Marine Environment

Objective

To support Member States to address and mitigate their most pressing marine challenges using nuclear and derived techniques while enhancing their expertise and capability to develop tailored science-based strategies for the sustainable management of marine ecosystems.

NUTEC Plastics: Marine Pollution and Impact Assessment

Plastic pollution is one of today's most pressing global environmental challenges and plastic debris is the most abundant type of pollution in the ocean; it can be found on shorelines, on the sea surface, in deep ocean trenches and in ocean sediments. Marine plastic debris can act as a reservoir for chemical contaminants that are either inherently present in plastic as manufacturing additives or taken up from the environment. Following exposure to the environment, plastic debris breaks down into microplastics, which are vectors for transmitting chemical contaminants into marine food webs. Isotopic techniques offer unparalleled precision and reliability in assessing the impact of plastic in the marine environment.

The downstream component of the Agency's Nuclear Technology for Controlling Plastic Pollution (NUTEC Plastics) initiative builds on the Agency's efforts to deal with plastic pollution through marine monitoring using isotopic tracing techniques. The IAEA Marine Environment Laboratories in

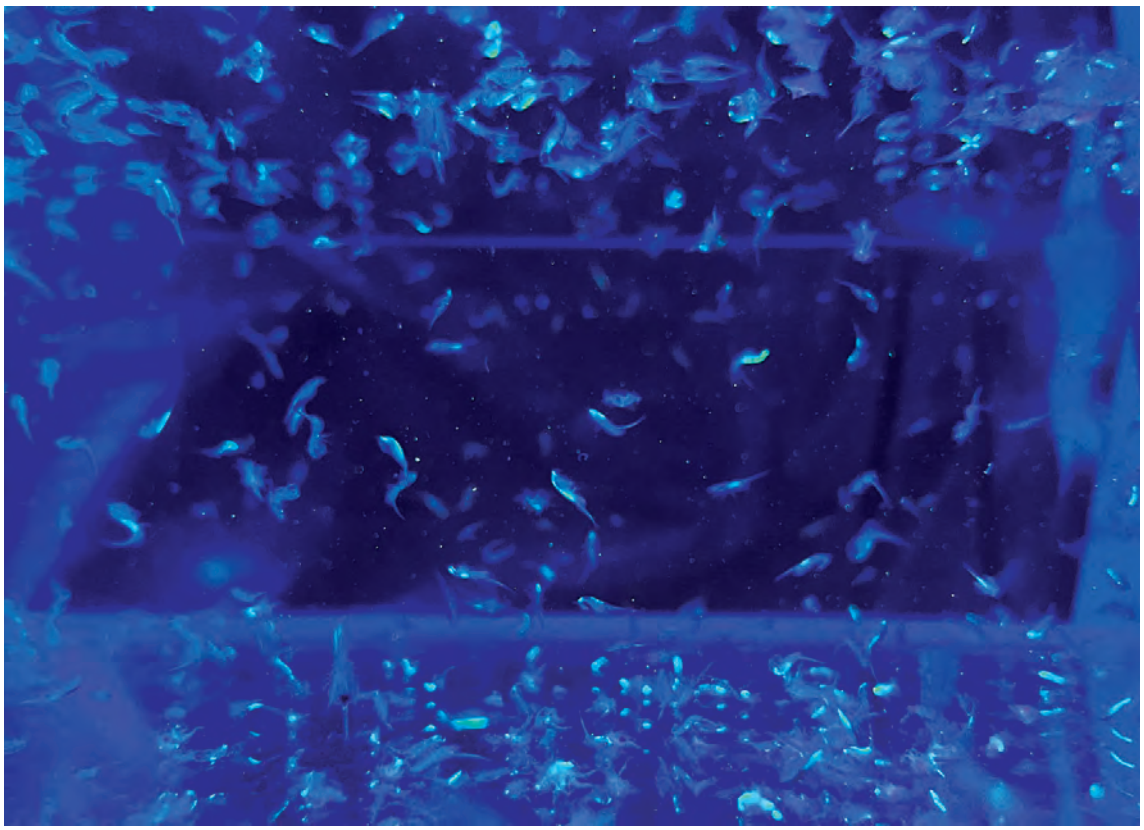
The Director General delivers his opening remarks at a NUTEC side event at the 66th regular session of the Agency's General Conference, September 2022.

Monaco — the only marine laboratories in the UN system — are central to NUTEC-related activities. In 2022, the laboratories enhanced their capability to characterize marine microplastics and their related in-house expertise in order to become a reference laboratory in marine plastic pollution monitoring for the NUTEC Plastics global monitoring network of specialized laboratories. To better monitor plastic pollution, significant progress has been made in harmonizing sampling and analysis protocols in collaboration with the Agency's Department of Technical Cooperation.

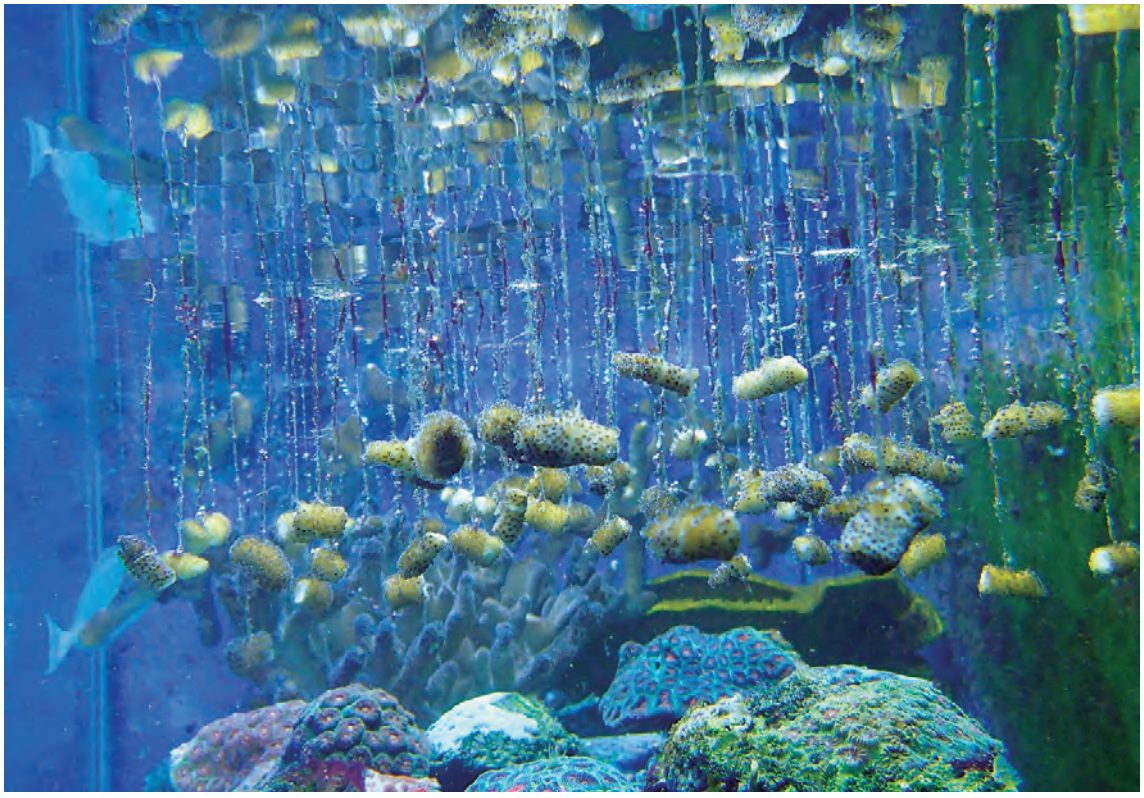
Experimental work was also conducted to look at biofilm growth on plastics; the transfer of pollutants to marine organisms via microplastics; the physiological effect of microplastics on marine organisms; and the development of new tools such as radioplastics and isotopically enriched nanoplastics.

As marine plastic debris can act as a reservoir for chemical contaminants, the Agency has developed methods for analysing plasticizers and flame retardants through the use of stable isotopes and mass spectrometric techniques to accurately measure these toxic contaminants in the marine environment. In 2022, these methods were used by the Agency, in collaboration with the Scientific Centre of Monaco, to demonstrate that plastic debris collected from shorelines around the Mediterranean Sea releases large amounts of chemicals. It was also demonstrated that leached chemicals accumulated in corals induce physiological stress on coral nubbins, and that these adverse effects are intensified by rising water temperatures. For Member States, these are valuable new insights into the effects of exposure to chemicals linked to plastic debris and ocean warming that will assist policymakers in their efforts to protect marine ecosystems.

In 2022, high-level discussions, side events at the Agency's General Conference and UN forums, and participation in scientific conferences were used as vehicles to raise awareness about NUTEC Plastics. For example, side events were organized at the UN Ocean Conference in Lisbon and the 7th annual Multi-stakeholder Forum on Science, Technology and Innovation for the SDGs to highlight the Agency's efforts to tackle marine plastic pollution on the global stage and emphasize the benefits of nuclear and isotopic techniques to advance knowledge of plastic pollution and its impacts.



Fluorescent microplastics ingested by shrimps can be seen through translucent skin.



Coral nubbins grown in a laboratory environment for future use in studies on chemical impacts.

Using Radionuclides to Assess the Potential of Blue Carbon as a Nature-Based Solution to Climate Change Worldwide

Through the IAEA Marine Environment Laboratories, the Agency is involved in research projects with international research institutions in around 30 countries worldwide. Under these projects, eight peer-reviewed publications were issued in 2022 on the capacity of mangroves, seagrass meadows and salt marshes to sequester carbon in ocean sediments in Costa Rica, Denmark, Spain and the United Republic of Tanzania, among other countries. By using radiochemical separation, alpha spectrometry and gamma spectrometry to identify naturally-occurring isotopes in sediment cores, the Agency can determine the rate at which sediments — and therefore blue carbon — accumulate in a variety of marine and vegetated coastal ecosystems. Although more data is needed worldwide, blue carbon has provided the international community with a compelling case for taking action to preserve marine and coastal ecosystems to the greatest extent possible. At the 2022 UN Ocean Conference and COP27, the use of blue carbon as a nature-based solution to climate change was extensively discussed by experts, who highlighted the need for additional in-depth research and swift action to conserve these ecosystems.

Emergency Response Support to Peru to Assess the Impact of a Major Oil Spill on the Marine Environment

Following an emergency request from the Government of Peru concerning a marine oil spill, considered to be the country's worst ever environmental disaster, Agency experts were dispatched on a fact-finding mission. Impact assessments of the oil spill on the marine environment of the Ventanilla coastline were made and a post-spill monitoring programme was designed in coordination with the Government of Peru. The expert mission visited laboratories involved in monitoring the coastal area to evaluate their capacity to conduct long-term monitoring and fingerprinting of petroleum hydrocarbons in environmental samples. To enhance the capabilities of these laboratories, equipment is being provided for the analysis of oil hydrocarbons from seawater, sediment and biota. This equipment includes freeze-dryers, microwave extraction systems, automated solvent evaporation systems, laser diffraction grain size analysers and a spectrofluorometer. Once the equipment has been delivered to Peru, Agency experts will travel to participating laboratories to train staff in its use and in methodology harmonization.