Pollution and Marine Species: New challenges of an old problem

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SUMMARY:

Continued releases and slow breakdown rates mean that legacy chemical pollution (such as from DDT) remains a major concern. However, concerns have been raised recently over a wide range of novel chemicals now being found in marine ecosystems or suspected to be harmful to marine life. High-profile examples include brominated flame-retardants, fluorinated compounds, pharmaceuticals and synthetic musks used in detergents and personal care products.

Some of these chemicals have been located recently in the Canadian Arctic seas, and some are known to be endocrine disrupters or can damage immune systems. Marine litter and plastics are also of major concern, and there is evidence that certain plastics can transport other harmful chemicals in the marine environment.

MAIN TEXT:

Emerging chemicals of concern

Recently, concerns have been raised over a wide range of novel chemicals now being found in marine ecosystems or suspected to be harmful to marine life. As a group, they are often referred to as "emerging chemicals of concern" since scientists have been alerted to their potential biological impacts, but they are currently not extensively monitored under international programmes (e.g. OSPAR, UNEP, Water Framework Directive).

High-profile examples include brominated flame-retardants, fluorinated compounds, pharmaceuticals and synthetic musks used in detergents and personal care products. Some of these chemicals have been located recently in the Canadian Arctic seas, and some are known to be endocrine disrupters or can damage immune systems. Marine litter and plastics are also of major concern, and there is evidence that certain plastics can transport other harmful chemicals in the marine environment.

Taking into account these factors, together with nutrient-associated pollution concerns (mainly related to agricultural run-off), the Millenium Ecosystem Assessment concluded that pollution of the global coastal and marine environment shows a very rapid increase in impact. Understanding the cumulative risks of these chemical mixtures or 'cocktails' is a critical issue for protecting the marine environment.

The IPSO workshop made clear that the increasing presence of harmful chemical pollutants in the ocean threatens to further undermine the resilience of marine species facing multiple stresses from climate change, ocean acidification and overfishing.

In terms of priority pollutants, some chemical substances are especially hazardous because they are persistent, liable to bio-accumulate in living organisms and are toxic. They can contaminate the marine environment, with harmful effects on marine life and ultimately human health via the food web. In the Northeast Atlantic, the international body OSPAR is using its Hazardous Substances Strategy to identify which substances are hazardous for the marine environment, to prevent, reduce, and ultimately eliminate pollution with these substances. Hazardous substances

enter the marine environment from natural sources (e.g. polycyclic aromatic hydrocarbons from oil seeps, volcanoes and forest fires) and as a result of human activities (e.g. oil spills). Other synthetic chemicals reach the sea via direct discharges, through estuaries or via the atmosphere.

'Legacy' chemicals still a concern

Legacy chemicals are a diverse group of heavy metals and persistent organic pollutants (POPs), which have been a focus of pollution concern since the United Nations Conference on the Human Environment held in Stockholm in 1972. More recent studies have shown that some of these chemicals act as endocrine disrupters or are able to damage the immune and neurological systems of marine animals. For example, DDT is a neurotoxic pesticide that has been shown to also interact with marine biotoxins. Restrictions on the use and release of many of these legacy chemicals has successfully led to major reductions in the levels of POPs in some regions (e.g. see UK study).

In other areas, however, continued releases and slow breakdown rates mean that legacy chemical pollution remains a major concern. For example, the OSPAR 2010 Quality Status Report concluded that for the Northeast Atlantic, levels of polycyclic aromatic hydrocarbons and polychlorinated biphenyls are still unacceptable in fish, shellfish and sediment in many coastal areas, even though the main sources have been regulated.

Chemicals are an essential part of marine ecosystems, ranging from naturally occuring substances such as algal biotoxins, metals in the Earth's crust, or sex hormones released by spawning corals. Synthetic chemicals have also become central to human society over the past decades.

We need to understand more about the biological effects of mixtures of chemicals on marine ecosystems. For example, some endocrine disrupting chemicals can show additive (cumulative) effects in fish that extend beyond the effects of single chemicals. We also need more data to determine the significance and risks of emerging chemical contaminants (e.g. pharmaceuticals) in the marine environment.

Concluding statement:

We realise today, more than ever before, the serious threat posed to the health of marine ecosystems from multiple factors such as climate change, ocean acidification and chemical pollution. In the context of pollution caused by harmful chemicals, we need to continue to prioritise the most important chemical concerns through international organisations like OSPAR and use a holistic scientific approach to understand their potential cumulative biological impacts on marine organisms.

References

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