IAEA fellows protect the marine environment

By Oleksandra Gudkova

Researchers trained at the IAEA Environment Laboratories in Monaco are applying various nuclear techniques back in their home countries to preserve the marine environment. The techniques are helping the former IAEA fellows better protect their oceans and seas — from fighting toxic algal blooms to tracing pollutants in water.

"To foster sustainable development, it is not only important that researchers establish the techniques back in their countries, but that they also transfer the knowledge and expertise they have gained to their colleagues," said Marie-Yasmine Dechraoui Bottein, a research scientist at the IAEA Environment Laboratories. A few months after training the fellows, IAEA experts visit the countries to provide further advice and support them in ensuring the full operation of the laboratories, she added.

Through fellowships, the IAEA's technical cooperation programme strengthens capacities and expands opportunities for professionals working with nuclear science and technology.

Last year, for example, experts from Cuba, Morocco, the Philippines, Singapore, Sri Lanka and Tunisia had the opportunity to participate in specialized fellowships. This article provides an overview of what some of them learned.

Researchers at the IAEA Environment Laboratories study pollutants in the oceans and in marine organisms. (Photo: J. Weilguny/IAEA)

Helping fight toxic algal blooms

Biotoxins — toxic substances of biological origin — are a global problem. They come in many forms and can be produced by nearly any type of living organism, from animals to fungi. When toxin-producing algae grow in large quantities, they can affect marine organisms. These phenomena are called harmful algal blooms, or HABs.

If people eat seafood contaminated by biotoxins, they can be poisoned and their lives threatened. It is therefore important to detect biotoxins before the seafood reaches people's plates.

Last year, fellows from affected countries, including Morocco, the Philippines and Tunisia, spent between one and six months at the IAEA laboratories, learning how to detect biotoxins in seafood to better manage HABs.

"Our laboratory will be the first in Morocco to use the technique I learned during my training in Monaco," said Jaouad Naouli, who works at the Water and Climate Division of Morocco's National Centre for Nuclear Energy, Sciences and Technology (CNESTEN).

Naouli's training included learning to apply the receptor binding assay (RBA) technique for biotoxin analysis. RBA focuses on the properties of biotoxins and on the interactions between biotoxins and the receptors they bind with. By using radiolabelled biotoxins, this method allows scientists to determine the quantity of toxins that are present in seafood or in seawater.

"With this highly specific, sensitive and rapid technique, we will have a stronger biotoxin monitoring programme in Morocco," Naouli added.

Singapore's environmental monitoring programme

In 2016, the IAEA Environment Laboratories hosted, as part of an IAEA technical cooperation project, four fellows from Singapore's National Environment Agency

Scientist at the IAEA Environment Laboratories in Monaco.
(Photo: J. Weilguny/IAEA)

and the Public Utilities Board, Singapore's national water agency. During their three-month stay, the fellows were trained in applying various radioanalytical techniques to measure the activity concentrations of various radionuclides in rainwater, seawater, air, animal and plant samples.

"The hands-on laboratory work allowed me to pick up new skills and good laboratory practices, and all the lectures and exercises trained me to deal with radioanalytical work independently," said Wei Ning Yap, a senior chemist at the Public Utilities Board's Water Quality Office.

They learned in particular how to extract specific radionuclides from large volumes of seawater by applying a sequential separation method.

After collecting 200 litres of seawater and separating out the targeted radionuclides, they performed tests to detect caesium, strontium and plutonium isotopes. The knowledge obtained will help them measure radioactivity levels in Singaporean seawater, seabed and fresh water sediments, and surface water from reservoirs.

"The techniques I learned give me the basis to develop various methods for local application in Singapore," Yap said. "This is very important to safeguard Singapore's water cycle from a radiological perspective."

Tracing marine pollution in Sri Lanka

Scientists at the IAEA Environment Laboratories in Monaco also train fellows in the analysis of carbon and nitrogen stable isotopes in marine samples to investigate pollution and nutrient enrichment. Nuclear and isotopic techniques can be used to trace the source of pollutants in the mixing zones of estuaries and in coastal and shallow waters. These techniques provide a unique source of information on the origins of contaminants and are used to trace their pathways in the environment. They also help scientists reconstruct past environmental conditions, allowing them to track changes in climatic conditions.

Two fellows from Sri Lanka spent two months in the laboratories in Monaco learning about these techniques and instruments. Their training in elemental analyser-isotopic ratio mass spectrometry (EA-IRMS), a technique used to measure the abundance of stable isotopes in different materials, will enable them to use a similar instrument supplied to them by the IAEA upon their return to Sri Lanka.

Scientists at the Sri Lanka Atomic Energy Board are planning to establish an EA-IRMS facility to better develop analytical procedures for stable isotope analysis and to control marine pollution in the country.

"Identifying sources of contaminants with these precise techniques is crucial, especially in the Negombo lagoon, which provides a direct livelihood for over 5000 families in around 35 villages," said Dulanjalee Rajapaksha, Scientific Officer at Sri Lanka's Atomic Energy Board. "We must continue our work to improve the water quality in our coastal waters."