

Le flash

TARA OCEANS



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A second year of expedition gets underway



The thirty-six metre schooner was designed to withstand the pressure created by pack ice and very low temperatures. - © F.Latreille/Fonds Tara

On 5 September 2010, exactly one year after setting sail from the port of Lorient in Brittany, France, the Tara Oceans Expedition left Cape Town, South Africa heading east into the second of its planned three year journey.

During this second year, Tara will cross the Atlantic and Pacific Oceans, from east to west, sailing from Cape Town to arrive in Auckland, New Zealand in August, 2011.

Most of this 43,000 kilometres voyage will be in the southern hemisphere, including eight months of sampling in the coastal waters around South America.

At the end of 2010, Tara and her crew will be sailing for Antarctica, happy to be on their way back to the polar region which is one of the schooner's favorite sailing grounds. In 2011, Tara will be making her way from Chile to New Zealand via Easter Island, the Galapagos Islands, the Clipperton Islands, the Marquesas Islands and Papeete.

Overall, more adverse weather conditions than that experienced during the previous year are to be expected.

One of the objectives of the Tara Oceans Expedition is to study the little-known world of marine plankton ecosystems, from viruses to fish larvae, along with certain coral ecosystems.

These micro-organisms sustain all the life in the ocean, and thanks to them the oceans produce half of the oxygen we breathe. Despite this fact, we know relatively little about this complex ecosystem and its huge wealth of biodiversity. Not only do the oceans play a decisive role in our climate and our future, they also nourish our body and dreams. To explore the ocean is to understand the changes our planet is experiencing.

Around one hundred scientists from top laboratories – specialists in a wide range of complementary disciplines ranging from physical and chemical oceanography to plankton biology, using genomics, microbiology, modeling, ecology and bioinformatics – are investing their energies on a daily basis to expand our knowledge of marine biodiversity.

Once again the expedition's two directors, Etienne Bourgois and Eric Karsenti, along with the entire Tara Oceans team, will be sharing their enthusiasm for marine life as they report on the unfolding story of this voyage.

Get ready for the next stage of the adventure! ■

The scientific interest of the ocean areas to be visited

by Lisa Garnier

Upwelling zones. In certain places around the world deep ocean currents rise to the surface, carrying with them nutrients and decomposing debris (dead animals, waste and so on). These currents act as a natural fertilizer pump allowing the plankton to feed and flourish, providing fish and shellfish with their food. These areas, which form the basis for major fishing grounds, have a direct influence on humans. The Tara Oceans team is in the process of determining the key species of plankton responsible for this burgeoning life. One such zone to be visited is off the coast of Chile.

Little-known coral reefs. The Tara Oceans team is surveying several reefs to ascertain their capacity to withstand global warming and ocean acidification. In 2011 the team will be studying zones around Easter Island and the Marquesas Islands.

Life in ocean deserts. Ocean deserts are areas lacking in the minerals and organic matter necessary for plankton to live. The expedition will seek to establish a precise description of these environments and draw up an inventory of the organisms capable of surviving there.

Life in acidic zones. The proportion of carbon dioxide in the atmosphere is increasing inexorably. One way to better understand the consequences of this increase on ocean life is to observe naturally occurring acidic zones. Do

some species benefit at the expense of others? Are changes in plankton communities already having an influence on the world's carbon pump? This data is essential if we are to understand the future of marine biodiversity and this issue will be the subject of a particular study in an area around the Galapagos Islands.

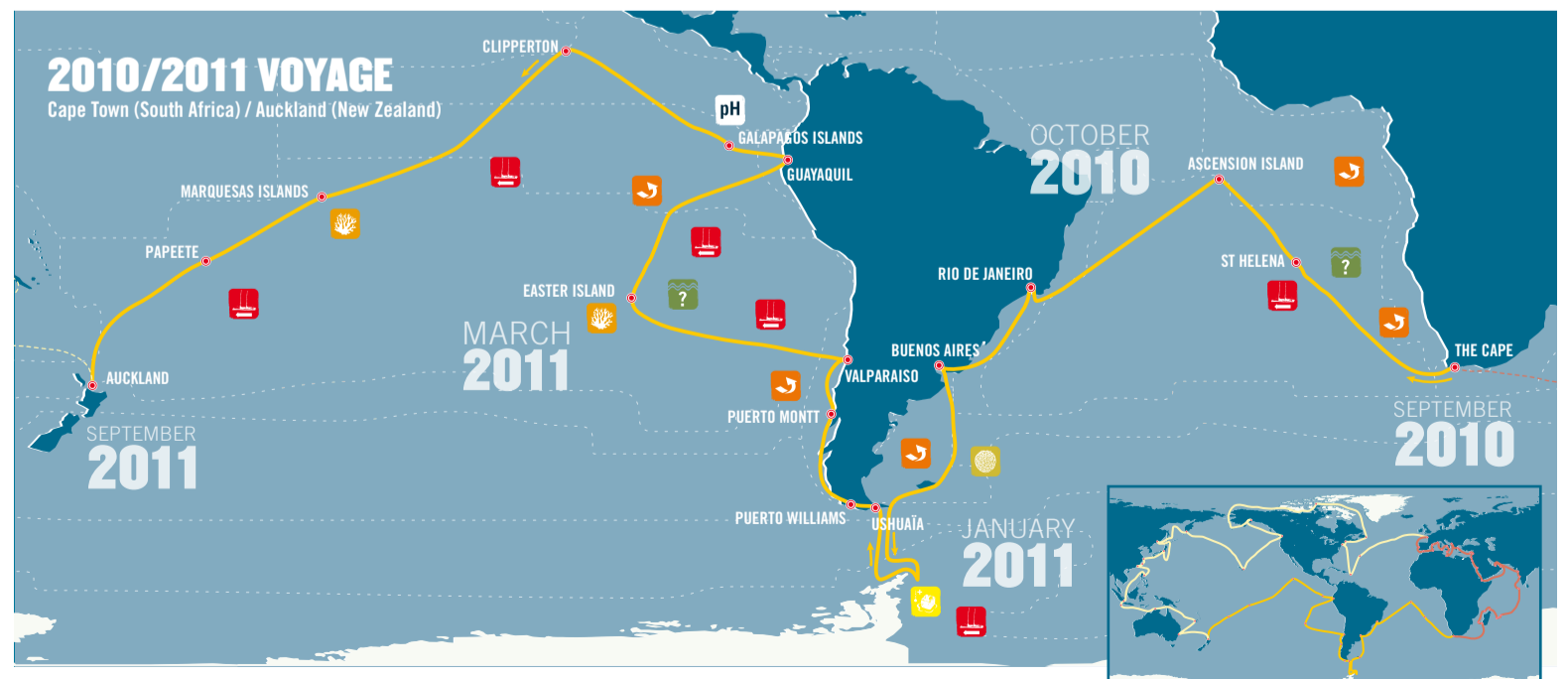
Plankton blooms. These zones benefit from nutrients brought up from the deep ocean during winter periods. Here, certain plankton flourish in surface waters before suddenly disappearing,

sometimes to be replaced by other species. In December 2010 the Tara Oceans team will be investigating this mysterious phenomenon, off the coast of Argentina.

Ice melt zones. Ice creates a whole new marine ecosystem because light and temperature are different from non-frozen zones, making for less more plankton. What effect does melting ice have on plankton communities? That's what the Tara Oceans team is hoping to find out in Antarctica.

Crossing oceanic provinces. What are the characteristic features of seawater? Since oceans first became the subject of scientific interest, studies have focused on their physical parameters. But what do we know about the nature of plankton?

Very little. This is because, generally speaking, microscopes do not form part of an oceanographic vessel's equipment. The Tara Oceans expedition will be filling in this huge gap in knowledge by taking the time to describe the plankton in each of the oceanic provinces ■



An initial scientific assessment

“For the first time since the great scientific expeditions of the 19th century, in the wake of Darwin, around-the-world expedition is once again examining underwater plant and animal life to try and find out where the planet is headed.” It was in these terms that Françoise Gaill, director of the CNRS's Environment and Sustainable Development department, described the Tara Oceans expedition at the time of her initial report in June 2010.

After one year of expedition, 300 days at sea and 66 sampling stations, the results are encouraging: the methodology is proving to be promising and the leading laboratories taking part in the project have already started to analyse the thousands of samples taken by the Tara Oceans team so far.

A. All the protocols designed and implemented since the beginning of the expedition have been validated, ranging from the acquisition of physical and chemical data and the samples taken on board through to their analysis on land. This validation was completed just two months into the expedition.

B. Sixty-six sampling stations to study plankton were undertaken in a wide variety of ecosystems: the Atlantic, the Mediterranean, the Red Sea, the Arabian Sea and the Indian Ocean.

Gene analysis performed during the first year shows that over 90% are unknown.

C. Plankton samples are of a very high quality and can be examined by the laboratories as soon as they arrive. Quantification of groups of organisms from viruses to fish larvae using automated microscopes has begun, and is now complete for certain sampling stations.

D. Mass molecular sequencing of organisms, with sizes ranging from a few microns to one millimetre, has begun at the Genoscope and is progressing well. Initial estimations show that the overall biodiversity

of the sampled stations can be characterized using this new method.

The comparison of the sequences found with those already present in global databases confirms that we only know about a tiny proportion of them: analysis of these genes shows that over 90% were previously unknown.

E. A large number of new bacterial viruses have been discovered; moreover, different communities of protists¹, associated with different physical and chemical conditions, have already been identified.

F. A «missing link» in the evolution of metazoa² has been discovered: a species of amphioxus³ with primitive eyes and brain.

G. An experiment using submarine gliders to study a gyre to the south of Cyprus with distinctive physical structures proved to be a highly successful cooperative effort.

H. NASA equipment was used with success on board to calibrate data from their satellites.

I. Thanks to her shallow draught, Tara can get very close to coral reefs. Twenty-eight dives were completed on the coral site near Djibouti, 17 dives on the Saint Brandon site (a coral atoll which has never before been sampled, in the Indian Ocean to the north of Mauritius) and some twenty or so dives on the Mayotte coral reef. The coral reef sampling has been a complete success.

Ocean sampling must take into account both diplomatic and safety considerations.

K. The 32 port calls have gone well, as have the many crew changeovers, thanks to efficient logistics and the effectiveness of both on-board and land teams.

In conclusion, the scientific findings for the year have confirmed that the sampling method works

properly and that it produces high-quality data. The analysis of the data has been very promising in scientific terms, despite the fact that ocean sampling has to take into account both diplomatic and safety considerations (ranging from sea conditions to piracy).

It is too early to talk in terms of properly completed scientific findings, but it is already clear that the expedition has been a success. ■

1. Micro-organisms produce half of the oxygen we breathe and play a vital role in how the carbon pump works. Protists are a determining factor in this because they transfer carbon from the atmosphere to deep sediments.
2. Metazoa are the group of animals whose bodies are composed of more than one cell. This includes all animals except protozoa, which are single-celled.
3. Small marine animals, amphioxus are a type of invertebrate which share many of the characteristics of vertebrates.



The Rosette is a seawater sampling device. © J.Girardot/Fonds Tara

Figureheads



1. Etienne Bourgois, 50, head of the fashion company agnès b and co-director of the Tara Oceans expedition.
2. Doctor Eric Karsenti, 61, senior scientist at EMBL and co-director of the Tara Oceans expedition.
3. Skipper Hervé Bourmaud, 39 (above) and Olivier Marien, 35 (below). The two captains take it in turns to lead the expedition.
Hervé Bourmaud was already at the helm for the Tara Arctic polar expedition between 2006 and 2008.

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The Tara Oceans expedition is a unique French-led, marine based initiative, involving an international team of renowned scientists whose purpose is to discover and study the largely unexplored world of microscopic organisms that inhabit the oceans.

Tara Foundation For Marine Research has been established in the U.S., as a 501-C-3 tax deductible organization to further the mission of Tara Oceans through an educational outreach and fund raising program.

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FOR MARINE RESEARCH

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Facts and figures for the first year

300 days at sea, from Lorient (Brittany) to South Africa
17,000 nautical miles / 31,000 kilometres travelled
66 sampling stations
32 port calls
Oceans and seas visited: Atlantic Ocean, Mediterranean Sea, Red Sea, Indian Ocean
14 people on board at any one time, including crew, scientists and journalists
100 people have sailed on the Tara, 70 of them scientists
45 days refit in South Africa

Facts and figures for the second year

23,000 nautical miles / 43,000 kilometres to be travelled
15 port calls: St Helena, Ascension Island, Rio de Janeiro, Buenos Aires, Ushuaia, Puerto Williams, Puerto Montt, Valparaiso, Easter Island, Guayaquil, Galapagos Island, Clipperton, Marquesas Island, Papeete and Auckland
Oceans and seas to be crossed: South Atlantic Ocean, Scotia Sea, Weddell Sea, South Pacific Ocean
3 weeks at sea carrying out scientific research between each port call

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