolerable daily intake (TDI). However, there is some concern about consumers of large amounts of seafood with comparably high TBT levels (e.g. sardines in Greece, brown shrimp in Belgium, The Netherlands and Germany as well as bivalves in Portugal and Italy), for which the TDIs were partly exceeded. From the U.S. Environmental Monitoring and Assessment Programme of the Environmental Protection Agency (EPA) there is evidence that contaminant levels (in particular mercury) in fish used for human consumption partly exceeded current EPA criteria values for human safety. A consumer ingesting four fish meals per month would ingest sufficiently mercury to exceed the non-cancer health endpoints from fish taken from up to 23% of the estuarine area along the Atlantic and Gulf of Mexico coast. The risk for recreational fishermen and subsistence fishers with a much higher consumption of fish would be considerably higher (up to 40% and 60% of the estuarine areas, respectively). Poster G:12 provided information on automated determination of mercury species (e.g., methyl mercury and inorganic mercury), in marine biota by means of gas chromatography (GC) coupled with cold vapour atomic fluorescence spectrometry (CVAFS). A speciation is feasible if the concentration of the toxic mercury species (methyl Hg) is to be analysed.

The only presentation related to harmful algal blooms and their risks to human focused on the advantages of a chemical analytical method (liquid chromatography coupled to mass spectrometry; LC-MS/MS) to detect toxins causing diarrhetic shellfish poisoning (DSP) compared to the mouse bioassay with toxicity as endpoint (G:13). Apart from ethical considerations, the major disadvantage of the mouse bioassay is its low specificity and robustness (too many false-positive or false-negative results). Although not yet all analytical standard compounds (toxins or their metabolites) are commercially available, the chemical method is currently considered to guarantee the highest level of consumer protection.

Presentation G:03 (only available as extended abstract) described the dramatic spread of the Pacific oyster (*Crassostrea gigas*) in coastal waters of The Netherlands and associated human health risks, i.e. injuries from contact with the sharp edges of the oyster shell during swimming, surfing or diving. Results from a questionnaire distributed in local communities and from a subsequent risk assessment revealed that up to 7000 people per touristic season experience partly serious injuries in areas with high abundance of Pacific oysters.

Paper G:09 and poster G:07 focused on parasites (G:07 also on bacteria) in fish species from the Russian EEZ in the Baltic (including the Vistula and Curonian Lagoons). A number of fish parasites were recorded that are potentially harmful to humans if fish is consumed that is not appropriately prepared. These parasites were helminths and encompassed larval trematodes, nematodes, acanthocephaleans and cestodes. However, no recent cases of human diseases have occurred in the region.

Before closing the Theme Session, T. Lang provided an overview of issues not dealt with in the session, summarised the major information presented and provided an outlook on future research and regulatory needs. This was followed by a general discussion.

### **Final considerations and conclusions**

60% of the world's human population live on or near the ocean coasts and the population, particularly in the coastal zone, is still increasing dramatically. Since humans use the oceans in many ways, the pressure on the oceans is increasing and it is obvious that ocean health and human health are directly linked.

There are numerous human health risks associated to the quality of the marine environment, the most significant of which are considered to be contamination of seafood (from wild catches or mariculture) and direct contact with contaminated water or coastal soils. Major risks in this context are being posed by pathogenic bacteria, viruses or parasites, by algal and cyanobacterial toxins and by anthropogenic chemicals. Problems may also arise from growing industrialisation and physical alteration of water/land interfaces (e.g., related to mariculture), depletion of natural food resources (e.g., through overfishing), 'dangerous' water organisms (including genetically modified organisms and their pathogens) or from increase of recreational use of water/land interfaces (contaminated beaches and water, contact with dangerous species).

Although the participants of the Theme Session realised that many of these risks are causally linked to human activities, it was emphasised that human activities, i.e., an improved science and technology, has also helped to utilise potential human health benefits from the oceans, e.g. related to improved and sustainable food supply, the discovery of new pharmaceutical lead compounds and new cures for human diseases.

The following conclusions were made:

- There are persistent human health risks that are linked to the quality of the marine environment.
- On a global scale, problems largely occur in less developed countries. However, there is also evidence of risks and effects in ICES member countries.
- Many of the health risks are directly or indirectly caused or influenced by human activities.
- There is strong evidence that human health risks will increase in the future due to the continuing growth of the human population, use of the oceans and ocean/land interfaces and due to adverse effects of global climate change.
- Actions aiming at a reduction of the risks and at an improvement of marine environmental quality have to be continued or even enhanced.
- Because of the growing importance of linkages between human health and the quality of the marine environment and because of ICES' attempts to implement a holistic and multidisciplinary ecosystem approach in its work, ICES should pay more attention to human health risks and benefits. It is, therefore, recommended that the ICES Marine Habitat Committee reviews the outcome of Theme Session G and develops a plan as to how this can be achieved (e.g. by developing Terms of Reference for existing ICES Expert Groups, or by creating new ICES Expert Groups).
- Issues to be dealt with include an improved toxicological assessment of the link between anthropogenic contaminants and human health risks, the development of strategies for integrated monitoring and assessment of environmental and human health effects of contaminants (preferably harmonised on the European level), benefits and risks related to 'new' marine products.

- It was suggested to organise a Theme Session on marine bioproducts, i.e., pharmaceutical compounds, for one of the next ICES Annual Science Conferences.