Ifremer

Annual report

2009

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Foreword

2009 was a milestone year for Ifremer, for two main reasons: not only did our Institute celebrate the twenty-fifth anniversary of its creation, but it also began to implement its new four-year contract with the French State, covering the period from 2009-2012. Enlightened in part by the observations from the research assessment agency, and Ifremer having chosen to be the first public industrial and commercial establishment to try out this new form of evaluation, in 2009 our scientific activities began to be focused on confirmed priorities like operational oceanography, ecosystem dynamics or aquaculture, as well as on new priorities, such as oceans and health, or tools to study and protect coastal seas.

Ifremer is thus endeavouring to best fulfil its role as an institute of excellence in the field of marine sciences, by contributing to scientific progress and steering national, European and international projects in the forefront, as is related in this annual report.

Faced with the second year of a major crisis for French shellfish farming, our Institute significantly mobilised its forces. Work was done with partners from coastal universities to determine the factors that could explain this phenomenon, to strengthen and extend its studies in the field of epidemiology and virology and, working closely with professional shellfish farmers, to build scenarios for a way out of the crisis, in response to one of the most serious challenges ever seen in the history of French shellfish farming.

Concurrently, the Institute pursued its effort of modernisation, with ISO 9001 certification of Ifremer headquarters opening the way for all our activities to be certified in two years from now. For the first time, the 2009 accounts were certified, with special effort made to help the managers concerned in carrying out their managerial duties. The results will make a very direct contribution to our strategy of forecast-based management of jobs and skills, which will enter into a new, highly active phase in 2010.

All these efforts had the aim of creating more favourable conditions for carrying out our fundamental missions of research, marine environmental monitoring, expertise and support for our country's maritime economy. In this respect, new orientations defined at the highest level in the field of marine renewable energy sources provide new scope for our Institute to demonstrate its reactivity and ability to federate all stakeholders, while the work done by the Grenelle de la Mer marine summit meetings and the conclusions drawn by the Cimer inter-ministerial committee for the sea have helped clarify priorities for the marine science community. This community will now be brought together within the new «food, water, climate and territories» alliance called AllEnvi. Its objective will be to contribute to France's scientific and technological development and more broadly to that of the European Union, in the field of environmental sciences. May we express the wish, and above all, take the action required for applied marine sciences to be given the place they fully deserve

Jean-Yves Perrot
Chief Executive Officer of Ifremer

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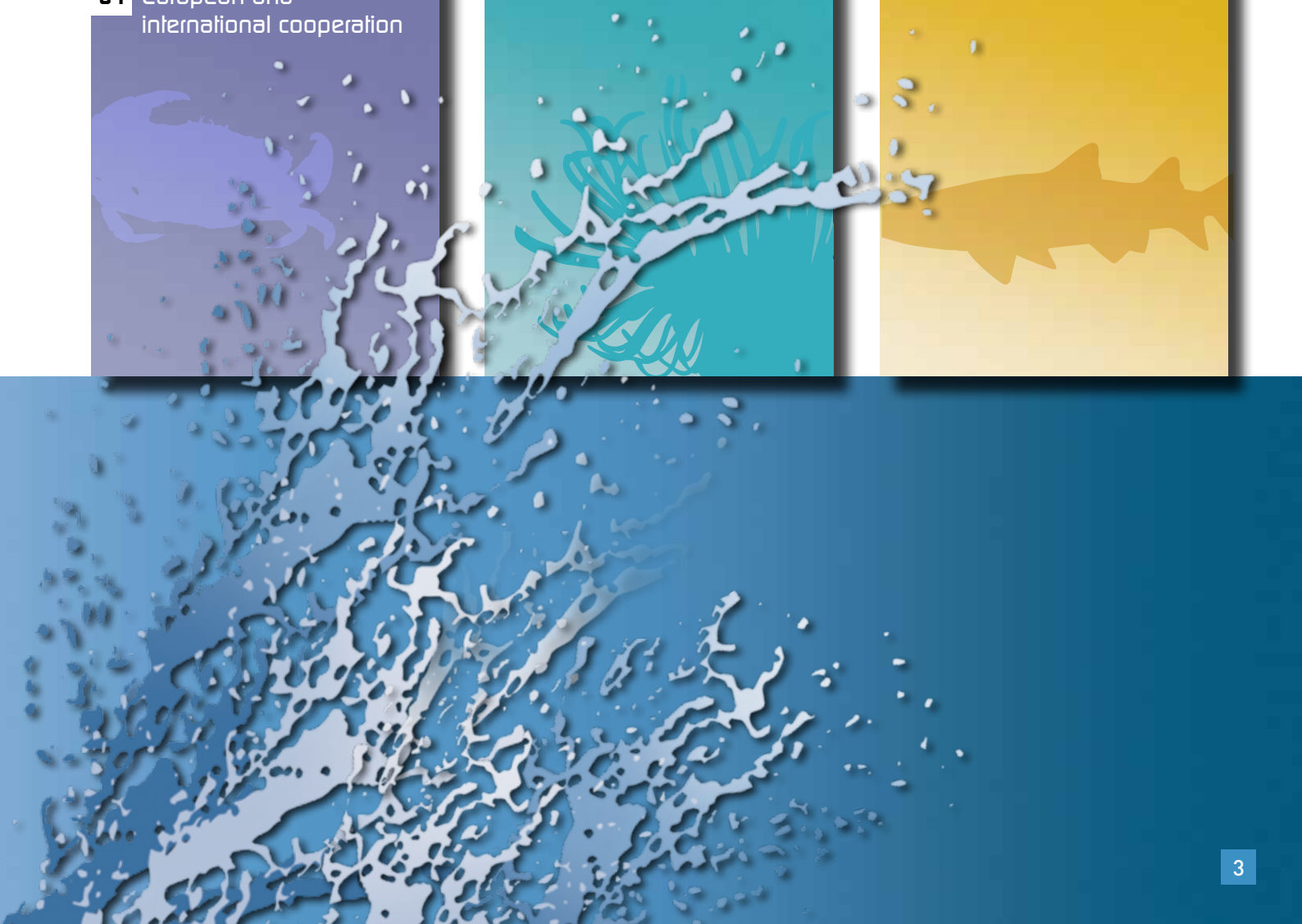
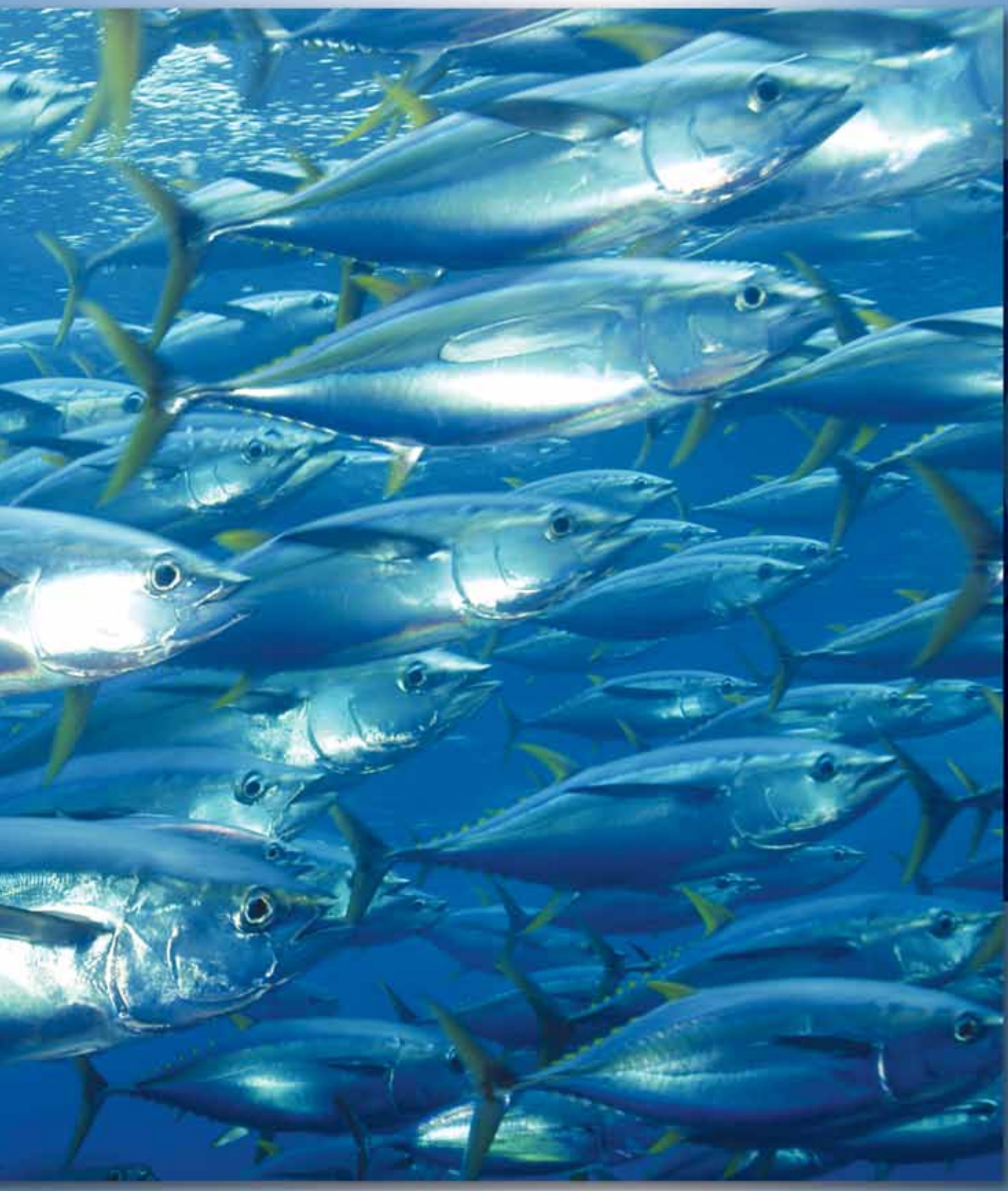


LARGE-SCALE EXPERT ASSESSMENT AND RESEARCH ACTION



Discovering the oceans with Ifremer...

OCEAN AND CLIMATE DYNAMICS AND BIO-GEOCHEMISTRY

Helping hone the diagnosis of global climate change

In a context of climate change, it is crucial to monitor ocean temperature and salinity trends. The "ocean and climate dynamics and biogeochemistry" programme contributes to this in the framework of one of Ifremer's strategic plan priorities, which is to "learn about ocean circulation to fuel the diagnosis of global change". It aims to determine the relationships between ocean circulation and climate change on a large scale, including by studying the processes of exchanges between coastal zones and offshore. The deep convection occurring in some parts of the ocean does play a key role in the climate's equilibrium, contributing to redistribution of heat between polar and equatorial regions.

Auscultating the world ocean

Ocean observation is combined with analysis and modelling of the data. The main results in 2009 were obtained firstly by increased use of information gathered by the Argo network's floats, and secondly thanks to analyses from the Ovide (see text box) and Goodhope cruises (aiming to better understand biogeochemical exchanges and cycles in the Southern and South-East Atlantic Oceans), conducted in 2008 in the frame of the world climate research programme (WCRP). The information is further supplemented by the analysis of high resolution simulations carried out with Japanese partners at Jamstec. Finally, significant activity at sea in the coastal field made it possible to deploy a new measurement network in the Bay of Biscay (Aspex cruise).

Establishing increasingly accurate diagnoses

Since 2002, thanks to some 3,000 profilers in the Argo network distributed over all the world's oceans, Ifremer has drawn up monthly temperature (heat measurements) and salinity (freshwater measurements) maps. They show a trend towards rising sea level and perturbations in deep sea currents.

In fact, they show an increase in sea level of one millimetre per year

Ovide: what impact do oceanic variables have on Europe's climate?

Launched in 2002, the Ovide project aims to repeat a hydrographical and geochemical section from Greenland to Portugal every two years, over a period of ten years. Inter-annual variability of the North Atlantic Ocean's subpolar gyre is studied through the variations in transport of main currents and in subpolar modal water properties. The data collected will contribute to better understanding of how ocean variability impacts Europe's climate.

The Ovide programme is based on all the data collected in the subpolar gyre of the North Atlantic: observations by merchant ships, satellite altimetry data, from arrays of drifting ARGO profiling floats, as well as from databases on wind and fluxes generated by models in meteorology centres. It implements a series of models to summarise the data.

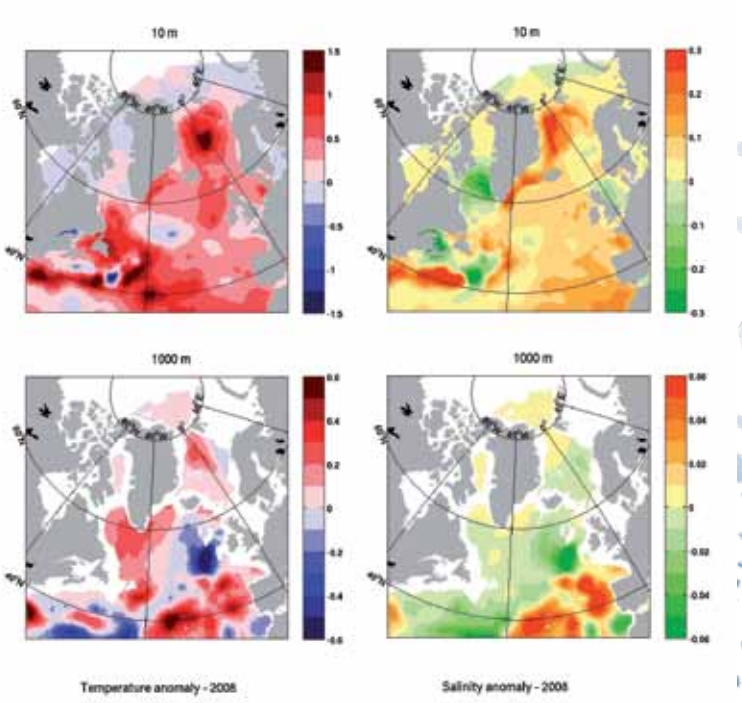
due to greater dilation of surface waters. The readings, which also make it possible to analyse trends in the North Atlantic Ocean, also highlight a modification in the deep sea circulation in winter. In the Labrador Sea, the "winter mixing" which reached depths greater than 2,000 m in the mid-90s, "increased" to between 700 and 1,100 m during the period from 2001-2007. During that time, deep convection almost disappeared. However, recent data show that deep convection in the North Atlantic (Labrador Sea, Irminger Sea) resumed unexpectedly during the winter of 2007-2008.

Taking the pulse of ocean circulation

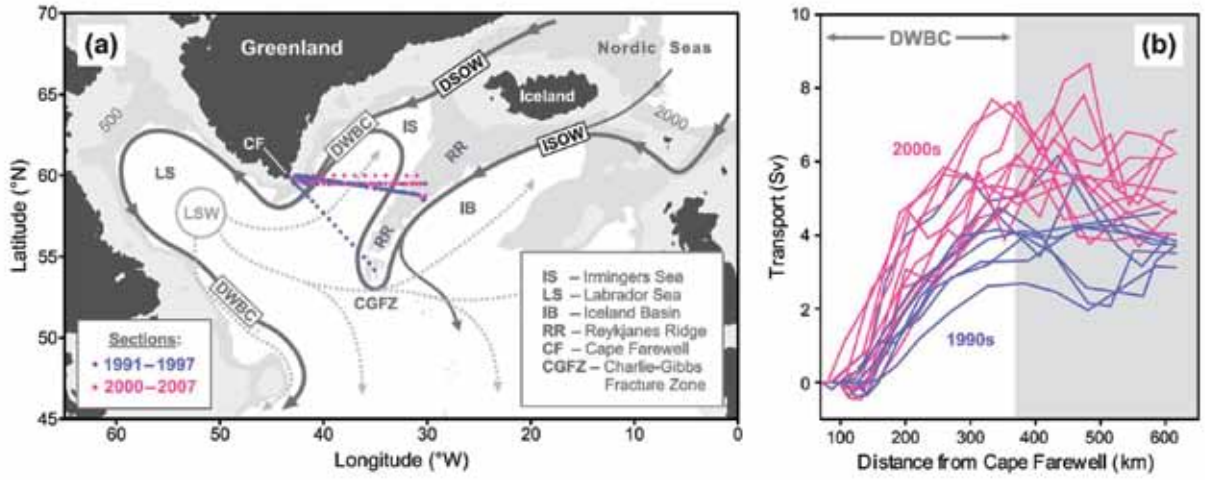
International efforts to observe the ocean have made it possible to measure deep thermohaline circulation over long periods. This circulation regulates meridian heat transfers, and thus, the climate. Joint analysis of data from the Ovide cruise and the polar oceanography group of the Shirshov Institute of Oceanography in Moscow has revealed the trend of the deep western boundary current (DWBC) over a ten year period in the Irminger Sea (North Atlantic). Now, this current is the deep branch of thermohaline circulation which carries the cold, dense water masses formed in Nordic and subpolar waters southward to the Southern Ocean. In the period from 1991-1997, the DWBC's intensity was 25% higher than that in 2000-2007. Furthermore, the DWBC was strongest during the periods of weak convection in the Labrador Sea. However, this non-correlation does not explain the variations observed over this ten-year period. The reasons for this trend must still be determined.

X-raying the "ocean" body

One of the major advances of recent years has been the arrival of satellite observation techniques (see text box). They enable quasi-global coverage of the world ocean to be obtained in a few days, in outstanding detail. This is the case for measuring surface temperature, the wind and its action on the upper layers of the ocean, wave height and the free surface topography which is used to infer the intensity and direction of surface currents. Working in collaboration with Jamstec research scientists, Ifremer's digital simulations highlighted the remarkable potential for the data which will be supplied by the future very high



Temperature (left) and salinity (right) anomalies with respect to climatology, near the surface (top) and at 1,000 m depth (bottom)



(a) Positions of observations used. (b) Variability of barocline transport in the deep western boundary current (DWBC)

Drop-down chassis with 300 kHz acoustic current profiler

resolution SWOT-type altimeters. The Franco-American Surface Water Ocean Topography (SWOT) space mission is slated to be launched around 2016-2018. It will offer an altimetric image in relief of all ocean surface waters. The data collected will enable both surface currents and their vertical velocity to be rendered to depths of about 300 to 500 m, which no observational data has made possible to date. Very high resolution ocean modelling has shown that vertical velocities of currents, associated with structures over a very small scale (1 to 10 km), raise the previously underestimated global matter and heat budgets by a factor of 2 in the first 500 m below the surface.

Ifremer also showed that this important role played by fine spatial scales on energy flows seems to be generalised over depths ranging from 500 to 2,000 m, surrounding the main thermocline in the ocean. Recent observations of geoseismics in the water column enabled sampling of the ocean's internal structure at a lateral resolution of less than ten metres. In this way, high resolution seismic acquisition systems have highlighted a specific organisation of subsurface 3D thermohaline filaments in a "staircase" structure made up of horizontal, unconnected segments whose length ranges from a few hundred metres to several kilometres. Numerical simulations have also made it possible to better distinguish the mechanisms of energy dissipation in subsurface ocean eddies, by establishing the possibility of an "inner" pathway of dissipation of ocean circulation energy, far from lateral boundaries and from the ocean surface. These studies combined physical oceanography and marine geophysics to reveal ocean dynamics with much greater energy than previously imagined. Thanks to them, the actual mechanisms of energy dissipation in the ocean have been reviewed.

The Aspex programme: discovering ocean circulation in the Bay of Biscay

Significant economic activity (aquaculture, shellfish farming, fisheries, shipping and tourism) takes place in the Bay of Biscay and its ecosystem is subjected to strong pressures related to its exploitation, river inflows and pollution. Accurate knowledge about the seasonal variability of its environment (temperature, salinity, currents) is essential to ensure smooth progression of human activities. The Epigram programme, involving several organisations, was created to this end, to better understand and model ocean physics in the Bay of Biscay. Ifremer leads the Aspex project which is one of the strands of this programme and aims to study ocean circulation in this zone. Twelve current-meters were submerged at depths between 60 and 1,500 metres on the continental shelf and margins in the Bay of Biscay to study the seasonal cycle of ocean circulation at a low frequency (i.e., less than that of the tide). Hydrology measurements (temperature, salinity and fluorescence) are also made during each cruise, using a towfish which oscillates between the surface and the seafloor. The devices remained in place until spring 2010, and will be deployed again in 2010-2011.

This array is the largest of its kind to date. It enables ocean circulation to be observed over the Armorican and Aquitaine shelves, measuring variations over various time scales and supplying elements about the processes of coast-to-offshore exchanges. It also makes it possible to observe vertical and time structures in several important features: circulation around the "cold bulge", the "warm tongue" of water in autumn, the slope current on the continental slope, with particular attention to its structure and its interactions with the mesoscale turbulence present in the open ocean in the region of the Landes plateau, and the flows from the Cantabrian knoll.

OPERATIONAL OCEANOGRAPHY

A service of general interest concerning the ocean

By bringing together analytical and forecasting capabilities, operational oceanography delivers better knowledge, understanding and monitoring of the ocean to meet the needs of those who use the sea and of public policies. For Ifremer and its partners, the current challenge is to propose a public interest service concerning the coastal and high seas. This programme thus contributes to organising operational oceanography on national and European scales. To this end, Ifremer conducts research and development projects on observation systems (satellite-based and *in situ*), analysis and forecasting. In 2009, four major actions were conducted by the Institute in the frame of implementing operational oceanography. They were:

- a partnership with CNES to develop and use data on soil humidity and above all, ocean salinity;
- coordination of a study aiming to promote Europe's sustainable contribution to the Argo ocean observation network;
- participation in setting up the "MyOcean" service in the framework of creating "European public services";
- installation of a prototype for a national operational oceanographic service.

Cooperating with space scientists

Ifremer has set up a partnership with CNES in order to develop and use the downstream data processing centre (CADTS) of the SMOS mission (see text box) on soil humidity and ocean salinity, which are two important keys to climate trends. The main developments for CATDS and its salinity expertise centre were conducted by CNES in 2009 with Ifremer's support. The SMOS mission was successfully launched in November 2009 and the CATDS will begin to supply its products in 2010. Work to prepare the calibration/validation phase and studies on SMOS data processing algorithms also continued in 2009.

SMOS mission: uncovering the main keys to the climate

The SMOS mission is a joint Earth observation programme bringing together the ESA, CNES, CDTI (Spain) and Ifremer. SMOS was initiated by the Centre for space studies on the biosphere (Cesbio) and launched in 2009. Its objective is to supply maps of soil humidity and ocean salinity, which are two key variables for climate monitoring, surface/vegetation/atmosphere transfers and ocean/atmosphere cycles.

The SMOS satellite is made up of a platform, derived from the CNES/Alcatel Proteus platform and adapted to the specificities of the mission, and a payload supplied by the ESA. The SMOS satellite control centre is located in Toulouse and being developed by CNES teams based on the Proteus generic ground segment. A mission centre located in Villafranca (Spain) is being developed by the ESA and another SMOS data processing centre is being set up with CNES's support at Ifremer's centre in Brittany.

Promoting Europe's participation

Ifremer is coordinating what will be a lasting contribution from Europe to the international Argo profiling float network. These studies are conducted in the frame of the Euro-Argo preparatory phase. Euro-Argo is a project within the European FP7 R&D framework programme on new European research infrastructures. In 2009, the partners for the preparatory phase (fifteen partners from twelve countries) agreed on the objectives, the organisational model and the legal structure for the future research organisation. In addition, a number of studies have been carried out on consolidating and facilitating the user community, improving scientific data processing, technological developments like Iridium communications, Argos 3, measurements under the ice and new biogeochemical sensors.

Developing a "European public service"

As of today, each Member State has its own oceanographic capacities on the global or regional scale, but the organisations, procedures and operational levels vary greatly from one country to another. The objective of "MyOcean" is to establish (define, design, develop and validate) an integrated European capacity for monitoring, analysing and predicting the oceans' status, based on all skills, facilities and resources existing on national levels. "MyOcean" is part of an overarching EU project to create "European public services" to meet the needs of health, welfare, safety and economic development. These services fall within the frame of "Global Monitoring for Environment and Security" and use data from space and *in situ* measurements. Setting up the three services to be given priority has been entrusted to projects funded under FP7 R&D. Coordinated by Mercator Ocean, "MyOcean" is thus the first GMES Marine Core Service project. It aims to create an operational service for ocean forecasting and analysis for the World Ocean and European regional seas.

The Cersat building at the Ifremer Centre in Brittany

MyOcean: a new "European public service"

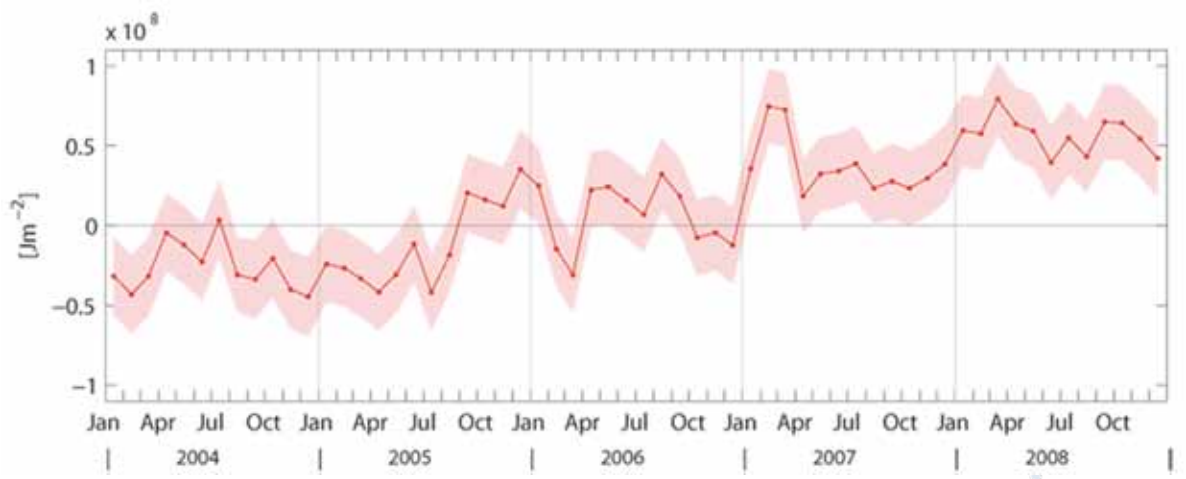
The EU project to create "European public services" is part of the GMES (Global Monitoring for Environment and Security) programme framework. Currently, three main services are considered as taking priority, including MyOcean, which is coordinated by Mercator Ocean.

"MyOcean" is a consortium of sixty partners found in twenty-eight countries. These are the twenty-two of the 27 Europe states with a seafront, joined by Norway, Russia, Ukraine, Morocco, Israel and Canada. Two European entities (JRC and ECMWF) are also partners, while the EEA (European Environment Agency) and EMSA (European Maritime Safety Agency) have representatives on the Board of Directors. The total budget is 55 million euros, 33.8 million euros of which comes from European subsidies, for a period of thirty-six months. The total work load represents the equivalent of one hundred ninety full time staff, but in practice, over three hundred and fifty people will be involved in the project. The European Space Agency is in charge of procuring and supplying the spatial data that these services require as input. It will also ensure the coherency and continuity of space missions under the GMES label.

Ifremer coordinates the *in situ* data services (Coriolis). As our Institute is strongly involved in activities related to spatial data (Cersat), it takes part in cross-cutting actions on information systems, analysis of links with coastal operational oceanography and fisheries applications. In 2009, it also contributed to creating or improving products, quality monitoring and operational reliability of systems. A catalogue of MyOcean products has been drawn up. In partnership with Mercator-Ocean, the Camioon software tool hosted at Ifremer received input from the project's sixty-three European partners. This database can be queried by users from the MyOcean website. Both the stringent process developed for the updating of information and the publication system foreshadow how the European Marine Core Service will operate. The effective availability of catalogue products is automatically monitored by the Institute.

"Charting" oceanic waters

The operational oceanography system being developed in France has three parts: surface observation using sensors aboard satellites, *in situ* measurements from ships or autonomous, moored or drifting devices and incorporating *in situ* and satellite data into an ocean circulation model. Coriolis contributes to the *in situ* part of this system, aiming to develop continuous, automatic and permanent observation arrays or networks. The data collected are used to create maps of water properties, including temperature and ocean circulation. In January 2009, the directors of Coriolis member organisations (CNES, CNRS, Ifremer, IPEV, IRD, Météo France and SHOM) signed a new agreement to create the French *in situ* data service for operational oceanography. Coriolis already enables real time information from Argo floats to be processed and deployed. It offers the possibility of developing measurements from research vessels and ships of opportunity, likewise taken in real time. In 2009, Coriolis set up a new *in situ* database, this time with batch-processed data. This database is qualified for Mercator Ocean analytical activities and climate studies. The first "climate indicator" type products have been proposed within the MyOcean project, along with a service for the European Environment Agency.



Time series of ocean heat content depth-integrated over the first 2,000 metres (Argo array data)

Serving those who use the sea

Supplying short term marine forecasts

A series of observations and numerical modelling tools make it possible to deliver four-day forecasts on the sea state, currents, tidal levels, temperature and primary production. In partnership with SHOM, Météo France, IRD, IUEM and the Technopôle Brest Iroise science park, Ifremer is setting up the technologies required to build this relevant information to be disseminated daily via Internet and archived in the coastal operational oceanography data centre.

Developed in the frame of the contract between the State and the Brittany region, the Prévimer pre-operational system thus addresses a broad public of people who, for personal or professional reasons, want short term forecasts for the coastal environment on the three Channel, Atlantic and the Mediterranean seafronts of Metropolitan France. In 2009, Prévimer was developed by implementing dissemination of digital products and changes in the Mars 10 computing code, perfecting data assimilation methods, combining data "Mercator Ocean", pairing of current/wave data, enlarging the primary production model to the English Channel, extending forecasts from two to four days and launching a new website where observations are displayed.

Arvor, the new Argo profiling float

Prévimer home page

Prévicot: serving coastal maritime activity

The Prévicot project aims to set up and market special products of ocean forecasts and analysis in the coastal zone, intended for all sectors of coastal maritime activity (maritime civil engineering firms, pleasure boaters and all sorts of surfers, water treatment plant managers, fishermen and aquaculturists). The Prévicot products, particularly developed with data from the Prévimer base, concern the French coasts and could be transposed to other regions of the world. The Prévicot project is coordinated by Actimar and has been awarded the Brittany and PACA marine clusters' labels.

Improving knowledge and monitoring of recreational water quality

Coastal cities have made great efforts in collecting and treating wastewater. But bathing waters are very sensitive to modifications in the quantity and quality of discharges, particularly those related to meteorological variations. The Girac project undertaken by Ifremer along with the Véolia group, aims to optimise the real-time management of sewage treatment facilities. With this goal, Véolia, Ifremer, Littoralis network members and Météo France have drawn up a modelling approach which will lead to a simple-to-use system for network managers. Developed within the Brittany and PACA marine clusters context, Girac utilises basic information supplied by the Prévimer system in particular. It has entered the intensive model development phase based on sites in Brest, Saint-Malo and Toulon. Smatch buoys have also been deployed to validate the extents of effluent plumes.

Proposing an "offshore to shore" service

In June 2009, the Committee of directors of organisations (CDO) discussed the implementation of a future national coastal operational oceanography service (Snoco). This service aims to perpetuate French efforts based on coastal operational oceanography. It was suggested that ties be strengthened with "Mercator Ocean" in order to propose a comprehensive and coherent information service from the open sea to the coast. This proposal was brought before the joint ministerial council for the sea (Cimer) in December 2009 and was included in their conclusions.

Developing high-performance tools

The performances of the Arvor, a new Argo profiling float, were demonstrated by the regular, high quality profiles supplied during the year 2009. The first three instruments mass-produced by Ifremer's industrial partner NKE

were deployed in the Atlantic and Indian Oceans. The coastal Arvor float set up in the Bay of Biscay, proved its interest with the capability of creating a virtual mooring. Built-in Iridium satellite communications in the Arvor and Arvor-C made it possible to reduce the time spent at the surface and remotely pilot the instruments. However, scientists noted that the instruments were vulnerable in coastal areas.

In order to better estimate nitrate and silicate inputs in the Vilaine bay, two *in situ* Chemini chemical analysers were deployed in May 2009 on the Marel Molit instrument buoy. Prototypes designed in the framework of the Trophimatique (ANR Precodd) project were added to other sensors on the buoy (temperature, conductivity, fluorescence, dissolved oxygen and turbidity) to deliver real-time, high-frequency (four points daily, surface and bottom) monitoring of nitrate and silicate concentrations on the site. The data collected will ultimately help to compare and parameterize Prévimer biological models.

Deploying the Molit buoy

Chemini, the new generation of chemical analysers

SURVEYING AND CHARACTERISING THE CONTINENTAL SHELF

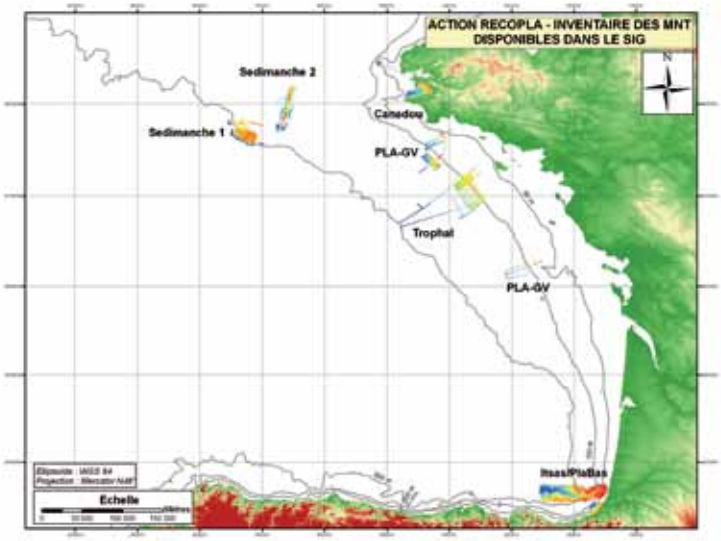
Knowing about the continental shelf: one of the stakes for sustainable development

Very close to land, but still very poorly known, is the continental shelf. It is the extension of the mainland under the surface of the sea, for instance, the Channel between France and England is part of the continental shelf. Accurate mapping of the shelf is one way of responding to the stakes of sustainability of maritime activities and promote sustainable management of coastal zones and oceans. Knowing more about this area would make it possible to adapt and comply with the terms and deadlines set by international and European agreements on marine protected areas. Carrying on from the Grenelle environmental summit meetings for the Sea and the Convention on Biological Diversity, the objective to extend marine protected areas in France (10% by 2012 and 20% by 2020) means an additional 1.1 million square kilometres in 2012 and 2.2 million km² by 2020. Moreover, the work done to prepare the case for the legal extension of the continental shelf will make it possible to increase our country's surface area by nearly

1.5 million km². And finally, European directives require a status report on the quality of waters and seafloors for the 400,000 km² of Metropolitan France. This will entail an initial inventory in 2012 and proposals for measures to recover good environmental status by 2020. Therefore, managing this space requires appraisal of the natural phenomena occurring there, the ecosystems living there and the impacts threatening it. The programme to "survey and characterise the continental shelf" developed in particular with SHOM, aims to strongly improve sedimentary and biological knowledge about the seabeds in this area.

Closely examining the continental shelf

In December 2009, the joint ministerial committee for the sea decided to map the "zones at stake" on the continental shelf. To this end, Ifremer drew up an inventory of numerical data from the past thirty years in order to supply information about the bathymetry and seabed reflectivity that are the basis of marine knowledge. Sustained effort has been deployed to harmonise the methods and procedures, including the mapping "supply chain" from data acquisition to production of baseline documents. Reflectivity data acquired on the Aquitaine shelf were reprocessed using a modern method (semi-automatic characterisation using the Sonarscope software with image segmentation). Likewise, the reflectivity data acquired in the Gulf of Lion were processed, with support from the ministry of ecology, energy, sustainable development and the sea (MEEDDM), in order to produce a summary of the shelf's sedimentary properties.



Atlantic continental shelf map

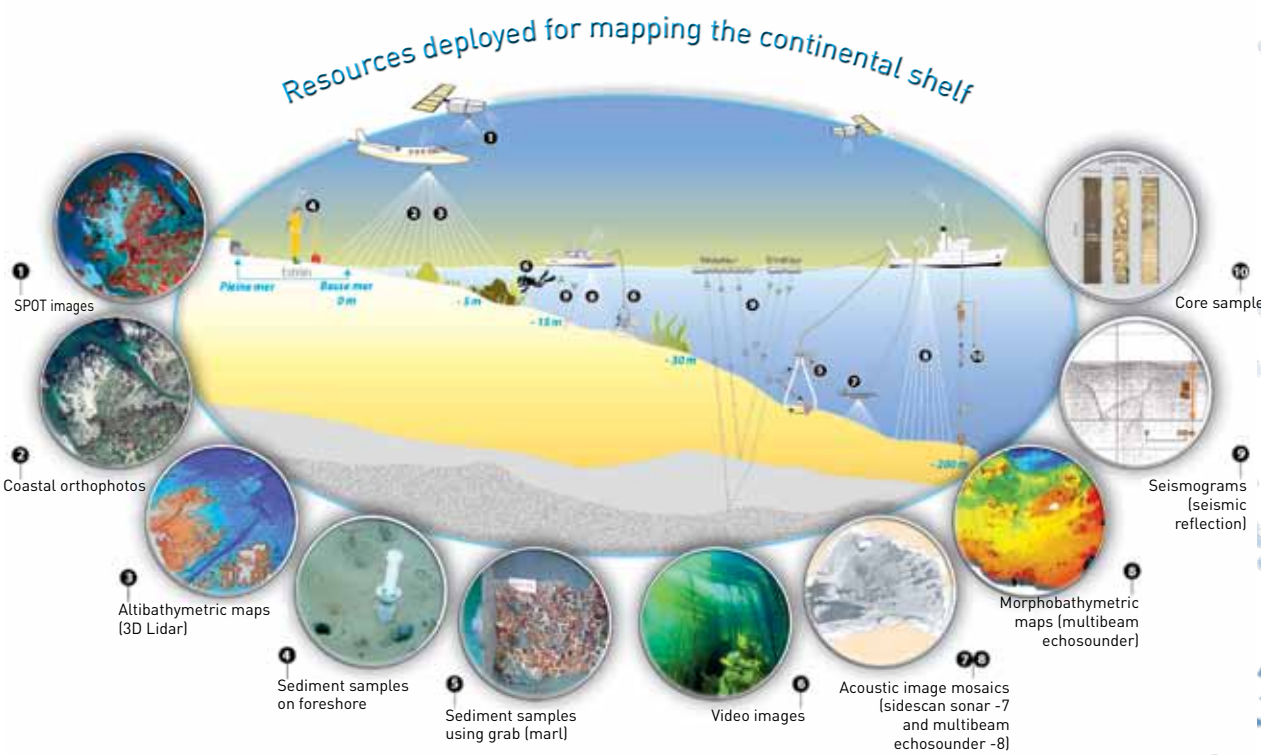
Increasing the surface areas exploited

Legal extension of the continental shelf

The continental shelf of a coastal State includes the seabed and subsoil to the outermost edge of the continental margin (underwater area located on the edge of continents into which most of the sediments from mainland erosion are transported), or up to 200 nautical miles from the baselines (formed by the low water tide mark, the limit of zones which are always covered by the sea at any tide). When the continental margin extends beyond 200 nautical miles, States can file claims to extend their jurisdiction, depending on some geological criteria. To be able to claim this extension, a Coastal state had to draw up a technical and legal submission which had to be lodged with the United Nations Commission on the limits of the continental shelf by May 2009, at the latest. Some thirty countries are in this case, including France, particularly on account of its overseas territories. Thus, on 13 May 2009, France filed its claim for extension with the UN Commission on the limits of the continental shelf (CLCS). In France, the dossiers required for this claim are drawn up by the Extraplac (reasoned extension of the continental shelf) programme which brings together Ifremer and its partners, i.e. SHOM, IPEV and IFP.

French requests validated by the UN

France has submitted completed claims to the UN for eight geographical zones, two of which are presented jointly with neighbouring countries. The eight zones in the order submitted to the UN are: Bay of Biscay (joint submission), Guiana, New Caledonia, Kerguelen, West Indies (Martinique and Guadeloupe), Crozet (joint submission), Reunion Island and Saint-Paul-et-Amsterdam. It also submitted three letters of intention to the United Nations Secretary-General concerning the areas offshore from Saint-Pierre-et-Miquelon, French Polynesia and Wallis and Futuna to make later submissions to the authorities for extensions possible. Finally, France formally announced its intention to extend the shelf off Adelie Land in Antarctica at a later date. Already, the CLCS has validated the limits of extension for the Bay of Biscay seabeds which were jointly proposed by France, Ireland, Spain and the United Kingdom. These countries must now decide on the sharing of approximately 80,000 km² of surface area official. The commission also validated two claims concerning France alone: the extension of the continental shelf on Lord Howe Rise (south-west of New Caledonia) and the outer limit of the plateau of French Guiana, i.e., a total surface area of about 150,000 km². This now gives France the right to exploit the seafloor and subsoil in these zones, and the obligation to protect the environment there.

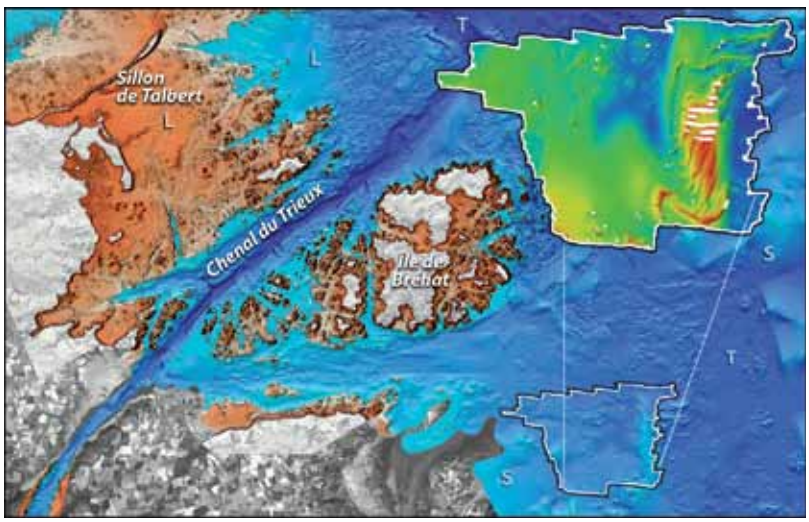


An EDF mission on the state of the seafloor

In 2007, the EDF electricity board commissioned a study from Ifremer on the area located offshore from the Flamanville nuclear power plant in the English Channel. The objective was dual, both to define the benthic baseline state (from the coast to the area where extracted material is disposed), and to update the marine habitats map for the sector made twenty-five years ago. Two cruises aboard RV *Thalia* enabled the exploration of a 40 km² zone using high resolution acoustic sensors (sonar and multibeam echosounder) and observation and filming of the seabed. These explorations indicate that due to strong hydrodynamics and the regional geology, the characteristics of the sea floors there have evolved over time to become a complex arrangement of biomorphosedimentary assemblages. For all that, the sedimentary and biological make up of the bottom has not changed much in qualitative terms over twenty-five years, with the exception of the arrival of the *Crepidula* slipper limpet (marine gastropod molluscs from North America which have become an invasive species in Europe) in relatively low densities.

Towards coastal habitat discoveries

In April 2008, a new oceanographic vessel, the launch *Haliotis*, joined Genavir's inshore fleet. Designed to map seabed type and morphology in shallow waters (1 to 15 m), it has already enabled 1,700 kilometres of profiles to be covered, to map remarkable coastal habitats in terms of the biodiversity and natural heritage interest. In April-May 2008, the shallow zone in the Bréhat archipelago (between 0 and 20 m) was surveyed over 34 km². In July 2009, 26 km² were entirely covered in the bay of Morlaix. In both cases, maps with a terrain resolution of 50 cm were combined with those created by jointly using altibathymetric Lidar in the intertidal zone and very shallow areas and RV *Thalia*'s multibeam echosounder offshore. The *Haliotis*



Altibathymetric map of the Trégor-Goëlo area (Côtes d'Armor)

launch has proved to be perfectly adapted to studying coastal marine habitats, whether in describing the nature and distribution of substrates or in identifying the boundaries of remarkable and structuring populations, such as beds of phanerogams, large seaweeds, marl or other biogenic constructions. The accuracy and resolution of the sensors are opening new pathways for comprehensive surveying of marine coastal habitats and better understanding of how they function.

BobGeo: exploring cold water corals in the Bay of Biscay

The BobGeo cruise took place from 13 to 28 October 2009 in the Bay of Biscay aboard RV *Pourquoi pas?*. This mission should provide the characterisation of the geology of seafloors where deep sea coral live. BobGeo is supported by the ministry of ecology, energy, sustainable development and the sea and the Agency of marine protected areas, and is part of the EU CoralFish project which is pursuing several objectives: to better understand the habitats of cold-water corals in Europe and the associated fish there, develop indicators to estimate the impact of fisheries on the coral habitat and their genetic fingerprinting, as well as developing tools to better manage this ecosystem. As part of the European Framework Programme 7, CoralFish brings together sixteen partners, including one French partner which is Ifremer. Six zones have been explored, from the Norwegian Sea to the Ionian Sea. Amongst them is the Bay of Biscay

DYNAMICS, ASSESSMENT AND MONITORING OF COASTAL ECOSYSTEMS

Coastal zones, at the core of marine environmental protection

The research programme on "Dynamics, assessment and monitoring of coastal ecosystems" combines research, monitoring and expert appraisals. It falls under the context of global change and anthropogenic pressure and focuses on coastal ecosystem trends. It is deployed in three specific directions: sedimentary dynamics in coastal zones which condition natural habitats and the transport and fate of numerous pollutants; sensitivity and diversity of benthic habitats and their role in coastal ecosystem functions; and chemical contaminants' fate, transfer in food webs and effects on populations.

These studies contribute to defining environmental indicators and pressure indicators for chemical contaminants. In this way, they help define good environmental status for the marine environment, the objective set by the marine strategy framework directive (MSFD). In addition, they meet Ifremer's objective of developing a general (physical-chemical, chemical, microbiological, phytoplankton and related phycotoxins) monitoring strategy for coastal zones.

Extended and improved monitoring

An extension of areas and species studied (Rocch network)

At the request of the Ministry of food and fisheries, the Rocch monitoring network enlarged its regulatory chemical monitoring plan to new species and shellfish farming

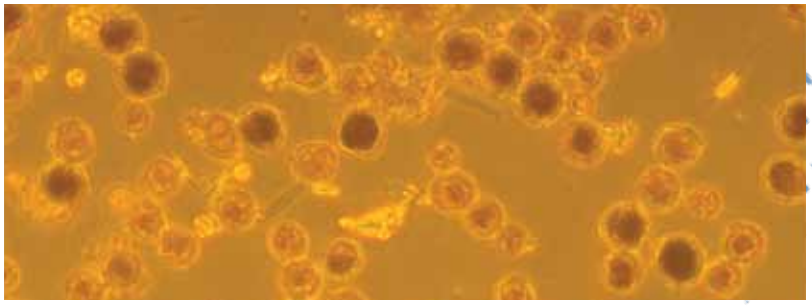
areas. The development makes it possible to take account of the true yields in the areas studied. This has taken the number of sampling points from 78 to 131 and the number of species sampled from 2 to 6. In 2009, the sediment sampling survey aboard *Thalia* took place in the coastal zone lying between the Pointe du Raz and Antifer. In order to meet the requirements of the WFD and the Convention for the protection of the marine environment in the North-East Atlantic (Ospar convention), the cruise was financed by the Loire Brittany and Seine Normandy Water agencies. In all, 383 core samples were taken, enabling the acquisition of 99 samples to be analysed for chemical contaminants.

More comprehensive health studies (REMI network)

European regulations have imposed that studies be developed to classify zones and to define a monitoring strategy, which should lead in turn to more complete health and hygiene studies being carried out. To this end, a national study to identify the sources of microbiological contamination is underway. A methodological guide presenting the health study has also been created and distributed to the partners concerned. Currently, the presence of *Escherichia coli* is closely monitored by the REMI network, following the methodologies (impedance measurement using BacTrac equipment) recommended by the national reference laboratory (NRL).

Checking for phytoplankton toxins (Réphy network)

Phycotoxins are toxins produced by some species of phytoplankton. Since they accumulate in filtering molluscs, some are dangerous for consumers. Those observed in France, classified into broad categories, are lipophilic toxins which include diarrhoeic (DSP), paralytic (PSP) and amnesic (ASP) poisoning toxins. Since the 1st January 2010, they have been detected by chemical analyses performed by Ifremer's "Phycotoxins" laboratory in Nantes. All year long, this monitoring



Alexandrium minutum *microalgae*

is complemented by an active vigilance system (mouse bioassays, observation of phytoplankton, chemical analyses) at ten reference points along the French coast in order to detect any emerging lipophilic toxins which have not yet been listed. Moreover, Ifremer is continuing to coordinate a network to monitor benthic populations (Rebent network) and discharges at sea from large-scale power plants (IGA monitoring network).

Ifremer and the water framework directive

Ifremer is responsible for implementing biological monitoring (phytoplankton, physical-chemical parameters, benthic invertebrates, macro-algae and angiosperms) in coastal and transitional waters, as well as ensuring ongoing sampling work (water, sediment, biota) monitor for chemicals. Implementation of tasks related to the WFD relies on the existing monitoring networks (Réphy, Rebent and Rocch) and requires special developments.

Ifremer is working closely with Water agencies and Onema to prepare the reports expected on the EU level in June 2010. Conclusions have already been drawn from the monitoring of several biological and physical-chemical quality elements (dissolved oxygen, temperature, phytoplankton, nitrate, benthic invertebrates, intertidal and subtidal macroalgae and blooms of opportunistic species, zostera sea grasses, posidonia and macrophytes in Mediterranean lagoons). Methodological studies must be continued to consolidate the monitoring studies (nitrite, ammonium, silicate, macroalgae in some coastal sectors and marl) for some quality elements.

In June 2009, at a seminar in Nantes jointly organised by Ifremer, Onema and MEEDDM, an initial inventory was taken for the implementation of the WFD in the ROM overseas regions (Reunion, Mayotte, Martinique, Guadeloupe and Guiana), on the parameters currently monitored and the conceptual and operational difficulties encountered. Working orientations were chosen concerning phytoplankton, physical-chemical parameters, corals, benthic invertebrates, angiosperms, fish, hydromorphology and databasing.

Controlling the silting of estuaries

Progressive silting

In geological terms, estuaries are young. They were formed following

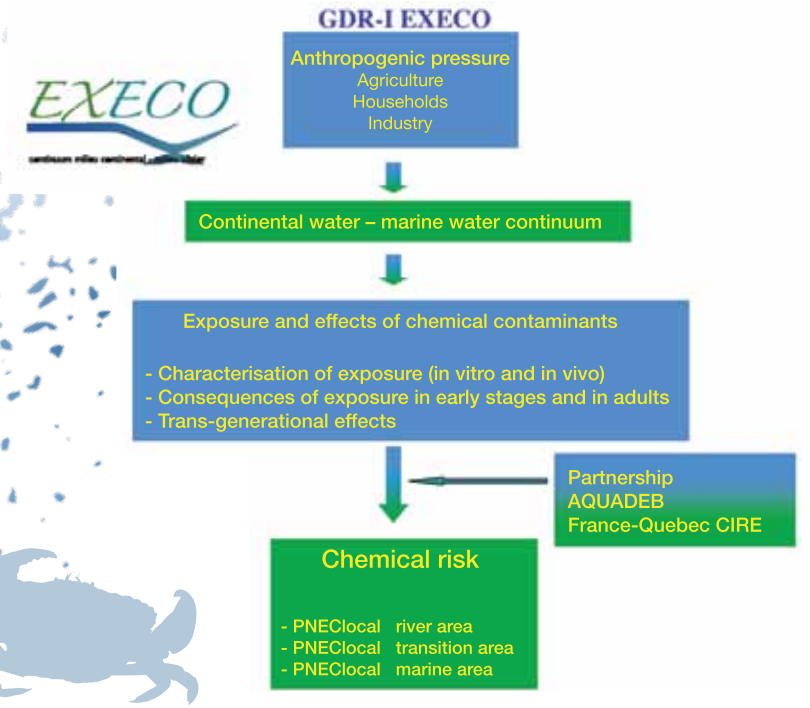
Réphy network sampling operation (Arguin bank, Arcachon)

Studying bivalve molluscs (Rebent project)

the glacier melt which led to rising sea level, coastal flooding and river beds getting wider. Since then, there has been a gradual filling up with sediments. It is important to ensure the preservation of the natural balance between sediment deposits and water circulation in estuaries. And yet, estuaries have been slowly silting up since their formation and run the risk of closing up and preventing navigation.

Active research

In 2009, Ifremer performed continuous sediment measurements at the mouth of the Seine River in the framework of the Colmatage and Model projects which were funded by the Seine-Aval scientific programme. Furthermore, sedimentation in estuaries has been the subject of theses which are either finished or underway, on "modelling of particulate transport in the Gulf of Lion" (concerning the fate of radioactive tracers from the Rhone river), on "particulate exchanges as the mouth of the Loire River" and on "the impact of zostera on the sedimentary dynamics of the Arcachon basin". In the frame of the European Procope programme, there are also exchanges with the University of Oldenburg (Germany) on the modelling of flocculation processes. Within the context of the Freplata action, the University of Buenos Aires (Argentina) is currently using data collected using satellite imagery. And finally, Ifremer helped organise the seminar on Sediment morphodynamics and management in estuaries, bays and deltas in the framework of the "31st hydraulics conference" organised in September 2009 by the Société Hydrotechnique de France. Ifremer presented papers there on particulate fluxes at the mouth of the Seine, erosions/deposits and turbidity generated in the bay of Marennes-Oléron and the numerous possibilities for Altus altimeters.



Checking chemical pollution levels

International cooperation

The international Execo research group was launched in April 2009, linked to the Trans-Atlantic ecotoxicology network of Quebec. Associating CNRS, INRA and Ifremer, it is working on chemical contaminants' effects, from individuals to populations, on species in living coastal waters (fresh water-sea water continuum). The group includes a research strand which is both cognitive and applied, complying with Ifremer's mission to monitor and assess chemical risk. In this framework, Ifremer also proposed that the relationship between "pesticides and phytoplankton" in the Charente estuary be analysed within a project which has obtained funding from the MEEDDM's "pesticides" programme.

Circulating scientific information

Under Execo's aegis, the research group co-organised the annual Ecobim conference on Biological effects of chemical contaminants in bivalves and fish in Quebec. Ifremer also co-organised the Primo (Pollutant responses in marine organisms) conference held in Bordeaux last May. Finally, the GDR research grouping started a national think tank to assess whether it is opportune to use mesocosms and production of ecotoxicological data for the WFD and MSFD.

Artificial biological stations

Two cruises aboard RV *L'Europe* complemented Mytilos programme sampling by placing thirty artificial mussel stations in Cyprus, the Strait of Sicily and on the coasts of Libya. These bio-integrator stations were submersed for three months and supplied new data about the level of chemical contamination in the Mediterranean. These data supplement those acquired since 2004 on the 220 points currently used on western and eastern Mediterranean coasts.

"High-tech" buoyage at sea

The Roustan Est maritime buoy marker, designed for oceanographic measurements and located in the mouth of the Rhone river, was replaced by a rigid buoy with a submerged float which is better adapted to seas with weak tides. Equipped with multi-parameter (subsurface and near- bottom) sounders, a weather station, an irradiance sensor and power and electronics units, this buoy enables information to be acquired and transmitted to the Coriolis database via the GSM network. The technological platform also has a Doppler current meter and sensors at the base of the buoy and will supply new data for studies underway on Rhone river inflows to the sea. It is an invaluable observation tool in the context of the Mediterranean study site being constructed and reinforces the development of coastal operational oceanography in the basin. Today, the Rhone is the river which discharges the largest amount of continental fresh water inputs to the Mediterranean and the largest inflows of nutrients, particles and chemical contaminants. These fluxes are decisive for the ecosystems of the Gulf of Lion. This high-tech maritime buoyage project was co-financed by the PACA regional council and has six partners: the Lighthouse and beacons service, the Centre of oceanology in Marseilles, Cerege (CNRS Aix-Marseille), IRSN, LSCE and Cetmef.

Giving information better visibility

Mapping of coastal contamination

The Quadrige database associates a tool kit for interpreting and elaborating information products with the database itself. It is an element of the Water information system and contributes to work by the Secretariat of the national administration for water-related data. Quadrige is the national reference base for coastal waters monitoring data. Putting it into production has led to the development of new software applications to assimilate monitoring data, particularly those from the Rebent network. The Ifremer website http://wwz.ifremer.fr/envlit/ opened to the public in 2000 to inform people about monitoring results has added a new mapping product summing up the chemical contamination of the coastline of metropolitan France. It includes thirteen chemical parameters acquired by the Rocch monitoring network over the period from 2003-2007.

A well-received monitoring bulletin

On the occasion of its tenth anniversary, the "coastal environment

A consensus on coastal cities' threat to marine ecosystems

From 10 to 12 February 2009, a scientific workshop on the "impact of Mediterranean large coastal cities on marine ecosystems" was held in Alexandria (Egypt). The workshop was co-organised by Ifremer and attracted some forty scientists and experts from ten countries on Mediterranean shores and from international organisations.

The scientists' objective was to better understand the disturbances to the natural environment caused by these urban areas in order to preserve the good environmental status of the sea and its ability to provide services to society. Beyond sharing experience about the perturbations engendered by large coastal cities on Mediterranean marine ecosystems, the work done over these three days made it possible to identify scientific obstacles and formulate proposals for progress in terms of public management.

Seeing their rapid growth, particularly on the southern and eastern shores of the basin, and the numerous pressures they exert on the environment, today large coastal cities represent a threat to marine ecosystems and a real challenge for sustainable development in the Mediterranean.

monitoring bulletin" was audited in the autumn of 2008. The audit showed that the bulletin is the first, and almost the only, source of information for coastal marine environmental quality. It has become a reference whose scientific and technical standard is widely acknowledged. The audit also led to a recommendation that a nationwide summary on marine environmental monitoring be drawn up. The first report was produced in 2009. The 2008 summary concerning the microbiological inspection monitoring network (Rémi), the phytoplankton and phycotoxins monitoring network (Réphy), the chemical contamination observation network (Rocch) and the aquaculture resource mollusc network (Remora) is now available.

FISHERIES ECOSYSTEMS AND RESOURCES

Sustainably exploiting marine resources

This programme conducts a series of actions for observation, research and expertise intended to promote sustainable exploitation of ecosystems and resources used by fisheries. It helps in meeting regulatory obligations, collecting fisheries data and feeding our marine databases. Concurrently, it develops studies that particularly take the socio-economic, ecological and technological dimensions into account, so that new sustainable fisheries strategies can be designed. The work done within this programme will have repercussions on a series of Ifremer's objectives, like knowing more about biodiversity, setting up a global monitoring strategy for coastal and high seas environments, adding knowledge about tropical environments and promoting the socio-economic development of French overseas ROM POM regions and areas by supporting local supply chains. In 2009, the programme displayed sustained activity in terms of observation, research and expertise in the framework of world-class studies.

Better collection of information

Cross-checking biological and economic data

In 2009, Ifremer achieved the launch of the Sacrois application, which cross-checks individual raw data for fishing effort, catches and fish auction data with positions from the VMS (Vessel Monitoring System). VMS is used for commercial fisheries to enable the bodies in charge of regulating fisheries to monitor various parameters (position, time at a given position and ship speed). This new application makes it possible to supply a series of accurate and comprehensive data to the Fisheries and aquaculture information system of the Directorate of maritime fisheries and mariculture (DPMA). It moreover meets the European obligations for declarations. Finally, these data form the

Deploying a trawl aboard RV Thalassa

foundation for biological and economic sampling plans set up within the Data Collection Framework regulations.

Estimating the resources in overseas France

The Fisheries Information System (FIS) in overseas French regions has now been deployed in the four ROM. In particular, it has enabled the impact of setting up collective fish aggregation devices (FAD) on fisheries activities in Guadeloupe to be assessed. The partnership with fishers led to creating the Martinique fishermen's 2009 calendar-agenda, which received a prize at the Ifremer 2009 Trophies.

Assessing fisheries activity

In 2004, Ifremer launched the Recopesca project whose aim was to set up a network of volunteer fishing vessels to measure fisheries activity and environmental data. It is based on deploying sensors on fishing gear and aboard fishing vessels which have volunteered to take part in the operation and which are representative of all the métiers (combinations of gear, species, grounds) practised. These sensors collect both data on fisheries efforts over space (and on catches in the long term) and environmental data (temperature, salinity, etc.). Thirty vessels were fitted with them in 2009 and forty others are slated to be equipped in 2010. The first industrially produced Recopesca scales, developed by the NKE company, were tested at sea on one of the volunteer boats. The first trials were conclusive and supplied information about catches per fisheries operation. Recopesca is a nationwide network associating scientists and professional fishermen and is the tangible outcome of a participatory approach.

Measuring recreational fisheries

The national survey on recreational fisheries in France has been completed. Based on telephone polls aiming to estimate the population of recreational fishers and *in situ* surveys to assess catch yields and economic return, the study completed its initial estimations. It estimates the number of recrea-

Fish stock estimation: the acoustic "revolution"

Multibeam echo-sounders are hybrid sonar-sounder systems which combine beams working on a vertical axis and others working on a vertical axis. These systems are the latest generation in scientific sounders, mainly used to assess resources. The first trials of the first model were run in October 2005 aboard Thalassa. Fisheries acoustics have an extremely wide field of use: rivers, lakes, dam reservoirs, estuaries, continental shelves, deep sea environments, etc. This means they cover environments ranging from depths of a few metres to several hundred metres, from fresh water to saline water, to hyper-saline water. They are used for measuring organisms on scales of millimetres (plankton), centimetres (mesopelagic fish), decimetres (fish found on continental shelves) or metres (tunas and billfish in the open seas).

tional fishermen, mostly practising rock pool fishing, at approximately 2.45 million (71% of fishers) followed by angling from shore (33%), angling from a boat (25%) and spear fishing (5% from shore and 2% from a boat). In addition, estimates of spending were proposed for gear, boat and transport and spending for accommodation and meals. Thanks to the new methodology, this study provides a better assessment of the weight of recreational fisheries in the maritime economy.

Sharing knowledge

In the frame of the DPMA-Ifremer agreement, the Institute is helping with project management for observations at sea, thanks to observers on board fishing vessels. The sampling plan and schedule for time on board were drawn up in consultation with the professionals. The protocol manuals have been harmonised and are available on Ifremer's FIS website (http://www.ifremer.fr/sih).

Better known resources

Assessing species' capacity to adapt

The Progrès (individual processes and environmental adaptation of marine organisms) project was created in 2009. It is designed to obtain better knowledge about the type and intensity of the physiological reactions of marine organisms (species' adaptation strategies, population genetics) to changes in their environment. Progrès also aims to develop new methodologies to study these adaptation processes. In April at Ifremer's centre in Brittany, the first world conference on the "dynamic energy budget theory" was organised, bringing together one hundred scientists to talk about the applications and developments of this theory in the fields of biology and ecology. Its goal is to understand and model processes such as the growth of living beings, functioning of wastewater treatment plants, phenomena of intoxication and detoxification in living organisms or sustainable management of fisheries.

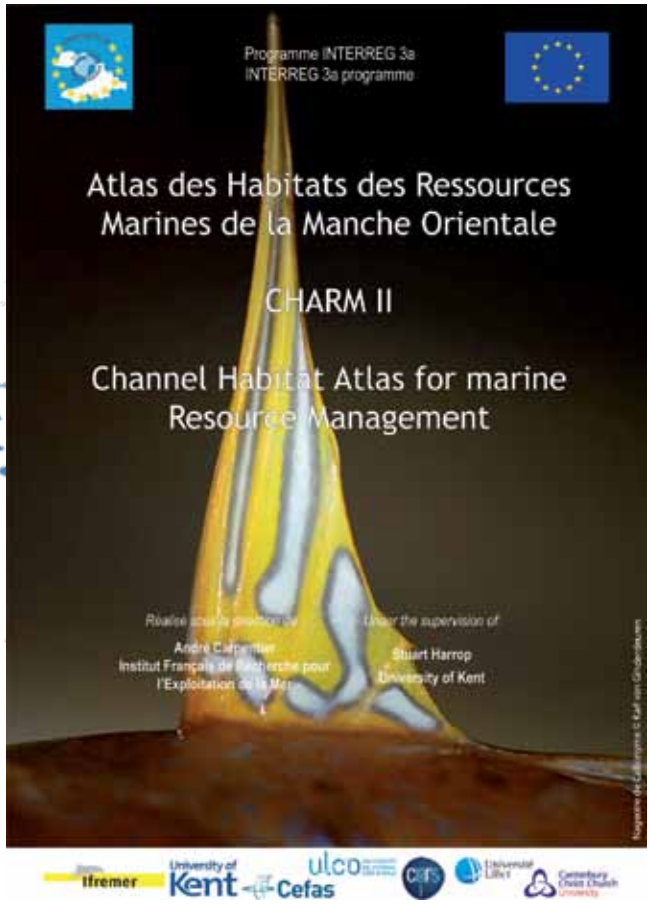
Setting up tools for responsible fisheries

Fishing systems: management through "transferable quotas"

The aim of the European Tranze project, which ended in 2009, was to better understand management systems in New Zealand and Europe. Methodological tools were developed within it that enabled an empirical analysis of fleet dynamics in the context of management using individual transferable quotas (ITQ). In addition, it developed bioeconomic models and applied them to New Zealand and European mixed fisheries. Its outputs contributed to scientific bases used for current discussions on access rights to fisheries resources (individual quotas) and the role of economic incentives in the future management of European fisheries.

English Channel: studying an overfished area

The Channel and the southern part of the North Sea have long been subject to strong human presence (fisheries, tourism, leisure activities, marine aggregate extraction, maritime traffic and shipping, harbour areas, international cargo shipping, deteriorated estuarine areas, offshore wind turbines, etc.). There are considerable economic stakes for these zones subjected to a multiplicity of users whose interests are often conflicting. In this frame, the European Interreg IIIA-Charm 1 & 2 projects provided an initial multidisciplinary approach to fisheries in the eastern English Channel, combined with an innovative study of spatial modelling of ecosystems. The information collected gave rise to the publication of a bilingual book called Eastern Channel Habitat Atlas for Marine Resource Management, available at www.ifremer.fr/charm. The publication covers a full range of subjects (environment, marine species, fisheries, legislation, and so on), for all readerships (scientists, professional seafarers, managers and the



general public), and delivers comprehensive and invaluable knowledge about the socio-economic and ecological stakes concerning this maritime area.

The new Charm 3 project is developing an ecosystem-based approach and broadening the scope of investigation to the entire Channel. Its three objectives are to collect, standardise and map the data, integrate them through modelling and disseminate information.

Fisheries in French Guiana: setting up a sustainable model

The main objective is to supply professionals and managers with information to support sustainable development of fisheries in Guiana. To do so, the GECO project aims to give structure to a local and regional community of scientists working in the "Guiana-Antilles-Amapa-Para" areas, by developing new models which are appropriate for tropical fisheries management. The challenge lies in making French Guiana a regional leader in sustainable fisheries management, a goal which is part of the context of the West Central Atlantic Fisheries Commission.

Deep sea fisheries: managing the stocks

The three-year Deepfishman project was initiated and funded by the European Union and is designed to perfect deep water fisheries management in the North East Atlantic. It is coordinated by Ifremer, gathering thirteen scientific partners from nine countries and associating all stakeholders (fishing industry, NGOs, governments and the European Commission). A study on blue ling stock trends based on data from French fishermen indicates that the stock has been stable since the early years 2000. The results obtained seem to indicate that the management implemented since 2003 could make sustainable exploitation of this previously overfished species possible. This conclusion gives a glimpse of the possibility of raising quotas which are currently below the stock's long-term potential.

Guianese boat

Resources: using multibeam echosounders for evaluation

Observations using a multibeam fisheries echosounder (SMFH) focused on analysing the impact of the incidence angles on fish, in order to calculate the entire biomass from the amount sampled and use simulations to analyse the bias due to sampling or to the instrument on small schools of fish.

Movies3D software developments now make 2D and 3D visualisation in the water column possible. After studying the method used to assess the biomass of small pelagic species using acoustics, Ifremer examined the integration of new sensors, methods developed and standardising the storage of scientific cruise data.

Fisheries techniques: testing more selective methods

Most fish escape from a trawl through the meshes of the codend, whence the idea of a device to let unwanted catches escape. Two techniques are used: the first utilises larger mesh sizes, grids or special shapes of mesh in the trawl net and the second creates different levels to separate the fish within the trawl.

More "open" gill nets

The Prespo project (Sustainable Development of the Artisanal fisheries in the Atlantic Area) is designed to improve fisheries resource management by developing alternative instruments. The project was launched in early 2009, and an initial cruise tested a codend with T90 mesh, so-called because its meshes are twisted by 90° compared to the usual diamond meshes. Experiments have confirmed that the meshes open very well, and a large number of both fish and Nephrops (79% of individuals of commercial size for Nephrops over 9 cm) can escape.

Selective flexible grids

In the frame of the Selecmer project, which Ifremer is a participant in, scientists tested the concept of a flexible selective grid intended to reduce discards of undersized whiting (less than 20 cm long). Trials made in tanks and aboard fishing vessels confirmed the perfect ergonomics and effectiveness of the grid. Following these encouraging results, additional trials will be run on a grid with wider space between bars and a square-mesh net panel. These tools will enable professional fishers to propose reliable technical solutions to the European authorities.

Folding basket traps

Within ITIS Squal (a Brittany Marine Cluster labelled project), tank trials on different folding fish trap concepts were performed. Five

models were tested in the bay of Douarnenez, working in collaboration with fishermen and the Iroise marine nature park, to determine how they held up at sea and their catch potential. The outcome was that the cylindrical vertical pot offset from the seabed caught a large number of good-sized bib but without catching many eels. These trials will be continued by volunteer professional fishing vessels all along the coast and in the Crozet archipelago, in the frame of the Orcasav project (see text box).

five years;
- creating a regulated access fishing zone (ZPR/FRA) in the Gulf of Lion (proposing that fishing effort be held at the current level), debated during the CGPM Commission meeting in Tunis in April;
- managing bluefin tuna stocks, in the frame of the examination by the International Commission for the Conservation of Atlantic Tunas (Iccat) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Cites) of the situation for bluefin tuna and the measures to be taken to ensure its sustainable exploitation;
- assessment of southern Patagonian toothfish on the Kerguelen plateau, within a Franco-Australian working group. Ifremer brings its methodological (modelling) and diagnostic support to the MNHN.

Vertical double-chamber cylindrical fish pot

The Orcasav project: an example of deep sea fisheries management

The Patagonian toothfish is a large-sized (reaching 2 metres and 80 kilos) deep sea fish which lives in cold, southern ocean waters. In the 1990s, it was the object of keen gastronomic interest, especially in Asia and the United States. Because of the price of Patagonian toothfish (some 30 euros per kilo compared to about 10 euros for salmon) it was dubbed "white gold".

In Reunion Island, the top-producing region worldwide, these fisheries carry significant economic weight. Today, Patagonian toothfish fisheries are closely monitored. Each vessel has an observer on board who ensures that the boats comply with the fisheries regulations and those concerning the environment. This fish is caught at depths reaching 2,000 m, above all with longlines, which is the only method authorised by the French Southern and Antarctic lands (TAAF) administration. However, this is not a satisfactory fishing technique.

Around the Crozet archipelago, sperm whales and killer whales have learnt to take fish from the longlines, although Patagonian toothfish were not a natural prey for the latter of these two species. And yet, their takes are assessed at 30% of gross production, and are debited from the shipowner's quotas. In addition, longlines are a threat to seabirds, which are attracted by the bait and get caught on the hooks. Patagonian toothfish are also fished by trawling.

At the end of 2008, fisheries technicians from Ifremer's station in Lorient contributed to perfecting a fishing technique for Patagonian toothfish in the French Southern Lands, using deep water pots so that killer whales do not come and eat the fish on longlines and seabirds no longer get caught on the hooks. The Brittany marine cluster and the Qualitropic cluster in Reunion Island supported this project, which was created with the Reunion Island fishing boat owners.

Sustained activity for expertise appraisals

Participating in major international cases

Ifremer takes part in numerous international working groups set up to establish fisheries science diagnoses. In 2009, Ifremer invested its efforts in the following actions:
- assessing the North Sea herring stock in the frame of the ICES "Herring" (HAWG) working group, which showed a stabilisation in the number of broodstock following a sharp drop over the past

Backing up national sustainable fisheries management

Ifremer actively supports the Maritime Affairs authority in order to create local or regional fisheries management measures. Our Institute also offered its services to the Directorate of maritime fisheries and mariculture (DPMA) in defining public policies. This led Ifremer to conduct a study on the balance of fishing capacities and resources, supplying information and proposing recommendations on implementing real time closures to reduce catches of unwanted fish (undersized cod, to begin with).

Analysis of French fisheries in foreign waters

Based on VMS data, the analysis

of French vessels' fishing effort in foreign coastal waters and of foreign vessels in the coastal waters of metropolitan France shows that French boats are not very dependent (in terms of fishing time) on foreign inshore waters. This dependence in terms of turnover must still be quantified.

Summing up the state of fisheries resources

A document drawn up to prepare the Fisheries conference on the state of the French fisheries sector, made in partnership with IRD, MNHN and FranceAgriMer, proposes a summary of the current status of resources, situating them with respect to the maximum sustainable yield target (by 2015), indicators of long term trends which highlight a rise in catch capacity in spite of a drop in the number of vessels and a downturn in yields in terms of tonnage and value. An analysis of the current situation for fishing fleets and its trend, as well as of how the sector is structured and market trends, complete this panorama.

Stock assessments with the professionals

Along with the self-sampling operations for cod carried out by professionals in the Celtic Sea zone (estimations of stock structures in catch size), Ifremer carried out a sentry cruise with pelagic trawlers to improve knowledge about how pelagic ecosystems function and about variations in sardine and anchovy stocks. This operation also enabled a working group to be set up on constructing bioeconomic decision-making tools for fisheries planning: the group will base its work on examples concerning species which are important for French fleets, such as Nephrops, hake, sole or scallops. Lastly, aerial flyover operations provided proof that bluefin tuna schools were present in the Gulf of Lion.

SUSTAINABLE AQUACULTURE

Promoting high quality aquaculture production

French aquaculture's assets are mainly built on shellfish production, which remains one of the top-ranking in Europe, on animals produced in hatcheries (molluscs and fish) and on a dynamic processing sector. Interesting perspectives for local economies are present in the overseas French territories and departments, mainly for pearl oysters in Polynesia, shrimp in New Caledonia, tropical fish in the West Indies and the Indian Ocean. Integrating the new conditions of globalised trade, criteria of sustainability, quality and traceability of products (including processed ones) means that companies have to be more productive and profitable in a context of strong competition, protecting consumers with respect to quality, health and safety standards, keeping livestock safe and protecting the environment.

The "Sustainable aquaculture" program contributes to maintaining and developing sustainable aquaculture in both metropolitan and overseas France. Covering all types of aquaculture (fish farming, shellfish farming, shrimp farming, pearl farming and microalgae), it can feed the monitoring databases and help provide knowledge about marine biodiversity.

In 2009, Ifremer's studies focused on excess mortality in cupped oysters in order to minimise or even control it, and a programme was launched to bolster research and make it more legible both inside and outside the Institute. The "Sustainable aquaculture" programme, playing an active role in the nationwide fish farming think tank, also launched a number of actions to strongly promote development of fish farming in French overseas and metropolitan regions.

Oyster farming: working with the profession to respond to the crisis

In 2009, the second year of the crisis due to excess mortality in oysters, Ifremer teams were highly mobilised, both in terms of monitoring and research, to analyse the causes of the crisis and find solutions, working with professional oyster farmers.

Ifremer teams strongly involved to understand and explain the crisis

As of 2008, Ifremer undertook several research actions to describe and explain the excess mortality phenomenon. Emphasis was put on diagnosing and finding the infectious agents which could cause these excess mortalities by implementing different technical approaches. Three molecular diagnosis tests were developed to find the herpes virus and *V. aesturianus* and *V. splendidus* bacteria. In the frame of the National molluscan shellfish pathology network (Repamo), it was demonstrated that 76% of the batches analysed showed the OsHV1 herpes virus and 48% of them were infected by a new variant of the virus. Experimental studies showed the transmissible and infectious nature of this new variant not previously described in France.

In 2009, twenty-six research actions supplemented the system already in place. Eight regional and national studies were conducted to describe the excess mortality phenomenon, including setting up the nationwide shellfish farming observatory. It has thirteen stations located over all the main French production sites, and the shellfish farming observatory has made it possible to quantify the growth and survival of *Crassostrea gigas* cupped oysters over time and space at different rearing phases as well as from different sources (hatchery and naturally collected spat).

This observatory has been complemented by regional "sentinel observatories" which can monitor dynamics when mortality episodes appear, in relation to monitoring the targeted infectious agents of herpes virus and vibrios, in Normandy, Marennes Oléron, Pertuis charentais, Bay of Quiberon and the Mediterranean. They have made it possible to confirm the excess mortality of *C. gigas* nationwide and follow its geographic spread. Very frequent recordings showed that these mortalities are related to a temperature threshold situated around 16-17°C being exceeded. They also revealed the sudden onset and short duration of these excess mortality episodes. In juveniles less than a year old, the mean mortality rate is relatively high (54%), with significant regional variations: from nearly 80% in the Mediterranean (Thau lagoon) to 34% in Normandy (Bay of Veys) or in the Bay of Quiberon (farmed oyster site in deep water). These monitoring operations were made possible by the creation of the first network of "recognised" laboratories benefiting from the transfer of diagnostic techniques perfected by the National Reference Laboratory for mollusc pathologies in 2008.

Several research actions were also conducted to better understand the interactions between the oysters and infectious agents, to supply the first elements of response on how to assess oysters' survival capability depending on their origin and rearing. Significant differences observed in terms of survival between families selected as being "Resistant" or "Sensitive", confirm the role played by their genetics in excess mortality. In the period of lower pressure for infection (from August on), the families selected as "Resistant" showed a survival rate of 76%, associated with the ability to limit the multiplication of the virus, or even eliminate it, contrary to families selected as "Sensitive", whose survival rate was only 10%. Biomarkers for survival are being developed and should enable the selection of broodstock which can produce spat displaying better survival.

All the research results obtained converge towards the hypothesis that a new variant of herpes virus OsHV-1, either alone or in synergy with vibrios, is responsible for these excess mortality episodes. The virulence of the new variant seems to be linked to the age and/or size of spat when seeded, on environmental factors like temperatures rising rapidly over a few days and reaching the critical threshold of 16°-17°C, and immunological and physiological factors (presence of genes related to better survival capabilities). The way the animals

Oyster bags on La Tremblade channel

Various techniques to obtain high quality pearls (French Polynesia)

have been reared (origin, early and/or late date of collection, survival in the year N of collection, density of rearing in bags, bathymetry, periods when transferred, etc.) seem to modulate the excess mortalities. A proposal for a crisis recovery strategy in 2010 has been presented. It is based on the that fact that different mortality rates have been observed between the families selected as "Resistant" and "Sensitive" by setting up a 2010 protection plan for seeding using Resistant spat. The plan is currently being carried out with the involvement of Ifremer, SRCs and the CNC.

Moving towards implementing a recovery strategy

Following the conferences on "excess mortality in cupped oyster juveniles" devoted to outcomes in 2008 and 2009 which were organised by Ifremer and with the participation of universities and technical centres, our Institute suggested that a specific research project be created for 2010-2012 to support the shellfish farming supply chain.

This cross-cutting multidisciplinary project gathers all stakeholders in the shellfish farming sector, from scientists (Ifremer and universities), technical centres, professional organisations (SRCs and CNC), to the DPMA and DGAl. Its mission is to coordinate all the studies on the causes and understanding of excess mortality in cupped oysters spat, to support commercial hatcheries in their national selection programme and to examine the feasibility of directed seeding of "resistant" 2N spat related to this selection. This will rely on five major, high-priority actions whose results will be available at different stages, in the near-, medium- and longer- terms. These actions are as follows:

1. qualifying the hatchery and nursery products: strengthening management measures in a controlled environment to improve safety and security of the spat produced in hatcheries and nurseries (traceability, prophylactics, qualification of animal health and genetics and ploidy rates);

2. characterising the farming sites and natural beds: developing epidemiological field studies to better understand what triggers the mortality events and the parameters which exacerbate the virulence of the new herpes virus strain; characterising the genetics and animal health in wild beds; studying the effectiveness of directed seeding of "resistant" diploid oysters to improved the supply of reared spat.

3. taking inventory of farming practices which favour the choice of juveniles better able to resist the herpes virus variant: drawing up lists of risky practices and recommendations to facilitate crisis

Pearl farming improving grafting techniques

The Pearl farming service and Ifremer's laboratory in Tahiti tested the influence of the level at which graft tissues were cut on Pinctada margaritifera pearl quality. To this end, experimental grafting was done using graft tissue cut at different heights of the mantle's edge. 1,615 oysters were grafted using four levels of cutting. The test confirmed that the height at which graft tissue is cut will more or less influence pearl characteristics, depending on the criteria observed. Thus, slicing at a certain height to include part of the outer fold can optimise most of the characteristics required to obtain quality pearls. Indeed, the closer the graft tissue is cut to the fold, the higher the percentage of high quality pearls. This increases the thickness of the mother of pearl deposits and reduces the number of surface defects. These initial, highly promising results will lead to a new experimental graft designed to confirm and further optimise the choice of the height at which graft tissue is cut, in order to obtain the largest possible number of quality pearls in a harvest. Concurrently, the molecular mechanisms involved in these biomineralisation phenomena are being studied in approaches to explore genes whose expression varies between the different levels of graft tissue cuts.

management; and the social and economic impact of these recommendations depending on the type of enterprises involved.

4. pursuing fundamental research studies in pathology, genetics, physiology and immunology: better understanding of the pathogenesis, virulence of infectious agents depending on environmental parameters and/or the host's biological characteristics; studying the synergy of viruses and vibrios in mortality, selecting broodstock that can produce offspring which are resistant to this variant of the virus; and selection aided by resistance biomarkers.

5. communications: strengthening and developing ties with professionals and the CNC; setting up a collaborative website to centralise all the validated data on the subject and the official documents which can give the stakeholders greater interactivity.

Farming of red drum on Reunion Island

Working groups have been meeting since late February 2010, bringing together scientists from various institutions, technical centres, professional oyster farmers, SRCs, CNC and DPMA and DGAl representatives. Preliminary work has been done to take inventory of actions underway, harmonisation of methodologies and protocols nationwide, pooling of teams and skills, defining the role of various stakeholders, the need for additional scientific support and the status of actions to be undertaken.

Fish farming: rearing of bluefin tuna progressing

One of the stakes for sustainable development

Two European research consortia, Selfdott which Ifremer is a partner in, and Allotuna, succeeded in controlling Atlantic bluefin tuna reproduction (*Thunnus thynnus*) in captivity. Obtaining viable eggs from captive bluefin tuna is the first and extremely important step in domesticating this species and developing a sustainable aquaculture industry kept separate from wild populations. The medium-term objective is to succeed in rearing bluefin tuna larvae and producing juveniles. In the frame of Selfdott, comparisons are made between three larval rearing principles: the mesocosm (in Greece), pseudo green water (in Spain and Malta) and closed loop clear water (in France) techniques. Bonito (*Sarda sarda*), which breeds a month and a half before tuna and whose larval development is similar, is also being studied.

Promising progress

The clear water rearing technique developed by Ifremer and used for seabass (*Dicentrarchus labrax*), turbot (*Scophtalmus maximus*), red drum (*Splataciaenops ocellatus*) and batfish (*Platax orbicularis*) had never been adapted to bluefin tuna (*Thunnus thynnus*) or bonito (*Sarda sarda*). These two species are very fragile in the larval phase, and show a high mortality rate between the third and fourth day after hatching, particularly due to individuals coming to the surface to fill their swim bladder. This rising to the surface is essential for rearing performance and requires controlled hydrodynamics and lighting conditions and a clean water-air interface. A second series of trials undertaken at Palavas on bonito enabled a rate of swim bladder inflation of nearly 70% to be obtained, which means that larval rearing of bonito in clear water could be envisaged in the long term. However, in spite of 140 million eggs being produced, the first trials on bluefin tuna have not yet reached this result, which must be confirmed and optimised.

Consumption: towards bio-preservation of seafood.

Seafood products have high nutritional value and their consumption has grown over the past few decades. However, these products are fragile in microbiological terms, which limits marketing of the "fresh seafood' range. The Imibiomer project is studying the impact of microbial interactions on food safety and quality, aiming to deliver the knowledge and tools needed to study microbial ecosystems of cooked tropical shrimp and fresh salmon. This project is testing an innovative method called biopreservation which can extend the preservation use-by-date. The technique proposed consists in seeding the food with flora selected for its ability to inhibit the development of spoilage or pathogenic flora.

New analytical techniques

Studies on shrimp showed a majority of lactic bacteria, mainly from the *Carnobacterium*, *Enterococcus* and *Lactococcus* genera. In addition, a new species of the Vagococcus (*Vagococcus penaei*) genus was shown up for the first time in a processed seafood product.

Harvesting Litopenaeus stylirostris *shrimp*

A molecular fingerprinting method (PCR-TTGE) developed with the Agro-industrial technical institute (Adria) and the National teaching and research institute in food science and technology (Enitiaa enabled the monitoring of microbiota dynamics during the storage period. Significant changes in composition were observed, depending on the temperatures at which they were stored. A database of molecular fingerprints was created and will be used for presumptive identification of flora profiles obtained from new seafood matrices.

Industrial development for enhanced use of bacterial strains

Three bacterial strains with anti-listeria activity in seafood products were developed through an agreement for transfer of material combined with a licensing option with the Sacco company which produces lactic ferments. This action was carried out by Ifremer in partnership with the Marine biomass science and technology laboratory (STBM), Enitiaa and Sacco.

DEEP SEA RESOURCES AND ECOSYSTEMS

Knowing and sustainably exploiting the seafloors

Ifremer's programme on the deep seafloors aims to learn more about their mineral and energy resources, while taking part in furthering understanding and conservation of their ecosystems for responsible exploitation. Thanks to numerous partnerships with public- and private-sector organisations, the programme has reached its four-year objectives.

Great progress has been made in the frame of the Carnot Ifremer-Edrome institute, devoted to exploration and the sustainable exploitation of mineral and energy resources in the ocean. In compliance with the ANR's request, its activity report was submitted to the public authorities in September 2009. In particular, it reports that the Institute, which received the Ifremer label four years ago, has reached its objectives of strongly

increasing revenues from research in partnership with industrial firms, of signing new framework agreements with socio-economic stakeholders and putting the additional amount researchers receive (in return for results achieved) towards actions for scientific resourcing. The Edrome institute, which was one of the first Carnot institutes to receive the label, will keep it for an extra year. A request for renewal with a possible extension should be made during the year 2010, in accordance with the procedures which will be specified by the ANR.

Partners like Total, Petrobras and Sonatrach have joined the Institute in carrying out research for fossil fuel resources. In addition, Ifremer began to make contacts which are now well underway with industrial firms interested in exploiting deep sea mineral resources, which offer some very short-term perspectives. As regards environmental studies which particularly aim for better knowledge about the biodiversity of deep seafloors, Ifremer has perfected a number of innovations in the field of culturing microorganisms. Technological developments have enabled scientific tools like seabed observatories to be developed, providing vast perspectives. Finally, in 2009, Ifremer was highly involved in projects for demonstrators and in the national partnership-based Initiative for emerging marine energy sources Ipanema (see text box on the marine renewable energy platform).

Exploring a Mediterranean margin

Franco-Algerian cooperation

The multiannual, partnership-based research programme called Spiral aims to study the deep structure (at sea and land) of the North Algerian margin using seismic methods. It is conducted in the frame of an agreement between the partners representing France (Ifremer, CNRS, UBO, IRD and Sophia-Antipolis university) and Algeria (Sonatrach, Centre of astronomy, astrophysics and geophysics research, the General directorate of Scientific Research and Technological Development of the Ministry of Higher Education and Scientific Research). The programme is the outcome of the will to strengthen collaboration between partners on both sides, and has two parts: acquisition of data on the deep geological structure of the North Algerian margin (to depths of 30 km) and exchanges of scientists between the research centres associated with the project.

Evaluating potential oil resources

Data acquisition will make it possible to assess the oil potential of the Algerian margin as well as the seismic hazard in northern Algeria which is a highly sensitive zone. Bringing together Algerian and French researchers and scientists from top-ranking universities and centres for the first time, this programme will also include exchanges of expertise between the partner research centres. This will lead to co-supervised PhD theses and joint scientific publications and communications.

2009 Golodrill cruise (Eastern Corsica)

An ocean-drilling mission in the Mediterranean

A partnership-based research contract in marine sedimentology (Golo) was signed by Ifremer and the ExxonMobil, Total, Fugro and Golodrill companies. The Fugro firm became a partner in 2009 and has provided 100% funding for a drilling cruise which was coordinated in autumn by Ifremer. It was conducted offshore from Bastia aboard the drilling vessel SRV Bavenit (Fugro company), and enabled five boreholes ranging from 60 to 125 metres in length to be drilled in the catchment area of the Golo river (East-Corsica) and more than 450 metres of sedimentary core samples to be obtained. Ifremer, now a partner with the ExxonMobil Corporation, is thus contributing to in-depth knowledge about sedimentary systems in the deep sea production source area which is where they are deposited. Furthermore, by making it possible to explore the effects of previous climate periods on natural environments, the Golo study can draw analogies of geological reservoirs. The initial results already show that we have more than 500,000 years of continuous paleoclimate recordings.

Black, orange and white corals (Médéco cruise)

Prospecting for mining resources

Investigations re-launched by public authorities

On grounds of geopolitical and strategic changes observed worldwide concerning mineral raw material supplies, in 2009 the MEEDDM proposed that research on mineral resources be re-launched. These investigations, carried out on both land and in the deep sea, are of definite interest for BRGM (on land) and Ifremer (seafloors). One of the effects of this expectation from public authorities is the revival of metallogenetics (study of the mechanism of metal-bearing deposits, in order to define methodological tools and guides for prospection which can be used by mining explorers and prospectors), a discipline which has been neglected in France for the past twenty-five years. Training courses are being set up in theme-based or specialised schools (ENAG).

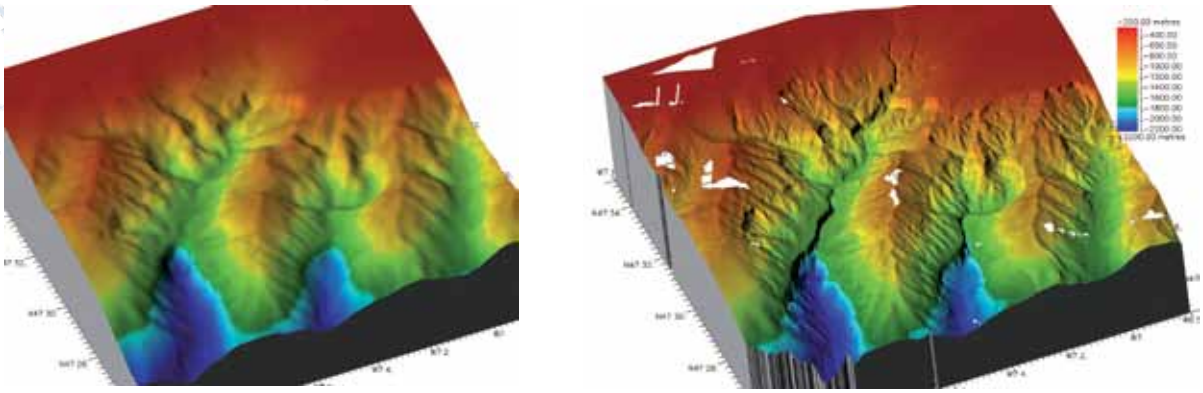
National think tank on resources

In 2009, Ifremer launched a national level think tank on mineral resources in the deep sea. Discussions were also engaged, involving the MEEDDM, Technip and the Areva and Eramet groups, to set up a public-private sector partnership to explore subsea sulphur-containing deposits. One of its objectives is to locate hydrothermal deposits in the French EEZ, particularly around the island of Futuna. The proposed approach will include a biological baseline assessment and identification of mineralised areas.

Studying deep ecosystems

Four zones of observation

Ifremer was one of the forty-one European institutional partners in the Hermes project designed to study hotspot ecosystems on the margins of European seas. It lasted for four years (2005-2009) and enabled four zones to be explored, all of them involving large scale actions at sea: the Nordic margin (Vicking cruise, 2006), the Var canyon (Envar cruises, 2005-2007), deep sea coral reefs off Sicily, East Mediterranean mud volcanoes and the Nile delta (Medeco cruise, autumn 2007). Data acquired will continue to be exploited, in collaboration with European partners in the form of publications, as well as in the Hermione project launched



Improved bathymetry of the echosounders of RV L'Atalante *(left) and* Pourquoi pas? *(right)*
Same sector of the Bay of Biscay margin

in April 2009. This project will add the Azores as a fifth geographical zone and this time will focus on the concepts of governance and conservation of marine ecosystems.

Knowing and protecting cold water corals

Cold-water coral, which do not have zooxanthelles, develop on continental margins and seamounts in waters where the temperature ranges from 4° to 13°C. Over the very long term, they can form reef formations or large sized carbonate mounds. These rich, diversified habitats are particularly vulnerable to deep sea fisheries impacts and the acidification of oceans and have been the object of intense attention and protection measures in recent years. In the Bay of Biscay, the presence of these coral reefs was indicated last century but they have hardly been studied at all. In 2009, in the frame of the European Coralfish project set up to study the relations between cold-water coral reefs, fish and fisheries, exploratory surveys were conducted by Ifremer, with support from MEEDDM and the AAMP. The CE0908 cruise, carried out with a ROV in collaboration with the University of Galway (Ireland), also discovered reefs in the Le Guilvinec and Le Croisic canyons (Brittany) at depths between 600 and 1,100 metres, as well as cliffs which were even deeper. In addition, the BobGeo cruise conducted aboard RV *Pourquoi pas?* used multibeam echosounders to perform high resolution mapping of thirty-four canyons (a quarter of the margin). Using the towed Scampi camera on the BobGeo1 and Evhoe 2009 cruises complemented the observations in five canyons and enabled two new reefs to be discovered. The impacts of fishing activities were highlighted in several canyons. In the zone comprised between 200 and 500-600 metres in depth, until now, no coral massifs have been observed, only coral debris found.

A deep ocean observatory infrastructure

Bringing together institutions, people, tools and know-how about deep seabed observatories, the European Esonet network of seafloor observatories was launched in 2007. It aims to promote the application and management of a multidisciplinary network of ocean observatories around Europe, with the ultimate goal of defining sustainable solutions through a joint activity programme. An observatory is composed of a deep sea station linking various underwater sensors to the coast using acoustics or cable in real time or near-real time. The objective is to acquire data on oceanological and climatological phenomena at very frequent intervals. In 2009, the phase to demonstrate the multidisciplinary seabed observatories capabilities was pursued. Ifremer is developing technologies involved in deployments over long periods at this time.

Methane emissions analysis

This demonstration mission (Loome) is conducted on the Håkon Mosby mud volcano, one of the main methane seeps on the European margin. The site harbours a cold-seep ecosystem at a depth of 1,250 m, in the south-western Barents Sea, in Norway. These eruptions, which produce large gas emissions, sharp changes in temperature (about 10°C in a few days) and modifications in the volcano's morphology, are still poorly known due to the lack of continuous monitoring. An instrument array was deployed around the volcano's active zone in order to measure a number of parameters (temperature chains, chemical sensors for pH, dissolved oxygen and redox potential) in and on the seafloor (below and on its surface) and in the water column (turbidity, pressure, salinity, DO and methane bubble fluxes).

Marmara seismic fault: under close watch

The region of Istanbul, where fifteen million people live, is seriously threatened by a deep fault located in the Sea of Marmara, connecting the Mediterranean to the Black Sea. This fault, which is deforming at a rate of 20 millimetres per year, makes this one of the most exposed seismic sites in Europe. A demonstration mission is currently setting up continuous monitoring to allow the spatial and temporal relationships between fluid expulsions, their chemistry and seismic activity to be understood. It is paired with a feasibility study, with a view to creating a permanent communications array integrated into the geological hazard monitoring system. Thanks

Plunging to great depths: a European network of observatories (Esonet and EMSO)

The European Sea Floor Observatory Network (Esonet) was launched in 2007 to promote the application and management of a multidisciplinary network of ocean observatories around Europe, whose ultimate goal is to define lasting solutions through a joint programme. An Esonet observatory is made up of a deep sea station connecting various underwater sensors to the coast via acoustics or cable, providing data acquisition on oceanological and climatological phenomena.

Esonet is a Network of Excellence (NoE) co-funded by the European Commission in the Framework Programme FP6 R&D with a grant of 7 million euros for four years (2007-2011) and an estimated total cost of approximately M€50. According to the European Commission's definition, the Esonet network of excellence will overcome the fragmentation of research in Europe in order to unify EU initiatives to implement deep sea observatories. The project currently involves fourteen European countries, plus fifty institutions and SMEs and approximately three hundred scientists, engineers and technicians.

The EMSO project for seabed observatories is in its preparatory phase, which will last until 2011. The project aims to deploy observatories off the European coasts for the continuous, long-term monitoring of the environment and its trends with respect to climate change and geological hazards. It is part of the French and European roadmap in the high priority Esfri category for large European research infrastructures. In 2009, the scope of the French participation in EMSO was defined by an inter-organisation steering committee and firstly concerns three of the eleven EMSO sites, i.e., the Marmara Sea, the Azores and the Ligurian Sea. The EMSO project is also a candidate for recognition as an experimentation and observation system over the long term for environmental research.

to the AUV *Aster*^{x} marine observation vehicle, the Marmesonet cruised conducted aboard RV *Suroît* enabled seabed mapping and the use of two very special seismic seafloor observation devices: the "Ocean Bottom Seismometer" (OBS) and the "Bubbles Observatory modules" (BOB). The latter is a new apparatus designed by Ifremer enabling gas bubble fluxes from the seabed to be monitored.

Marine renewable energy sources, after forward-studies work comes action

An initiative engaged following Ifremer's prospective studies on 4 subjects in 2008, the national partnership-based initiative for the emergence of marine energies (Ipanema) has been designed to create networking of stakeholders in the sector and propose a roadmap for the development of marine renewable energies. Working with Ademe, Ifremer acted as general rapporteur. The founding members have been joined by more than one hundred institutional, industrial and scientific organisations. The Minister of State Jean-Louis Borloo, who is Minister of Energy, Ecology, Sustainable Development and the Sea, signed the agreement on 8 June 2009 at the Ifremer centre in Brittany. All of the work organised within six theme-based groups, was used to produce a progress report in November 2009 which already contained proposals, keeping notably to the frame of recommendations from the Grenelle marine summit meetings. They concern the way research is structured, training, implementation and management of trial sites, the tools needed to produce demonstrators and the industrial supply chain, as well as financial aspects. Lastly, the report put forward proposals for the missions of the renewable marine energies technological platform, whose setting up and coordination were entrusted to Ifremer in July 2009 by the President of France. A final report was published in the first quarter of 2010. A think tank is working on perpetuating Ipanema and making full use of it within this new platform.

Marine renewable energy technologies platform

In early 2010, Yann-Hervé de Roeck was appointed project leader for the technological platform on renewable marine energies. Behind the creation of this new structure lies the will expressed at the highest State levels in June 2009 to enable France to become a leader in the field of low carbon energy production, particularly thanks to a technological platform on marine energies located in Brest and which Ifremer has been given responsibility for. By associating the public- and private sector partners concerned who can pool all possible resources it aims to speed up the development of various possible supply chains for marine energy generation.

THE OCEANS AND HEALTH

Reducing and anticipating health hazards

The "Ocean and health" programme coordinates activities which concern microbiological and chemical health hazards, predicting toxic algal events and developing sensors, measurement and sampling methods and systems. It mainly works on studies concerning upstream developments for monitoring.

Guaranteeing that shellfish are safe to eat

Meticulous monitoring

During the past ten years, the consumption of shellfish accounted for approximately 4% of food poisoning and infections, taking all foods into account. Since 2003, inspection and monitoring of bacteria and viruses in bivalve molluscs in France comes under the responsibility of Ifremer's Atlantic centre based in Nantes. It has been designated as a National Reference Laboratory (NRL) by the Ministry of Food, Agriculture and Fisheries, with the mission of guaranteeing the application of national and European health rules in each country and in its field of expertise. With this aim, the Shellfish microbiology NRL coordinates the laboratories at Ifremer, approved county laboratories and the veterinary laboratories in charge of bacteriological (*Escherichia coli* and Vibrios) and viral (Norovirus and hepatitis A virus) analyses. The risks of contamination are checked and controlled from the production of shellfish to their marketing. Each year in France, from three hundred to six hundred analyses for viruses are performed, upon the request of the Shellfish health administration. This involves meticulous health hazard monitoring with Ifremer working on several levels:

- checking that Rémi procedures are implemented, with quality assurance, at the production and harvesting phases;
- providing the administration with scientific and technical support in drafting regulations or standards of national, European or international scope;
- performing analyses of samples for confirmation or expert assessments;
- monitoring episodes of food poisoning and food infections working in collaboration with the InVS and the Food health safety sub-division (DGAL);
- analysing samples, either supplied by the administration or upon its request, which have had or could have impacts on public health;
- crisis management;
- collecting and managing national and European data related to health alerts.

Better compliance with current requirements

In 2009, the NRL opened a new building designed to meet the new requirements and current Cofrac standards for regulatory criteria (*Escherichia coli* and *Salmonella* spp) and enable inter-laboratory aptitude trials to be organised on the basis of these parameters. The new premises now make it possible to:
- participate in developing new rapid analysis methods, particularly in collaboration with the network of European NRLs and the Community reference laboratory (CRL) at Cefas (United Kingdom);
- guarantee high quality of analyses through the technical coordination of the network of approved county laboratories and organising comparative inter-laboratory trials;
- better understand the contamination/decontamination of bivalve molluscs.

Within this same objective of complying with regulatory changes and meeting increasing requests from the administration, the NRL has set up a new organisation associating three units: virology, environmental microbiology and official inspection methods.

Studies recognised by the scientific community

Results from research at the NRL were recently taken into account in planned European standards in methods to detect hepatitis A virus and noroviruses, as well as to detect potentially pathogenic Vibrio using real-time PCR. Moreover, the CRL ruled favourably on studies (EN ISO 16140) to validate the impedance measurement rapid method developed by Ifremer for enumeration of *Escherichia coli* bacteria in shellfish and its use for official inspections.

Preventing food poisoning

In order to feed, shellfish like mussels, clams and oysters filter the water, ingesting phytoplankton microalgae in particular. Some species of the latter synthesise toxins which are harmful to humans. Since the proliferation, or blooms, of toxin-producing microalgae species cannot be controlled, it is impossible to avoid contamination of shellfish. In order to prevent consumers from being exposed to these toxins, constant monitoring and in-depth studies are devoted to them.

Identifying toxic species

The toxic plankton algae species are currently being study by Ifremer in the context of plankton biodiversity, done in collaboration with MNHN. The study is carried out at Concarneau, and developed in the framework of a State-region plan contract, with funding from the Finistère county council. Its main objective is to identify the still poorly known benthic dinoflagellates and to perfect tools with the ability to anticipate toxic invasions. Population models that can be used to predict toxic events are being developed for the three main groups of known species, i.e., species with winter cysts, species which are sensitive to agitation and rare species like Dinophysis, which are behind the majority of bans on marketing in France. In June 2009, these models were discussed at an international forum organised in Galway under the "Global Ecology and Oceanography of Harmful Algal Blooms" (IOC-SCOR Geohab) programme. A scheme to forecast toxic events in the Arcachon bay is also currently the subject of a thesis which is co-financed by the Aquitaine regional council.

Perfecting a biological sensor

Ifremer tested and validated the functioning of a biosensor (biological material sensor) based on plasmon surface spectroscopy (surface plasmon resonance) during an ocean research cruise. The surface plasmon is a wave which decreases exponentially on either side of an interface separating a metal from a no-loss dielectric medium (for instance, a biological medium). The plasmon wave acts as a probe in the environment where the biomolecular reaction takes place.

The objective was to perform a qualification of its operation at different depths, from 0 to 40 m. Ifremer thus detected domoic acid at concentrations around 0.1 ppb. Domoic acid is a phycotoxin which causes a form of food poisoning. In humans, it acts as a neurotoxin which can cause short term memory loss, brain damage and even death in severe cases.

These studies are continuing in the framework of international cooperation with NOAA (United States) with the aim of developing an operational system ultimately able to routinely detect toxins in the natural environment. To that end, a patent for an "optode for an optical transducer" (detectors working as transducers between the analyte to be measured and an optical fibre) was filed in March 2009 (n° 09 51 751).

Strong international involvement

Prepared by Patrick Lassus, a biologist specialised in microbiology and phycotoxinology, the seventh International Conference on Molluscan Shellfish Safety (ICMSS) was a great success. It was held on 14 June in Nantes, attracting more than two hundred fifty participants hailing from thirty countries and gave rise to seventy-two papers presented, twenty-five scientific poster presentations and forty-two communications. The conference is exclusively devoted to shellfish safety and has become one of the most important fora for scientists, hygienists, shellfish producers and regulatory bodies, devoted to these issues.

Shellfish contamination: tracking marine biotoxins

Phycotoxins or marine biotoxins are produced by phytoplankton microalgae and consumed by molluscan shellfish which ingest them by filtering the water. However, some microalgae species synthesise toxins which are harmful to humans and some animals. Once the contamination of the shellfish reaches a certain threshold, which varies depending on the type of toxin, eating them can create health hazards for the consumer. Approximately seventy species of microalgae are capable of producing phycotoxins. Several families of known toxins which have been well characterised can be counted, along with emerging toxins (recently arrived on our coasts, or not yet characterised). A large number of different toxins can be present in molluscan shellfish. They are currently classified in terms of their chemical nature and divided into nine families.

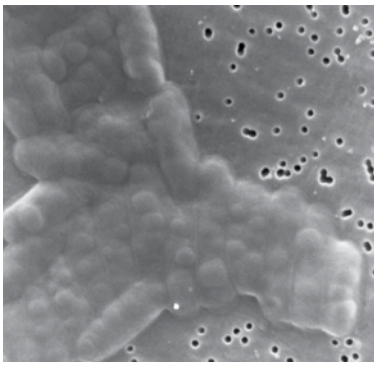
BIOPROSPECTING AND ENHANCED USE OF BIOLOGICAL RESOURCES

Marine microorganisms: a huge reservoir of new molecules

The diversity of marine environments and habitats is reflected by the very great diversity of organisms and their metabolites. For this reason, the marine environment holds immense potential in terms of novel molecules of interest for biotechnologies. Microorganisms (bacteria and microalgae) have often escaped notice, but the significant progress made in molecular biology now makes it possible to study and utilise new aspects of marine life. Although hitherto were overlooked due to technical reasons, the exploration and use of these marine microorganisms will be the next major step in our knowledge and utilisation of this biodiversity. The progress will go through a step of taking inventory with molecular biology and genomic analysis tools. This unknown and unexploited resource could well be the main source of new molecules in coming decades. One of the major stakes for research will thus revolve around developing methods to identify, characterise and analyse the non-cultivable fraction, i.e., bacteria, and the corresponding genetic resources.

Marine biotechnologies: a solution for the environment?

Creating supervisory instruments (European directives on water and on biocides, the Reach directive system to record, assess, authorise and restrict chemical substances, aiming to improve protection of human health and the environment while keeping Europe's chemical industry competitive, and so on), launching general think tanks (Grenelle forum on the Environment, Grenelle forum on the Sea, etc.), bringing of specific issues to the fore (CO_2 release, exploiting fossil fuels, etc.), and the rising awareness of society all lead to examining how marine biotechnologies can help protect the environment. Environmental biotechnologies are now the focal point for research projects on biopolymers, including exopolysaccharides and biodegradable polyesters.



Observation of bacterial cells using scanning electron microscope

An alternative to plastic

Biodegradable polyesters produced by bacteria, from renewable resources, could be an alternative to using synthetic polymers made by petrochemistry. Research underway on biodegradable multilayer films, used in the food sector, is aiming to identify the producer microorganisms and fabricate biopolymers in the laboratory whose efficiency is equivalent to that of synthetic polymers. These biopolymers may also have applications in the field of medicine. Indeed, the possibility of controlling their biodegradation properties upstream, along with their acknowledged biocompatibility (a biomaterial is biocompatible when it can do its job without any adverse effect on the environment it is supposed to function in), make them a source of interest in the framework of administrating active ingredients either orally or by injection, or as biomaterials. Research is also continuing

Biodegradable polyester film produced by marine bacteria

on their use in cosmetics or in the packaging field.

Towards ecological and medical applications

Exopolysaccharides are also of interest for the environmental biotechnologies sector. In the oil mining field, they could meet the rheological (study of the deformation and flow of matter under the effect of an applied constraint) and thermal stability criteria required in deep drilling. Moreover, the ability of these biopolymers to prevent the formation of biofilms and macrofouling could lead to applications in hospital settings (enabling nosocomial infections to be combated), in the agrifood sector or in designing antifouling coatings. Exopolysaccharides could also be used in the context of eliminating heavy metals in the environment (bioremediation) and in treating industrial effluents.

Bioremediation is now recognised as a complementary action which is essential for the chemical and physical pathways in the environment. The process can be carried out by the bacterial compartment. Bioremediation is not just for hydrocarbons, but for any biological type of action engendered by macro- and microorganisms aiming to transform, degrade or eliminate any organic or inorganic molecule which is toxic for the environment.

All these avenues of utilisation are now undergoing specific study, generally conducted in collaboration with the industrial sectors involved. Finally, because of their wide range of structures, exopolysaccharides are of interest for the field of health. Current studies are seeking to confirm this potential in the context of tissue regeneration, but also concern cancerology or oncology, and cardiology.

Innovative processes of depolymerisation

In order to strengthen the market for bioactive exopolysaccharides, innovative processes to modify and depolymerise polysaccharides using physical (mechanical grinding) or enzyme-based methods must be developed, along with discovery and use of new enzymes. The objective remains to obtain novel oligosaccharides which could open the way to new applications for these bacterial biopolymers, both in the medical and cosmetic fields. This approach requires both growing the catalogue of polysaccharides that will ensure the diversification of macromolecules' chemical structure and increasing the tools for modification and analysis that are indispensable for the structural characterisation of these new compounds.

Microalgae: new potential to be explored

Microalgae's potential has not been exploited much worldwide, and even less so in France. And yet the potential is huge, with a wide range of fields of study or applications and very high added value, such as new energy sources (with oils, hydrogen and fermentation), health (with pigments, enzymes and secondary metabolites), aquaculture, environment (through understanding the mechanisms of toxinogenesis and pollution abatement tools) and industry (with enhanced uses for silica, enzymes or pigments). Four projects were started by Ifremer in 2009 on enhanced utilisations of microalgae in the fields of medicine and energy.

To energy and environmental ends

In the field of energy, our Institute's research explores the use of oil from microalgae to produce a biofuel and the production of biomass for methanation. These two programmes are studying, in one instance, the way microalgae respond to environmental variations (nutrients, climate) in storing energy (oils), and in the other, the symbiosis of microalgae/bacteria in the natural environment and under controlled conditions. Understanding the mechanisms and the response of algae to the environment will provide a knowledge base for the future and the potential for biotechnological developments in all fields currently reserved for plants grown on land.

Bioreactor used to study algal physiology

Promising use in medicine

An initial study is aiming for the expression of therapeutic recombinant molecules in microalgae, allowing genetic regulatory pathways to be explored. A second study is currently seeking to identify the presence of photosensitive molecules. These photosynthetic plants have novel pigments - unknown of on land - and mechanisms of response to radiation which make them highly interesting sources in the framework of photodynamic therapy. This medical treatment designed to treat certain types of cancer combines laser rays of a specific wavelength with oxygen and a light-sensitive medicine in order to destroy cancer cells.

Conserving strains of microalgae

TOOLS TO STUDY AND PROTECT COASTAL SEAS

Managing and protecting coastal zones

Marine strategy framework directive

The EU Marine Strategy framework directive, adopted in 2008, is the major environmental component of the European Union's maritime policy. Its aim is to achieve the good ecological status of European seas by 2020, by setting the framework for sustainable conservation of ecosystems and of their capacity to render the services expected of them to society.

Assessing the ecological status of the seas

The MSFD requires Member States to produce an initial assessment (baseline) by July 2012 for the marine environment, along with the description of good ecological status of the seas and the environmental targets needed to achieve or maintain this status. Part of a very ambitious approach, this directive encompasses marine waters from the shore to offshore and covers a vast range of themes: physics-chemistry, biodiversity, marine resources, eutrophication, ha-

bitats, chemical contamination, solid waste and noise pollution.

A strong contribution from Ifremer

In 2009, Ifremer took part in the ramping up of the directive's implementation, in support capacity to MEEDDM. In France and Europe, researchers from the Institute took part in seven of the ten expert working groups set up to meet the imperatives of an integrated, ecosystem-based approach and to propose the indicators, criteria and methodological standards required to define good ecological status. Our Institute also contributed to studies on information and data exchanges with the European Commission (DIKE: Data, Information and Knowledge Exchange group) and supplied ministries with information for the possible breaking down of the directive into marine sub-regions (English Channel, Bay of Biscay and Western Mediterranean). Nationwide, the MEEDDM entrusted Ifremer with coordinating the assessment of the current ecological status and defining good ecological status in the frame of an organisation bringing together stakeholders from research, including MNHN, CNRS, SHOM, AAMP, BRGM, Afssa and universities, as well as a series of contributors with targeted skills and expertise in the theme-based fields to be covered. Ifremer is also taking part in the initial assessment coordinated by the AAMP, designed to measure the pressures and impacts of human activities on the environment, along with the socio-economic aspects and the costs of their deterioration. With this perspective, an in-house census of existing information was performed. Finally, Ifremer made its contribution to the "Quality Status Report 2010" established in the framework of the Ospar convention (North East Atlantic's state of health for the period from 1997-2006).

An opportunity for scientific progress

Although putting the MSFD into application represents a true challenge, it also offers the opportunity to integrate and make enhanced use of knowledge and data about marine ecosystems acquired and databased by Ifremer. It also spurs marine research, which must now mobilise its forces to move towards understanding the relationships between pressure exerted on the environment and the status of ecosystems. Lastly, it promotes the definition of relevant and usable indicators to monitor their trends.

Ifremer, SINP project manager

Ifremer contributes to the marine-SINP project as the main contractor of the IT system and in supplying its scientific expertise on marine biodiversity indicators and on benthic habitats. This work is carried out under the aegis of the MEEDDM, in partnership with the AAMP and MNHN. The studies conducted in 2009 made it possible to draw up the system specifications, create a model and define system architecture prioritizing the adaptation and interoperability of existing databases like Quadrige² and Sextant at Ifremer or the INPN at MNHN. The system's design takes account of the need to open the SINP to those producing and using data from a range of sources (State services, research bodies, universities and NGOs).

"Nature and landscapes information system" (marine strand)

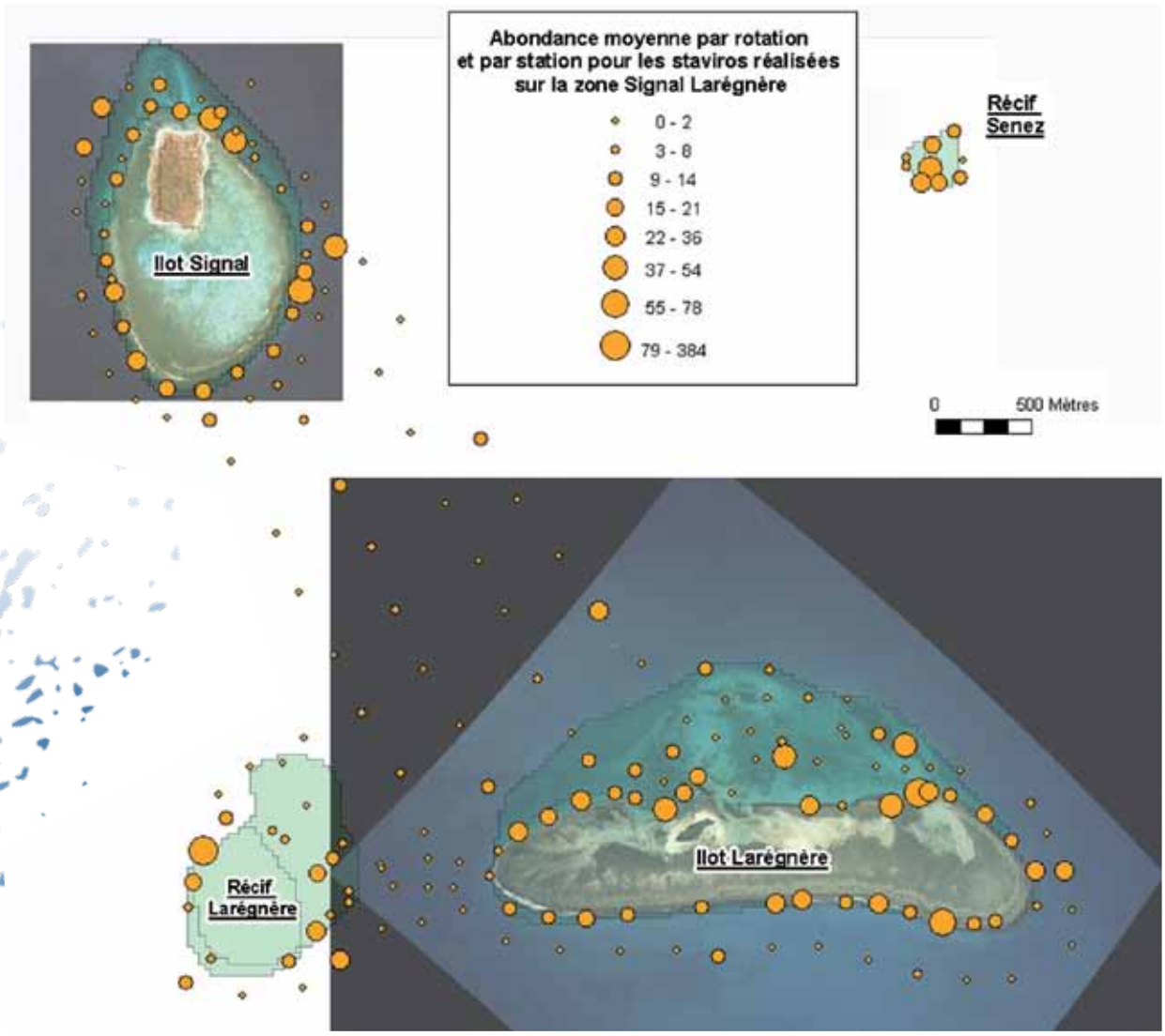
In order to fulfil the commitments of the Convention on Biological Diversity adopted in 1992 at the Rio Earth Summit (whose three main goals are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources), France launched a nationwide strategy which led to setting up a National biodiversity observatory with a information technology tool called the Information system on nature and landscapes (SINP). This is a national structure operated by the MEEDDM to inventory and gather the observation systems concerning nature and French landscapes. This information system fits into the policy aiming for better scientific knowledge and better management of biodiversity in France. The Marine strand of the SINP should provide databasing and single-portal access to historical and current data on the biodiversity of French marine waters.

Performance indicators for marine protected areas

The Pampa project was set up to test and validate a series of performance indicators for marine protected areas for the management of coastal ecosystems and their uses. Currently at its midway point, the project's output is already considerable, as confirmed by the forty partners (scientists and MPA managers, the French coral reef initiative, etc.) who gathered in Marseilles in November 2009.

Creating tools and field studies

The principal work carried out over the year was to create tools for data management and computation, as well as a large part of data collection. These data include surveys of fisheries and recreational boating in the Noumea lagoon and underwater video surveys on the site. Three thesis studies, co-funded by Ifremer or the New Caledonian ZoNéCo programme (whose objective is to collect the information required to inventory, utilise and manage mineral and living resources in the EEZ of New Caledonia and make this data accessible) are currently being developed in the frame of the Pampa project. Two of them are based on using the ISIS-Fish modelling tool, producing indicators of the dynamics of fisheries managed



200 stations in the Larégnère and Signal reserve in the Southern Province (New Caledonia)

thanks to setting up marine protected areas. Hosted by the Côte Bleue marine park, the third aims to compare several performance indicators for MPAs on this site.

Assessing biodiversity in images

An exploratory cruise in the Southwest lagoon of New Caledonia tested the operational interest of video techniques (automatic rotating HD video system) in order to assess the biodiversity and the resources of reefs and lagoons. This was organised in June and July 2009 in protected (Signal islets, Larégnère islet, Aboré reef) and unprotected zones, and also validated the biodiversity indicators developed in the frame of the Liteau/Ifrecor Pampa and ANR Gaius project and tested the protocols for reliable estimations of these indicators in routine monitoring. The number and quality of images will enable habitats and macrofauna to be characterised, caught species to be identified and the presence and density of remarkable species (turtles, shark, rays, humphead wrasse, snakes, etc.) in these zones. In technical terms, the automated rotating HD video system has numerous advantages. It is simple to deploy, provides matchless spatial coverage, avoids the need to use divers who are experts in identifying species, avoids the bias inherent to human observations and facilitates the archiving and replaying of images. This system is covered by a patent filed jointly by Ifremer, IRD and Adecal. The University of New Caledonia is a partner in these studies.

Developing sustainable management solutions

The Spicosa project aims to produce tools to help in sustainable management of coastal areas. It is intended to support or create methods which can solve problems of coastal zone exploitation, by fostering the participation of those involved. Integrating knowledge into a systemic rationale and developing numerical models make it possible to explore the conditions and potential consequences of alternative management options.

In 2009, Ifremer focused its efforts on two sites (Pertuis charentais and Thau lagoon) where catchment management strategies have a determining effect on the quality of coastal waters and shellfish

farming activities. A simulation platform for each of these sites has been built using the ExtendSim® software program. Aiming for optimal efficiency and legibility, these studies have led to:
- creating special software showing the key processes taken into account;
- integrating a database which, in particular, lets complex scenarios be managed and results analysed;
- developing tools which can display the simulation of putting an alternative management option into place;
- building a user interface which makes the representation of the system and its interactions comprehensible and provides easy access to the commands of the simulation platform.

Encouraging experience-sharing

In 2009, Ifremer was strongly involved in the French coastal research network (RFRC). As such, it took part in organising a "spring school" session (from 11 to 15 May) entitled "the coast, between climate change, new uses of resources and new territories. How should we organise and take decisions? What knowledge is needed for this?". The objective of these days of discussions was to promote the meeting up of coastal managers, particularly scientists, in an unconventional context. They provided an opportunity to share a wealth of experience and knowledge about the steps and procedures, study and regulatory instruments, possible practices and ways of organising, in order to manage coastal zone issues. The event was held in collaboration with the Brittany regional council, Cetmef and the greater Lorient urban council, in the framework of the Week for the sea and coast in Brittany. Three themes were addressed: the challenges of cohabitation between uses of the sea, planning tools and instruments confronted with coastal territorial stakes, erosion and climate change.

Micado HD autonomous rotating observation station

SCIENTIFIC EXPERTISE

Enlightening public policies

During the year 2009, Ifremer's function and role as scientific expert grew increasingly intense. New missions were added to our Institute's usual, recurring tasks and actions, particularly in the frame of the Grenelle maritime forum.

Maritime policy: decisive studies

The amount of activity devoted to providing support for public policies represented 346 FTE. This figure covers the acquisition of coastal and offshore fisheries data in response to public-sector orders; maintenance of the tools used to qualify, manage, disseminate and exploit these data; drawing up approximately three hundred expert assessments referred by central or regional services of the State (DPMA, DGAL, etc.) or its operators (Afssa, Onema, etc.), which represent 10% of the total for the activity. Some of these expert assessments were determining factors in the implementing of decisions or solutions for the various current issues related to maritime policy in the broad sense of the term. In this way, Ifremer's work contributed to:

- France's obtaining extensions of its continental shelf in the Atlantic (Extraplac),
- comparative diagnosis of fisheries resources and fleet capacities for the fisheries conference meetings in order to prepare the review of the Common Fisheries Policy (CFP),
- assessment of the risk related to discharges of arsenic-containing compounds in a shellfish farming area by an alginate-producing industrial plant,
- acceptability of the impact on the benthic environment of the underwater stream turbine demonstrator planned by EDF off the Isle of Bréhat.

Marine resources: health-related "diagnostic" support

The year 2009 was marked by a greater number of cases referred from the DPMA (thirty-one in all), for stock diagnoses and regulatory tools (individual transferable quotas, blue contracts), and referrals from the DGAL in the health field, whether it be for viral hazards (twenty-five referrals) or for renegotiation of salubrity criteria and tests with respect to toxin-related hazards (advice given on nine cases). In terms of health monitoring in oyster farm stocks, demand from State services was very strong for expert assessments from the community reference laboratory in La Tremblade (over one hundred and thirty reports) to find both the pathogens for which reporting is compulsory and the OSHV1 virus in oysters experiencing a wave of mortality from March to October. The laboratory's recognition as a NRL was published in the Official journal in early 2010.

Coastal planning: determining opinions

For coastal planning and development, requests for scientific advice mostly concerned dredging in harbours, since the sensitivity of those living nearby often leads the contracting manager to implement both *a priori* and *a posteriori* (impact monitoring) inspection provisions which are specific to the sites in question, above and beyond the existing procedures.

Grenelle summits for the environment and the sea: active participation

The Grenelle environmental and marine forum meetings both solicited Ifremer's participation in various working groups and spotlighted its scientific expertise as such in the framework of a charter drawn up by our Institute.

Drawing up the expertise charter

Through the conclusions of its operational "research-expertise" committee (Comop), the Grenelle environmental summit led to drawing up the National expertise charter, in the frame of a mission entrusted to Ifremer's CEO Jean-Yves Perrot by the Minister Valérie Pécresse. The charter was presented on 24 November 2009, after consulting the higher research and technology council, to the Minister of Higher Education and Research, who then proposed it to the relevant authorities in research bodies and universities to be adopted by their Boards of directors in 2010.

The charter, which is meant for universities and research organisations alike, aims to make scientific expert assessment practices more professional and secure, as requests for them grow apace. It should be further specified and complemented by a charter for each organisation depending on the particularities of the environments and circles they work in.

Contribution to the Grenelle maritime summit meetings

Some twenty-five experts from Ifremer (including an Ifremer rapporteur for the state board) took part in the working groups for the Grenelle maritime forum or summit and in the operational committees set up to ensure the implementation of the Grenelle meetings' recommendations. These experts worked in the context of the "five-party dialogue" in the four working groups set up. Sixteen proposal sheets were presented by our Institute with the "impact studies Comop" chaired by Jean-Yves Perrot, and five other committees which are specialised in crucial issues or themes (deep sea fisheries, innovation research, training, ships of the future and macrowaste).

On the deck of RV Pourquoi pas?

ACTIONS TO SUPPORT RESEARCH

Discovering the oceans with Ifremer...

Better dissemination and sharing of scientific information

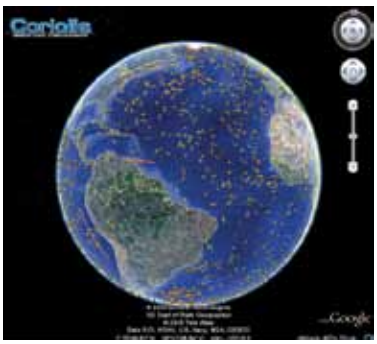
OCEANOGRAPHIC DATA CENTRES

In relation with its supervisory authorities and its main partners, Ifremer is constantly developing the databasing of its marine observations. This is a service which can create a coherent medium at each step in the creation and management of information: transferring data from sea to shore, analysis, checking, archiving and disseminating it.

An international marine database

Observations made at the surface, in the water column, the seafloor or subsea floor, on environmental quality, especially in the coastal environment or on biology and fisheries science are thus archived in secure storage. In addition, they are made accessible to agencies and teams of scientists or technicians to provide enlightenment for public decision-making on European, national and regional scales. They are made available in real time or batch-processed, depending on the circumstances and requirements. Thanks to this databasing, the general public can also access part of the information, especially as provided for by the water framework directive.

Aiming for interoperability and easier integration within national and European systems, Ifremer's services systematically comply with the standards in force: ISO 19115 for metadata (all the technical and descriptive information added to documents to better describe them), Open GIS Consortium for geo-located data and Unidata for numerical fields. Finally, steps for ISO 20000 certification were begun in 2009, by setting up a Configuration Management Database to share knowledge, ensuring availability, reactivity and matching of needs and requirements. This database inventories manual procedures, materials and software which make up the infrastructure of the service, along with their technical dependence links. For instance, reports on over one-hundred fifty new cruises were archived in 2009. Moreover, considerable efforts have been made to format and store the results of fisheries cruises within the Harmonie system. This has made it possible to create a single database holding the observations from CGFS (assessing fisheries resources in the Eastern English Channel) from 1988 to 2006, DYFS (inventory of young demersal fish in the coastal nurseries) from 1978 to 1983, Langolf (*Nephrop* stock estimations in the Bay of Biscay) from 2006 to 2008, Medits (international demersal trawling cruise in the Mediterranean) from 1994



Real-time databasing of data from automated obervatories (shown here, location of Argo floats in December 2009 represented using Google Earth)

to 2008, Evhoe (assessing fisheries resources in Western Europe) from 1997 to 2008 and IBTS (assessing fisheries resources in the Eastern Channel and the North Sea) cruises from 1999 to 2008.

Harmonised information

The European directive Inspire makes it compulsory to draw up catalogues of descriptions which can inform the interested public about archived environmental data.

In the frame of the European SeaDataNet project, a network of forty data centres, Ifremer developed the Mikado software to automatically generate descriptions of metadata from mixed information. Thanks to this, each user can describe cruise reports, observatories, projects and marine data bases and sets. Mikado is considered to be a vital contribution to the standardisation of marine data descriptions and to date over seventy copies have been distributed within SeaDataNet and to several partner projects in Europe and worldwide. Training in SeaDataNet procedures, including an introductory course for Mikado, has been opened to non-European countries (Black Sea, Caspian Sea and Red Sea).

Historic orthophotos (at top: Arcachon, middle: Saint-Jean-de-Luz, bottom: Boulogne-sur-Mer) http://wwz.ifremer.fr/photos_anciennes_littoral

The data discovery portal provided by SeaDataNet (shown here, historic observations of nutrients conducted by pan-European teams)

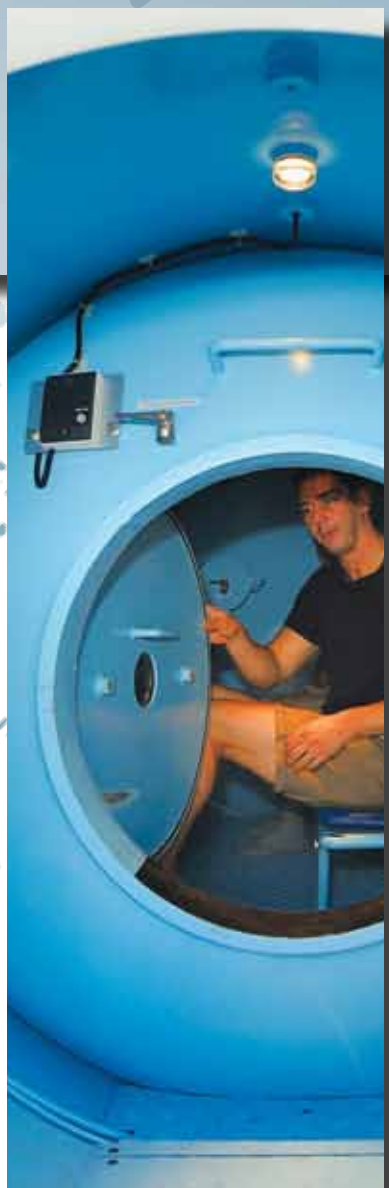
The pooled catalogues provide access to a significant amount of information. All the French data for water column observations are now available via the SeaDataNet portal. The Geoseas project, which extends SeaDataNet to geoscience data (geology, geophysics) began in June 2009, bringing together all the organisations of the National network for marine geoscience data management (BRGM, IRD, INSU, Ifremer, SHOM) in France. SeaDataNet also provides technical support for preliminary actions to set up the Emodnet network. Ifremer is taking part in this for hydrographic, chemical and biological data.

An "à la carte" choice of information media

Since October 2007, when version 3 of the Sextant data portal was put into service, over 670 geographic areas covered, representing more than 3,000 maps, have been made available to users and partners through some forty theme-based websites. Ten digital terrain models (representing the topography of a terrestrial area in a form adapted for use by a computer), developed by Ifremer, have also been rendered accessible. In addition, Sextant's user interface can be adapted to specific geographical and/or thematic requirements of each user. This capability makes it possible to provide simplified cartographic portals intended for a wide audience. Finally, Ifremer has pursued its efforts to digitize geographical data by opening a site giving access to the historic aerial photography library that the Institute possesses. The images were digitized and geo-referenced in the framework of regional or national partnerships.

The needs related to activities drawing up expert appraisals and research on marine aggregates and renewable energy sources (e.g., offshore wind), the baseline master plans for disposal of dredge spoil at sea, or the "Nature and landscapes information system" require developing cooperation between organisations in order to facilitate access to complementary geographical information, like the bathymetry, resources or uses. To this end, agreements for use have been set up with our institutional partners like the SHOM or BRGM. While respecting each one's mandates, these agreements enable joint responses to be made, particularly in the framework of State action at sea.

MAJOR FACILITIES SERVING OCEAN RESEARCH



Optimising use of the ocean research fleet

Since December 2008, the French ocean research fleet, managed by several bodies – French Navy, SHOM, IPEV, IRD, INSU, Cemagref and Ifremer - falls under the French roadmap for very large research infrastructures (VLRI). This fleet, serving all the marine science disciplines, is also used for public service missions (fisheries stock assessments, marine environmental surveillance and monitoring in compliance with France's international commitments, etc.) for cooperation (notably with the French Navy or the IEO) or for industrial developments. In this capacity, Ifremer acts as a resource agency, ensuring its mission of managing and maintaining a high level of quality for a very significant part of the offshore and inshore fleet, as well as mobile and subsea vehicles and facilities which fall within the scope of the VLRI.

Ocean research vessels

RV *Pourquoi pas?*

Amongst RV *Pourquoi pas?* scientific cruises in 2009, the ZMAG mission, the vessel's first coastal hydrography cruise on behalf of SHOM, should be mentioned. This was the first time since the ship's launch in 2005, that SHOM's ocean research launches were deployed from it. Another example is the Bathyluck cruise (IPGP-CNRS mission from 31 August–29 September), within the framework of the Momar programme on the Lucky Strike study site. This zone has nine sites and holds several hydrothermal fields located at various depths. Like each of the programme's cruises, this one involved installing or retrieving submerged instruments, continuing to take samples of fluids or rocks and taking biological samples in a range of colonised spots. Different large and deep-water facilities were deployed for this mission: the *Nautile* submersible, the ROV *Victor 6000* and the AUV Aster^{X}.

Finally, following the disappearance of a French plane flying from Rio de Janeiro to Paris during the night of 31 May to 1 June in the Atlantic Ocean, the French authorities decided to deploy large scale air and naval resources in the zone where the accident was assumed to have taken place. Although it was just ready to get underway for a series of scientific cruises, RV *Pourquoi pas?* interrupted its schedule sine die to go to the accident zone, as commissioned by the Bureau of investigations and analyses (BEA), to take part in localising the flight recorders which were thought to be located at depths between 2,500 and 5,000 metres. The manned submersible *Nautile* and the ROV *Victor 6000* were on board for the first operation which was initially planned to last until 30 June. The second phase, begun on 10 July, consisted of underwater research using Ifremer's vehicle, including the SAR towed sonar. On 20 August, in the absence of convincing results, the searches were suspended.

This public service mission on behalf of national interest showed the availability and quality of RV *Pourquoi pas?* and Ifremer's major facilities, as well as the reactivity of the crews in charge of deploying them.

RV *L'Atalante*

Commissioned for service in October 1990, within the first fleet renewal plan, the multidisciplinary research vessel *L'Atalante* was mainly designed for marine geoscience, physical oceanography and marine biology uses and its equipment need to be adapted. The upgrading was slated in the framework of the 2005-2008 four-year contract and was part of the objectives of Ifremer's new ocean fleet renewal plan, aiming to ensure that the ship remains operational until 2020/2025.

ROV Victor *and* Nautile *submersible aboard RV* Pourquoi pas?

The upgrading was carried out with the budget and deadline. It was launched at the Piriou shipyards in Concarneau from November 2008 to May 2009, and consisted in installing new scientific and navigational equipment without modifying the platform, improving its operational capabilities and performances and simultaneously proceeding with a major maintenance overhaul.

After two months of validating the equipment, including a new multibeam echosounder, RV *L'Atalante* resumed its scientific programme for a hydrography and physical oceanography assignment in the Bay of Biscay for the SHOM, in the framework of the French Navy/Ifremer partnership and thus filling in for RV *Pourquoi pas?* which was mobilised elsewhere by the BEA.

This mission was followed by that of Spiral, scheduled in the framework of a research-industry partnership from 14 September to 14 November. Through a "public-private-sector" partnership (PPP) engaged over several years now, Ifremer associates large industrial firms (oil companies in particular) with both French and local institutes and university laboratories. Spiral programme members include, along with Sonatrach, DGRSDT and Craag for Algeria, IRD, CNRS, the Universities of Nice and Brest and Ifremer for the French contribution.

RV *Le Suroît*

Le Suroît, was built in 1975 and upgraded in 1999, and is used to perform high-quality bathymetry, core-sampling, CTD seismics and hydrology operations. In 2009, it made three important cruises: the first, called Kashallow (from Karukera, the Caribbean name for Guadeloupe and shallow) set out to study sedimentary and tectonic evolution over 23 million years from the Lesser Antilles fore-arc in the Guadeloupe sector. The second cruise called Gwadaseis then enabled IPGP scientists to learn more about the seismic and volcanic hazards in the Lesser Antilles arc (from the Virgin Islands to Martinique), thanks to bathymetric data, high resolution seismics and core sampling, and to discover the traces of past earthquakes. Surveying for a future drilling site was also undertaken on behalf of the International ocean drilling programme (IODP). The Marmesonet mission continued to study seismicity and fluid expulsion events along faults in the Sea of Marmara and prepared the setting up of permanent seafloor observatories in the framework of the Esonet project.

RV Pourquoi pas? *at sea*

AUV Asterx on deck of RV Suroît *(Marmesonet cruise)*

RV Suroît *in the Sea of Marmara (Marmesonet cruise)*

RV *Thalassa*

As it does each year, the vessel took part in a series of recurrent fisheries cruises (IBTS, Evhoe, and Pelgas, and two Pelacus missions for the Spanish scientists at IEO) to calculate the distribution and abundance indicators for various commercial fish species fished in the North Sea or the Bay of Biscay. As such, anchovies are considered as a target species, since they are at the core of the pelagic ecosystem.

Thalassa proved its multi-purpose vessel capacity in conducting the Aspex-2009 cruise, one of the experimental strands of the multi-organisation research effort in the Bay of Biscay, by setting up an array of current meter moorings along its margins to observe the seasonal cycle of low frequency (less than that of the tide) circulation on the Armorican and Aquitaine shelves and slopes.

RV L'Europe *at quay at Ifremer's Mediterranean centre*

Profitable returns on ship-time exchange agreements and barter arrangements

RV *Beautemps-Beaupré*

This Navy ship, derived from *Thalassa* and managed by the French Navy, was co-financed for 5% by Ifremer, which gives our Institute the right to use it for ten days a year, in the frame of the agreement signed with the Ministry of Defence in 2003. Co-scheduling with the SHOM is established each year for RV *Beautemps-Beaupré* and RV *Pourquoi pas?* Out of the quota of days reserved for the scientific community, in March, BHO made the OWEN cruise (Owen fracture zone) between Djibouti and Salalah (sultanate of Oman). The cruise was conducted by CNRS-INSU to survey and map the boundary of the active plate between Arabia and India (North-West Indian Ocean).

In the study zone, 10,891,787 bathymetric soundings were validated and 147,420 gravimetric measurements taken with magnetic measurements and sub-surface echo-sounder profiles. This active fault was mapped over 800 km for the first time, and its examination confirms that Arabia is sliding northward with respect to India.

RV *Sarmiento de Gamboa*

The Forclim mission, for the Universities of Bordeaux and Angers in particular, was conducted from 1 to 21 April in the Bay of Biscay during the first year of the new Spanish vessel *Sarmiento de Gamboa*, which belongs to CSIC. This cruise was co-financed by the ANR, and aimed to reconstruct past ocean hydrology to reproduce the hydrological variability in the North Atlantic over the past millennium. Access to the Spanish vessel was made possible through the multilateral ship time barter agreement (OFEG agreement). Due to the significant seasonal constraints of this mission, calling on European partners was the only solution for these studies to be conducted as of 2009 and was given in return for rights acquired by France in 2007 during cruises by RV *L'Atalante* in the Bay of Biscay.

This practice of exchanges and access to various platforms was initiated by Ifremer nearly fifteen years ago (first through a tripartite agreement in 1996, then with the creation of the OFEG in 2002) and foreshadows an integration approach for European fleets, which should progress even further in the frame of the Eurofleets project coordinated by Ifremer.

Inshore vessels

The coastal launch *Haliotis*, put into service in 2008, was very much in demand throughout the year 2009

Attempt to set a distance record by AUV *Idef*^{x} in the Mediterranean

Ifremer's AUV *Idef*^{x} is back from a sea cruise conducted from 12 to 22 October. It was designed for underwater monitoring in the coastal zone and its practical range in its initial "battery-based" configuration is 100 km. Thanks to the development of a fuel cell by the Hélion firm, a subsidiary of the Areva group, which the AUV was fitted out with during the cruise, this performance has been raised to nearly 300 km, and it will be tested in the Mediterranean. The survey falls under the framework of the PACSM programme, with the PACA marine cluster label, and is co-financed by the National research agency (ANR) in the context of the PANH programme.

(over sixteen missions, some of them lasting five weeks). RV *Haliotis* has regularly ensured its assignments, going from one seafront to another thanks to the advantageous road haulage system which gives it great flexibility for scheduling and use.

Ifremer's decision to purchase and equip this 10.30 m launch with instruments aimed to foster access to very shallow water (less than 15 m) in coastal areas, with the possibility of deploying high performance instrumentation (acoustic imaging, electronic mapping, etc.) and thus ensure the continuity between the shore and inshore areas.

The inshore RV *L'Europe* had a very heavy schedule in the Mediterranean, its programme was balanced between short missions for technological tests, especially the AUV technical trials, and missions for fisheries, or environmental observation or monitoring (chemical contamination on the city of Marseilles' outlet site) or in the frame of WFD obligations. The two long Mytior missions should be mentioned, consisting in mooring (in April-May) then retrieving (in August) mussel pots to be used to assess the chemical contamination of coastal water masses along the shores of Sicily, Tunisia, Libya, Egypt and Cyprus. In the context of its international scientific cooperation policy, Ifremer took advantage of each call made by the vessel to promote exchanges with research organisations in the neighbouring countries visited.

The activity of the two other inshore vessels present along the Channel and Atlantic seafronts was more mixed in nature. RV *Thalia*'s programme, predominantly environmental and living resource-oriented (scallops, Nephrops, etc.), with technological themes (particularly trials on selective gear and trawl doors) was busy from the month of March onward, the period when vessels can go back to sea thanks to better weather conditions.

The activity of RV *Gwen-Drez* was more evenly spaced out into two main periods, from April to June and from September to mid-December, mostly in the Bay of Biscay and the English Channel, in order to measure the state of resources and stock abundance and perform fisheries-related technological trials.

Efforts continued to coordinate with INSU, which is the other principal manager of French inshore vessels, to enable informed scheduling and limit the trips in transit from one site to another.

Major facilities

Major overhaul of *Victor 6000*

After an initial ten-year cycle of scientific activity (with the first technical trials in 1997 and the first scientific cruise on the German RV *Polarstern* ice-breaker in July 1999), the remote operated vehicle (RVO) *Victor 6000* went for its regular overhaul in late 2009. This lasted the entire first semester of 2010 and will be followed by a test cruise before resuming its scientific activity. The overhaul involves replacing the obsolete equipment, hardware and software components to start out on another ten-year operational cycle, optimising the system's deployment conditions (going from three to two operators in some cases, etc.) and improving the IT systems.

Before beginning this long refit, *Victor 6000* took part in the Antares programme's eighth Neutrivic cruise, inaugurating a new series in the framework of the agreement signed between Ifremer and CNRS (IN2P3) to maintain the Antares neutrino detector in operational condition. The ROV was deployed from a ship of opportunity in November, in spite of unfavourable weather conditions and the objectives set for the mission were achieved.

Overhaul of ROV Victor 6000

Side-scan sonar

A call for bids for tender was launched to replace RV *Thalia*'s side-scan sonar. Trials were conducted on a range of equipment. The side-scan sonar chosen, a Klein 3000, is marketed by the Cadden firm.

Seabat echosounder aboard RV *Pourquoi pas?*

The Evalhydro cruise to validate the shallow water echo sounder aboard *Pourquoi pas?* was led by SHOM in February 2009. This was an essential prerequisite to carrying out the cruises at the end of 2009 (ZMAG). At the outcome of these trials, including a very spectacular survey of the Four Bank, the echosounder was validated by SHOM for its hydrographic applications, thus completing an important final step in the development of this difficult and innovative project.

Development of the multibeam echosounder aboard RV *Suroît*

The EM300 multibeam echosounder was installed aboard *Suroît* in 1999 and is a system that can map

Acoustic experts' work aboard RV Suroît *during the Marmesonet cruise*

seabeds from 100 to 2,000 m in depth. The recent commissioning of very high performance echosounders on other Ifremer vessels (*Pourquoi pas?* and *L'Atalante*), along with the growing requirements of users (better bathymetric quality, displaying echoes in full ocean depth), made it vital to upgrade the system. A development of the EM300 (EM302) was fitted on-board, which also required that the echosounder's transmission and processing electronics, the operator station and the real-time processing software be replaced. Very interesting new functionalities, like frequency modulated pulses, a larger number of beams, simultaneous acquisition of two swaths or the display and recording of data acquired in the water column are thus available. This upgrading was done in October 2009 and the trials at sea were followed by operational deployment of the echosounder during the Marmesonet cruise to detect gas plumes in the Sea of Marmara in November 2009. This bringing up to standard makes RV *Suroît* more efficient and effective in scientific terms.

Software developments

The policy for development, maintenance and enhancing the utilisation of shipboard embedded software on behalf of the scientific community has been pursued. In particular, thirteen new licensing contracts were signed in 2009, including the supply of a software suite for the Pelagia overhaul (NIOZ).

Streamlining and coordinating ocean research fleet management

In 2009, three milestones concerned initiatives which should ultimately have an impact on management of France's marine fleet resources. The first was that taken by Ifremer, with the Eurofleets project, a crucial step towards coordination of the European research fleets in compliance with one of the four-year plan objectives. Next come two national initiatives to streamline fleet management, with the national Fleet and vehicles commission and the Strategic and technical committee for the offshore and inshore fleet.

Eurofleets

The Eurofleets project's launch took place from 22 to 24 September in Paris, at a meeting bringing together nearly one hundred scientists and fleet operators. It has twenty-four partners, research bodies or research vessel managers, from sixteen European Union member states or associated countries, whose main objective is to develop the integration of European research fleets and interoperability of large equipment.

Ifremer coordinates the Eurofleets project, which covers the following three aspects: networking through working groups and actions; transnational access to host scientists, through European calls for tender, aboard five large global/ocean going vessels and thirteen regional vessels; and joint technological research. This four-year project enjoys significant funding from the European Commission (M€7.2 out of a total budget of approximately M€9).

The launch of the Eurofleets project at the Cité des sciences et de l'industrie in Paris

Eurofleets project partners

First exercise for the new interdisciplinary assessment commission

Every scientific cruise planned at sea must be submitted for evaluation, in compliance with the rules inherent to each scientific community. Until the end of 2008, each offshore cruise request was submitted to one of three inter-organisational theme-based commissions (OPCB, Geosciences and Ecorec).

In response to the request from MESR, Ifremer suggested to its partners that these three commissions be merged into a single interdisciplinary scientific commission to assess cruise requests, keeping the name of CNFE (National fleet and vehicles commission).

As well as assessing cruise requests, the commission gathers information based on indicators to evaluate the French ocean research fleet's ability to effectively perform the cruises, for which the scientific quality is assessed on criteria of excellence alone. The fleet management organisations have also developed tools enabling them to assess the level of activity of the naval facilities they implement. For Ifremer, these indicators are set out in the four-year contract signed with the authorities it reports to.

The new development in 2009 is the possibility of assessing a cruise *a posteriori*, in a few special cases. Hereafter, every cruise will be subject to assessment.

First conclusions from the CSTF

The Strategic and technical committee for the offshore and inshore fleet (CSTF), bringing together representatives from the managers and main users of the French oceanographic fleet (Ifremer, INSU, IPEV, IRD, SHOM), along with the ANR, was set up in September 2008 to formulate recommendations to the MESR on the ocean research fleet's evolution as a VLRI. Four working groups (economic model, indicators, renewal of the fleet and overseas) were organised for these examinations and their work reported at the six plenary sessions held in 2009 alone.

In order to compare and analyse management methods, representatives from major ocean-going fleets, particular from NSF (USA) and the Alfred Wegener institute for polar and marine research (Germany) were auditioned.

A progress report was submitted at the end of the first semester of 2009, drawing up an objective assessment of the overall cost of the "Fleet" system. The conclusions of the report on overseas France have now been taken up by the overseas strategy and the various committees supporting it. Recommendations were made in terms of fleet renewal for 2010-2020. Likewise, a series of new indicators was considered, with the particular aim of measuring the activity and services rendered by the French ocean research fleet and its impact in terms of scientific production.

Finally, with financial support from the Ministry of Higher Education and Research, the CSTF analysed publications on oceanographic cruises from 1994 à 2004, by going through the citations in peer-reviewed journals. This work shows that the scientific production generated by the ocean research fleet holds up to comparison with other scientific disciplines. It should be emphasised that this study is unprecedented worldwide in the field of marine sciences.

PARTNERSHIPS

Discovering the oceans with Ifremer...

SPOTLIGHTING IFREMER AND ITS INDUSTRIAL PARTNERSHIPS

Promoting and sharing Ifremer's know-how

For Ifremer, generating economic value from our research is an essential stake. In 2009, four types of action led to significant involvement of all Institute teams: in promoting technologies from Ifremer in trade shows; signing contracts with industrial firms and professionals for service provision, cooperation or licences; managing patent portfolios and pursuing collaborative research.

Participation in professional events

In 2009, the commercial service of the Value development department organised the promotion of Ifremer's products, services, facilities and know-how at seven professional trade shows:

- The "Fish Morocco" trade show organised in March 2009 in Agadir (Morocco), gave Ifremer an opportunity to present the activities of its "Food sciences and technologies" and "Ecology and models for fisheries" departments.
- The "Seafood" trade show was held in April in Brussels. Ifremer presented its products and services developed in the field of seafood processing and aquaculture there.
- During its participation at the "Offshore Technology Conference" held in May in Houston (USA), Ifremer was able to significantly promote its equipment and know-how in the offshore field, i.e., the vessels and equipment proposed (ROV *Victor 6000*, AUV *Aster*^{X}, Penfeld penetrometer, Assem monitoring array), studies made on geohazards, testing facilities and equipment, test tanks, hyperbaric chambers, behaviour of materials in the marine environment, and partnerships with oil companies and service provision firms (Gassy Soils, Wacup, OHP and Tideep II).
- The "Oceans'09" show organised in Bremen in May, was an occasion for Ifremer to present its action in the framework of the seafloor observatories project and the Esonet and Trophimatique projects. Our Institute also highlighted the test facilities, fleet and software developed by the "Vessels and on-board systems" department for the participants

Stand at Fish Morocco trade show in Agadir

Ifremer's stand (World Fishing Exhibition in Vigo, Spain)

INRH Ifremer stand at the Itechmer trade show in Lorient

there. Finally, this trade show strengthened the ties between Ifremer and its German counterparts from the University of Bremen, the Alfred Wegener Institute and Marum.

- Ifremer was an exhibitor at the French collective pavilion organised by the Fisheries-Aquaculture sector of the Association for the development of international exchanges in agricultural and agrifood products and techniques (Adepta) during the "World Fishing Exhibition" show held in September in Vigo (Spain). This trade show is held every six years and is a major event for the seafood industry. This was the first time it was combined with the "Aqua Farming International" event devoted to aquaculture. Ifremer spotlighted its offers for studies and expert assessments in fisheries selectivity, the DynamiT software, its testing facilities for fisheries-related trials and its technological proposals for which licences are available in the aquaculture field.
- "Itech'Mer", the trade show for fisheries professionals is held every two years and welcomes all stakeholders in the fisheries supply chain, from ship design and building to fisheries techniques (spotting, catch, safety, energy savings) to processing, packaging, marketing and distribution of seafood. Ifremer presented its test facilities and equipment for trials on land and sea, as well as its latest studies on fisheries resource management and biology, on fuel savings related to fishing gear and on reducing the impact of these gears on benthic habitats. This year, Ifremer shared its stand with INRH, a follow-up their hosting at the Fish Morocco 09 show.
- In December 2009, Ifremer took advantage of the annual "Pollutec" trade show meeting to further develop its industrial partnerships. This is the international meeting point for those supplying equipment, technologies and services for the environment and the event gave our Institute the possibility to promote its technological and biological solutions to help protect the marine environment.

Agreements with industrial firms

In 2009, two-hundred-eighty-six companies signed a contract with Ifremer. Working in collaboration with the Legal affairs division, the Value development department negotiated, for instance, fifty-one service provision agreements and managed the negotiation of twenty-three contracts for consortia or cooperation, ten of which were signed this year. Notable examples amongst them include a contract to work with an Ifremer spin-off company start-up to develop therapeutic products (for fish farm bacterial pathologies) to be administered in feed and a contract for a consortium between academic and industrial partners working in bioenergy to perfect processes for biogas production by combining bacteria with microalgae. Furthermore, a number of partnership agreements highlight the strong will to create interactions between Ifremer and its industrial partners.

Scientific and industrial partnerships

France-Algeria partnership (Spiral programme)

The partnership-based research programme called Spiral aims to study the deep structure (at sea and on land) of the North Algerian margin using so called "deep penetration" seismic techniques. It is conducted in the frame of an agreement between the partners representing France (Ifremer, CNRS, UBO, IRD and Sophia-Antipolis university) and Algeria (Sonatrach, Centre of astronomy, astrophysics and geophysics research, the General directorate of scientific research and technological development of the Ministry of higher education and scientific research). Data acquisition in the frame of the programme is of capital interest in defining potential oil resources on the Algerian margin and assessing the geohazard in northern Algeria as a site with high seismicity. This is also the first entirely equally co-funded scientific research programme associating top-ranking Algerian and French scientists and researchers.

France-Brazil partnership (SanBa project)

The SanBa (*Santos Basin*) project is one of scientific collaboration between Ifremer, the University of Lisbon, UMR 6538 and the Brazilian oil company Petrobras. The first part of the project will study the Santos basin/Rio Grande plateau system in an oceanographic seismic survey mission designed to determine the different crustal domains of the basin. This surveying is essential, firstly in order to understand how passive continental margins form and secondly for deep sea oil exploration. The agreement was signed in November 2009 and will lead to the first cruise, slated in the fourth quarter of the year 2010. The examination and processing of the data will continue until 2012.

Enhanced utilisation of software and know-how

As well as making its sea-going facilities available, in 2009, Ifremer continued to sell its software abroad (Australia, the Netherlands, Spain, Germany) and develop uses for its know-how in terms of developments, technical trials for industrial facilities, sale of data, impact studies and other expert assessments in the fields of aquaculture and fisheries technologies.

Managing the portfolio of inventions

Patent steering committee created

The Value development department of the Institute adopted a selective policy for Ifremer's filing of patents. In 2009, as in other research bodies with an EPST or EPIC status, it set up a "patent steering committee" within Ifremer aiming to optimise the industrial property policy. In May, an initial positive experience concerning the declaration of an invention submitted by the Marine

Launch of "Cahiers de laboratoire" publication

In September 2009, the Value development department, working in collaboration with the Legal affairs division, announced the launch of the "Cahiers de laboratoire" publication to Ifremer's scientific community. These laboratory journals have been recognised by the Ministry of higher education and research and the National intellectual property institute (INPI). Providing true traceability of research studies, this national lab journal is vital for ensuring that skills are transferred in the laboratories, for accurately estimated the contributions of each party in the frame of private- or public-sector collaboration projects and for assessing whether it is opportune to protect research results by filing a patent. Moreover, this initiative falls under the quality approach to research activities as set out in Ifremer's strategy.

biotechnologies and molecules laboratory (LBMM) confirmed the relevance of creating this committee.

Inventions, patents and licensing contracts

In 2009, eight declarations of utility for inventions were processed and four patents filed by Ifremer. They dealt with:

- a rotation system for an underwater movie camera (patent filed on behalf of Ifremer, IRD and Adecal);
- a process to recover microparticles (patent filed in co-ownership with INSA);
- a process of depolymerization of polysaccharides by mechanical milling (patent filed in co-ownership with Pierre & Marie Curie University);
- a process to fix CO2 and treat organic waste by combining an anaerobic digestion system with one producing phytoplankton microorganisms (patent filed in joint ownership with INRA and INRIA).

The Value development department's technology transfer activity was also illustrated by the negotiation of fourteen licensing contracts (patents and know-how), six of which were signed in 2009.

Developing collaborative research

In 2009, Ifremer took part in negotiating numerous project of national and international scope, especially in the fields of seafood, renewable energy sources, technology transfers to the industrial sector and partnership-based research with competitiveness clusters.

Enhanced utilisation of studies on products from fisheries and aquaculture

Ifremer took part in defining the "ten agrifood priorities", in the think-tank programme started by the Ministry of Food, Agriculture and Fisheries. Following this, our Institute proposed Philippe Bécel to be project leader for the national "Enhanced utilisation of seafood" priority. The latter then evolved into one of the four major theme-based orientations which were finally selected. It is called "Products from fisheries and aquaculture" and is still directed by Philippe Bécel.

Boom in marine renewable energies

The Value development department provided support in drawing up the projects submitted by Ifremer and its partners in the frame of the AMI-Ademe call for tenders in the marine renewable energies field, to verify that the main principles in terms of governance and sharing/exploitation of results were in compliance with our Institute's expectations. In the same sphere, the Value development department contributed to setting up the Marine renewable energies platform in Brest and is still working on its launch. This platform should rapidly federate the stakeholders in the field, in order to meet the targets set by the Grenelle marine forum for marine energy sources (3% of the total French energy budget by 2020).

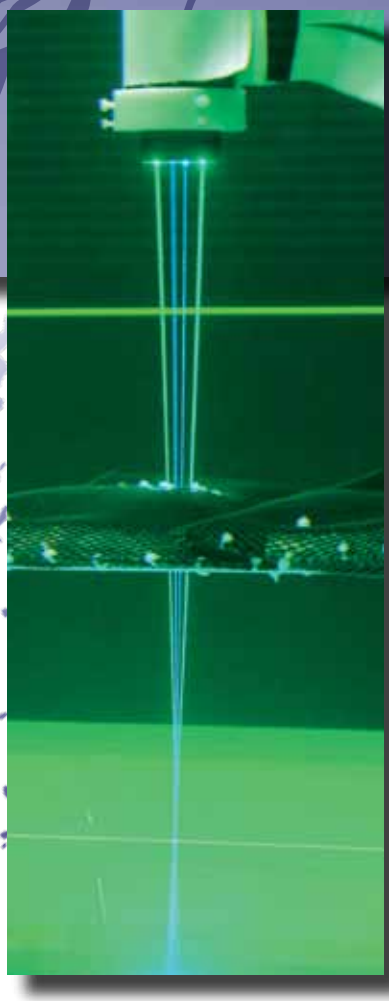
Sharing methodologies for technology transfers

Ifremer is involved in the European Prottec (Public Research Organisation Technology Transfer through Regional Economic Clusters) project. It was launched in March 2009, and aims to improve transfers of technology from public-sector research to industrial firms, notably by raising researcher's awareness and taking a comparative look at technology transfer practices and professionalising the valorisation officers. A consortium of five partners (Ifremer, UBO-Bretagne, Plymouth Marine Institute, University of Exeter and Marine South East) should create four work modules by 2012. In 2009, the first step took stock of the regional strategies and the technology transfer methodologies used by the regions involved in the project (Brittany, Nord-Pas de Calais, and South East and South West England). Upcoming studies will define "best practices for valorisation" to be communicated to players in research and innovation. A dozen joint projects from the partners will emerge in the final phase in 2011.

Working in collaboration with competitiveness clusters

In 2009, Ifremer contributed to bringing new projects to the fore in the competitiveness cluster context. Our Institute is also strongly involved in five clusters: the Brittany marine, PACA marine, Aquimer (Nord-Pas-De-Calais region), Atlantic Biotherapies and Valorial (Brittany) clusters.

REGIONAL PARTNERSHIPS AND RELATIONS WITH LOCAL AUTHORITIES



In metropolitan France

Nord-Pas de Calais and Picardie region

Motivated by the upcoming creation of a marine park where its three estuaries open, the Picardie region has set up an approach to maritime and shellfish farming issues, mainly coordinated within the Littoral cluster of the Somme county. In the Nord-Pas de Calais area, Ifremer has pursued its commitments aiming to develop partnerships and collaborative work with universities, decentralised State services and professionals.

Opening scientific clusters and upgrading the test tank

In May 2009, Ifremer's Channel-North Sea centre opened its sclerochronology, taxonomy and zooplankton ecology clusters. They were officially inaugurated by Jean-Yves Perrot, the Chief Executive Officer of Ifremer, Daniel Percheron, Senator for Pas-de-Calais and president of the Nord-Pas de Calais regional council, Hervé Malherbe, sub-prefect of Boulogne-sur-Mer, Frédéric Cuvillier, MP and mayor of Boulogne-sur-Mer and president of the Boulonnais urban community and Jack Lang, MP for Pas-de-Calais.

The Boulogne-sur-Mer test tank facility was originally designed to test the behaviour of underwater vehicles submitted to currents. It was upgraded to meet current requirements and new requests for trials. It was equipped with a wave generator, so that the effects of combined swell/current/structure interactions can be studied, as well as with a wave-damping artificial beach. The first applications defined focus on systems to recover energy from currents (stream turbines) and studying disturbances to local sedimentary dynamics created by the placing of oyster farm racks.

Financial support from local and regional authorities

The local and regional authorities, and especially the Regional council, provide financial support. In 2008-2009, Ifremer obtained supplementary funding from the Regional council in the frame of a contract

Inauguration of the sclerochronology and zooplankton taxonomy and ecology clusters at Ifremer's English Channel-North Sea centre

Wave and current tank at Ifremer's English Channel-North Sea centre

for project, which helped finance the facilities of the sclerochronology cluster, the zooplankton cluster and the test tank. It likewise promotes the hosting of PhD students and post-doctoral fellows; and ensures the Marel Carnot measurement station's operation.

Organisation of the sea products and aquaculture cluster

Ifremer holds the vice-chairmanship of the Aquimer cluster (formerly that of the seafood products supply chain) and is in the scientific grouping along with Afssa, the university of Littoral Côte d'Opale (ULCO) and the Seafood processing and enhancement research centre (CEVPM). In this capacity, following the ranking of various competitiveness clusters, Ifremer contributed to setting up a new organisation of the entity as requested by the ministries. Our Institute is currently engaged in thirteen labelled projects of the seventy-seven projects carried by the cluster.

Cooperation with universities

Cooperation between Ifremer and university gets stronger every year. In this context, our Institute joined the "University of Lille northern France" research and higher education cluster (PRES) and signed a partnership agreement with USTL. Collaborative work with ULCO led to the creation of a joint technological unit in association with Afssa and CEVPM.

Participation in the regional climate plan

In late 2008, the Nord-Pas de Calais was the first region to launch its regional climate plan and Ifremer associated itself by setting up workshops. Six working groups were set up, on energy savings, changing behaviours, highlighting initiatives, exploratory research and innovation and the aspects, outlooks and adaptation of the regional climate plan.

Contributing to economic development

Ifremer's contribution to economic development led teams from the Institute to take part in drawing up the local plan and the SRDE regional master plan, where they brought their vision and skills in the field of fisheries and more generally that of the seafood-agrifood business.

Enhancing the value of sea products

Although Ifremer has always maintained close ties with the CEVPM centre for studies on seafood processing and enhancement, it had become essential to make the way we collaborated evolved by giving priority to a contract-based partnership based on validated projects. Within this framework, Ifremer kept its vice-chairmanship and dual representation, with the Valorisation department, of the association's Board of directors.

The first working groups were set up and the initial basis of work and cooperation with the Nord-Pas de Calais delegation of marine protected areas was established as of October 2008. Ifremer is monitoring and working on the creation of a future marine park along the Opale coast, where three estuaries open onto the sea.

Upper and Lower Normandy region

Cyana and the mock-up of Nautile *at the Cité de la mer in Cherbourg*

The Cité de la Mer in Cherbourg hosts *Cyana*

Amongst the festivities organised for our Institute's twenty-fifth anniversary, there was a special day on Friday, 16 January, for the signing of the renewed partnership between Ifremer, the Cité de la Mer and the Cherbourg urban council.

Jean-Yves Perrot, Bernard Cauvin, the Cité de la Mer's Chief Executive Officer and Bernard Cazeneuve, MP and mayor of Cherbourg-Octeville as well as chairman of the Urban council of Cherbourg, took advantage of the occasion to unveil the manned submersible *Cyana* to the public, loaned by Ifremer to the Cité de la Mer, and to inaugurate the temporary exhibition on Life in the ocean depths, composed of photographs belonging to Ifremer.

European regional policy

Organised in October in Brussels by the Committee of the Regions, the "Open days" bring together European cities and regions for seminars, workshops and exhibitions on the EU regional policy implemented by groups of local authorities. On this occasion, the region of Upper Normandy and that of Southern England, both belonging to the group of authorities, presented a seminar on "Advanced Cooperation in the North Sea/English Channel". "Open days" also provided the opportunity to hold the launch seminar of the Camis product, illustrating maritime cooperation and development of integrated maritime strategies. The Camis project aims to play a federating role, whose first step is to seek better mutual understanding about projects and initiatives. The seminar promoted exchanges and connections between projects and initiatives linked to the three themes of governance, transport and innovation and clusters (or centres of excellence).

Joining in the "Arc Manche" approach

The Upper Normandy region which was lead partner in the Interreg EMDI project, launched a political approach in 2003 called "Arc Manche", intended to pool research and training resources. Joining the approach has brought Ifremer closer to the Universities on either side of the Channel. Linkage between EMDI and Charm 3 is being constructed in the Channel studies context. How to strengthen the Channel study site within Arc Manche is being examined.

Finally, seeing the first results from the EMDI project, the Camis project's goal is to draw up and implement an integrated maritime policy in the Channel space whilst fostering concrete cooperation between stakeholders. Like the EMDI project, Camis falls under the

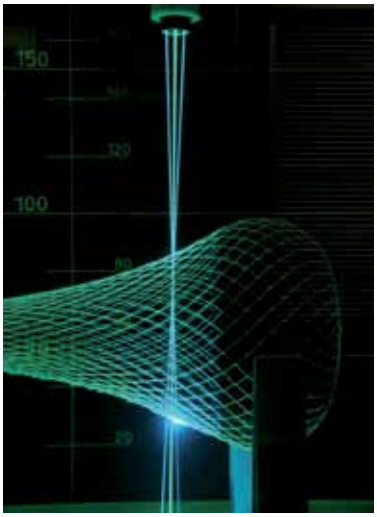
Fisheries and cephalopods

The Cresh project was launched in April 2009 under Interreg IVA, with the objective of studying the "pre-recruitment" of cephalopods (cuttlefish and squid) present in the English Channel. Knowledge is lacking about the period between spawning and when a new generation arrives in these fisheries. The species have recently become quite important for Channel fisheries, particularly trawling, and have an especially short lifespan and are subject to relatively significant fluctuations in abundance. The arrival of new generations in the fisheries seems to depend more on environmental conditions than on the broodstock biomasses. Steered by the University of Caen, the project gathers eight laboratories from different French and English universities and institutes and the two laboratories of the Channel-North Sea fisheries science department.

guidelines set out by the assembly of Arc Manche regions and enjoys its political support.

Support for sector-based issues

Ifremer has developed a partnership within the scientific interest grouping, particularly on the theme of "Impacts of marine aggregate extraction" (Siegma SIG). When confronting this issue, which was widely discussed during the second Forum du Littoral in February 2008, the delegates of professional bodies of marine aggregate extractors gave a reminder of what they expect from Ifremer in terms of environmental studies and monitoring that should be associated with extractions at sea. To meet those expectations, our Institute has proposed a programme to assess the biodiversity in dredged materials which the professionals were immediately ready to set up. In addition, the ICES working group on the effects of marine aggregate extraction on ecosystems produced a report on the impacts on fisheries, based on studies conducted in France on the Dieppe and Bay of Seine sites.



Flow measurements using laser velocimetry in a codend

Partnerships with regions

The Channel-North Sea centre is working more closely with the regions along the English Channel, particularly with two regions in Normandy, through a proactive policy of proposing clearly targeted projects (Icore, Clarec, Channel study, etc.), with ties to local universities and the university of Lower Normandy's UMR 100 joint research unit. The Chairmen of both Normandy regional councils have publicly expressed their satisfaction about the signing of projects that bring together coastal universities from Caen to Lille.

Managing the shellfish farming supply chain

The Ogive project's objective is to know more about the shellfish farming ecosystems in Lower Normandy, in order to establish as joint data platform shared by its partners. This information will make it possible to develop innovative tools to supply opinions and expert reports to those managing the State-owned maritime domain. Ogive will thus contribute to sustainable development of the supply chain by optimising production while protecting the environmental quality of the ecosystems supporting it. Three tools will be developed by the project:

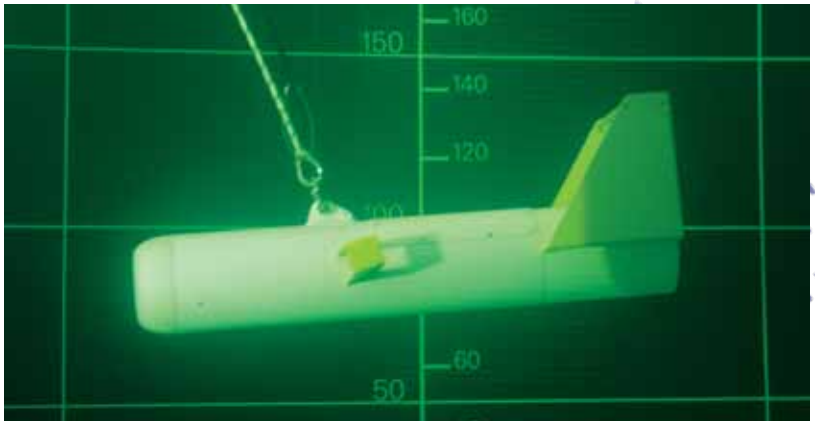
- a GIS to answer questions raised by restructuring (moving a lease, changing the species farmed) or setting up operations in a new geographical area;
- a non-spatial modelling tool to assess the optimal biomass to be farmed;
- a spatial modelling tool designed to fine-tune estimates of the support capacity and test various scenarios for the redevelopment of farming areas.

Partnerships with Water Agencies

The partnerships with the Seine Normandy (AESN) and Artois Picardie (AEAP) water agencies are tools for steering cooperation and define orientations along three main directions:

- improving knowledge: understanding how the Normandy coast functions and evolves, assessing anthropogenic pressures and their impact on the chemical and ecological status of ecosystems, characterising the condition of environments and developing numerical modelling tools;
- monitoring: designing and implementing chemical and biological monitoring networks, particularly under the Water Framework Directive, databasing, managing and making optimal use of data;
- drawing up management plans and supporting territorial policies for the Seine Normandy basin: revising the SDAGE master plan, defining the measurement programme and management and planning aids.

A specific example of this collaborative work is the study on inspecting benthic monitoring in the frame of the AGIL-BN (lower Normandy integrated management assistance) programme.



EasyFish trials in the test tank at the English Channel-North Sea centre

The tools are being developed on the pilot site in the Bay of Veys, for which Ifremer and its partners have the most knowledge to date. In 2009, a series of new actions were implemented:

- using the Easyfish towfish to test the recurring phenomenon of depletion observed in the Bay of Veys;
- setting up research experiments on growth and reproduction of the blue mussel *Mytilus edulis* under the environmental conditions of waters in Lower Normandy;
- launching a socio-economic strand, with an internship study devoted to improving knowledge about oyster farmers' farming strategies in the Bay of Veys.

Deploying EasyFish for sea trials

Brittany region

Projects, collaboration and support

Three major projects were carried out in 2009 with the Brittany regional council, in the frame of the State-Region contract plan:

- purchasing and installing a powerful scientific supercomputer at a total cost of 2.6 million euros. It is called Caparmor and will be used by the marine science community, offering vast perspectives for knowledge and progress. Caparmor was inaugurated on 16 September, with representatives from all co-funding entities in attendance. They included scientific partners (UBO-CNRS, SHOM) and local authorities (ERDF-Brittany, Finistère county council and Brest-Métropole océane urban council);
- the international ARGO project, in the framework of the global climate research programme, aiming for *in situ* observations of the world ocean. The objective is to maintain a global array of 3,000 autonomous profiling floats in the ocean (Ifremer is in charge of 300 of them), that drift freely under the water and take temperature and salinity profiles between the surface and depths of 2,000 metres every ten days. The data is transmitted to the Ifremer centre in Brittany (Coriolis centre) and made available to scientific communities;
- the Prévimer programme, which aims to supply a growing number of users in coastal zones with the real-time forecasts they need, while taking the regulatory context into account. Based on observation and modelling, the www.previmer.org website offers forecasts for the French coasts, of current directions and intensi-

Presentation of the Caparmor 2 supercomputer (Brittany centre)

ty, wave heights, frequencies and directions, sea level and surges, temperature and salinity and nutrient and phytoplankton concentrations. These data, along with retrospective analyses, become vital tools for managing and using coastal areas.

Other regional support

In 2009, the Ifremer Brittany centre obtained co-funding for five of its thesis grants thanks to the Brittany region's research allowance (ARED), as well as contributions from the Regional council and the Finistère county council to finance three large scientific conferences (Carhambar, DEB, Sineco 2) and several types of specialised laboratory equipment (microscopes, high-precision scales) or testing equipment (rolling gantry).

Working in collaboration with the Marine cluster

Ifremer is particularly active in the Brittany marine competitiveness cluster, taking part in its governance, technical team work and in half of the projects bearing its label, making our Institute the main research operator of the cluster.

Since 2006, the Brittany marine cluster, closely coordinated with the Provence-Alps-Côte-d'Azur cluster, has approved ninety-five projects, sixty-three of them financed at the end of 2009 to the amount of 51 million euros. Ifremer has invested particular efforts along the lines of "biological resources and biotechnologies", "environment and coastal planning" and "marine energy resources", from the angle of renewable marine energy sources. One the projects the Institute is in charge of is Vegeaqua (adaptation of farmed fish to plant-based feed) conducted with INRA and industrial firms from three regions. In 2009, the Ifremer centre in Brittany also hosted the cluster's general assembly meeting, where the new cluster performance contract for 2009-2011 was presented.

Support for professional fishers

Ifremer and its station in Lorient provide ongoing scientific support for Breton fisheries, though regular stock assessments. An annual survey to assess scallop stocks performed in summer enabled the fishery to be organised and the volume of catches that fishermen can expect in the bay to be estimated. For the 2009-2010 season our Institute recommended that a quota of about 4,800 tonnes be maintained. A cruise to study Nephrops was also made in the Bay of Biscay and the Celtic Sea.

Elsewhere, Ifremer experts have supplied opinions and expert reports to the county directorates of Maritime affairs in Brittany, to the DDE county directorates for public works and amenities and other decentralised State services. In 2009, Breton fisheries and fleets were the subject of nearly three hundred economic investigations and landings were sampled at every fish auction in Brittany. Finally, in partnership with fisheries professionals, Ifremer's fisheries technology specialists tested pot fish traps in the Iroise marine nature park.

Oceanographic training

The research consortium Europôle Mer came into being in 2007, bringing together fifteen organisations in Brittany which are specialised in oceanographic research and training. Ifremer and the University of western Brittany's IUEM are the main partners, with CNRS, INSU, the Roscoff biological station and the University of southern Brittany. Top-level engineering schools (Ensieta, Naval academy, ENST-Bretagne) take part, as does Océanopolis. Research scientists and engineers from Ifremer are involved in the five research orientations (genomics and blue chemistry, ocean-marine ecosystem interactions and global change; observation and dynamics of coastal systems; deep sea exploration and understanding; complex systems for observation, measurement and intervention).

The consortium obtained the creation of an international chair on deep sea exploration and understanding, financed by the Brittany regional council, ERDF and PRES UEB, with participation from Ifremer and UBO. Dr. Olivier Rouxel (WHOI), an expert in isotope geochemistry was appointed to this Chair. In addition, the consortium has moved to work more closely with ClimSat in theme-based investigations on the vulnerability of the marine and coastal environment with respect to climate change.

Osia and project presentations

The DEB2009 symposium on bioenergy of living organisms was held in Brest from 19 to 22 April. This event was the occasion to explain the DEB (dynamic energy budget) theory and its applications in aquaculture, fisheries, ecology, ecotoxicology, biotechnologies and economics. Based on physiological observations, the theory gives a quantitative description of effects of the environment on the physiological functions of living organisms. The symposium brought together scientific teams working on the DEB theory and its applications in biology, chemistry, physics, geology and mathematics.

The Ecokelp project, financed by the ANR, aims for better knowledge about the dynamics of kelp forests in the Northern and Southern hemispheres, from ecological, economic and social viewpoints. In France, several sites are being studied at the tip of Brittany. The project partners communicated information about their studies to seaweed professionals and the media at Ifremer's Brittany centre in February.

Developments and new builds

Two large construction projects were decided on during the year: renovation and upgrading of the

Lorient station's test tank, with funding from the Regional council and the Morbihan county council (M€1) and creating workshops and storage space to prepare ocean research cruises (M€2). They will both be completed in 2010. New European Customs restrictions also imposed that the warehouse-shipping unit, used to ship scientific cruise material safely all over the world, be brought up to standards. The work was launched at the end of the year and was financed by the Brittany Regional council and the Finistère county council.

Ifremer takes part in Cresco's creation

The Cresco Centre for research and education on coastal systems was created by Ifremer and MNHN to create a modern research platform which is well adapted to coastal environmental research. It was inaugurated on 6 February in Dinard by Jean-Yves Perrot, the Chief Executive Officer of Ifremer, Bertrand-Pierre Galey, the president of MNHN and Jean-Yves Le Drian, the Chairman of the Regional council of Brittany. The new station employs twenty-five staff members. Apart from joint research missions with the MNHM museum, Ifremer is pursuing its monitoring and surveillance activity there as an Environment-Resource laboratory, sharing the title with the Concarneau station.

The one-hundred-fiftieth anniversary of the MNHN marine biology station which was celebrated in Concarneau in September was also an opportunity to examine how teams from Ifremer Concarneau and from MNHN could work more closely in the museum premises there and to agree on plans for its fitting out and financing.

Cresco building

Pays de la Loire region

Development and facilities

In June 2009, the Ifremer Atlantic centre based in Nantes inaugurated the new premises of the "Molluscan shellfish microbiology" NRL, the "Virology" unit and the regional nutrient analysis unit of the Morbihan-Pays de la Loire Environment resources laboratory (LER). The construction work was financed by Ifremer, the Regional council and ERDF in the frame of the State-Region project contract. Moreover, thanks to the aids to help complete laboratories' major equipment, the centre received regional funding to purchase a pilot freeze-dryer.

Knowledge transfers

In 2009, an example of developing added value in the transfer of research results could be seen in the development of marine resource biotechnology and the successful spinoff of the Algenics firm, which has continued to grow (fifteen employees) and by the hosting of the S3D (Solutions for waste and sustainable development) company working on photobiorector technologies.

Activity of the scientific network

Ifremer's Atlantic centre celebrated the twenty-fifth anniversary of the Réphy network. Within the network's activities, comparing results obtained using two methods to assess lipophilic toxins (mouse bioassays and chemical analyses) contributed to changing the

reference method used to manage decisions of whether or not oysters can be put on the market.

Enhancing the coastal area

Scientists from Ifremer presented the outcomes of their research on understanding, monitoring, managing, protecting and developing the Loire-Brittany coast. Carried out within the framework agreement with the Loire-Brittany water agency, the studies were explained to the catchment committee members and the Agency's board of directors, as well as to local elected officials and stakeholders (local authorities, administrations, unions, consumer NGOs, etc.). A new agreement for the period from 2009-2012 was signed in December 2009.

University and institutional partnerships

The Nantes-Angers-Le Mans university research and higher education cluster (PRES UNAM) was launched in June 2009. Ifremer made known its intention to become involved as an associate member.

Local authorities showed their support for research conducted in the frame of the Pays de la Loire joint consortium for the development of aquaculture and fisheries regarding the study on "locating phycotoxins in the cell compartments of contaminated bivalve mollusc tissues" and setting up a "Velyger" study site in the Bay of Bourgneuf, complementing the existing arrangement which monitors, analyses and compares oyster reproduction and recruitment performances on several collection sites in France.

On the interregional level, the regional councils of Brittany and Pays de la Loire supported three projects which also involved industrial partners, with the participation of the association for the promotion of the agronomics cluster of western France (PAO) and the Valorial competitiveness cluster label:

- the Mipromer project to learn about and control flora for biopreservation;
- the Surcook project to utilise by-products from seafood processing and fisheries by-catches;
- the Ostrea project on developing new products using oysters and research to match consumer perceptions with the degree of processing.

Réphy network group photo

The 25th anniversary of the Réphy network

Like the Institute itself, Réphy is celebrating its twenty-five years of existence this year. Through this network, Ifremer fulfills its mission of improving methods to monitor, forecast changes, protect and enhance the value of the marine and coastal environment. The environmental focus of our Institute is thus squarely at the centre of its scientific research in the field of coastal monitoring, as is the case for Réphy, and through such diverse themes as aquaculture, fisheries science, operational oceanography and biotechnologies.

The Réphy network was created by Ifremer in 1984 following numerous food poisoning cases observed in people who had consumed shellfish on coasts in Brittany. By filtering the seawater as they fed, the molluscan shellfish had concentrated a diarrhoeic toxin produced by Dinophysis phytoplankton in their tissues.

The phytoplankton also turned out to be a good biological indicator for coastal water quality, thus enabling Réphy objectives to be extended to environmental monitoring, consistent with the growing number of environmental stakes. This approach made it possible to monitor species whose appearance of development can represent a threat for the environment and the balance of marine ecosystems and the individuals within them.

Whether for health or environmental purposes, this monitoring is part of a regulatory framework set out by European public policies, relayed on the national scale, the "Hygiene package" for health issues, the WFD and then in the near future, the MSFD, which will extend surveillance for environmental stakes to the limits of exclusive economic zones.

Poitou-Charentes region

Research and communications

At the end of the second year of the State-region project contract's performance, feedback on the results was presented to the representatives of the Regional council. The research spotlighted was related to the excess mortality phenomena in cupped oysters and in fisheries, on diversification of the potentially exploitable species. The aspect of communicating information to other partners, particularly the regional shellfish farming section, was hailed, but must still be taken further.

In addition, the genetics and pathology laboratory was granted Cofrac accreditation in 2009 for histopathological analyses (diagnosis of diseases in marine shellfish for which reporting is compulsory).

Within the framework of the procedure set up to detect infectious agents, the genetics and pathology laboratory in La Tremblade detected the presence of a herpes virus genotype that had not previously been described, in oyster mortality events. Concurrently, the genetics team at this laboratory demonstrated the resistance of oysters selected for the sixth generation at La Tremblade to mortality episodes.

Regional thesis

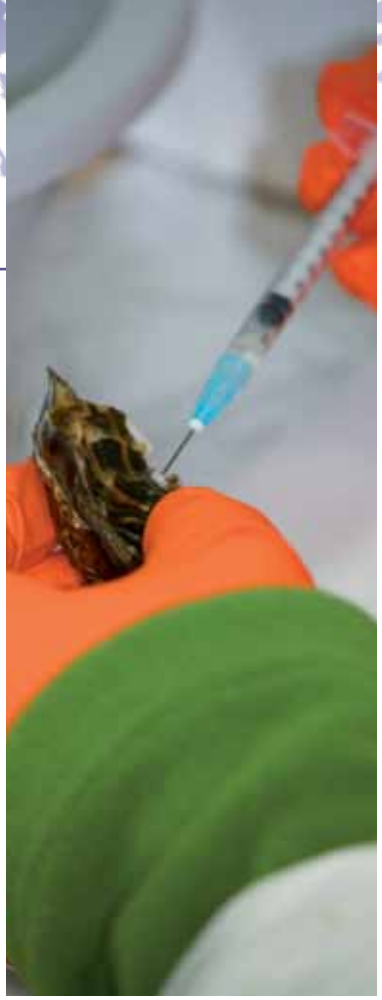
Following the call for applicants to receive regional PhD thesis grants, Ifremer obtained co-funding of a thesis on the "genetic characterisation of the spawning effort in cupped oysters in the context of summer mortality of juveniles: QTLs approach" at La Tremblade genetics and pathology laboratory.

Hosting foreign scientists

A guest researcher grant was obtained from the Regional council of Poitou-Charentes to host a British scientist from Cefas in the fisheries resource laboratory in La Rochelle. The research project aims to take part in studying exchanges within a sole stock in the Bay of Biscay.

Scientific facilities

For the financing of scientific equipment for laboratories, Ifremer benefit from financial aid from the Poitou-Charentes region to purchase real-time PCR equipment, a tissue grinder and an automated pipetting station for the genetics and pathology lab in La Tremblade. This complements the sample analysis platform.



Taking an intravalve liquid sample in an oyster at Ifremer's La Tremblade station (Charente Maritime)

Ifremer's work in Marennes-Oléron farmed oyster beds

Aquitaine region

Collaborative research work

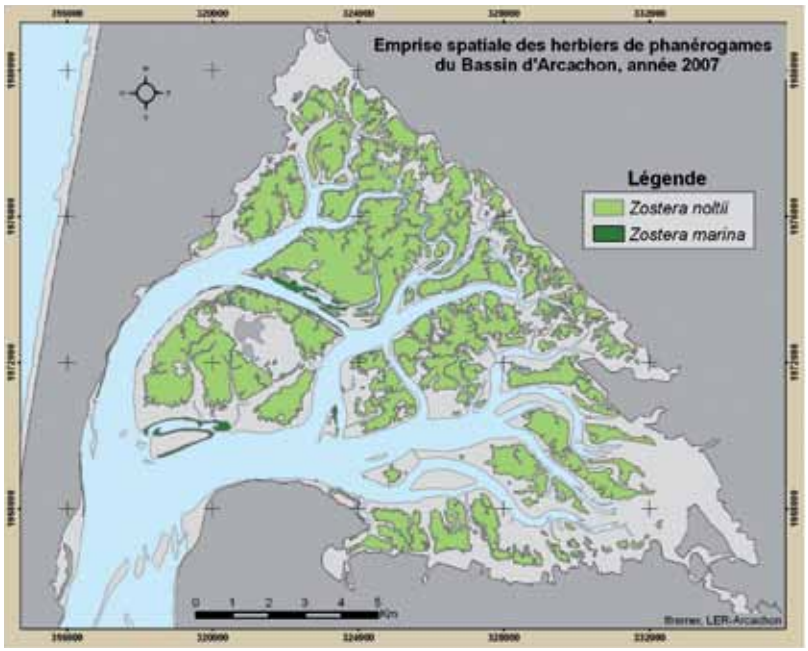
The "Environment and Resources" laboratory in Arcachon took part in developing a chemical test to fine lipophilic toxins, working in collaboration with teams from Nantes and the Aquitaine region. Within this context, multidisciplinary research studies were carried out there on the causes of atypical toxicities in the bay of Arcachon.

Partnerships with the region

The Aquitaine regional council and the Gironde county council supplied a financial contribution for Ifremer to conduct research on the causes for the regression of seagrass beds in the Arcachon bay. Furthermore, as is done each year, an agreement for scientific and technical assistance from Ifremer was signed in 2009 with the Aquitaine Arcachon shellfish farming section.

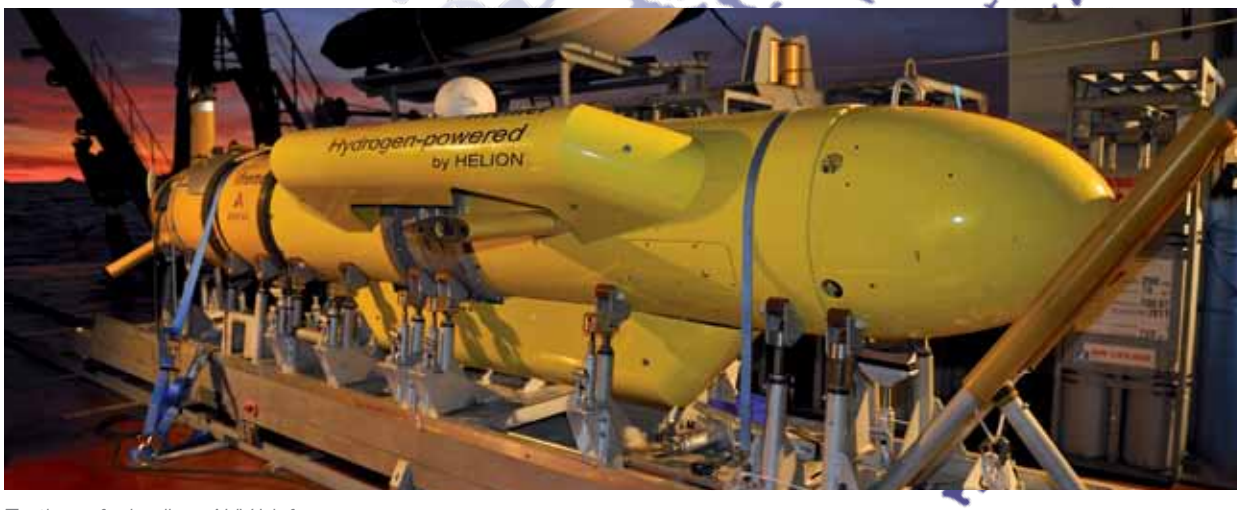
International meetings for professionals

Ifremer's fisheries science team based at Anglet within the University of Pau and Pays de l'Adour, co-organised the international small-scale fishers meetings which were held in Biarritz from 25 to 27 November 2009. These meetings were planned and held in cooperation with CNPMEM, CNPPED and the North Atlantic Salmon Fund.



Map of zostera beds in the Arcachon basin

International meeting for small-scale fisheries (Biarritz)



Testing a fuel cell on AUV Idef[x]

Languedoc-Roussillon region

Financial support

In 2009, the Languedoc-Roussillon regional council showed its interest and provided financial support for four actions conducted by Ifremer. These include:

- funding for a PhD thesis on "hydrosedimentary processes acting on the Palavas lagoon complex, Or lagoon and Rhone canal at Sète";
- (Adecom), aiming to reduce cupped oyster mortality in the Mediterranean, in partnership with the Hérault county council and the regional shellfish farming section;
- a study on the dynamics of phytoplankton communities in Mediterranean lagoons, descriptors of water mass quality and of benthic ecosystems;
- study on the cost-effectiveness of three models for fisheries enterprises, including tests of equipment and of three types of vessel in order to measure energy savings could be made possible by three, less environmentally-invasive, fisheries techniques.

Monitoring surveys

In 2009, Ifremer conducted the first monitoring cruises under the WFD, on the scale of the Mediterranean seafront, with the financial support of the Rhone Mediterranean water agency.

Communications action

During the first Open house days at Ifremer's Mediterranean centre, organised on 12 and 13 June 2009 in Sète, the scientists gave a comprehensive view of all our Institute's activities, equipment and mission on the Mediterranean seafront, including underwater vehicles, acoustics, hydrological data acquisition, tours of the microbiology laboratory, fish farming, macro-algae, fisheries technologies, and more. This operation is devoted to the general public and school groups and will be renewed every four years.

Expert appraisal actions

In 2009, Ifremer's marine expertise was shared on a regional level, through participation in four work projects:

- drawing up the regional coastal aquaculture sustainable development plan led by the regional prefecture authority,
- study to create a marine nature park on the Vermeille coast;
- launching an aerial survey to assess bluefin tuna in the Gulf of Lion, to detect schools at the surface and begin a series of independent observations of fisheries catches;
- establishing a fisheries protection zone in international waters in the Gulf of Lion, based on a scientific proposal drawn up by Ifremer and Spanish scientists.

Electronic tagging of a tuna

Linkages with the economy

Ifremer's activities are connected to the regional economy in a number of ways:

- setting up a partnership in the framework of the Blue contracts signed with the Mediterranean association of producer organisations for sampling of anchovies and sardines in Gulf of Lion. These data have provided detailed monitoring of populations to supplement the scientific cruises conducted over the past fifteen years;

- strengthening the fisheries observation network in the Mediterranean, which supplies information for Ifremer's research programmes and enlightenment for public policies;
- involvement in the Grenelle marine forum consultations, in revising the Common Fisheries Policy and the European Union's Green Paper;
- participating in regional fora on fisheries and their future: the Assises de la Pêche conference organised by the Regional fisheries committee of Languedoc-Roussillon and the Regional marine meetings organised by the PACA region;
- signing industrial contracts with regional firms to create hybrid individuals for use in aquaculture.

Scientific cooperation

In 2009, there was significant cooperation with the academic research realm. A few examples include:

- work in collaboration with the University of Montpellier II in the context of projects on oyster physiology, participation in the UMR Ecolag joint research unit for the marine organism immunology strand;
- organising, in collaboration with UMR Ecolag, the fourth European conference on coastal lagoons, from 14 to 18 December in Montpellier. This brought together over two hundred twenty research scientists and managers from eleven countries;
- starting up new research projects in cooperation with IRD, University of Montpellier, CNRS, INRA and professional fisheries or aquafarming organisations, on topics of marine protected areas, adapting farmed fish to plant-based feed, treatment of fish farm effluents to comply with changing regulations, and the ecosystem-based approach to aquaculture.

Provence-Alps-Côte d'Azur region

State-Region projects contract

On 23 October 2009, the first stone of the European centre for underwater technologies was laid at La Seyne-sur-Mer by Hubert Falco who is Secretary of State for Defence and Veterans, Mayor of Toulon and Chairman of the Toulon Provence Mediterranean agglomeration, Michel Vauzelle who is Chairman of the Provence-Alps-Côte d'Azur regional council, Horace Lanfranchi who is Chairman of the Var county council and Jean-Yves Perrot who is Chief Executive Officer of Ifremer. This is one of the projects under the PACA State-Region contract and it also plans to create a set of equipment and facilities to be shared by marine research laboratories. In 2009, the first equipment (Doppler current meters and underwater gliders) to be used to study coastal and mesoscale processes was purchased.

Laying the foundation stone of the European centre for underwater technology (CETSM) at the Ifremer Mediterranean centre

The Regional council allocated a PhD grant to Ifremer for a thesis to be made on the role of plankton in trophic transfer of organic contaminants in the Mediterranean.

Regional marine expertise

Our Institute's advice was requested about operations for fisheries conservation zones, extending aquafarming areas and maritime engineering. Ifremer actively participated in the regional marine meetings organised by the Regional council, contributing to presentations and moderating round table sessions. Likewise, our Institute is involved the Grenelle marine forum being held in Marseilles.

Partnerships with economic stakeholders

Several projects are being implemented in partnership with regional economic players. They have often received the PACA marine cluster label and are financed through the single joint ministerial fund, with supplementary funding from local and regional authorities. Among these projects are:

- Sea Explorer, coordinated by the ACSA company, aiming to develop an innovative underwater glider for oceanographic research.

Coastal water monitoring operation in the frame of the WFD

A prototype has been built and motor-driven propulsion, positioned on the lightweight survey AUV market, is envisaged;

- PACSM, coordinated by the Helion company, whose objective is to fit out an autonomous underwater vehicle with a fuel cell. Trials have demonstrated that the concept is operationally viable;
- Pipe watch, coordinated by Subseatech, with aim of developing a pipe inspection system. The project has been completed.

Ifremer also contributed to the Marine cluster contract's renewal and is involved in facilitating the "marine core services" programme. Beyond the studies carried out to implement the WFD, a network was set up to study the ecotoxicity of sediments on the scale of the seafront with the financial support of the Rhone Mediterranean Corsica water agency.

Finally, an experiment for the bathymetric survey of walls at canyon heads was performed with the Comex company in the framework of a contract with the AAMP.

Regional scientific cooperation

Active regional scientific cooperation with the Océanomed SIG laboratories took place. The projects include the creation of a hydrosedimentary numerical model for the bay of Marseilles, working in cooperation with the University of the Mediterranean, IRSN and USTV. Furthermore, the first measurements to assess inputs of contaminants from the Greater Marseilles area were made in the sewage and storm water systems, working in collaboration with the Marseilles urban council, the municipality of Marseilles and the services for water, sewerage and water treatment. An automatic measurement buoy was placed at the mouth of the Rhone River.

Major international scientific cooperation in the PACA region

In 2009, milestones in international cooperation included:

- working with AWI to develop underwater drones. A system for AUV water sampling was created and reformatted at Ifremer;
- two calls by the German research vessel Meteor, with scientific teams from the University of Bremen and from Geomar at La Seyne-sur-Mer,in the frame of a French-German geology cruise;
- a workshop held in the framework of a European project on underwater robotics;
- integrated sea trials of the EU GREX project, aiming for coordinated deployment of autonomous vehicles, with the participation of German, Portuguese, English and French engineers;
- the organisation of an international workshop in Alexandria in February 2009 on the impact of large coastal Mediterranean cities on marine ecosystems;
- pursuing programmes to assess the chemical contamination of the Mediterranean with measurements taken in Sicily, Libya and Cyprus.

Corsica region

State-Region projects contract

In the framework of the Mediterranean waters management and valorisation project which is part of the CPER plan for 2007-2013, Ifremer continued its work on pathogens limiting the development of aquaculture in the Diane lagoon.

Expert appraisal actions

The research expertise of the Ifremer teams in Bastia has been further strengthened by the ramping up of expert report activity since 2008 (ecotoxicology, macrowaste, etc.), leading to the facilitation of a working group in the frame of the Grenelle marine forum and to prepare the EU Marine Strategy Framework Directive.

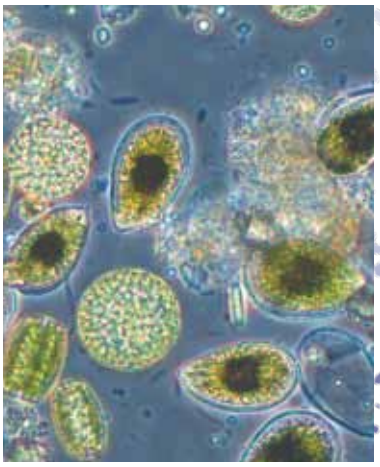
In the framework of environmental quality monitoring, our Institute help train the administration to survey the microalgae Ostreopsis ovata, whose extension has been observed along Mediterranean shores.

Linkage with the regional economy

Corsica was not spared by the high mortality rates in oyster spat seen in 2009. Ifremer monitored the phenomenon and has launched a nationwide programme to find the causes. A monitoring point was set up in the Diane lagoon to this end.

Regional scientific cooperation

The Momar project launched in 2009 associates laboratories in Tuscany, Liguria and Corsica and aims to develop an integrated system to measure the impact of human activity on the marine environment. A deep sea drilling cruise was performed in the underwater Golo river channel off Bastia in the framework of an international research project on sedimentary processes. This area provides a model for studies on the paleoclimate and formation of oil reservoirs.



Ostreopsis ovata *microalgae identified near the Frioul archipelago*

Overseas France: significant stakes

France ranks second worldwide as a maritime nation, with an EEZ of over 11 million km^2. 97% of this surface area is covered by marine waters of Overseas France. French overseas territories are thus a significant stake in terms of fisheries resources, biodiversity and mineral and energy resources.

10% of Ifremer's staff is based overseas: in the Indian Ocean (Reunion Island), the West Indies or Antilles (Martinique), French Guiana, Saint-Pierre-et-Miquelon and the Pacific (French Polynesia and New Caledonia). Our Institute's activities based on three main priorities, i.e., research actions to support sustainable development of production supply chains, observation and monitoring activities to support public territorial planning policies and research aiming to utilise scientific added value of overseas environments, particularly in the field of biodiversity. These activities are conducted within a scientific partnership strategy between Ifremer's teams overseas and in metropolitan France, with other national and local research institutions by helping to build local expertise, and also through cooperation with neighbouring countries in the area, thus contributing to the regional integration of the French overseas regions and countries called ROM-POM.

In order to strengthen the visibility and monitoring of our actions overseas, Ifremer set up an overseas General delegation in 2009.

In addition, beyond the activities carried out in the different establishments, the overseas teams took part in local Grenelle marine forum events, in the overseas Convention and the Assises de la Pêche fisheries meetings.

French Guiana

Changes in the local context

Following studies made on Ifremer's initiative on shrimp trawl selectivity, in 2009 the Regional fisheries committee of French Guiana deliberated and decided to make use the use of a device to reduce discards and catches of sea turtles compulsory to obtain a fishing permit. This is a tangible outcome of work done to benefit sustainable development of the supply chain.

In 2008, fish production from inshore fisheries exceeded that of shrimp and tropical red snapper for the first time. In 2009, catches from these coastal fisheries rose again, contrary to those of shrimp and tropical red snapper.

Activities and milestones

In 2009, the Dépêche action on sustainable development of coastal fisheries in Guiana and their bio-ecological and economic potential was launched. The action received ERDF funding. It involves an initial economic assessment of small-scale inshore fisheries in Guiana, along with potential fisheries production. Developing the fisheries supply chain requires better knowledge of the small-scale coastal segment which now ranks first for fisheries production in French Guiana. The FIS for this segment was set up in 2005 and is continuing in this framework.

The GECO action on bioeconomic modelling of coastal fisheries in Guiana, with funding from the Ministry for Overseas France was also launched in 2009.

Also in 2009 several significant partnerships were implement, particularly with the Guianese university cluster (University of the Antilles and of Guiana), in the frame of the Dépêche project on coastal fisheries dynamics and economics in Guiana. Participation by CNRS and MNHN in this study supported the development and fine-tuning of bioeconomic modelling for this fishery. An ANR project called "AO Biodiversity 6th extinction" on the same subject began in late 2009 and will include a PhD thesis beginning in 2010. Within this same project, the Brazilian Pescap Institute is taking part in producing statistics on the State of Amapa which are similar to those produced in Guiana. In addition, the National office for hunting and wildlife (which manages the Grand Connétable nature reserve) is participating in the study of the Goliath grouper's (*Epinephelus itajara*) exploitation and bio-ecology, with a PhD thesis which will begin in 2010.

Traditional coastal fishing vessels at Cayenne

Shrimp trawling fishing in the waters of French Guiana

West Indies

Farming of red drum

Changes in the local context

A large-scale strike that paralysed the West Indies for several weeks marked the year 2009. The high price of fuel, which also affects the fisheries sector of these islands, triggered the event. During the year, regulatory measures related to the pollution of aquatic life by chlordecone were implemented. They led to restrictions on its use by professionals in some fishing areas and for some species.

The new constraint has appeared as the bans set up following the adoption of the latest EFF operational programme have come into full force. They concern financing FADs and fishing boats, while the need to redeploy fisheries towards offshore resources began to grow. Today, West Indies fishing vessels which exploit offshore stocks benefit from exemptions from safety regulations which would have limited them from fishing beyond the five nautical miles zone in which all the coral reef fish life of Martinique and Guadeloupe is found.

Environmental and public health concerns have grown since the announcement about the impact of pesticides on marine fauna was made, leading to more and more requests to the Ifremer teams working there. Mariculture, which is free of chlordecone, enjoys the reputation as a high quality product and the organisation of the supply chain is beginning to show positive effects.

Activities and milestones

In the field of aquaculture, the Ombrigen project is ongoing. It has enabled all stakeholders to be consulted about the management of genetic resources of red drum and has led to several options being drawn up. The main ones will be tested in the frame of the Genodom project which has just been launched and whose aim is to secure the genetic heritage of farmed red drum in the West Indies and the Indian Ocean (Reunion Island and Mayotte).

To respond to strong expectations in the region concerning the reduction of potential environmental impacts from aquaculture, an action on "nutrition-feed-discharge" in the Sustainable development of overseas marine fish farming project, was implemented in Martinique. It aims to characterise discharges from red drum and study the influence that feed has on rearing performance, the quality of the fish's flesh and on its faeces.

In terms of fisheries science, the main actions taken focused on organising the fisheries observatory, as the pilot project reached completion and the transfer was made to a outside operator for the long-term observatory in Guadeloupe; the pilot project continued in Martinique, including the developing and testing of the protocol for observations of landings and the first newsletter on West Indies fishing vessel activity was put on-line in compliance with the national standard.

The multidisciplinary project Magdelesa, dealing with sustainable development of fisheries associated with moored FADs, was submitted to Interreg Caribbean.

Lastly, at the fisheries-environment interface, a project to characterise the chlordecone contamination of fish fauna around Martinique and Guadeloupe was conducted and expert assessments were made to help define fisheries management measures that are in compliance with public health objectives and that best limit the impact on fisheries.

For the environment, the Office for Water, as the contracting authority and Ifremer, supporting this project management, resumed the Rocch monitoring network's work in Martinique, after it was interrupted in 2008. For Ifremer, this meant an operational transfer of field actions to a consulting firm, along with continuing its chemical analysis work, databasing and standard interpretation of results.

Saint-Pierre-et-Miquelon

Changes in the local context

Since cod stocks collapsed and a moratorium was declared on the species in 1994 (landings dropping by about 90%), professional fishers have tried to diversify their activity by turning to aquaculture, particularly scallop and mussel farming, for the local market.

Concurrently, in May 2009, France submitted a letter stating its intention prepare a file to claim extension of its sovereignty beyond the 200 mile EEZ to the UN Commission on the limits of the Continental Shelf. Preparing this claim would require organising a data acquisition cruise in the Extraplac project context in 2011.

An Ifremer representative is based at Saint-Pierre-et-Miquelon. In order to continue supporting local development, particularly in the field of scallop farming, the decision was taken to renew this position and a new delegate took up his post in January 2010.

Activities and milestones

Our Institute contributes to acquiring the biological data needed for better understanding of fishery stock status, so that the total allowable catches (TAC) can be determined each year on a regional level along with the quotas which enable the local fishing fleet to be active. From now on, the assessments are not only targeting cod, but are extended to other species of economic interest, like snow crabs, sea cucumbers, swordfish and whelk. Following the signing of a Franco-Canadian agreement in 1994, Ifremer also takes part in cooperation with Canada, in the scientific assessments of fisheries resources of the southern coast of Newfoundland, around the Saint-Pierre-et-Miquelon archipelago.

Since 2007, Ifremer has supported a project to farm the giant scallop (*Placopecten magellanicus*), involving growing them on suspended ropes and seeding of juveniles in deep water. Ifremer has contributed to mapping the seafloor, hydrodynamic modelling, technological developments of monitoring facilities and acquisition of environmental data. By integrating all of the environmental data, monitoring the farms and production conditions, recommendations could be formulated for developing aquaculture. Finally, Ifremer took part in technical meetings of the steering committee set up to develop scallop farming and supplied advice to local mariculture committees.

*Seeding of scallops (*Placopecten magellanicus*) in the bay of Miquelon*

Snow crabs

Taking inventory of the benthos on a dive in the frame of the WFD (Reunion Island)

Reunion Island and the Indian Ocean

Changes in the local context

The predominant role played by fisheries in the economy of Reunion Island justifies that Ifremer's research activity in this field be maintained. Our Institute also intends to meet growing demand from the State and local and regional authorities in the fields of the environment, biodiversity and renewable energy sources. That is why the Reunion Island laboratory, which has always been specialised in fisheries science, extended its scope of skills to environmental activities in 2009.

Activities and milestones

Environment

Studying water quality
Several projects have been launched, working collaboration with Diren and Onema, to define the indexes of water quality indicators which are adapted to the inter-tropical context, complete the inventory of coastal water masses and draw up the monitoring networks to be initiated in 2013.

Hydrodynamic modelling
A collaborative platform (European Union, Regional Council, Office for Water and Diren) was set up to develop seven hydrodynamic models covering the coast in order to predict the fate of discharges in the coastal zone with respect to movements of water masses, moving with currents generated by tides or winds.

Making data available
The SINPMer (Diren, AAMP, MNHN and Office for Water) approach to databasing and making available the publicly financed data acquired on water quality of biodiversity was launched. This programme comprises developing the Quadrige² database at Reunion Island and in the longer term, opening the Indian Ocean Sextant portal which will be a server with maps and theme-based layers of georeferenced data online.

Mapping
The Spectrhabent OI project (Diren, AAMP and TAAF), utilising hyperspectral images (acquired concurrently with the Litto3D operation) in order to map benthic habitats of French islands in the Indian Ocean at depths from 0 to 30 metres, was launched in 2009.

Preserving biodiversity
Ifremer's involvement alongside the "Kélonia" sea turtle observatory led to a project which will sum up the data acquired (turtle's migratory pathways) over the past thirty years, so that a conservation plan in the Indian Ocean can be defined. As of 2012, the plan will be drawn up jointly by the Diren of Reunion Island, TAAF and the DAF of Mayotte. "Tagging" of spawning individuals or those accidentally caught by French fisheries began in 2009 and will continue to the end of 2011 (one hundred and ten Argos beacons in all).

Assessment and protection of fisheries resources

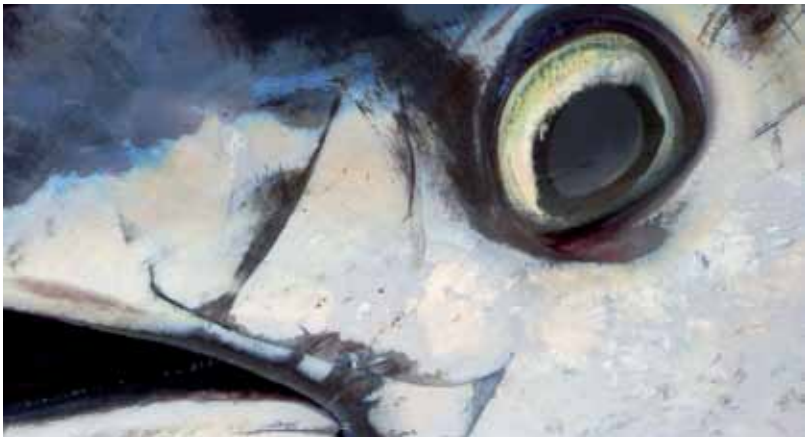
Sustainable management
Ifremer's activities in the fisheries science field have been ongoing, with the Reunion Island FIS being strengthened and made permanent and the starting up of the Indian Ocean Swordfish Stock Structure (IOSSS) project (European Union, Reunion Island DRAM and Regional council). The objective is, by using the population genetics tool and taking samples over the entire Indian Ocean (working in collaboration with South Africa, Australia, the Seychelles, Thailand, Sri Lanka and Pakistan), to determine whether there are one or more separate stocks of swordfish. This fundamental knowledge will enable sustainable management measures for the species to be taken.

Releasing a female green sea turtle equipped with an Argos beacon

Marine protected areas
The CAMP project (connectivity of marine protected areas) is between fisheries science and biodiversity. It aims to assess the degree of exchanges of reef fish between islands and reef areas of the entire South-western Indian Ocean and verify whether some sectors "export" their populations towards others. The results of this study, which uses the population genetics tool, will provide support for choices to be made within the Indian Ocean Commission on where marine protected areas should be positioned. In 2009, the Ifremer Reunion Island team also pursued its activities in the Pampa project (assessing the positive effects of making the lagoon a reserve), working in collaboration with the Marine reserve public interest grouping and IRD.

Developing renewable energies
Ifremer took part in the first think tank meetings on impact studies and monitoring to be performed in the frame of marine renewable energy projects, a sector in which the Reunion Island region is particularly in the vanguard (Gerri project for the Island to become energy self-sufficient without relying on fossil fuels by 2030).

Involvement in Mayotte to support marine fish farming
Farming of fish at sea started in Mayotte in the late 1990s. With 140 tonnes produced yearly, today it has the largest production in overseas France, with the greatest potential for development. Ifremer was asked to provide scientific support to the local marine fish farming supply chain by the SEOM and the Mayotte local authority. Working in cooperation with Aquamay, a four-year support project is currently being set up, with the initial objective of safeguarding the existing supply chain.



Tuna eye

The Pacific

Ifremer's centre for the Pacific area includes the establishments in French Polynesia, the Pacific oceanology centre at Vairao, on the island of Tahiti and those in New-Caledonia (Noumea, Saint-Vincent, Koné). Scientific activity is strongly focused on supporting the sustainable development of aquafarming supply chains (shrimp-, pearl- and fish-farming), as well as studying resources and the marine environment (marine protected areas, impacts of human activities and environmental quality).

In 2009, new lines of research came to the fore, particularly in the field of marine renewable energy sources, and an increase in that devoted to biotechnologies. Developing these research activities has been made possible thanks to greater synergy between the two Pacific delegations and strengthening the dual backup with scientific teams based in metropolitan France.

French Polynesia

Changes in the local context

The pearl farming supply chain, Polynesia's top-ranking economic sector for exports, sank into a crisis situation in 2009. In 2009, the pearl price per gram reached its historic low. Significant efforts were deployed to re-boost economic activity in this field, creating an entity called the "Maison de la Perle" to implement stricter supervision of the quality of pearls produced and exported. Efforts were also made to develop aquaculture, with the creation of the aquaculture technical centre (CTA) of the "Pays Vaia" region, just next to Ifremer's site, which will act as a relay between Polynesian professionals and aquaculture research developed along with the Fisheries service. 2009 was also marked by strong will displayed by the Pays entity and the State to promote the emergence and development of renewable energies from marine sources.

Pearl oysters awaiting grafting (Rangiroa, French Polynesia)

Activities and milestones

Support for pearl farming

In 2009, scientific studies for pearl production came to a turning point, with significant and tangible results for the sector. For instance, the influence of the type of nucleus and its coating on the rejection rate, mortality and pearl quality, were studied, using more than 6,000 experimental grafts. The results showed that the quality of the nucleus and its type of coating have a determining impact on the quality of the pearl obtained. Scientific studies on grafting techniques and cellular and genetic mechanisms (donor and receiver nacre quality, etc.) have also shown that flaws have multifactorial causes. The results obtained on the heritability of pearl colour, along with those on domestication of pearl oysters, should provide much greater mastery of the quality of the Polynesian production. These outcomes could revolutionise a number of key points in the pearl supply chain, or even generate new types of jobs.

Launching a fish farming supply chain

The fact that rearing of the batfish (Platax orbicularis) has now been mastered under experimental conditions makes it possible to envisage transferring the technique to the professionals, and running some marketing tests. This new farmed fish supply chain will benefit from the creation of the "Vaia" CTA aquaculture technical centre, whose work began in 2009. Ifremer is providing significant support in terms of designing the facilities and training the staff.

Pearl in a pearl sac

Selecting donor pearl oysters for graft

The graft and nuclei are inserted into the oyster's pearl sac

Assessing renewable energies
The Pacific centre's commitment to the theme of renewable energy sources took concrete form in 2009, with the work done by a Tahitian team in the framework of assessing the marine current resources for a stream turbine. An agreement signed with the State and the Pays entity will make it possible conduct an initial one-year study aiming to measure the potential in the pass between Hao Atoll and the Tuamotus.

Current measurements with an ADCP profiler (Tahiti lagoon)

Finally, several important partnerships came into being in 2009, including:

- the Great Observatory for the Environment and marine and terrestrial Biodiversity in the South Pacific (GOPS) which has eleven French partners (universities and national and territorial research bodies). Our teams from Polynesia, from New Caledonia and from metropolitan France will all be associated in this project;
- the international grouping for research on "Coral reef biodiversity" initiated by INEE;
- working more closely with IRSN, hosting the laboratory for environmental study and monitoring (LESE) at the Pacific oceanology centre at Vairao;
- creating the "Fa'ahotu" French Polynesian innovation cluster (twenty companies, four research institutions and the university of French Polynesia).

*Cage rearing of orbicular batfish (*Platax orbiculatus*), Ifremer's Pacific centre*

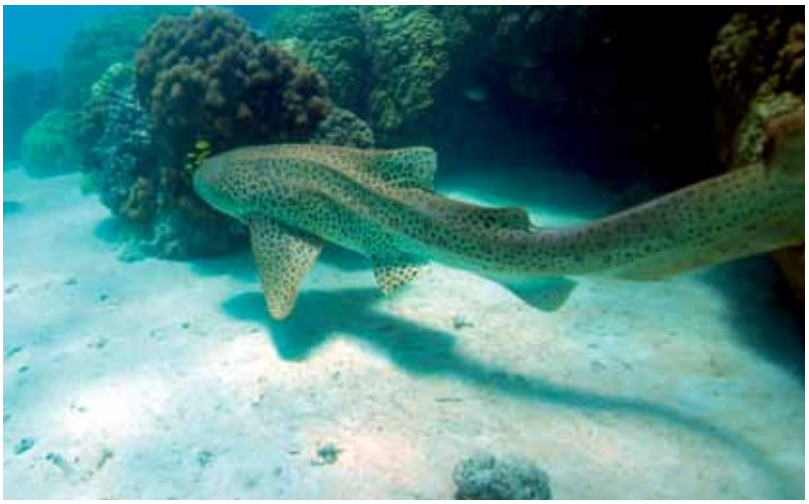
New Caledonia

Changes in the local context

2009 saw the ramping up of the multidisciplinary work on "Lagoons of New Caledonia" which is part of the programme called "Systemic approaches and study sites" and falls under the four-year contract binding our Institute and its regulatory authorities. During the year, work was done on Ifremer's Saint-Vincent station, financed by local and regional authorities and the State. A new hatchery was fitted out, the new pumping station is operational and the first batches of larvae were successfully reared.

Activities and milestones

Support for shrimp farming
Ifremer is involved in a programme providing scientific and technical support for shrimp farming activity. The programme is called Deduction, and has furthered research on the determinism of virulence in bacteria incriminated in shrimp mortality episodes and on identifying quality indicators for the bottoms of rearing ponds. In addition, Ifremer helped professionals and local authorities in defining biosafety rules related to the risk of viral infection from the Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHN), and contributed to consideration launched for the Strain conservatory and the setting up of an Aquaculture technical centre.



Zebra shark and its pilot runner fish

Rizophora *sp. mangroves (south-eastern coast of New Caledonia)*

Marine geosciences and international oceanographic cruise

Ifremer's Marine geosciences department took part in an international workshop organised by the Directorate of industry, mines and energy, BRGM, UNC, Australia, New Zealand, the USA and Germany, aiming to define the scientific programming of a regional blue water cruise for a vessel like RV *L'Atalante*.

Contribution to the lagoons study sites

Responding to calls for tender, Ifremer obtained one of the first formalisations by contract for new environmental observation activities in the New Caledonian lagoon. In this capacity, in particular, it perfected the specifications for the systems to monitor the impact of mining activity (setting up a network to monitor marine environmental parameters and creating an FIS specific to the Caledonian lagoon and reef fisheries, both financed by ZoNeCo).

Preservation of marine protected areas

In the frame of the national Pampa project automated underwater high resolution video camera stations were deployed in various marine protected areas of the southern lagoon. In order to characterise the performance indicators for these areas, Ifremer carried out surveys on the frequenting of the area and filed a patent with IRD on the rotating HD video technology.

*Curious bluespine unicorn fish (*Naso unicornis*)*

RESEARCH AND EXPERTISE IN THE FRENCH AND EUROPEAN MARINE SCIENCE NETWORK

Improving the way French marine research is structured

The Alliance for Marine Science international symposium

Developing an alliance for marine sciences

In 2009, Ifremer worked to promote and structure French marine research, by laying the foundations for a marine science alliance. The goal of this initiative was to bring together the national players engaged in this sector of research.

Our Institute also organised an international scientific conference on 28-29 September 2009, where the principle of this alliance was proposed. With over three hundred participants, this event made it possible to set up a discussion platform whose main topic concerned networking of the marine science community on global and national scales. Pierre and Marie Curie University and the vice chancellorship of universities, MNHN, IPEV and INSU were united in agreement on this principle. A written proposal laying the foundations for this alliance followed the conference. The "Alliance for marine sciences" programme has become an integral part of that of the Alliance for the environment (AllENVI), created on 9 February 2010.

Inter-organisational research

Prospecting mineral resources

Ifremer has coordinated national initiatives for forward studies involving two or more organisations on specific subjects they have in common. In the marine renewable energies sector, our Institute initiated a national study on marine mineral resources (Renima) whose main objectives were to assess the potential of these resources and their strategic value within a twenty year time frame, as well as the conditions required to bring them to the fore in the context of sustainable development. The partnership and the Research and Development measures needed were also estimated.

Food safety in the Mediterranean

Ifremer supported the international Samaqq 2030 study devoted to food safety in the Mediterranean. It was commissioned by the Agro-

polis scientific and technical council. This forward study is an extension of the "Mediterra" Ciheam study, which tests in particular different scenarios of climate change. It backs up the Ipemed studies and provides a contribution to the studies carried out for the "Mediterranean" study site as well as those by the Homere prospective think tank workshop supported by ANR.

And lastly, Ifremer participated in various inter-organisational forward studies conducted in 2009 by our scientific partners (for instance, INEE), and took part in creating a network of prospective services at the initiative of the Ministry of Food, Agriculture and Fisheries.

Initiating or extending research programmes involving several organisations

The national coastal environment programme

In 2009, Ifremer was very active in initiating or managing multi-organisational research programmes. For instance, the PNEC, which is linked to the continental and coastal ecosphere programme (EC2CO), a national programme coordinated by INSU, is also an interdisciplinary programme of CNRS. EC2CO is particularly careful to take the different types of anthropogenic pressures on the coastal and mainland ecosphere into account. PNEC is one of the thematic actions of the EC2CO programme and concerns some twenty-five scientific projects, half of them renewed annually. Teams from Ifremer are partners in a third of these scientific projects.

Networked studies

Multidisciplinary projects, made up of five research teams on average, make it possible to network with scientific partners such as Pierre and Marie Curie University, the Oceanological centre in Marseilles, the EPOC laboratory, the European institute of marine studies and USTL in particular. The EC2CO conference to be held in 2010 will be the opportunity to draw up a report on the four years of PNEC actions.

Ifremer also chaired the scientific council of the Liteau programme and co-organised an international seminar in Galway, in the frame of the Geohab programme, with over one hundred participants in attendance, giving rise to a Unesco publication in 2010.

Redefining a policy for expert appraisals, advice and training in the field of fisheries research

The "exploited marine ecosystems" unit

The first step in optimising the national fisheries science system in terms of making research actions coherent and effective took concrete form with the "exploited marine ecosystem" UMR being submitted to Aeres. Ifremer, IRD (CRH/Sète) and the University of Montpellier II are together in the project. It aims to establish a significant move to work together by Ifremer and IRD in the fields of research an observation, particularly for a joint contribution to a scientific fisheries observatory combining Ifremer's fisheries information system, IRD's tuna observatory and MNHN's databases. The project should also provide better expertise, particularly on an international scale, with better coordination of ORGP regional fisheries management organisations.

Projects for cooperation

Preliminary discussions were held in 2009 to set up a project between Ifremer and the University of Montpellier to work together. This will associate the ecology and fisheries science models department (DEMH) at Ifremer and the fisheries ecology laboratory (LEH) of the fisheries science cluster in Agrocampus Ouest (whose four-year project is being reviewed in 2010). Research projects drawn up on the basis of cooperation make it possible to open up this type of coordination to the entire scientific community.

Developing special research groupings

In 2009, Ifremer sponsored initiatives for nine national research groupings (GDR/fr), covering various research themes laid out in the four-year contract, as well as three European level research groups (GDRe). Three other GDRe groupings are being created on genetics-related themes (Global Ecological Genetics), as follow ups to the European network of excellence Marbef, "coral reefs" and "ecology of canyons and deep rocks in the Mediterranean" in the frame of collaboration between Ifremer and Pierre and Marie Curie University. In addition to this, Ifremer is a partner in six UMR joint research units and one UMS joint services

The Euroceans programme

Within the Euroceans programme, the international research consortium formed by twenty-nine institutions responded to the European Union's request to ensure that the activities from networks of excellence are perpetuated. The consortium was started in 2009 for a period of four years, with the aim of facilitating research efforts by institutes and universities over the long term in the field of ocean ecosystems subjected to natural and anthropogenic pressure. The "exploited marine ecosystems" UMR joint research unit was put in charge of its scientific coordination. Activities in 2009 mainly focused on creating an ecosystem modelling workshop, setting up a summer school with advanced courses on integrated economic-ecological modelling and building scenarios for marine ecosystems.

unit, especially the UMR EME with IRD; and finally a project with a joint UPMC/CNRS/Ifremer team is being planned with the marine station in Roscoff.

Setting up cooperation with the University of Paris VI and its marine research stations

On 19 March 2009, Ifremer signed a framework agreement for cooperation with Pierre & Marie Curie University (UPMC). Inventory was taken of the many actions involving scientific cooperation between Ifremer and UPMC, particularly those with the marine stations. A proposal to strengthen the work done in collaboration was made in December 2009. It particularly focuses on:
- creating an Ifremer-UPMC-CNRS team within one of the UMRs at the de Marine genomics institute (Roscoff) to work on the molecular mechanisms involved in the emergence of pathogenic vibrios in marine invertebrates. A joint chair is being considered for this theme;
- creating a GDR extended to Spain on the ecology of canyons and deep rocks in the French Mediterranean;
- consolidating and broadening collaborative work in order to perfect *in situ* sensors, especially for instrument bearing observation means (buoys, gliders and AUV).

Sea trials for AUV Aster[x] *in the Mediterranean*

EUROPEAN AND INTERNATIONAL COOPERATION

A new directorate regrouping both European and international affairs was created on the 1st September 2009 with the general aim of contributing to designing and implementing Ifremer's strategic position in the European and global context. This positioning is based on setting up scientific, institutional and economic partnerships intended to strengthen the efficacy and impact of our Institute's work and studies. The inspiration behind this creation is derived from the European Commission framework programme's increasingly international scope, particularly with the encouragement to set up research projects in cooperation with other (non EU) countries and the growing interest shown by the European Union for its policy with neighbouring countries.

A European research policy

Ifremer's action within marine ERA-Nets

The objective of the ERA-NET (European Research Area Network) scheme in the European Research Area context is to step up the cooperation and coordination of research activities carried out at national or regional level in the Member States and Associated States, between the main national sponsors of European research. The objective will be furthered itself through the networking of research activities, including the mutual opening of research programmes, drawing up and implementing activities and joint calls for projects.

Two ERA-Nets reached completion in 2009. They were: Ampera (accidental marine pollution) and MarinERA (marine ecosystems), coordinated by Ifremer, whose most successful outcome was the setting up and promoting of a Europe-wide network of funding agencies for marine research.

The "fisheries" partnership (seventeen partners) conducted in the MariFish ERA-Net (2006-2011) for the development of strategies for sustainable fisheries set within the ecosystem-based principle led to the funding in 2009, through a call for projects, of research on the ecosystem approach to fisheries and related indicators. ANR and Ifremer participated in the financing of the project for the amount of 557,000 euros. Amongst the three best proposals receiving funding, French teams were partners in two: Badminton (Ifremer) on by-catches and discards and Reproduce (Ifremer and UMR Liens) on understanding recruitment processes using combined physical and biological models of the pelagic ecosystem. In the frame of a package coordinated by Ifremer, partners are also establishing "joint programmes" for collaborative research to achieve more significant outcomes. Based on the recurrent funding of national programmes in interested countries, two regional programmes (English Channel and Mediterranean) and three thematic programmes have been launched. Ifremer thus pursued its partnership and signed the agreement on the theme of the "influence of climate on fish biology and population dynamics" in September.

Creating a new ERA-Net, SEAS-ERA

The proposal for a new marine ERA-Net called SEAS-ERA was accepted on 20 July 2009 in the FP7 R&D framework. It is an overarching network of the above-mentioned marine ERA-Nets with a total of twenty-two Funding Organisations from 20 countries in the basin regions of the Atlantic, the Mediterranean and the Black Sea. SEAS-ERA intends to play a major role in implementing the marine research agenda in Europe and in drawing up joint research programmes. It will encourage lasting transnational cooperation and coordination between national research programmes working towards joint objectives and better management and sustainable use of Research Infrastructures. This new ERA-Net will be one of the instruments for implementation of the marine science joint programming. ANR and Ifremer are the respective coordinators of the "Joint Programmes" and "Infrastructures" packages.

European maritime days

The European Union's integrated maritime strategy includes a way to improve awareness of European citizens about how the seas and oceans contribute to their quality of life and well-being. One special tool in this arrangement is the European Maritime Day celebrated on 20 May, an opportunity to inform and consult stakeholders about the latest developments in maritime policy.

The second edition took place in Rome in 2009, the sign of a new ambition to bring the stakeholders together in order to promote rational and sustainable use of goods and services from seas and oceans. It was the occasion for the launch of a platform bringing together stakeholders in the field of research (represented by the ESF's Marine Board) as well as NGOs, institutional operators (represented by the Conference of Peripheral Maritime Regions), the European Commission and industries. The objective of this platform is to facilitate the interface between the European Commission and stakeholders and promote dialogue and interaction between stakeholders from different sectors, just as the EU Integrated Maritime Policy does.

In the plenary session, Jean-Yves Perrot presented the role of public research and regional clusters in creating value, particularly in a difficult economic context. During an economic crisis, and when the consensus on the Lisbon strategy is fragile, we need to strengthen the position of public research, which does not only target the short term, but focuses its efforts as well on emerging sectors like marine energy sources, exploiting marine resources, biofuels and "bioeconomics".

European projects in the 7th Framework Programme for Research and Development

Call for proposals: "*Ocean of tomorrow*"

In December 2008, the European Council adopted a marine and maritime research strategy. One of the tools for this strategy established within FP7 Research and Development is the cross-thematic call for proposals named "*Ocean of tomorrow*". The principle of the call is to match the priorities and funding of several thematic priorities in the Cooperation programme. In 2009, three ambitious projects were opened to applications with a total budget of 34 million euros. Their topics were sub-seabed carbon storage, vectors of changes in marine life and environmental changes in the Arctic and their impacts on economic sectors. Ifremer is a partner in proposals submitted for the first two projects. The initiative will continue in 2010, with a strong focus on research in the Mediterranean Sea.

Ifremer and research facilities projects

Through its function of operating research infrastructures for the French scientific community, Ifremer is naturally led to assume intensely determined activity in European projects which tend to create networks of these infrastructures to fully benefit from coordination on the European scale. In 2009, the Eurofleets, EMSO and Euro Argo were milestones in this field.

The SeaDataNet project should also be mentioned. It is a European research infrastructure project under FP6 aiming to establish and exploit a Europe-wide network of real-time or batch-processed *in situ* or satellite marine data. Its aim is to structure all European marine data and make them available. Ifremer is the coordinator of this network which federates fifty organisations found in thirty-eight countries. In 2009, an extension of SeaDataNet devoted to geological data, called Geoseas, was selected and began its activity.

Finally, the 2010 FP7 call for European projects concerning research infrastructures gave rise to new proposals for integrated facilities in which Ifremer was strongly involved. The assessment and final selection will be made known in 2010. They are:

- Jerico, coordinated by Ifremer, proposing a European network of automatic coastal observatories for the acquisition and transmission of *in situ* data. This is a vital infrastructure for all systems aiming for operational supply of marine data;
- Marinet, a network of test tanks and *in situ* locations to perfect scaled down demonstrators and real size pre-operational prototypes using different forms of marine renewable energy. Ifremer is in charge of organising the transnational access, thanks to its experience in the similar Metri 2 project;
- Aquaexcel proposes a European network of experimental installations for aquaculture research which can cover the main commercial species and themes in the field. This concerns the sites of Palavas and Brest.

Successful call for projects, the ERC's "*Starting Grants*"

In the framework of the programme called "Ideas" supervised by the ERC, which supports the researchers selected for their scientific excellence and their research project to go beyond the frontiers of knowledge. For the first time in 2009, Ifremer became the host organisation for a "starting grant" project for young researchers setting up their first research team.

Projects supported by the European cohesion policy

Research, the key for growth

Since the Lisbon Agenda was adopted, all European policies are taking part in pursuing the ambition to make Europe one of the leading world economic powers. Research, innovation and environmental quality have been acknowledged as key factors which can secure economic growth and attractiveness of the European territory. The cohesion policy has therefore shifted funding orientations to devote the majority of them to projects which support innovation and research and contribute to sustainable management of the environment. These orientations are seen in the objectives of the inter-regional cooperation programmes which now finance projects with a strong research component.

Decision-making tools for public- and private-sector stakeholders

Based on the experience acquired during the MESH, marine habitat

mapping network from 2003 and 2007, and Charm, conducted in 2003-2005 then 2006-2008 (budget of MĐ11.6) projects, two new projects have been approved by Interreg programmes. They are Charm 3 in the English Channel-North Sea and MESH Atlantic, in the Atlantic Ocean. Along with pursuing knowledge about environments and resources, these projects aim to provide decision-makers and public- and private-sector stakeholders with relevant tools for integrated management.

Developing maritime potential: the "Atlantic MESH" programme

The purpose of the MESH Atlantic programme is directly related to knowledge about the marine environment and its mapping. It aims to develop maritime potential by promoting the implementation of strategies to create jobs and activity in the economic sectors in question. By focusing on changes in coastal zones and rising sea level, it will provide better marine and coastal protection.

The project is slated to last three years, starting in 2010. It has eleven university and research institute partners (Spain, Portugal, France and Ireland) for a budget of 3.5 million euros and grant money amounting to 2.27 million euros. The administrative coordination of the project is ensured by the project building and monitoring unit of the European and international affairs directorate.

International cooperation agreements

Creating a legal framework

Ifremer maintains cooperation agreements with several similar European and international research bodies. These agreements aim to provide a legal framework for scientific cooperation initiated by Ifremer laboratories, giving them both legitimacy and visibility that can strengthen partnerships while promoting exchanges of researchers and enlarging the fields of study. Such agreements make it easier to obtain funding support from the cultural action and cooperation services in French embassies located in these countries. As specified by contract, an annual joint bilateral committee meeting was held with the organisations which signed the agreement in order to take stock of the joint scientific activity (staff mobility, results, publications, etc.) and to schedule the new areas of research for the year 2010. In 2009, Ifremer signed a new cooperation agreement with Algeria and strengthened its ties with Morocco, Tunisia, North America, Japan and organisations like the Blue Plan.

Scientific cooperation with Algeria

Ifremer and the Algerian Ministry of Higher Education and Scientific Research signed a draft agreement on 12 June 2009 in Ifremer's headquarters, setting up scientific and technical cooperation in the field of oceanology. This cooperation is intended to promote jointly-conducted research programmes in marine sciences, staff training and exchanges, sharing of scientific information and drawing up joint bids for calls for tender or calls for proposals for scientific projects.

A technical and scientific agreement with the USA

Following the signing in autumn 2008 of a scientific and technical agreement between the French and American governments, the first joint committee meeting, which Ifremer took part in, was held on 12 June in France. The meeting

Signing of the memorandum of agreement with the Algerian Minister of Higher Education

Meeting of the NOAA/Ifremer joint committee

was chaired by the Ministry of Research for France and by the National Science Foundation for the United States and ratified the new dynamics of collaboration between Ifremer and NOAA. The joint committee meeting was followed by a scientific workshop on some targeted themes. The NSF expressed its wish that Ifremer and NOAA be invited to present the results of their cooperation efforts at the next joint committee meeting which should be held in the USA in 2010.

Cooperation with Morocco

The high quality and diverse nature of the exchanges between INRH and Ifremer were hailed by the chairmen of the two bodies at the annual joint committee meeting bringing them together on 8 and 9 July 2009. Both institutes hoped for a larger number of scientific co-publications.

During a visit to Ifremer's Channel-North Sea centre, the Moroccan delegation expressed its wish for partnership in the fields of marine habitat spatial mapping and of sclerochronology, as well as continuing exchanges in fishing technology fields. Support from Ifremer in setting up a Moroccan FIS began.

Long-term partnerships with Tunisia

The second Ifremer/INSTM joint committee meeting was held in Tunis on 12 November 2009. The meeting of the steering committee for scientific activities is part of the framework of the cooperation agreement established between the two institutions in 2006, the concrete expression of a partnership going back to 1986. Thus, in 2009, long-term cooperation was constructed in the fields of molluscan bivalve health and quality, enhancing the value and quality of aquatic products and seafood, developing the fisheries and aquafarming value of inland bodies of water and finally the ecosystem-based approached to study and planning of Mediterranean fisheries. Six co-publications by Ifremer/INSTM were presented in 2009, compared to eleven articles published between 2005 and 2008 and a PhD thesis on optimising methods in order to reduce the risks related to shellfish contaminated by fast-acting neurotoxins is being co-supervised.

Flourishing cooperation between France and Japan

The 23rd session of the Franco-Japanese sub-committee for oceanography was held in Tokyo on 13 October 2009. Reviewing cooperation projects showed that cooperation in oceanographic research between France and Japan is alive and well. The large number of new projects presented in this session should also be highlighted. On the French side, these projects involve Ifremer, CNRS/INSU, IRD and several universities. Jamstec remains the special partner for French marine science research, in half of the projects presented. The meeting was followed by an Ifremer-Jamstec on 14 October. During it, the interest of this active collaboration was mentioned along with some pathways for developing cooperative projects. For instance, a project to study the biomass presented under the crust on the seafloor will be set up during the IODP cruises. Jamstec also showed great interest in further developing cooperation with our Institute to develop new floats fitted with biochemical probes in the framework of the ARGO programme.

A proactive approach with China

China is establishing itself as a major new scientific partner in Ifremer's fields of interest (space oceanography, the environment, marine energy sources, living and mineral resources, etc). Since it is on the list of priority countries in Ifremer's four year contract and seeing the growing number of requests from China, Ifremer is focusing its cooperation on the organisations and universities in Qingdao, which is the capital of Chinese oceanography. Numerous meetings and exchanges took place in 2009 between Ifremer and different Chinese research bodies in order to prepare projects for cooperation, including some in partnership with other European institutes who share the same ambition. Furthermore, Ifremer is participating in the work by the China group organised by the MESR which will define the national strategy for research and innovation with respect to China.

Cooperation with the "Blue Plan"

The signing of a framework agreement for cooperation on 30 June 2008 led to an Ifremer agent being made available to the Blue Plan organisation in 2009. This is the regional activity centre for the United Nation's Environment programme's (UNEP/MAP) Action plan for the Mediterranean, whose mission is to shed light on the challenges for sustainable development in the

Mediterranean. Ifremer is providing assistance to the Blue Plan in developing its marine programme and thus has an early-stage observer on the stakes of this strategic region for our Institute.

On 18 December 2009 the first Ifremer/Blue Plan steering committee meeting was held, with the objective of taking stock of this arrangement of availability which has been in effect since mid-2009 and to schedule upcoming activities together. A study on the economic value of sustainable benefits coming from Mediterranean marine and coastal ecosystems was conducted. It should be continued and enlarged in 2010. It showed the importance of the services provided by marine and coastal ecosystems by quantifying the direct and sustainable benefits they supply for social and economic activities and the well-being of the populations, in the tradition of the international "Millennium ecosystems assessment" programme. To conduct the study, the Blue Plan worked with its partners to set up a methodology that was inspired by the principles of the "United Nations environmental and economic accounting" system (2003).

These studies respond to a request by Barcelona Convention contracting parties. They contribute to better knowledge about the services and benefits provided by ecosystems and give public-sector decision makers a common quantitative measurement in order to better manage environmental issues.

New regulations from the Seabed authority

The fifteenth annual session of the International Seabed Authority held in Kingston from 25 May to 5 June, focused on strategic issues of real interest to France and Ifremer, i.e.:

- drawing up two new regulations and special procedures on prospecting and exploration permits for mineral resources other than polymetallic nodules located beyond the zones under national jurisdiction, which are polymetallic sulphides and cobalt-rich ferromanganese crusts. Once these regulations are adopted (theoretically as of 2010 for sulphides), all research work on these types of geological formations and in these zones must be previously approved by the Authority, through the issuance of an exploration permit or contract;
- setting up site banking of reserved areas in the Clarion-Clipperton fracture zone (Pacific), in which no exploitation is possible. An international workshop under the Authority's aegis should be held in 2010 in order to examine this proposal. The Ministry of Foreign Affairs, France's representative to the International Seabed Authority, solicited Ifremer to prepare the French position on these issues.

Career plan mobility in Europe and globally

International mobility for experienced researchers

In 2009, Ifremer supported mobility abroad (stays lasting at least three months) for three experienced research scientists, in Australia at the Australian Commonwealth Scientific and Research Organization, in Japan at the Ocean Policy Research Foundation and in the United States at the Chesapeake Biological Laboratory of the University of Maryland's Center for Environmental Science.

PhD studies in Europe

In the context of doctoral training programmes, three requests for training for and through research, in the form of internships in foreign laboratories, were accepted. These stays gave the theses in question an international dimension, with:

- four months at the International Institute for Applied System Analysis (Laxenburg, Austria), for a thesis on adaptive changes generated by fishing in fisheries populations;
- three months at the Scottish Association of Marine Science (Oban, Scotland), for a thesis on identifying and characterising winter spawning zones in the Eastern English Channel and the southern North Sea;
- two months at the Institute of Applied Geosciences-Engineering Geology and Applied Mineralogy at Graz University of Technology (Austria), for a thesis on ocean gas hydrate dynamics during the Quaternary: an authigeneous carbonate dating approach.

LIFE AT IFREMER

Discovering the oceans with Ifremer...

HUMAN RESOURCES

Labour relations

The Ifremer-Genavir social and economic unit

A 2009 milestone included the negotiation of an agreement on social dialogue in practice and staff representation in the Ifremer-Genavir social and economic unit. The negotiation focused on how representative bodies for personnel, particularly the establishment committees, functioned as well as on grants, exercising union rights and the terms and conditions of negotiations. A general agreement on it was signed by the CGT, CFDT and CFTC unions.

Employment of seniors

Following on from the agreement on managing the careers of staff in the seniors age category signed in 2006 and in accordance with the law of 17 December 2008, a agreement to promote the employment of older workers was concluded with the CFDT, CFE/CGC and CFTC trade unions. The agreement was signed for three years, it supplements the previous one and features an operational approach intended to improve the employability of the over-fifties. The main measures are:

- developing a career interview intended to take stock of evolving jobs and the perspectives of being employed in our Institute (skills, training needs). A skills audit also enables salaried employees to analyse their skills and their motivations to define a career plan;
- giving access to a special training programme;
- transmitting knowledge and skills through mentoring;
- organising the last years of work and the transition from working life to retirement.

Indicators and tables were created in order to monitor the development and trends of this agreement.

Salary-related measures

The 2009 pay agreement signed with CFDT, CGT and CGC based on a rise of 2.6% in the mean pay for staff in place, made it possible to:

- apply a general increase of 0.45%,
- finance individual promotions at a level of 1%,
- give 25% of staff an individual merit bonus of 313 euros,
- make sixty-six choice-based and 25 seniority-based promotions.

In addition, this agreement made it possible to lower the carry-over effect, taking it from 0.69% to 0.45%.

Continuing education

The training budget provided for the equivalent of 29,000 course hours at a cost of 1,650 million euros (covering course fees, travel and payroll costs) for 880 trainees or participants. Training themes are defined by the priorities set out in the multi-annual training guidelines for 2009-2012, in compliance with the four-year contract. Outstanding aspects of the 2009 training plan included the setting up of three-day management seminars, with one hundred three heads of laboratories, services and departments took part in one of the four sessions that were organised in 2009.

There are two main types of courses in the training plan:

- courses to meet specific needs in various departments, consistent with programmes under way, like statistics, taxonomy, geostatistics, scientific software, sensitivity analyses, validation approach, etc. Some of the actions were organised in collaboration with other bodies, so that joint training courses could be offered to staff from Ifremer and from other institutions;
- those which support our Institute's general policy: scientific writing in French and English, quality assurance, English language, legal and accounting courses, safety training, etc.

Hiring and staffing

In 2009, Ifremer hired thirty-nine new employees, eighteen of whom were women. Moreover, one hundred thirty-three staff in worked full time equivalent (FTE) came to Ifremer on fixed-term contracts to back up the teams faced with higher workloads due to contractual commitments, especially those with Europe and regions.

Ifremer also hosted sixty-four doctoral fellows (FTE), twenty-two post-docs, (FTE), sixteen VCAT civilian technical volunteers (FTE) and seventeen professional contract holders (FTE).

The budget allocated for paying interns rose by 0.5%. This enabled ninety-one young trainees or students (FTE) to be hosted, fifty-four of them (FTE) on a wage-earning basis.

In 2009, Ifremer also committed to developing its ability to attract, integrate and keep valuable employees, through:

- diversifying the sources of recruitment (participation in the Research trade show, publishing ads on foreign websites like Euraxess and Osmmos);
- initiating career paths from start of the hiring and welcoming phases which are more clearly identified (seminar for new staff, management training, coaching when taking on new responsibilities)

Staff trends in full time equivalent positions over the year

Type of contract	2005	2006	2007	2008	2009
Permanent contract	1,309	1,320	1,328	1,316	1,303
Term contract	85	115	100	108	133
Post-doctoral candidates	16	14	18	27	22
PhD students	36	47	55	61	64
VCAT-VCI	8	8	14	17	16
Professional training contract	2	9	11	17	17

International external mobility and hosting

In the frame of the four-year contract, Ifremer has undertaken to promoting external mobility abroad and developing its hosting capacity. In 2009, setting up partnerships with Csiro (Australia) and the University of Tasmania in the field of bioeconomics, as well as extending the cooperation agreement between the Harvard School (USA), the Pasteur Institute and Ifremer in the framework of a comparative study of environmental strains, provided mobility for two researchers.

Lastly, in keeping with the spirit of the European Charter for researchers signed in 2008, Ifremer hosted numerous young researchers in our Institute's labs, particularly in the departments of functional physiology of marine organisms and biology of exploited marine organisms.

Forecast-based management of jobs and skills

The employment and expertise plan, called GPEC, is one of the objectives set out in the four-year contract. Using studies run since 2002 as a basis, the process has been reviewed, reinforced and optimised.

Objectives

The GPEC plan must reconcile the high priority necessity of preparing for future challenges with the pressure to hire to fill short term needs. This forward planning management approach is especially important at a time when our Institute is growing its capability to respond to competitive calls for projects or to immediate, short-term demands to support public policies. The ongoing approach is vital for Ifremer, enabling it to most optimally steer all its human resource management (in-house and external mobility, retirements, hiring and training) and fulfil needs in terms of both quality and quantity in compliance with commitments and time frames.

Actions conducted in 2009 and planned approach in 2010

The following actions were taken in 2009 in the frame of the GPEC plan:

- taking inventory of projected needs for the English Channel-North Sea pilot centre;
- finalising the dictionary of specialised terms for disciplines/specialisations for support duties;
- carrying out a study on assistants;
- setting up a three-year individual training plan;
- launch of management training action;
- developing the individual interview documentation.

The approach planned for 2010 includes the following steps:

- finalising the dictionary of specialised terms for disciplines/specialisations for support duties;
- translating the strategy plan into requirements for jobs/skills, with respect to the strategic orientations and guidelines, in order to identify the key skills and resources which are scarce, should be developed or which could disappear;
- modelling the actions undertaken for the Channel-North Sea centre so that they can be deployed throughout the Institute, with vision which is both "centre-oriented" and horizontal for fisheries science, in order to apply the same approach to other "support" divisions;
- involving the different players and managers, particularly based on the managerial approach engaged in 2009.

THE QUALITY APPROACH: TOWARDS ISO 9001-2008 CERTIFICATION FOR THE INSTITUTE

Reliability and traceability of results

The quality approach has accompanied all Ifremer's activities for several years now, to ensure the reliability and traceability of results. In March 2009, a new phase was entered with the ISO 9001 certification of the headquarters quality management system: "Steering Ifremer: strategy, programming, monitoring, assessment and developing the value of research programmes and sea-going facilities". The approach covers fourteen steering processes managed at our Institute's head office, such as strategy, development, communications, assessment, human resources, financial management, and project scheduling and coordination. The ocean research fleet has a special situation, with the steering of the management and scheduling of sea-going facilities, one of the achievement processes covered by the ISO 9001 certification.

Upcoming certification steps

The objective chosen for the four-year contract is to extend ISO 9001 certification to Ifremer's entire scope of action. To prepare this, the network of Quality assurance delegates was supplemented so that all of the Institute's centres are covered and a team of in-house auditors was formed.

This certification approach for our Institute is based on:

- certification of the headquarters,
- awarding of quality standards to laboratories:

The analytical unit of the genetics and pathology laboratory at La Tremblade received "animal histopathology" accreditation in 2009.

Previous accreditations awarded were confirmed in 2009 for the eight Environment and Resources labs and for the materials testing laboratory.

- Quality approaches were pursued for hydrological monitoring (nutrient analysis), in Nantes, Arcachon, Port-en-Bessin and Sète.
- Launching of Quality approaches, beginning in Nantes for the Environment, microbiology and phycotoxins and biogeochemistry and ecotoxicology departments for their monitoring-related activities.
- Other ISO 9001 certificates: monitoring audit for the Vessels and embedded systems service: "Design, development, maintenance and dissemination of shipboard software on ocean vessels and underwater vehicles".
- The Quality approach for ISO 20000 certification at the Information technology and marine data service.
- The integrated Quality, Safety and Environment management system underway at Genavir.

This certification should highlight theme-based research, work by researchers, agents and all Ifremer staff, and optimise the way our Institute works.

ACHIEVING IFREMER'S SUSTAINABLE DEVELOPMENT PROGRESS PLAN

2009 confirmed Ifremer's determination to be exemplary in the field of eco-responsibility. The inventory which began in 2007 has now been completed. The 2008-2011 Sustainable development progress plan, set out in our Institute's four-year contract, remains the roadmap for coming years. It has given rise to numerous actions for energy consumption plans, management and recycling of waste and use of recycled paper.

The main actions in 2009

Eco-responsibility for procurement

In the field of procurement and purchasing, eco-responsibility has entailed:

- a call for tender for office supplies launched nationwide, with the criterion of compliance with sustainable development standards for eco-labelled products,
- a call for tender for office furniture, with the criterion of compliance with sustainable development standards and particularly as concerns the obligation to use labelled wood,
- use of 100% recycled paper on several sites.
- a call for tender for "institutional catering" in Nantes, with the criterion of compliance with sustainable development standards with respect to the products consumed,
- a call for tenders for the "upgrading of research vessel *L'Atalante*" in compliance with sustainable development standards, particularly in terms of the environmental management of the work site and use of eco-labelled products.

The Institute's carbon budget

Ifremer launched a carbon budget audit which will be completed by the end of 2010, beginning with the Boulogne-sur-Mer, Sète, La Tremblade and Lorient sites.

Our Institute also started a company travel plan in Brest, with a carpooling website to be launched.

In Nantes, this initiative entailed renewing the incentive operations to use public transport: financial contributions, providing tickets for missions in the city or greater urban area. Ifremer also offered eco-driving classes.

Reducing energy consumption

In order to reduce energy consumption, Ifremer has undertaken programmes to construct or renovate buildings incorporating HQE high environmental quality standards: for the European underwater technologies centre at La Seyne-sur-Mer, upgrading of workshops where research cruises are prepared in Brest, reorganising warehouse areas in Brest, and so on.

With the same objective, the boiler at the Headquarters was replaced by an efficient condensing boiler, installing presence-detector lighting continued in Toulon, Boulogne-sur-Mer, Port-en-Bessin and Nantes, electrical grids were separated and sub-meters installed at the Nantes centre.

Green habits for green spaces

Eco-behaviour for green spaces mainly means mowing less often, treating surface areas without pesticides and herbicides and sustainable management of trees in Brest and Nantes.

Sorting and recycling of waste

For waste management, sorting and recycling of rubbish has been generalised to all our Institute's sites. In addition, a growing number of sites are working with charities to collect waste products like paper, toners, computer hardware, etc.

Regulating water consumption

In order to regulate water consumption, automatic taps were purchased for the Nantes centre, a study to recover rain water was made at Argenton, sub-meters were installed for each building and the automatic water feeders in the boilers at Nantes were replaced.

Organising the sustainable development policy

The Club for sustainable development in public establishments and organisations was hosted at Ifremer headquarters on 29 April 2009, for a working day devoted to professional integration, with some forty participants in attendance. Two annual meetings were also held by our Institute's eco-responsibility correspondents. Finally, messages were disseminated to all staff, to take stock of various actions on a site by site basis.

Indicator trends

The indicators presented in the 2007 and 2008 annual reports, were well monitored in 2009, so that the positive evolution of Ifremer's approach could be measured.

Energy management

The overall figures for 2009 confirm the efforts made, especially on the sites using technological and experimental equipment and facilities. Series of main meters per type of power and for fluids, as well as sub-meters for processes and hot water plumbing were installed. Centralised technical management was also set up in Ifremer's Atlantic centre and is planned at the two other locations of La Seyne-sur-Mer and headquarters in 2010. As planned, energy audits were run at several sites and appropriate plans for action established.

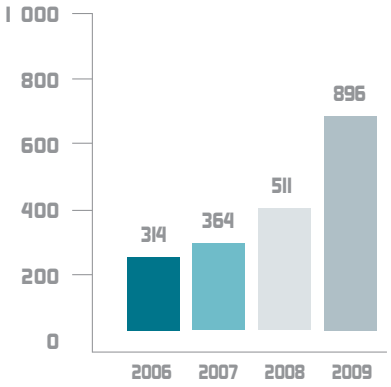
Water management

Reducing water consumption continued throughout the Institute with the exception of the Toulon centre, although the drop was less noticeable than in 2006, 2007 and 2008. Indeed, after repairing the leaks found in the mains of Brest and Nantes in 2006 and 2007, consumption dropped by 4% in Brest and by up to 10% in Nantes. Only the Toulon site, where vessels fill up with fresh water, showed a significant increase. Sub-meters have now been installed on all sites. Automatic taps have also been installed in Nantes, La Seyne-sur-Mer, Port-en-Bessin and Boulogne-sur-Mer.

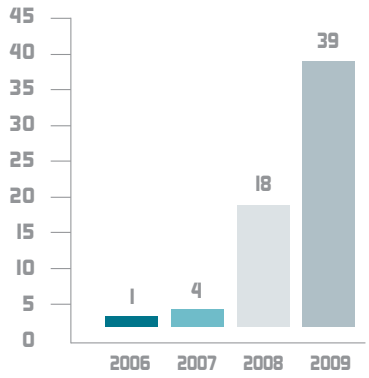
Video-conferencing use

Video-conferencing makes it possible to limit travel for simple meetings and thus is a true energy-saving factor. In 2009, eight hundred ninety-six video-conferences were held. This provides strong confirmation of growth, tracked over the past five years. Furthermore, the upgrading of video-conference systems on several sites has spectacularly boosted the number of connections. Seeing the exponential rise in reservations for the room devoted to this activity, a second video-conferencing room has been created at the headquarters. A second room for the Ifremer centre in Brittany is still planned.

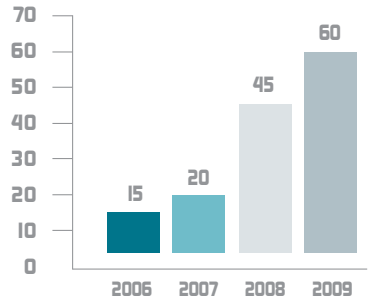
Number of videoconferences



Number of calls for tender with Sustainable Development Criterion



% waste recycled



Use of sustainable development criteria in calls for tender

In 2009, thirty-nine calls for tender or consultations used a criterion of sustainable development in their choices, particularly as concerns office supplies and furniture, the company restaurant in Nantes, several lots for the work to upgrade RV *L'Atalante* and to build the CETSM at La Seyne-sur-Mer.

Amounts of waste recycled

The percentage of waste recycled went to 60% in 2009. This sharp increase can be explained in particular by the fact that rubbish sorting was established on all Institute sites, but also by the full involvement of staff. It should also be noted that more and more sites work with charity associations to collect waste.

The outlook for 2010

In compliance with our Institute's "sustainable development progress plan for 2008-2011", several actions have been scheduled for the year 2010. They are:

- finalising the Institute's carbon budget audit in 2010;
- setting up company travel plans on other sites;
- generalising the analysis of eco-responsibility indicators, in accordance with the Prime Minister's circular dated 3 December 2008;
- generalising the use of sustainable development criteria to analyse future calls for tender;
- installing centralised technical management at La Seyne-sur-Mer and at the headquarters;
- renewing ecodriving course offers.

IFREMER'S COMMUNICATIONS

The dynamics of the communications strategy at Ifremer are two-fold. They first aim to reassert our Institute's ambitions and positioning in France and worldwide, by increasing its visibility and power of attraction. Second, they should give the widest possible public both understanding and empowerment with respect to Ifremer's studies and research results. To this end, Ifremer increasingly highlights the link between its research and societal stakes, to educate young people and to build a shared vision of the Institute from within.

Scientific results, the focus of communications

Communicating research results and developing the value in its fields of excellence and its strategy, in the medium and long-terms, are Ifremer's priorities. This is carried out both through its press relations policy and in developing partnerships, especially for written, digital and audiovisual productions.

An active press relations service

In 2009, Ifremer sent out forty-three press releases and press kits, highlighting all of our Institute's research themes and orientations. The press service strongly contributed to increasing the Institute's national and international visibility. With the information communicated to the media being relayed at a rate of 12.5% in 2009, the spin-off in the press remained at a high level. This is particularly due to the celebration of Ifremer's twenty-fifth anniversary, the Institute's participation in searching for the *Airbus AF 447* wreckage, the bans on sale and consumption of oysters from the Arcachon Bay over the summer, the successful Marmesonet and Bobgéo cruises, the Charm 3 project and the laying of the CETSM's foundation stone.

Close partnerships with the media

Ifremer's strength also lies in its partnerships with well-known media, particularly those in the mainstream. A special partnership was established with the first French-language continuous news channel for the foreign market, France 24. This led to the channel broadcasting the events organised by Ifremer for its twenty-fifth anniversary. A series of fifteen video vignettes called "Ifremer, an ocean of science" had its first run on *France 24*, making our Institute's activities better known.

Ifremer also continued publishing the magazine called *Les Nouvelles de l'Ifremer*, whose monthly supplement has been published for the past ten years in the *Le Marin* weekly covering the maritime economy. Since 2006, each edition has familiarised scientific journalists and stakeholders in the maritime realm with one of Ifremer's specific activities or working themes. This partnership will evolve in 2010 with the publication called *Rendez-vous de la biodiversité marine* in the context of the International year of biodiversity.

Ifremer, 25 years of action and innovation

On 5 June, Ifremer blew out its 25 candles, on World environment day. Ifremer was created on 5 June 1984 by the merging of the scientific and technical institute of maritime fisheries (ISTPM) and the National centre for exploitation of the oceans (Cnexo). For the past 25 years its work has covered all marine disciplines. It is one of the most integrated establishments worldwide in the field of marine sciences.

The 5 June celebrations were observed by Ifremer's staff, with a marine dictation recorded by Maud Fontenoy, and showings on various sites of the Institute of the film by Yann Arthus-Bertrand called *Home*, which was released the same day.

Twenty-five events were held over the year, like as many candles, to mark this anniversary. They all provided occasions to highlight Ifremer's activities and research work and make them better known. Every scientific discipline from our Institute was represented, from fisheries science to underwater technologies, to aquaculture, monitoring networks and operational oceanography.

Amongst the outstanding events were the publication of the book on Marine renewable energies - *Prospective foresight study for 2030* (Editions Quae), the discovery of the *Pyrococcus CH1* bacteria, organising the Réphy conference days (Nantes), the international conference on molluscan shellfish safety (Nantes), the inaugurations of the sclerochronology cluster (Boulogne-sur-Mer) and the shellfish microbiology NRL (Nantes), the private viewing of the "Women and seas" exhibition" (Biarritz), RV *L'Atalante*'s return to sea after overhaul (Brest), departures for the BobGeo1 and Marmesonet cruises and the launch of the SMOS satellite.

In-house communications, at the heart of collective dynamics

Contributing to our corporate dynamics and ensuring better dissemination in-house of major research results as well as Ifremer's strategy are part of the main missions of the Communications department.

Numerous communications media developed in previous years have been enriched or extended to cover the entire Institute. For instance, the in-house journal *Planète Ifremer*, will take on a new dimension in 2010 by being integrated into the new Intranet, and in-house conferences are now regularly held at the headquarters as well as in several centres (Brittany, Atlantic and Mediterranean).

The Ifremer Trophies

The principal new event of the year was the launching of the first edition of the "Ifremer Trophies" in June 2009. The trophies were launched on the occasion of the Institute's twenty-fifth anniversary, with the aim of fostering in-house recognition of teams and promoting cohesion and solidarity between colleagues. They provide a special opportunity to hail the excellence, spirit of innovation and the involvement of everyone who belongs to our Institute. They represent a rewarding way to make both individual and collective research results, studies, teams and creations better known, both inside and outside of the Institute. The first Ifremer Trophies awards were held on 28 September 2009 in the Great gallery of evolution in the MNHN national natural history museum, during an official dinner organised for the international "Alliance for marine sciences: from national network to global network" conference.

Winners of the first Ifremer Trophies

Institutional communications: 2009 was a rich year

2009 was an especially rich and busy year in terms of institutional communications. Above and beyond being cited by the President of France (in his speech at Le Havre on 16 July) and the Prime Minister (2 December speech at the fifth conference on the maritime economy), who assigned a predominant role to Ifremer in the new platform on marine renewable energies, the Institute inaugurated or laid the foundation stone of numerous buildings.

New research installations

The new premises of Ifremer's Atlantic centre, containing the "Shellfish microbiology" NRL and the Morbihan-Pays de la Loire Environment Resources laboratory of Ifremer's Nantes centre were inaugurated on 15 June, in the presence of Bernard Hagelsteen, the Prefect of the Pays de la Loire and Loire-Atlantique regions, Jacques Auxiette, the Chairman of the Pays de la Loire Regional council and Jean Yves Perrot, the Chief Executive Officer of Ifremer.

At the Ifremer English Channel-North Sea centre on 7 May, Jean-Yves Perrot, Daniel Percheron (senator for Pas de Calais, chairman of the Nord-Pas de Calais Regional council), Hervé Malherbe (subprefect for Boulogne-sur-Mer), Frédéric Cuvillier (MP and mayor of Boulogne-sur-Mer and chairman of the Boulonnais urban community) and Jack Lang (MP for Pas-de-Calais) inaugurated the sclerochronology, zooplankton ecology and taxonomy clusters.

On 23 October, Hubert Falco, secretary of State for the Ministry of Defence and Veterans, mayor of Toulon and chairman of the Toulon Provence Mediterranean urban council, Michel Vauzelle, chairman of the Provence-Alps-Côte d'Azur Regional council, Horace

Lanfranchi, Chairman of the Var County council and Jean-Yves Perrot, Ifremer's CEO, laid the foundation stone of the CETSM at La Seyne-sur-Mer. This 500 m² building which will be put into service in 2011 is designed to federate French scientific and technological activities in the field of underwater technologies and to host various European partners. The project is the tangible expression of the Var territory's special position in terms of underwater technologies and is the first strand of the CETSM project, comprising a set of shared premises for the PACA marine competitiveness cluster which will be part of the Marine techno park. The final strand of the project which will be managed by Ifremer, in partnership with the OceanoMed SIG and CNRS-INSU, aims to create a shared fleet of oceanological facilities.

Guided tours and information days

Alongside these flagship events, many visits were made to Ifremer sites, and amongst them were:

- that of the French sailor Maud Fontenoy to the Ifremer centre in Brittany: on an invitation from the Chief Executive Officer, her visit took the form of a two-day training course facilitated by scientists from the Institute, designed to let her learn more about the themes she regularly addresses in her activities to inform the general public. A large number of themes were presented (ocean physics, marine renewable energy sources, fossil energy resources, marine geosciences, the impact of fisheries on coastal seabeds, deep sea ecosystems and fisheries resources);
- a day of experimentation for a fuel cell for underwater applications: experiments were run on this anaerobic fuel cell from 12 to 22 October in the Mediterranean and the AsterX underwater vehicle was successfully propelled by it. Some forty industrial leaders and personalities from institutions were invited to the demonstration in the harbour basin of Ifremer's Mediterranean centre.

Finally, Ifremer joined the Marine Board Communication Panel (MBCP) working to promote marine sciences in Europe in four directions, called Forum, Synergy, Strategy and Voice. Although the Marine Board has a true political orientation, the Marine Board Communication Panel mainly focuses on aspects of education and awareness-raising. Communications directors or officers from various European institutes are on this panel.

Editions Quae ramping up

Adding publications to the "Sciences de la Mer" editions by encouraging scientific teams to publish or co-publish is an integral part of Ifremer's strategy. In 2009, Editions Quae again ramped up their activity with seven new publications and 2,570 books sold.

Amongst these new books, the following stand out:

- *Marine renewable energies. Prospective foresight study for 2030*, by Michel Paillard, Denis Lacroix and Véronique Lamblin;
- *Et si le littoral allait jusqu'à la mer ! La politique du littoral sous la Vème République* (If the Coast Went all the Way to the Sea! Coastal Policies under the 5th Republic in France) by Alain Merckelbagh;
- *Les filets maillants* (Gill nets) coordinated by Gérard Deschamps;
- *Les crustacés* (Crustaceans) a Néva/Quae/Ifremer co-publication, by Daniel Latrouite, Olivier Barbaroux, Yvon Morizur and Jacques Patrois.

Editions Quae also ensured their presence and visibility at numerous events, including the ninth Halieumetric forum (Brest, 30 June to 2 July), the fish farming conference (Paris, on 1 and 2 July), the International geography festival international of Saint-Dié (1 to 4 October), the European coastal trade show in Lorient (6 to 8 October), Itech'mer in Lorient (22 to 24 October) and the Pollutec trade show in Paris (1 and 2 December).

Flagship exhibitions for the year 2009

Three exhibitions were created either by Ifremer or through partnerships:

"The sea goes up to Paris"

On the occasion of the "Sea days" event, Ifremer, SHOM and IGN presented an exhibition dubbed "the sea goes up to Paris" at the French Navy museum from 12 to 14 June. Four large themes were addressed: deep seafloors, the interaction between man and the environment, knowledge and protection of the coast and sea and renewable energy sources. They were staged in an interactive coastal exhibit, where a giant map on the floor, models, an interactive terminal and film showings could all be found.

Marine energy sources: blue gold

The exhibition called "Energies of the sea: blue gold" at the Aquarium de la Porte Dorée and the Oceanographic institute in Paris, presented the technologies used to develop and utilise marine renewable energies in metropolitan and overseas France. The technologies exploit, or will do so in coming years, energy from currents, tides, wind, temperature differences between surface and deep water and microalgae to produce biofuel. The exhibition provided the opportunity to discover and understand how marine renewable energies can be used, which is one of Ifremer's research themes.

"100% ocean. From shore to abyssal plain"

Ifremer was a partner in the exhibition called "100% Ocean. From shore to abyssal plains" held at the Palais de la Découverte in Paris from 19 December 2008 to 24 May 2009. This event was organised along with the Coastal conservatory and the Marine protected areas agency for the general public. The contribution from each of the three entities displayed the wealth and diversity of seas and oceans, through educational texts about the coastal environment, biodiversity, renewable energy sources and life on the abyssal plains. Samples of organisms from the very deep seafloor and scale models of the *Nautile* and *Victor 6000* submersibles were positive additions to this exhibition.

Wide-ranging outreach action for marine sciences

Open House days at Ifremer's Brittany centre during Sea Days event

Ifremer acts as an interface for a range of groups -scientists, institutional representatives, professionals and the general public- whose expectations and needs are fundamentally different. Along with ensuring scientific and technological expertise, implementing educational tools is an integral part of the Institute's missions.

Sea days

These Sea days were organised for the first time in France, from 8 to 14 June, following in the wake of the Grenelle marine summit meetings, they enabled French people to discover the actors of the maritime world and its stakes and challenges.

This was a very important gathering, associating public establishments with a marine or maritime calling, players in the maritime economy, associations, researchers and scientists, teachers and more.

These days gave Ifremer, as the standard setter for French research in marine sciences, the opportunity to raise the public's awareness about the results and research conducted in various scientific fields. Numerous events were organised in Paris as well as in the Brittany, Pays de la Loire, Nord-Pas de Calais, Mediterranean and Aquitaine regions, to invite the public to discover our activities through different types of get-togethers: conferences, open house, tours of laboratories and of the research vessel *Thalassa*, scientific demonstrations, quizzes, film showings, exhibitions, etc.

Open house days at Ifremer's Brittany centre

The Ifremer/FMISM young jury prize

On 8 June, at the Oceanographic institute in Paris, the awards ceremony was held for the Young jury prize, awarded by young people to one of the films selected by the World Festival of Underwater Pictures. The event is supported by Ifremer and is considered to be the most important event of its kind worldwide. It began in 1994 and the competition concerns films by film makers from more than fifty countries. The prize-winning films are then shown in dozens of countries. Each year juries of specialists award a series of prizes to reward their makers. The Young jury prize was created in order to better understand they way young people look at the marine realm. The jury is made up of junior high and high school students from different regions in France.

The Night of the sea

Organised on 12 June 2009 by Ifremer's Atlantic centre, the Night of the sea is a new "open house" type concept. From 6 pm to midnight, some thirty research scientists and technicians mobilise to receive the public, enabling people to talk with the experts about themes like the coastal environment, fisheries resources, marine biotechnologies, marine pollution and phytoplankton. Guided tours of laboratories, demonstrations and organised events, mini-conferences and film showings are all on the programme, raising the awareness of the public of marine issues and the work that Ifremer accomplishes. Raphaëlla Le Gouvello was the patron of the event and gave a conference on marine biodiversity illustrated with previously unpublished visual documents from her crossing of the Indian Ocean on a windsurf board. Many other events were organised throughout the year, thus giving Ifremer the possibility of taking part in events with national and regional audiences.

"Researchers' night"

Ifremer once again participated in the "Researchers' night" a novel European operation aiming to put research within everyone's reach. It was organised on 25 September at Océanopolis (Brest), where scientists proposed a demonstration of how to recognise phytoplankton by its DNA. The audience was able to perform a DNA extraction and discover the bio-chip technology.

The science festival

The Ifremer centres of Brittany and the Mediterranean took part in the Science festival held from 20 to 22 November.

IN Brest, Ifremer helped facilitate the Science Village. It was organised at the conference centre by the Breton association for research and technology and brought together research institutions, graduate engineering schools, Océanopolis and associations. Ifremer teams were present to illustrate two themes: "In the ocean depths, life without sun" and "Marine protected areas" (in collaboration with IRD). Using spectacular (recreating a hydrothermal vent), fun (a game about marine protected areas) or demonstrative (observation of hydrothermal prawns under a binocular lamp) experiments, a number of research scientists, PhD students and technicians took turns showing, explaining, telling about and discussing them with the large audience in attendance.

IN Toulon, the first Science Village has held at the Petty officers' club on 20 and 21 November. Along with a presentation of our Institute and its activities on the Mediterranean seafront, the coastal environment was in the spotlight. The programme included the mapping of biocenoses on the Mediterranean seafront, a quiz on integrated coastal zone management and presentations of

the Prisme regional platform for underwater imaging, the Mobidic towed video system, the European Medicis project and the monitoring networks implemented by Ifremer (Rocch, Réphy, Rémi, Rinbio, etc.).

The Paris boat show

Ifremer was present at the Paris boat show from 4 to 13 December. Hosted by the MEEDDM stands alongside IGN, the Econav network and the Maritime Affairs authority, our Institute set out to introduce visitors to the stakes confronting the oceans, along three orientations:

- "An ocean of possibilities" guided the public through the missions and objectives, research facilities and infrastructures to provide better understanding and protection of the oceans and the tremendous potential for innovations that they hold;
- "An ocean of sharing" took them through the scientific research involving the participation of sailors and partnerships which have enabled innovative, eco-responsible and high-performance materials to be developed;
- "An ocean of knowledge" offered the public greater awareness about the wealth and dangers of the ocean. Knowledge about the environment, learning about the marine environment and forecasting sea states were the topics highlighted.

Ifremer's stand at the Paris boat show

Speech by the CEO during the Alliance for Marine Science symposium

The alliance for marine sciences: from national network to a global network

On 28 and 29 September in the context of celebrating its twenty-fifth anniversary, Ifremer organised an international symposium at the MNHN national museum of natural history, called "The alliance for marine sciences: from national network to global network".

Under the patronage of the Ministries of Ecology, energy, sustainable development and the sea, of Food, agriculture and fisheries and of Higher education and research, the conference was closed by the Minister of research Valérie Pécresse.

By bringing together the partners of marine sciences, it not only took stock of scientific advances over the past quarter of a century, but put them into perspective with respect to the societal stakes of coming years. All the major themes of marine science were addressed: the environment, biodiversity, biotechnologies, fisheries and aquaculture, marine geosciences, global ocean forecasts, the research fleet and very large research infrastructures.

A round table session with the Chairmen of the main research institutes was the first step towards creating functional links between the stakeholders in marine sciences, with the goal of successfully creating an "Alliance for marine sciences". This will aim to both optimise the utilisation of resources and facilities and to highlight and enhance the value of research results.

Networking of the marine science community's forces will provide a response to the major challenges of today and tomorrow: developing "blue" energy sources, protecting biodiversity, sustainably exploiting fisheries, reducing pollution from the sea, knowledge transfers and raising awareness of the general public to create vocations for jobs related to the sea. It is now an integral part of the Alliance for environmental sciences (Allenvi).

Meeting the professionals

One of Ifremer's priorities is to strengthen the ties created with all those who use the sea professionally, and particularly to support their economic activity through its teams' scientific contribution. This means that it is vital for Ifremer to be present at the main trade shows.

As every year, Ifremer was present at the Shellfish farming trade show (La Tremblade, 16-18 May), an important annual gathering for the profession. Along with presenting the studies and research results of the Ronce-les-Bains station on its stand, Ifremer, with the Creaa, also moderated two informative discussion meetings with the professionals. During this trade show, an "Open House" day at the station was also held.

The oyster farming and mariculture trade show (Vannes, 29-30 September) took place this year against a backdrop of a crisis situation. Ifremer's stand, run by scientists from the Trinité-sur-Mer station, presented the research done on summer mortality episodes as well as on the Velyger network (breeding and growth of *Crassostrea gigas oysters*) and the Risco project (shellfish farming risks in the bay of Quiberon).

Jointly organised by CNPMEM, Conapped, Ifremer and the NASF, the International small-scale maritime and continental professional fisheries meetings (Biarritz, 25-27 November), were on the programme for our Institute's twenty-fifth anniversary, drawing over one hundred participants, including many professional fishermen from inshore, estuarine and continental small-scale fisheries in various countries. The themes dealt with focused on the importance of these activities in terms of environmental monitoring, cultural diversity and the sustainability of a more environmentally-friendly social and economic development.

Besides being present at trade shows, Ifremer also contributed to designing two communication aids intended for fisheries professionals. This was done in the framework of the Obsmer programme, in association with the scientists in question. The aim of these teaching aids is to explain the work performed by on-board observers, who collect the data (on fisheries, the fishing trip environment, etc.) that scientists need for the research on fish stock trends and management, to the fishermen. The first aid is a sixteen-page colour booklet on "On-board observations. A practical guide for professionals", published in June 2009 and intended for distribution to professional fishers. The second is a slide-show which supplements the information in the booklet. It is designed to be shown by on-board observers to fishermen, from the second semester of 2009 on.

A varied and recognised on-line choice

The current Ifremer offer on Internet is the result of a strategy aiming to allow the largest number of people to understand and be empowered by our Institute's work and studies, as well as disseminating Ifremer's research results to a vast audience.

In 2009, nearly 179,000 monthly visits were recorded, making over two million for the whole year. Furthermore, thirty-four new Internet and Intranet sites have been created, meaning that Ifremer now offers nearly two hundred and thirty websites. During the year 2008, the Institute chose new software called eZiweb to construct its Internet site, which will make the sites developed more dynamic and interactive. Many sites have been revamped, since the software change provided an occasion for teams to update the content.

Two big jobs were begun in 2009: overhauling the Institute's Intranet portal and that of the institutional website. The Intranet portal will be operational in 2010, with the aim of better in-house sharing of information. In addition, thanks to collaboration spaces which both Ifremer's scientists and partner institutes can access, this will facilitate the sharing of experience and feedback, collaborative work of teams and management of internal or European projects.

The new institutional Internet portal will reposition Ifremer as a top ranking world-class research institute. Easier to consult and more dynamic, it will contribute to improving our Institute's visibility and power of attraction by highlighting Ifremer's scientific results and rich range of expertise.

FINANCIAL ELEMENTS AND APPENDICES

Discovering the oceans with Ifremer...

ACTIVITY INDICATORS

These indicators were set out in the 2009-2012 four-year contract linking the French State and Ifremer.

Research and expertise at the heart of the French and European marine science communities network and serving economic development

	Objectives	Indicators	2009
1	**Promote better structuring of French marine research**	The proportion of marine science publications by the alliance with respect to French, European and world production for oceanography, including Ifremer (LOLF P187)	444, i.e. 10%
		Mapping Ifremer publications in association with French partners, and proportion of co-publications Share of co-publications with P187 operators	419, i.e. 94% 77, i.e. 17%
		Average number of times Ifremer publications cited in 3-year indicator (LOLF P187)	657 – Index 1.52
2	**Be a driver of marine science policy in Europe**	Number of European projects and success rate for proposals to FP R&D (LOLF P187)	23, i.e. 57%
		Percentage of coordination of European projects (LOLF P187)	23%
		Number of co-publications with European partners (LOLF P187)	139, i.e. 31%
3	**Develop targeted international cooperation and strengthen action in the Mediterranean**	Mapping of international co-publications (including co-publications with the USA, Canada, Russia, Japan, Brazil, China and Mediterranean countries and with Southern hemisphere countries, LOLF P187)	109, i.e. 24% 37, i.e. 8%
4	**Optimise the links between public- and private-sector research**	Percentage of contacts with firms in total resources (LOLF P187)	6.3%
		Number of private-sector contracting parties.	286
5	**Make French research and expertise more responsive to the needs of society and public authorities**	Scientific and technological papers and presentations in professional meetings	509
		Number of annual FTE mobilised to respond to public tenders for data, expert appraisals and opinions	346
		Number of published opinions and appraisals responding to formally commissioned order by public authorities (LOLF P187)	388
		Level of satisfaction of those requesting expert appraisals and reports	(underway)
6	**Make technological transfer activity more professional**	Returns from fees/outside expenditures for filing patents and licenses (LOLF P187)	€548,000 / €235,000
7	**Raise awareness and encourage scientific teams to become more active in valorisation**	Number of patents and software programmes in portfolio (LOLF P187)	70
		Number of licences/number of patents	34/70

Scientific programming to support strategic objectives

	Objectives	Indicators	2009
8	**Learn more about ocean circulation to supplement the diagnosis of global change**	Number of publications	39
9	**Learn about and characterise marine biodiversity to better protect it**	Number of publications	135
10	**Develop knowledge and valorisation of biological resources through biotechnologies and bio-prospection**	Number of publications	25
		Number of patents	31
11	**Contribute to sustainable fisheries and aquaculture**	Number of publications	163
		Number of reports	311
		Level of satisfaction of those requesting expert appraisals in fisheries and aquaculture	
12	**Promote sustainable use of mineral and energy resources**	Number of publications	94
		Number of reports	225
13	**Develop a global surveillance and monitoring strategy, including both high seas and coastal areas, to meet international and European challenges**	Number of opinions and expert appraisals making use of monitoring and surveillance	298
		Number of reports	173
		Number of publications	87
14	**Design and set up a nationwide system of environmental forecasting of changes in coastal environments**	Number of publications	11
		Number of reports	57
		Number of professionals using operational oceanography services.	
15	**Implement a national and European strategy for marine databases**	Number of extractions/consultations of marine databases on line	494,563
16	**Promote shared capacity for technological innovation**	Number of instrument systems completed or transferred.	36

Mobilisation to meet challenges for Overseas France

	Objectives	Indicators	2009
17	**Promote social and economic development of ROM-POM (overseas regions and local authorities) through scientific support for local sectors**	Scientific and technological papers and presentations in professional meetings	148
18	**Add to scientific knowledge about tropical environments.**	Number of publications	41
		Number of reports	92
19	**Pursue and develop observation and monitoring activities in response to demands by higher authorities**	Volumétrie des bases de données de surveillance littorale, aquacole et halieutique. Acquises outre-mer	4,476,635 143,000 (databased in 2009)

A French oceanographic fleet serving research and marine exploration

	Objectives	Indicators	2009
20	Continue integrating the fleet in Europe and nationwide	Number of shipboard research scientists (French and from other European countries),	411
		Number of publications from research cruises	136
		Number of days of scientific activity for the blue ocean fleet, including public service, cruises submitted to bids for tender and partnerships.	520
21	Optimise fleet operations, equipment and facilities	Number of days offshore fleet commissioned	1073
		Ratio of activity for offshore fleet / potential days	60%
		Coastal fleet: number of days at sea	1,045
		Ratio of activity for inshore fleet / potential days	69%

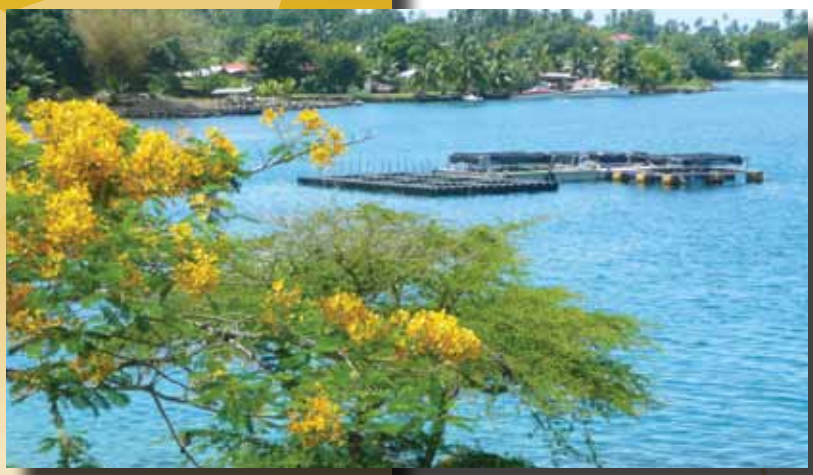
High-performance operations

	Objectives	Indicators	2009
22	Develop the capacity to attract, assimilate and generate loyalty of valuable personnel	Proportion of staff members, including French nationals, recruited outside of France (in compliance with conditions of eligibility for Marie Curie grants)	
		Number of salaried staff holding accreditation to supervise research	62
23	Reinforce forecast-based management of jobs and skills	Signature of an agreement (milestone)	Launching the GPEC approach
24	Promote external mobility and develop hosting capacity	Number of PhD students (including foreigners)	191 (40)
		Number of post-doctoral fellows (including foreigners)	40 (14)
		Number of Ifremer salaried employees on external mobility assignments longer than two months, including abroad	
		Number of guest scientists hosted for periods longer than two months, including foreign researchers	10
25	Create instruments to recognise and award individual and collective performance	State of progress of the approach (milestones)	Training courses implemented
26	Develop a multi-annual financing vision to meet scientific programming targets	Percentage of contractual resources (LOLF P187) Production of multi-annual plans (milestone)	26%
27	Broaden the modernisation of the Institute's financial management by providing stronger management support for scientists	Annual certification of accounts	2009 certified accounts with: - 1 reservation - 2 comments
28	Reassert Ifremer's ambitions and positioning	Number of mentions in the media	5,837
		Number of hits of Ifremer websites	179,000
29	Deliver understandable and empowering information about Ifremer's work for the broadest readership	Number of communications actions	673
30	Carry out Ifremer's sustainable development progress plan	MEEDDM composite indicator (fluids, energy, video-conferences, etc.)	258 kWh/m² 896 video-conferences 60% of waste processed
31	Aim for quality certification for all Ifremer	Rate of renewal for certifications obtained	2 new ones 1 extension 9 renewals
32	Make assessment an integral part of the organisation's operation, at every management level.	Rate of assessment for Ifremer units	2 units assessed
		Number of outside experts solicited for assessments	

FINANCIAL RESULTS FOR THE YEAR 2009

Ifremer's total assets for 2009 amounted to 254.79 million euros, which is an increase of + 7.41% from 2008 (M€237.22).

Not including internal operations (depreciation and book value of assets sold. A reminder that these accounts items have no impact on the budgetary balance of the Institute), the total assets for 2009 reached 215.62 million euros, which was up 8.30% from 2008, corresponding to an increase of +4.92% in subsidies for public service responsibilities (SCSP) and of +19.26% of contractual resources.



Total assets of Ifremer (in thousands of euros)

Total resources	2008	in% of total	2009	in% of total	Trend 2008-2009	Variation in%
Subsidies for public service responsibilities (SCSP)	152,164	64.14	159,657	+ 62.66	7,493	+ 4.92
Programme 187 : Research in the field of environmental and resource management	144,861	61.07	146,581	57.53	1,720	1,19
Programme 113 : Urban planning, landscapes and biodiversity	550	0.23	2,403	0.94	1,853	336.95
Programme 154 : Sustainable management of agriculture, fisheries and rural development	3,304	1.39	3,387	1.33	83	+ 2,52
Programme 206 : Food safety and health quality	3,227	1.36	4,138	1.62	911	+ 28.221
Programme 172 : Multidisciplinary scientific and technological research	222	0.09	148	0.06	- 74	- 33.33
Programme 315 : Programme exceptionnel d'investissement public		3,000	1,18	3,000	-	
Contractual resources	46,921	19.78	55,958	21.96	9,038	+ 19.26
TOTAL BEFORE INTERNAL TRANSACTIONS	199,085		215,616		16,531	
Book values of assets yielded	1,6241	0.26	516	0.20	- 107	- 17.23
Depreciation expenses - internal transactions	37,513	15.81	38,661	15.17	1,148	3.06
TOTAL ASSETS	237,222	100	254,793	100	17,571	+ 7.41

In view of these resources, Ifremer's consolidated expenditure for 2009 reached 250.32 million euros, up 2.51% from 2008 (M€244.20). Not including internal operations, Ifremer's consolidated expenditure for 2009 was 211.14 million euros, a rise of 2.46% from 2008 (M€206.07). This trend in spending takes specific account of:

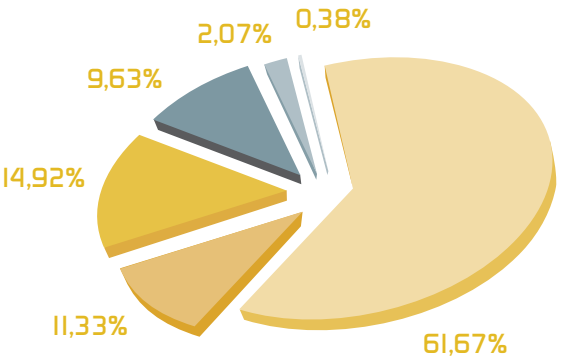
- increased resources allocated to programmes to fulfil the Institute's missions in the context of the first year of performance of the four-year contract;
- means required to achieve the Institute's objectives in terms of equity;
- investment operations more specifically related to the stimulus plan.

On the Ifremer financial performance balance sheet, two important facts should be noted: the credit balance of 6.64 million euros for the statement of operations and the 4.59 million euro rise in working capital.

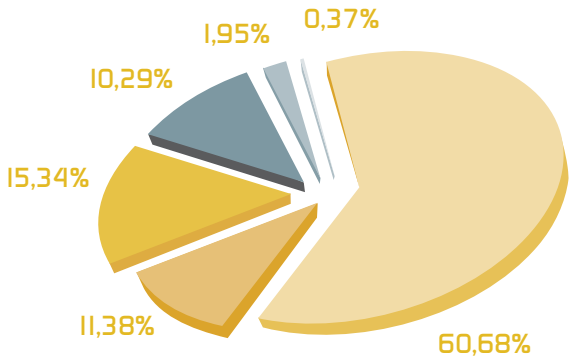
Total expenditure of Ifremer (in thousands of euros)

Total expenditure	2008	2009	Trend in volume	Trend in %
Staff costs (Ifremer)	106,877	108,398	1,522	1.42
Fleet-related expenses	45,808	43,756	- 2,053	- 4.48
Scientific programmes	29,283	32,380	3,097	10.58
Indirect funding for laboratories	19,840	21,724	1,984	9.50
Spending for support	3,480	4,109	629	18.07
Depreciation expenses - operating costs	777	777	-	-
GRAND TOTAL NOT INCLUDING INTERNAL TRANSACTIONS	205,288	211,144	5,856	2.851
Book values of assets yielded	624	516	- 107	NS
Depreciation expenses - internal transactions	37,513	38,661	1,148	3.06
TOTAL	243,425	250,322	6,896	2.83

Detailed budget performance (excl. internal transactions) in 2008



Detailed budget performance (excl. internal transactions) in 2009



Staff costs Ifremer + Genavir
Scientific programmes
Spending for support
Fleet-related (excl. Staff)
Indirect funding for laboratories
Depreciation expenses operating costs

Resources

Operations

The operating resources for 2009 reached 228.87 million euros, a rise of 5.15% from the 2008 fiscal year (M€217.65). Not including internal transactions, these resources came to 189.69 million euros, making a 5.67% increase with respect to 2008 (M€179.52).

This trend is mainly the result of the following factors:

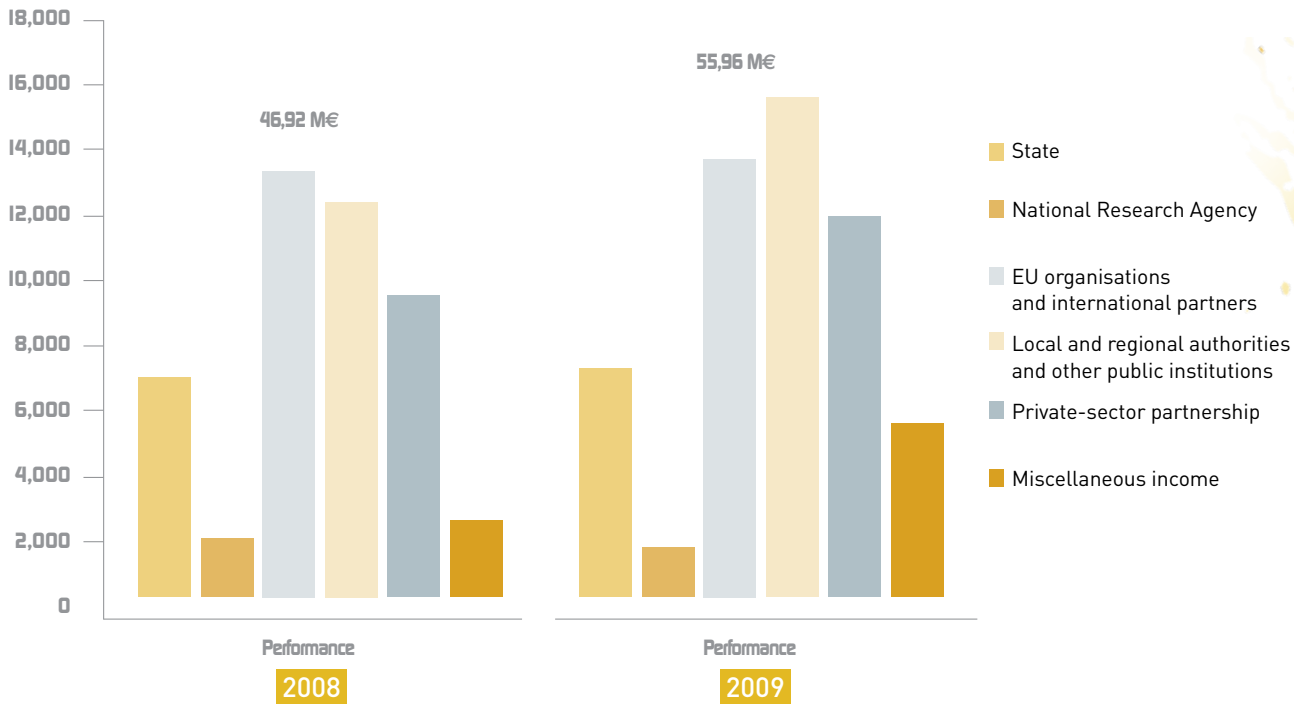
- a rise in the grant for the programme 187 public service costs (+ M€2.0), linked to the complete release of credits put aside in the LFI 2009 in order to shoulder new costs related to the variation in reserves (paid holidays, time-saving accounts and Unedix unemployment contributions) and depreciation of the share of assets re-evaluated in 2008;
- the increase in the subsidy under programme 113 "Urban planning, landscapes and biodiversity" (+M€1.85) particularly related to the implementation of the "Marine Strategy" framework directive (MSFD) and of an information system on marine biodiversity in the frame of the SINP nature and landscapes information system;
- increased own resources (+ M€5.95) mostly related to exceptional operations: deploying the fleet in a search operation for the crashed plane and recovery of provisions in the context of the move to certify the Institute's accounts.

Investments

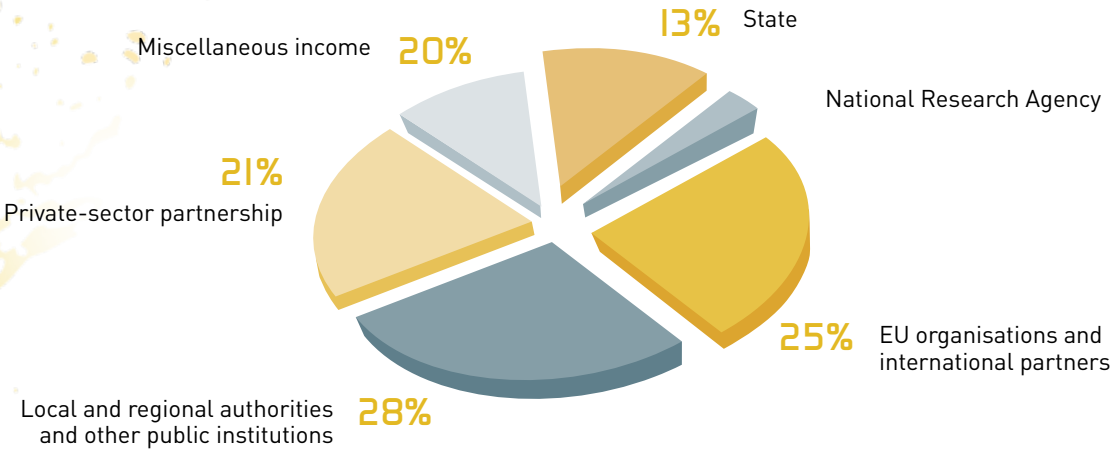
The increase in investment funds in 2009 compared to 2008 (+ M€6.35) mainly results from the combination of two factors:

- financing two exceptional operations (M€4.04) by grants for public service costs under programmes 315 "Exceptional public investment programme" (M€3 for work on Genavir workshops and purchasing fleet-related equipment/facilities) and 206 "Safety and health quality of food" (M€1.04, for the equipment and fittings required to set up chemical analyses). It should however be emphasised that the spending related to these two operations will be performed over both the 2009 and 2010 fiscal periods;
- a rise in the Institute's contract resources (+M€3.09) especially owing to the invoicing for the balance due on two operations performed in the CPER 2007-2013 plan context ("shellfish microbiology" national reference laboratory in Nantes and the high performance computer in Brest, to create a data-intensive computing cluster for use by the oceanography scientific community).

Contractual resource trends presented by sources of funding 2008/2009



Relative share of contractual resources presented by sources of funding (performance 2009)



Expenditure

Operations

The operating resources for 2009 reached 222.23 million euros, rising by 2.27% from the 2008 fiscal year. Not including internal transactions, these resources came to 183.05 million euros, making a 2.18% increase with respect to 2008 (M€179.15).

Ifremer's operating expenditure hinges on three large categories:

- Ifremer payroll costs, including those for temporary staff, reached M€108.40 in 2009 compared to M€106.88 in 2008, up by 1.42%,
- The overall sum of operating expenses related to the fleet (Genavir contract and contribution for operating RV *Beautemps-Beaupré*) came to M€32.36 in 2009, i.e. a drop of 3.35% with respect to 2008 (M€33.48). This lower 2009 expenditure mainly results from a lower fuel costs than those seen in 2008.
- Other expenses (laboratories, logistics and central services) reached 42.29 million euros. The rise seen from 2008 (+ M€2.53) is the result of higher provisions for the scientific programmes (+ M€2.67).

Internal transactions – depreciation expenses and book values of yielded assets – amounted to 39.18 million euros, up by 1.04 million euros compared to 2008. This increase is especially due to accounting adjustments made in the context of certifying the Institute's accounts.

Investments

Use of payment appropriations for the fiscal year equalled 28.10 million euros, not including capital assets, making an increase of M€1.18 with respect to 2008 (M€26.92).

This expenditure is broken down as follows:

- ocean research fleet (M€11.4, i.e. 40.6% of expenses): in addition to the completion of work to upgrade RV *L'Atalante*, these expenses also entirely include reflation plan operations and particularly, the acquisition of additional equipment for the underwater vehicle *Victor 6000* (umbilical cables and tethers);
- scientific programmes (M€8.90, or 31.7% of expenditure), including two major programmes (Previmer and Crest Argo) financed within the CPER 2007-2013 frame in Brittany;
- indirect funding for laboratories (M€6.98, i.e. 24.8% of spending), notably to finance the Caparmor supercomputer in Brest;
- spending for support (M€0.82, or 2.90% of expenses).

2009 budget performance (consolidated budget)

A presentation of expenditure broken down into the three main types of expenditure highlights payrolls' significant share, representing 51.34% if strictly Ifremer staff are considered and 60.68% taking Ifremer and Genavir personnel into account.

Detailed budget performance (excl. internal transactions) in 2008

Consolidated expenditure 2009	2008	% in 2008	2009	% in 2009
Staff costs Ifremer+Genavir	127,085,641	61,67	128,127,425	60,68
Fleet-related spending (excl. Staff)	23,344,328	11,33	24,026,596	11,38
Scientific programmes	30,749,805	14,92	32,380,148	15,34
Indirect funding for laboratories	19,839,878	9,63	21,723,979	10,29
Spending for support	4,268,501	2,07	4,109,351	1,95
Depreciation expenses - operating costs	776,874	0,38	776,874	0,37
GRAND TOTAL NOT INCLUDING INTERNAL TRANSACTIONS	206,065,028	100	211,144,373	100

BALANCE SHEET AND INCOME STATEMENTS FOR 2009

	Fiscal 2009			Fiscal 2008
ASSETS	Gross	Depreciations and reserves	Net	Net
Intangible assets	**27,236,526.51**	**20,177,101.17**	**7,059,425.34**	**14,570,446.64**
Initial expense	13,270.16	12,394.09	876.07	1,312.13
Research and development expenditure	0.00	0.00	0.00	5,936,914.32
Concessions, patents, licences, brands, processes	23,822,283.95	19,970,575.85	3,851,708.10	4,446,159.84
Other intangible assets	202,938.16	194,131.23	8,806.93	17,993.26
Current intangible assets	1,982,853.81	0.00	1,982,853.81	1,733,546.12
Advances and down payments	1,215,180.43	0.00	1,215,180.43	2,434,520.97
Tangible assets	**478,732,547.60**	**260,901,845.91**	**217,830,701.69**	**221,757,869.38**
Lands	6,750,269.34	689,938.87	6,060,330.47	6,039,954.53
Buildings	101,428,460.46	46,751,643.80	54,676,816.66	52,973,792.56
Technical installations, equipment and industrial tools	118,803,786.61	103,701,955.99	15,101,830.62	16,720,708.59
Collections	1,076,485.40	0.00	1,076,485.40	1,299,274.02
Vessels and vehicles	207,332,732.67	81,291,615.23	126,041,117.44	115,906,925.19
Other tangible assets	35,599,680.73	28,466,692.02	7,132,988.71	6,062,984.00
Current tangible assets	2,519,175.58	0.00	2,519,175.58	7,102,354.86
Advances and down payments	5,221,956.81	0.00	5,221,956.81	15,651,875.63
Investments	**6,591,909.30**	**345,451.85**	**6,246,457.45**	**5,980,233.79**
Shareholdings	755,069.93	345,451.85	409,618.08	534,886.48
Other holdings (Quae)	125,000.00	0.00	125,000.00	125,000.00
Other long-term investments	0.00	0.00	0.00	30.48
Loans	5,421,043.27	0.00	5,421,043.27	5,281,870.17
Deposit and guarantees paid	290,796.10	0.00	290,796.10	38,446.66
FIXED ASSETS - TOTAL (I)	512,560,983.41	281,424,398.93	231,136,584.48	242,308,549.81
Inventory	**54,255.66**	**0.00**	**54,255.66**	**60,713.41**
Raw materials	2,293.07	0.00	2,293.07	3,698.81
Other supplie	51,962.59	0.00	51,962.59	57,014.60
Advances and deposits ¨paid on"	**393,581.31**	**0.00**	**393,581.31**	**55,569.14**
Operating debts	**40,669,524.96**	**256,128.20**	**40,413,396.76**	**25,071,169.44**
Customer and related accounts receivable	17,927,323.23	256,128.20	17,671,195.03	14,865,443.07
Other supplies	22,742,201.73	0.00	22,742,201.73	10,205,726.37
Investment securities	**24,048,485.05**	**0.00**	**24,048,485.05**	**10,630,624.30**
Available funds	**6,835,480.74**	**0.00**	**6,835,480.74**	**16,232,786.01**
CURRENT ASSETS - TOTAL (II)	72,001,327.72	256,128.20	71,745,199.52	52,050,862.30
Deferred charges	**182,317.05**	**0.00**	**182,317.05**	**112,194.80**
Charges to be allocated over several fiscal	**0.00**	**0.00**	**0.00**	**0.00**
Foreign currency translation adjustments	**0.00**	**0.00**	**0.00**	**0.00**
ACCRUALS - TOTAL (III)	182,317.05	0.00	182,317.05	112,194.80
GENERAL TOTAL (I + II + III)	584,744,628.18	281,680,527.13	303,064,101.05	294,471,606.91

LIABILITIES

	2009	2008 corrigé	2008
Equity capital	**7,697,197.06**	**7,697,197.06**	**7,697,197.06**
Appropriation	4,111,016.74	4,111,016.74	4,111,016.74
Additional appropriations (State)	2,538,749.66	2,538,749.66	2,538,749.66
Additional appropriations (other than State)	1,047,430.66	1,047,430.66	1,047,430.66
Capital donations and legacies	**430,125.86**	**430,125.86**	**430,125.86**
Reserves	**16,643,949.86**	**16,257,996.30**	**14,723,893.30**
Re-evaluation difference	24,445,527.00	24,445,527.00	0.00
Optional reserves	- 9,689,810.82	- 10,057,538.65	12,853,885.35
Miscellaneous reserves	1,888,233.68	1,870,007.95	1,870,007.95
Retained earnings	**0.00**	**0.00**	**1,534,103.00**
Fiscal year results (profit or loss)	**6,646,241.99**	**367,727.83**	**367,727.83**
Investment subsidies	**195,161,242.16**	**207,607,825.70**	**207,607,825.70**
EQUITY CAPITAL - TOTAL (I)	226,578,756.93	232,360,872.75	232,360,872.75
Provisions for risks	**0.00**	**775,774.00**	**775,774.00**
Provisions for expenses	**11,177,053.67**	**11,190,720.46**	**11,190,720.46**
PROVISIONS FOR RISKS AND EXPENSES - TOTAL (II)	11,177,053.67	11,966,494.46	11,966,494.46
Financial debts	**3,448.41**	**21,674.14**	**21,674.14**
Shareholding related debts	3,448.41	21,674.14	21,674.14
Advances and deposits paid on	**2,890,559.00**	**0.00**	**0.00**
Current liabilities	**52,239,321.65**	**47,541,071.32**	**47,541,071.32**
Trade and related accounts payable	13,922,241.19	15,584,868.24	15,584,868.24
Tax and social contributions payable	34,424,858.20	29,052,395.99	29,052,395.99
Other	3,892,222.26	2,903,807.09	2,903,807.09
Miscellaneous debts	**7,876,823.66**	**1,674,988.24**	**1,674,988.24**
Debts on fixed assets and related accounts	7,876,823.66	1,674,988.24	1,674,988.24
DEBTS - TOTAL (III)	63,010,152.72	49,237,733.70	49,237,733.70
Deferred yields	**2,298,137.73**	**906,506.00**	**906,506.00**
Translation adjustment for liabilities	**0.00**	**0.00**	**0.00**
ACCRUALS AND DEFERRALS - TOTAL (IV)	2,298,137.73	906,506.00	906,506.00
GENERAL TOTAL (I + II + III + IV)	303,064,101.05	294,471,606.91	294,471,606.91

Income statement - CHARGES	Fiscal 2009	Fiscal 2008
OPERATING EXPENSES	218,190,943.12	216,359,483.15
Purchase price of goods sold during fiscal	**0.00**	**288,205.97**
Purchase of goods	0.00	71.23
Changes in inventory	0.00	288,134.74
Consumption by third parities	**71,383,682.80**	**69,857,570.38**
Purchased supplies in inventory		
• raw materials	275.22	2,504.45
• other supplies	100,014.38	101,634.58
Variations in inventory of materials and supplies	6,457.75	-8,924.05
Subcontracting purchases	31,852,671.95	33,138,880.63
Purchases of materials and supplies not inventoried	6,682,820.42	6,352,773.95
Outsourcing:		
• temporary staff	661,435.29	1,243,380.48
• other supplies	32,080,007.79	29,027,320.34
Taxes and similar payments	**9,686,916.44**	**9,199,741.75**
• on pay	8,168,209.53	7,817,913.90
• other	1,518,706.91	1,381,827.85
Payroll costs	**97,478,562.08**	**95,978,840.50**
Salaries and wages	66,990,103.24	66,176,285.74
Social contributions	30,488,458.84	29,802,554.76
Depreciation allowance and appropriation to the reserve	**38,494,046.38**	**40,431,214.75**
• on fixed assets: appropriation to the reserve	36,271,123.38	38,290,251.75
• on current assets: appropriation to the reserve	15,816.00	0.00
• for risks and expenses: appropriation to the reserve	2,207,107.00	2,140,963.00
Other expenses	**1,147,735.42**	**603,909.80**
Special expenses	240.00	4,165.00
FINANCIAL COSTS	137,594.74	217,594.49
Exchange losses	**4,088.70**	**11,594.49**
Other financial expenses	**143.64**	**6,000.00**
Depreciation allowance and appropriation to the reserve	**133,362.40**	**200,000.00**
EXTRAORDINARY CHARGES	3,873,508.65	654,950.01
• on management operations	**138,065.06**	**31,103.82**
• on capital operations	**568,625.09**	**623,846.19**
Book value of yielded assets	516,321.42	623,777.66
Other	52,303.67	68.53
Depreciation allowance and appropriation to the reserves	**3,166,818.50**	**0.00**
CORPORATE TAXES	23,012.00	53,954.45
TOTAL	222,225,058.51	217,285,982.10
CREDIT BALANCE = PROFITS	6,646,241.99	367,727.83
GENERAL TOTAL	228,871,300.50	217,653,709.93

Income statement- YIELDS	Fiscal 2009	Fiscal 2008
OPERATING INCOME	189,413,047.67	178,343,545.21
Inventory	**129,515.28**	**110,648.53**
Production sold	**26,407,421.87**	**27,899,396.29**
Works and services	24,559,424.43	25,980,620.97
Yields from additional activities	1,847,997.44	1,918,775.32
Capitalised production costs	**1,219,208.78**	**1,732,518.15**
Operating subsidies	**157,585,026.44**	**146,421,132.29**
Carry-over of depreciation and reserves	**3,071,652.99**	**513,971.29**
Other yields	**1,000,222.31**	**1,665,878.66**
INVESTMENT INCOME	221,433.35	956,440.73
Shareholdings	**96,780.00**	**67,470.00**
Other securities, stocks and bonds and receivables on fixed assets	**13,785.13**	**13,412.00**
Other interest and related yields	**0.00**	**339.74**
Exchange gains	**5,015.42**	**9,641.05**
Net yield on disposal of investment securities	**97,758.80**	**865,577.94**
Adjustments for reserves and charges	**8,094.00**	**0.00**
EXTRA YIELDS	39,236,819.48	38,353,723.99
• on management operations	**2,772.21**	**16,875.94**
• on capital operations	**39,234,047.27**	**38,336,848.05**
Yields from disposal of assets	56,658.37	198,883.04
Investment subsidies transferred to fiscal year earnings	39,177,388.90	38,137,155.01
Other extraordinary yields	0.00	810.00
Adjustments for reserves and transfer of charges	**0.00**	**0.00**
TOTAL YIELDS	228,871,300.50	217,653,709.93
DEBIT BALANCE = LOSS		
GENERAL TOTAL	228,871,300.50	217,653,709.93

IFREMER'S I.D. SHEET

Its missions

As the French Research Institute for Exploitation of the Sea, Ifremer contributes, though its studies and expert assessments, to improving knowledge of the oceans and their resources, monitoring the marine and coastal environment and promoting the sustainable development of maritime activities. To this end, it designs and deploys observational, experimental and monitoring tools and manages the French ocean research fleet and oceanographic databases on behalf of the entire scientific community.

Ifremer is the source of knowledge, innovation, monitoring data and expertise for the marine realm, both in terms of public policy and of socio-economic activity. It is the only organisation of its kind in Europe.

Its status and governance

Ifremer is a public institute of industrial and commercial nature (EPIC) created in 1984 and placed under the joint supervision of the Ministry of Higher Education and Research, the Ministry of Food, Agriculture and Fisheries and the Ministry of Ecology, Energy, Sustainable Development and the Sea.

Its locations

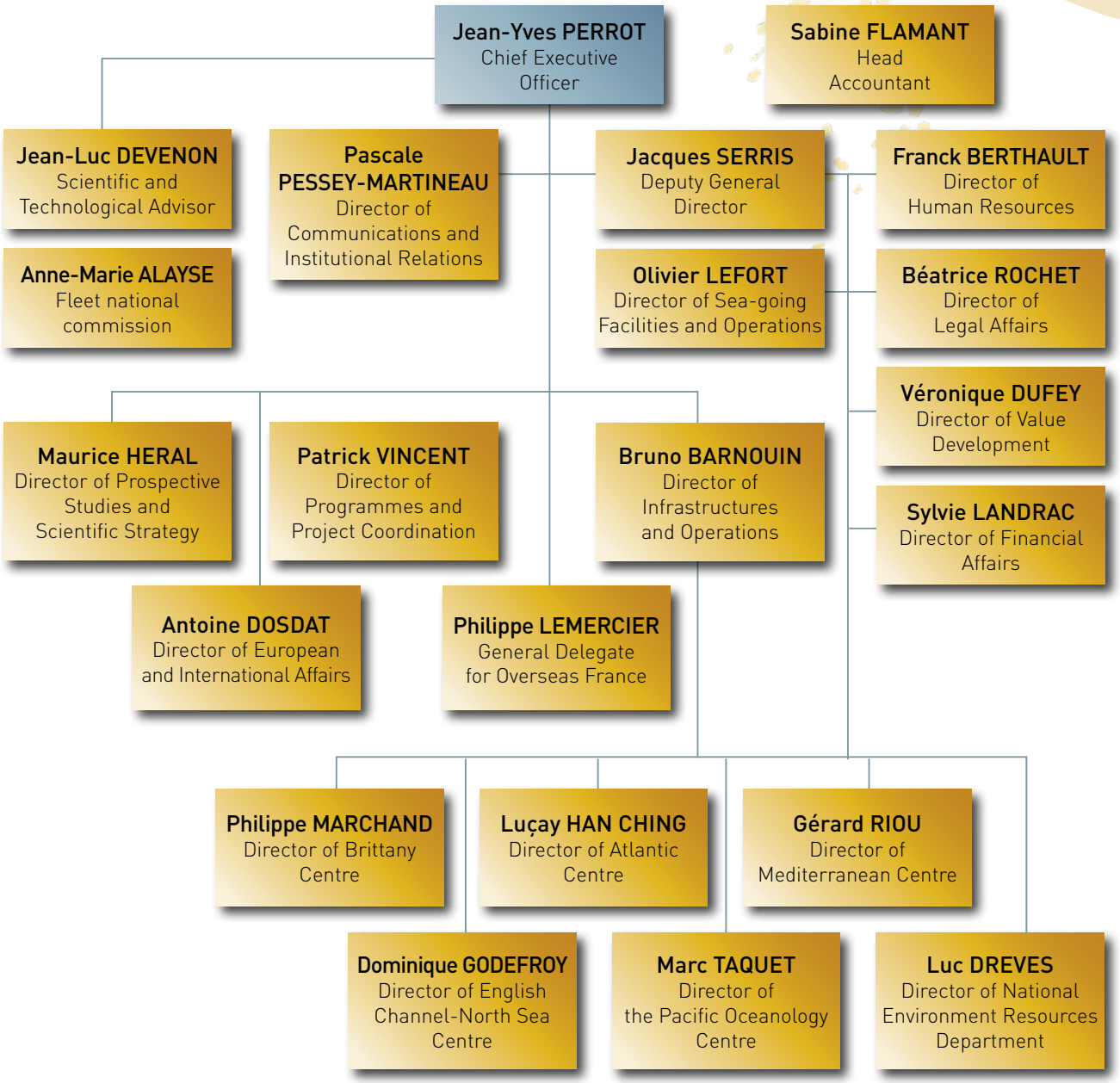
Ifremer is present on twenty-six sites along the coastline of metropolitan France and its overseas territories. It is organised into five centres (Channel-North Sea, Brittany, Atlantic, Mediterranean and French Polynesia) and twenty-one stations and laboratories. The head office is in Issy-les-Moulineaux.

Its staff

As of 31 December 2009, Ifremer had a staff of 1,495 salaried employees (both permanent and fixed term contracts), 60 PhD students and 19 post-doctoral fellows, in addition to the 359 employees at the Genavir shipowners of the ocean research fleet (244 seamen and 115 shore-based staff).

The organisation

The Institute's organisation chart was as follows on December 31, 2009:



Our locations

HEADQUARTERS
155 rue Jean-Jacques Rousseau
92138 Issy-les-Moulineaux Cedex
Tel. +33 (0)1 46 48 21 00
Fax +33 (0)1 46 48 21 21
www.ifremer.fr

CHANNEL-NORTH SEA

Channel-North Sea centre
150 quai Gambetta, B.P. 699
62321 Boulogne-sur-Mer Cedex
Tel. +33 (0)3 21 99 56 00
Fax +33 (0)3 21 99 56 01
http://wwz.ifremer.fr/manche-merdunord

Port-en-Bessin station
Avenue du Général de Gaulle
B.P. 32
14520 Port-en-Bessin
Tel. +33 (0)2 31 51 56 00
Fax +33 (0)2 31 51 56 01

BRITTANY

Brittany centre
B.P. 70
29280 Plouzané
Tel. +33 (0)2 98 22 40 40
Fax +33 (0)2 98 22 45 45
www.Ifremer.fr/brest/index.html

Concarneau station
13 rue de Kérose
Le Roudouic
29187 Concarneau Cedex
Tel. +33 (0)2 98 97 43 38
Fax +33 (0)2 98 50 51 02

Station de La Trinité
12 rue des Résistants, B.P. 86
56470 La Trinité-sur-Mer
Tel. +33 (0)2 97 30 19 19
Fax +33 (0)2 97 30 19 00

Cresco Ifremer Station
38 rue du Port-Blanc, B.P. 80108
35801 Dinard Cedex
Tel. +33 (0)2 23 18 58 58
Fax +33 (0)2 23 18 58 50

Lorient station
8, rue Frézier
56100 Lorient
Tel. +33 (0)2 97 87 38 00
Fax +33 (0)2 97 87 38 01

Station expérimentale d'Argenton
Presqu'île du Vivier
29840 Argenton-en-Landunvez
Tel. +33 (0)2 98 89 56 78
Fax +33 (0)2 98 89 57 77
www.Ifremer.fr/implant/argenton.htm

ATLANTIC

Atlantic centre
Rue de l'Île-d'Yeu, B.P. 21105
44311 Nantes Cedex 03
Tel. +33 (0)2 40 37 40 00
Fax +33 (0)2 40 37 40 01
www.Ifremer.fr/nantes

Station de La Tremblade
133 Ronce-les-Bains
17390 La Tremblade
Tel. +33 (0)5 46 76 26 10
Fax +33 (0)5 46 76 26 11

Bouin station
Polder des Champs
85230 Bouin
Tel. +33 (0)2 51 68 77 80
Fax +33 (0)2 51 49 34 12

Station d'Arcachon
Quai du Commandant-Silhouette
33120 Arcachon
Tel. +33 (0)5 57 72 29 80
Fax +33 (0)5 57 72 29 99

Station de La Rochelle
Place Gaby Coll, B.P. 7
17137 L'Houmeau
Tel. +33 (0)5 46 50 94 40
Fax +33 (0)5 46 50 93 79

Anglet site
1 Allée du parc Montaury
64600 Anglet
Tel. +33 (0)2 29 00 85 92
Fax +33 (0)2 29 00 85 52

MEDITERRANEAN

Mediterranean centre
Zone portuaire de Brégaillon
B.P. 330
83507 La Seyne-sur-Mer Cedex
Tel. +33 (0)4 94 30 48 00
Fax +33 (0)4 94 30 44 15
www.Ifremer.fr/toulon/index.htm

Station de Sète
Avenue Jean-Monnet, B.P. 171
34203 Sète Cedex
Tel. +33 (0)4 99 57 32 00
Fax +33 (0)4 99 57 32 94

Station de Palavas
Chemin de Maguelonne
34250 Palavas-les-Flots
Tel. +33 (0)4 67 50 41 00
Fax +33 (0)4 67 68 08 33

Ifremer station of Corsica
Immeuble Agoscini
SCI Endajola-Pastoreccia
Z.I. de Bastia-Furiani
20600 Bastia
Tel. +33 (0)4 95 38 00 24
Fax +33 (0)4 95 38 04 27

OVERSEAS

Pacific oceanology centre (COP)
Taravao, B.P. 7004
98179 Taravao, French Polynesia
Tel. + 689 54 60 00
Fax + 689 54 60 99
www.ifremer.fr/cop

Reunion Island delegation
Rue Jean-Bertho B.P. 60
97822 Le Port Cedex, Reunion Island
Tel. + 262 42 03 40
Fax + 262 43 36 84

French Guiana delegation
Domaine du Suzini, B.P. 477
97331 Cayenne, French Guiana
Tel. + 594 30 22 00
Fax + 594 30 80 31

West Indies delegation
Pointe-Fort
97231 Le Robert, Martinique
Tel. + 596 66 19 40
Fax + 596 66 19 41

New Caledonia delegation
Quai des Scientifiques, B.P. 2059
98846 Nouméa Cedex,
New Caledonia
Tel. + 687 28 51 71
Fax + 687 28 78 57

BOARD OF DIRECTORS

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Chief Executive Officer
Jean-Yves PERROT

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Bernard COMMERE
Substitute: Robert DELMAS

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Claire HUBERT
Substitute: Jean Loup PETIT
Odile GAUTHIER
Substitute: Agnès VINCE

Ministry of Food, Agriculture and Fisheries
Loïc LAISNE
Substitute: Pascal BERGERET

Ministry of Defense
Vice-Admiral Xavier MAGNE
Substitute: Capitain Laurent LEBRETON

Ministry of the Budget, Public Accounts and State Reform
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Substitute: XX

Ministry of the Economy, Industry and Employment
Yves ROBIN
Substitute: Claude MARCHAND

Ministry of Foreign and European Affairs
Elisabeth BARSACQ
Substitute: XX

Members chosen for their expertise in fields close to those of Ifremer

Goulven BREST
National shellfish-farming committee

Pierre-Georges DACHICOURT
National committee of maritime fisheries and mariculture (CNPMEM)

Patrick LAVARDE
National office for water and aquatic environments

Manoëlle LEPOUTRE
Total

Alain RATIER
Météo-France

Members elected by Ifremer personnel

Anne-Marie ALAYSE, CGT
Martial CATHERINE, CGT
Gilbert DUTTO, SNPO-FO
Raoul GABELLEC, CFDT
Sylvie HUREL, CFDT
Pascal MORICONI, CFDT
Jean TOURNADRE, CFDT

Board members in advisory capacity

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CCE secretary

Christine COSTE
Government commissioner Ministry of Higher Education and Research

Pascale DELECLUSE
Chairwoman of Ifremer's scientific committee Météo-France, CNRS

Sabine FLAMANT
Head accountant

Brigitte KLEIN
General comptroller for finance and economics "Ecology and sustainable development" mission leader

Rear-admiral Bruno PAULMIER
Deputy Secretary general for the Sea

Didier PEROCHEAU
Ministry in charge of Overseas

Jean-François TALLEC
Secretary general for the Sea

Scientific committee

The scientific committee reports to the Chief executive officer of Ifremer

It is consulted about research programmes and scientific aspects of technological development programmes carried out by our Institute. It issues recommendations on developing major facilities of general interest which are managed by Ifremer, upon proposals for allocating these facilities to the benefit of all users and periodically assesses the outputs and outcomes. The committee meets twice a year.

Its members are very high-level scientists holding positions of responsibility in their respective institutions.

Chairwoman

Pascale DELECLUSE
Météo-France, CNRS, Paris

Appointed members

Jean-Marie BECKERS
University of Liège, Belgium

Véronique GARCON
Spatial geophysics and oceanography laboratory, Toulouse

Gilles BOEUF
National museum of natural history

Jacqueline LECOURTIER
ANR, Paris

Miquel CANALS-ARTIGAS
University of Barcelona, Spain

Didier MAZEL
Pasteur Institute, Paris

Loïc CHARPY
IRD, Marseilles

Yves MOREL
SHOM, Toulouse

Françoise GAILL
INEE, Paris

Patrick POINT
CNRS, Pessac

Serge GARCIA
FAO, Rome, Italy

Marie-Hélène TUSSEAU-VUILLEMIN
Cemagref-HBAN, Antony

Members elected by Ifremer personnel

Marie-Édith BOUHIER
Substitute: Anne-Gaëlle ALLAIS

Karine OLU-LE ROY
Substitute: Jean-François PÉPIN

Raymond KAAS
Substitute: Christelle SIMON-COLIN

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Bernard DREYFUS
Substitute: Thomas CHANGEUX
IRD, Paris

Gérard JUGIE
IPEV, Plouzané

Dominique LE QUEAU
Substitute: Patrick MONFRAY
CNRS/INSU, Paris

Pol GUENNOC
BRGM, Orléans

Pierre TOULHOAT
Ineris, Verneuil-en-Halatte

Edwige QUILLET
INRA, Jouy-en-Josas

Secretary

Nicole DEVAUCHELLE
Ifremer

Living resources committee

The new living resources committee is now chaired by a professional. It ensures that relations between the inter-professional entities concerned and Ifremer continue to grow. To this end, as well as plenary meetings where current situations and programme orientations can be discussed, special groups have been created to ensure regular exchanges of information and to build and establish joint operations for research and development.

Chairman

Pierre DACHICOURT
National committee of maritime fisheries and mariculture (CNPMEM)

Appointed members

François PATSOURIS
Regional shellfish farming section of Poitou-Charentes

Hugues AUTRET
Regional fisheries and mariculture committee of the Pays de Loire

Luc BLIN
Federation of small-scale fisheries producer organisations (Fedopa)

Christine BODEAU
Science and sea

Goulven BREST
National shellfish-farming committee

Antoine DHELLEMMES
Union of fishery vessel owners of France

Jean-Pierre CARVAL
Local maritime fisheries committee in North Finistère

Serge LARZABAL
National committee of maritime fisheries and mariculture (CNPMEM)

Pierre COMMERE
Association of processed food companies

Yves LE BORGNE
Satmar

Dominique DUVAL
French union for marine and new aquaculture

Members representing ministries

Loïc LAISNE
Head administrator of Maritime affairs and Deputy director of maritime fisheries and aquaculture, Ministry of Food, Agriculture and Fisheries

Anne FONTAINE
Directorate of Water and biodiversity, Ministry of Ecology, Energy, Sustainable Development and the Sea

Bernard COMMERE
General directorate of research and innovation, Ministry of Higher Education and Research

Members elected by Ifremer personnel

René ROBERT
Substitute: Claire LE BAUT - MARCAILLOU

Fabien MORANDEAU
Substitute: Gilles SALAÜN

Yves MORIZUR
Substitute: Jean-Paul BLANCHETON

Permanent guest members

Pierre CAUMETTE
Laboratory of molecular ecobiology and microbiology, University of Pau and pays de l'Adour

Gérard DEVAUCHELLE
Research station for compared pathology, INRA/CNRS

Secretary

Joseph MAZURIÉ
Ifremer

Industrial and technical committee

Reporting to the Chairman, the technical and industrial committee's (TIC) role is to issue advice on the Institute's technological programme, industrial relations and enhancing value. It also takes part in the periodical assessment of technological units.

Chairman

Thierry GAIFFE, acting chairman
Ixsea Océano Technologies, Marly-le-Roi

Members

Geoffroy CAUDE
Marine and river technical studies center (Cetmef), Compiègne

Philippe DANDIN
Météo-France, Toulouse

Yves GILLET
SCE, Nantes

Michel DUTANG
Véolia Environnement, Paris

Édouard FREUND
IFP, Rueil-Malmaison

Victor SANCHEZ
CNRS, Paris

Claude VALENCHON
Saipem S.A., Saint-Quentin-en-Yvelines

Members elected by Ifremer personnel

Loïc PETIT DE LA VILLÉON
Substitute: Alexis KHRIPOUNOFF

Jean-Claude MASSON
Substitute: Sylvain DENIEL

Philippe CRASSOUS
Substitute:
Pierrette DUFORMENTELLE

Secretary

Roland Person
Ifremer

GLOSSARY

AAMP	Agency for marine protected areas
Adecal	New Caledonia economic development agency
Ademe	Agency for the environment and energy management
Adepta	Association for the development of international trade and exchanges of agrifood products and techniques
Aeres	Evaluation agency for research and higher education
Afssa	French agency for food sanitary safety
AUV	Autonomous Underwater Vehicle
AWI	Alfred Wegener Institute (Germany)
BHO	Hydrographic and oceanographic vessel
BOB	Bubbles Observatory modules
BRGM	Geological and mining research bureau
CADTS	Downstream data processing centre
Camis	Channel Arc Manche Integrated Strategy
CDO	Committee of Directors of Organisations
CDTI	Centre for the Development of Industrial Technology
Cefas	Centre for Environment, Fisheries & Aquaculture Science (UK)
Cemagref	National centre for farming mechanisation, rural engineering of water and forests
Cerege	European research and education centre for environmental geosciences
Cersat	Center for Satellite Exploitation and Research
Cesbio	Center for the Study of the Biosphere from Space
Cetmef	Marine and river technical studies centre
CETSM	European centre for underwater technology
CEVPM	Seafood processing and enhancement research centre
CFP	Common Fisheries Policy
Cimer	Joint ministerial council for the sea
CNES	National space research centre
CNFE	National fleet and vehicles commission
CNPMEME	National committee of maritime fisheries and mariculture
CNPPED	National committee of professional fresh water fisheries
CNRS	National centre for scientific research
Cofrac	French accreditation committee
Comop	Operational committee
CPER	State-region plan contracts
CPLC	Commission on the limits of the continental shelf
Craag	Astronomy, astrophysics and geophysics research centre
CREAA	Regional centre for aquaculture experimentation and applications
Cresco	Research and education centre for coastal systems
Cresh	Cephalopod Recruitment from English Channel Spawning Habitats
CSIC	Spanish council for scientific research (Spain)
Csiro	Commonwealth Scientific and Industrial Research Organisation (Australia)
CSTF	Strategic and technical committee for the offshore and inshore fleet
MSFD	Marine environment Strategy Framework Directive
DGAL	General directorate for food
DGRSDT	General directorate for scientific research and technological development (Algeria)
DIKE	Data, Information and Knowledge Exchange
DPMA	Maritime fisheries and aquaculture directorate
MSFD	Marine Strategy Framework Directive

ECMWF European Centre for Medium-Range Weather Forecasts

EEA European Environment Agency

EEZ Exclusive Economic Zone

Emodnet Marine Observation and Data Network

EMSA European Maritime Safety Agency

EMSO European Multidisciplinary Sea-Floor Observation

ENAG National school of geoscience applications

Enitiaa Engineering school for agricultural and food industry techniques

Ensieta Graduate engineering school for the Ministry of Defence

ENST Graduate engineering school in information technologies

EPIC State-funded industrial and commercial establishment

EPOC Ocean environments and paleo-environments laboratory

EPST State-funded scientific and technical establishment

ERC European Research Council

ESA European Space Agency

Esonet European Sea Floor Observatory Network

Extraplac Reasoned extension of the continental shelf

ERDF European Regional Development Fund

EFF European Fisheries Fund

FAD Fish Aggregating Device

FIS Fisheries Information System

FP R&D Framework research and development programme

FTE Full time equivalent

Geohab Global Ecology and Oceanography of Harmful Algal Blooms

GMES Global Monitoring for Environment and Security

Hermes Hotspot Ecosystem Research on the Margins of European Seas

Hermione Hotspot Ecosystem Research and Man's Impact on European Seas

IBTS International Bottom Trawl Survey

ICES International Council for the Exploration of the Sea

IEO Spanish Institute of Oceanography

IFP French petroleum institute

IGA Institute of applied geophysics

INEE National Institute of Statistics (Spain)

INPI National institute of intellectual property

INRA National agronomic research institute

INRH National fisheries research institute of Morocco

Inria French national IT and automation research institute

Inspire Infrastructure for Spatial Information in the European Community

INSU National institute for sciences of the universe of CNRS

INSTM National institute of marine sciences (Tunisia)

IODP Integrated Ocean Drilling Program

Ipanema National partnership initiative for the emergence of marine energies

Ipemed Institute of prospective economic studies on the Mediterranean

IPEV Paul-Emile Victor Polar institute

IPGP Earth physics institute in Paris

IRD Institute of research for development

IRSN Institute for Radioprotection and nuclear safety

ITQ Individual transferable quotas

IUEM University institute for marine studies

Jamstec Japan Agency for Marine-Earth Science and Technology

JRC Joint Research Centre

LSCE Climate and environmental sciences laboratory

Marbef Marine Biodiversity and Ecosystem Functioning

MEEDDM Ministry of Ecology, Energy, Sustainable Development and the Sea

MESR Ministry of Higher Education and Research

MNHN National museum of natural history

Mobidic Coastal biocenosis digital imaging observation module

NIOZ Royal Netherlands Institute for Sea Research

NOAA National Oceanic and Atmospheric Administration (USA)

NRL National Reference Laboratory

NSF National Science Foundation

OBS Ocean Bottom Seismometer

OFEG Ocean Facilities Exchange Group

Onema National office for water and aquatic environments

Ospar Convention for North East Atlantic marine environmental protection

Ovide Observatory of inter-annual and decadal variability in the North Atlantic

PAM Plan of Action for the Mediterranean

PCR-TTGE Polymerase Chain Reaction-Temporal Temperature Gradient Gel Electrophoresis

Pescap Fisheries development agency of Amapa (Brazil)

PNEC National coastal environment programme

POM French overseas "pays" regions

Progres Individual processes and adaptation of marine organisms to the environment

Prottec Public Research Organisation Technology Transfer through Regional Economic Clusters

PSP	Paralytic Shellfish Poison
Rebent	National monitoring network for benthic biocenoses
REMI	Microbiological inspection network in shellfish-farming areas
Rémora	Network for mollusc aquaculture yields
Répamo	Molluscan shellfish pathology network
Réphy	National network on phytoplankton and phycotoxins
RFMO	Regional fisheries management organisations
RMPP	Mean pay for staff in place
Rocch	National marine environmental quality monitoring network
ROM	Region of overseas France
ROV	Remote Operating Vehicle
SAR	Towed acoustic system
Sdage	Water management and planning master plan
SHOM	Hydrographic and Oceanographic Service of the French Navy
SINP	Nature and landscapes information system
SMFH	Multibeam sounder for fisheries
SMOS	Soil Moisture and Ocean Salinity
Snoco	National operational coastal oceanography service
Spicosa	Science and policy integration for coastal system assessment
Spiral	Deep seismic and regional investigation in the north of Algeria
SRDE	Regional master plan for economic development
TAAF	French southern and Antarctic lands
TIAC	Food-related toxi-infections
UBO	University of western Brittany
UNC	University of New Caledonia
UNEP	United Nations Environment Program
USTL	Scientific and technological University Lille I
USTV	University of southern France Toulon Var
VLIR	Very Large Research Infrastructure
VMS	Vessel Monitoring System
WCRP	World Climate Research Programme
WFD	Water Framework Directive
WHOI	Woods Hole Oceanographic Institution (USA)

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t : top
b : bottom
r : right
l : left
m : middle

155, rue Jean-Jacques Rousseau
92138 Issy-les-Moulineaux Cedex
Tél. (33) 01 46 48 21 00
Fax (33) 01 46 48 21 21
www.ifremer.fr

Hcomm - contact@hcomm.fr