The Scientific Centre of Monaco

In 54 years, the Scientific Centre of Monaco has become a reference in the study and understanding of coralline ecosystems, their evolution depending on their environment, and the economic impact of such evolutions. It has also successfully moved into medical research and the study of polar zones.

BY HÉLÈNE VAN HAMME

The Scientific Centre of Monaco (CSM) was founded in May 1960 on the initiative of Prince Rainier III and is presided over by Professor Patrick Rampal. It is an independent public body whose mission is to carry out multidisciplinary scientific research, and its expertise in environmental issues is widely acknowledged. Indeed, it ranks 8th in the world in terms of publications on coralline ecosystems, and its uniqueness attracts many international research teams.

It was created by Government Decree in May 1960 to replace the *Commission de Recherches Nucléaires Appliquées* which had been set up the previous year in the context of the "Atom for Peace" world programme. The CSM has been expanding ever since and has progressively become more specialised. Initially a laboratory of applied radioactivity, it became an observatory of seismology and meteorology, a laboratory of microbiology with units studying marine pollution and measuring the quality of the environment, and a oceanology laboratory. The CSM was completely restructured in 1990. It then became a centre of fundamental and applied research specialised in marine life and focusing in particular on coralline ecosystems. Since 2010, it has also moved into medical research and the study of polar ecosystems.

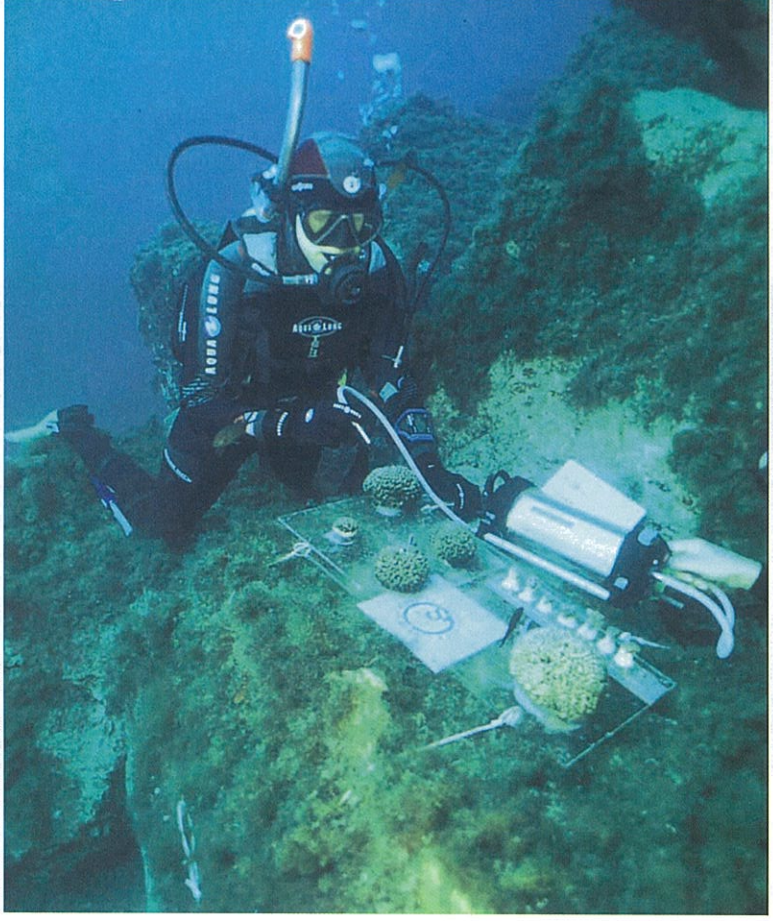
The environmental dimension so dear to Princes Albert I, Rainier III and Albert II can be retraced in most of the strategies on which the research at CSM is based. This no doubt explains the significant financial and material support allocated to the Centre by the Government – the latter contributes most of its annual budget, which is at present close to 2.5 million euros, and plays an indispensable role in providing this fast-developing centre with premises and technical and human resources.

CORALLINE ECOSYSTEMS

Spurred on by the Scientific Director of CSM, Denis Allemand, and in line with the objectives of the European and Mediterranean Major Hazards Agreement (EUR-OPA) signed in 1989 with the Council of Europe, research has progressively become centred on coralline ecosystems. This niche sector is of essential value because corals are very special organisms that play an important role as indicators and markers of the quality of the marine environment and changes occurring there. The CSM is the only centre in the world where various forms of coral have been grown in aquariums for research purposes for 25 years. They are multiplied using asexual reproduction techniques or cuttings studied using various hypermodern methods (radiography, biology etc.).

These corals are first studied by the "*Physiology and Biochemistry*" team. Its task is to better understand the mechanisms of coral physiology, in particular the symbiotic relations between coral and photosynthetic micro-algae, and the calcification process through which the coral's skeleton is produced.

Next, the "*Ecophysiology*" team studies the impact on coralline organisms of the various changes in the marine environment. It analyses the relationship between global warming caused by human activity and the bleaching of corals. Coral, stressed by the changes in water temperature, loses the algae that form its main source of



Left:
Diving on a coral reef.

Top right:
Oceanographic Museum of Monaco.

Bottom right:
Aquariums at the CSM's new premises.

energy and gradually dies. The team also studies another phenomenon – the slowing down of and disorders in the calcification process, hence of reef formation, due apparently to ocean acidification and also to greenhouse gas emissions and their dilution in water.

In future, the CSM wishes to develop its "*environmental economics*" hub, which is currently headed by Dr Nathalie Hilmi. It is crucial to assess the cost of what to do and what not to do about the damage caused to marine biodiversity and corals, with a view to giving the world's decision-makers a better understanding of the importance of protecting them. For example, economists estimate the economic repercussions of the benefits, both direct (fishing) and indirect (protecting coasts against erosion), derived from coral reefs at 375 billion dollars per annum. Developing this hub in partnership with influential actors such as the International Atomic Energy Agency (IAEA) will increase the visibility and importance of the research work carried out at the CSM.

EXTENSIONS

Apart from CSM teams working on coralline ecosystems, a new laboratory working in close partnership with the CNRS was opened in 2013. Its researchers study the behaviour of emperor penguins subjected to environmental changes in polar zones. The creation of this laboratory reflects Prince Albert II's manifest interest for polar ecosystems which are as sensitive to climate changes as coral reefs. CSM teams analyse data collected by remote devices or directly by researchers during fieldwork.

The CSM also includes a biomedical research division. Biomedical research is closely linked to research carried out on coralline ecosystems insofar as there are numerous similarities between coral organisms and the human body – so much so that coral proteins could be used to reconstruct human bones – and research on the absence of physiological ageing is of immense interest. Moreover, the CSM also encourages clinical research in the Principality's hospitals, in particular on cancerous tumours and the use of umbilical cord blood in the treatment of sickle-cell disease.

The CSM is indeed at the cutting edge of research in many fields which are becoming increasingly important. ■

THE CSM AND THE OCEANOGRAPHIC MUSEUM

The CSM and the Oceanographic Museum of Monaco (MOM) have been closely linked from the beginning, bearing in mind that the CSM was housed in the Museum until 2013, and that their fields of research are very close. This partnership is extremely important for the CSM because it contributes to giving some visibility to its research work and to the stakes involved in protecting marine ecosystems via the large number of visitors to the Museum (650,000 per year).