TARA OCEANS, AN EXCEPTIONAL ADVENTURE

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After two and a half years sailing the oceans of the globe, and receiving the prestigious visit of Ban Ki-Moon, the research schooner Tara has returned to Lorient.

For the entire 200-strong team of scientists, sailors, researchers, coordinators and artists—at sea and ashore—who have worked doggedly to make the expedition a success, her arrival is a major event and an emotional one. Why? Because the Tara Oceans Expedition which set out in 2009 to sail around the world has achieved all its goals. And more! She has been making waves with a stream of results (and there are more to come, see opposite) and a plethora of images and memories that those aboard brought back from their voyage (see page 7).

The purpose of the Tara Oceans Expedition was, through the study of plankton and remote coral sites, to provide scientists with information about the behaviour of the invisible world that populates the oceans, two-thirds of the Earth’s surface. It has been an innovative expedition which has proved that almost 70% of the genes that characterize plankton are unknown. Oceanographers, biologists, geneticists and physicists of the renowned international laboratories are working together to set up a multidimensional base of bio-oceangraphic data which will be free to access. Not only is plankton the key to the survival of marine life, it also absorbs much of the carbon produced on our planet. It is a veritable oxygen pump, and it needs protecting.

This special 24-page edition of the Tara News has an all-new layout and contains exceptional contributions from the painter Loulou Picasso, the photographer Yann Arthus-Bertrand, the scientists Eric Karsenti and Gaby Gorsky and the sailor Isabelle Autissier. The Tara News is all about the life aboard ship and the incredible human adventure which is set to continue. The scientific results have made it an essential project. It is no exaggeration to say the Tara needs our support. The Tara has been committed to the environmental cause since 2003. She is a peaceful weapon in the service of humanity and scientific research to help us understand the upheavals created by climate change. Not only active at sea, the team also does work ashore. In June they will be going to Brazil to defend a new “blue agenda” during the Rio+ summit (see page 22). We hope you enjoy reading the Tara News. Fair winds.

EMI DIEME AND MICHEL TEMMAN

**A SAILING SHIP WITH STRONG COMMITMENT**

*Meeting Ban Ki-Moon, the secretary general of the United Nations, was a wonderful recognition of the work we have been doing with Agnès since 2003. With the long term research carried out on the Tara, we intend to provide politicians with concrete information so they can engage in the debate and act on environmental issues.*

ETIENNE BOURGOIS, PRESIDENT OF TARA EXPEDITIONS

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**FONDS TARA AND TARA FOUNDATION FOR MARINE RESEARCH**

The Fonds Tara was created in France and the Tara Foundation for Marine Research was set up for the United States as a 501-c-3 tax deductible organization. Tara Foundation for Marine Research supports Tara Expeditions through a growing program to raise awareness and collect funds.

Contact: rytter@taramarineexpeditions.org
REPORT

“TARA OCEANS, A TREASURE FOR SCIENTISTS”

LAUNCHED IN SEPTEMBER 2009, THE SCHOONER’S SEVENTH EXPEDITION (TARA OCEANS) HAS BEEN A TWO AND A HALF YEAR VOYAGE AROUND THE WORLD, WITH FIFTY STOPOVERS. ITS PURPOSE HAS BEEN TO INVESTIGATE PLANKTONIC AND CORAL ECOSYSTEMS IN THE PERSPECTIVE OF CLIMATE CHANGES. ONE HUNDRED INTERNATIONAL SCIENTISTS HAVE TAKEN PART. THE INITIAL RESULTS OF THE EXPEDITION HAVE EXCEEDED EXPECTATIONS. BUT IT WILL TAKE MANY YEARS FOR THE DATA TO BE ANALYSED AND THE RESULTS PUBLISHED,

A n odyssey totalling 938 days at sea, the expedition sailed from the Mediterranean to the Atlantic via the Indian Ocean, the Pacific and the Antarctic. Now that the end is in sight, the team can legitimately claim that the mission has been accomplished! Indeed 70 crew members and 126 scientists from 35 countries spent two and a half years working on the Tara for a common goal.

Co-directed by Eric Karsenti (the scientific director of the expedition and CNRS researcher), and Etienne Bourgois (owner and chairman of the Tara), the expedition has enjoyed the support of France’s National Centre for Scientific Research (CNRS), the European Molecular Biology Laboratory (EMBL), France’s Alternative Energies and Atomic Energy Commission (CEA) and many public and private organizations. The ambitions of the project have been clear from the outset: to study the mysterious plankton ecosystems in the world’s oceans in order to identify their precious genomes.

Plankton is a diverse group of drifting organisms that comprises plants, algae, viruses, bacteria and animals such as the giant jellyfish Cyanea Capillata whose tentacles can be up to 37 m long. The name plankton comes from the Greek planktos meaning “drifting”, “errant”. Eighty per cent of the single cell organisms which began to appear on earth more than 3 billion years ago are plankton and they play an essential role in the global climate and biogeochemical cycles. The project captured Eric Karsenti’s enthusiasm. “The idea was to improve our understanding of plankton, how it evolves, how it interconnects and moves constantly from one ocean to another. It is a complex subject and we have a lot of questions. How are micro-organisms distributed in the oceans and what is their biodiversity? We only know a tenth, perhaps a hundredth, of what there is to know. And what about the risks to plankton, the bacteria and the viruses? Are all these kingdoms linked and similar to each other? In localizing areas or everywhere? How many of them are there? What influence does temperature, salinity, acidity and physico-chemical parameters have on these strange creatures, and in which regions?” To answer these questions the Tara Oceans Expedition called on an army of experts who specialize in genomics, quantitative imaging, biology, biochemistry, biogeography, oceanography, biophysics, genetics and bioinformatics, and more. A rare meeting of disciplines: “That’s why this expedition is special, revolutionary. And it makes it essential too.”

“The Tara collected 27,000 samples, a veritable panorama of hitherto unknown plankton”

In 1997, NASA published the world’s first estimate of how much chlorophyll is produced by plankton and went on to demonstrate its role in regulating our air through the process of photosynthesis.

The Tara Oceans Expedition has added to our knowledge an avalanche of data collected at sea during the 150 sampling operations which started in 2009. Tara’s researchers took 27,000 samples, an exploit that represents a giant step in the field of the infinitely small. The expedition has discovered a panorama of plankton hitherto unknown. Despite the discovery of 500,000 new micro-organisms, "99% of them remain unknown," says Eric Karsenti. “Our bioinformatic methods have shown us that, from one sampling operation to the next, bacteria have incredibly diverse metabolic activities,” says Eric Karsenti. That is why the scientists considered it essential for them to carry out ecosystem modelling, especially as the numerous sampling operations made it possible. “These kinds of models are essential. They can help us predict how the oceans are going to evolve, how their ecosystems are organized and distributed geographically. They are very useful in this era of sea acidification and global warming,” says Swiss-French biologist Colomban de Vargas, Protista specialist at the CNRS.

The Tara Oceans Expedition has enabled scientists to measure how marine life is responding to climate change. “The distribution of micro-organisms is in part determined by the environment, latitude and currents,” explains Eric Karsenti. “These models should help us predict how marine life is going to evolve in response to climate variation, the carbon cycle in both hemispheres and the overall regulation of the climate.”

“We noticed that the plankton was colonized by a large number of viruses and that it was adapting to the warming. It was continuing to produce its balanced quota of oxygen and CO2 and, therefore, continuing to play a role in reducing the greenhouse effect,” says Eric Karsenti. “We now have a more detailed view of its biodiversity and its complexity. Of the genes and bacilli analysed to date, 60 to 80% of them were previously unknown to science. This data is of capital importance because any variation in the composition of the plankton can have an impact on the balance of the planet’s gases.”

GOOD BILL OF HEALTH FOR THE CORAL REEFS EXPLORED

Another of the expeditions accomplished missions was to carry out a health check on coral ecosystems. In total 103 sites were studied off the coasts of Djibouti, Saint-Brandon, Mayotte and the Gambier Islands. A good state of health was observed on the coral reefs explored and they appeared to be resisting various thermal stresses and temperature increases. However the acidification of the oceans and the invasion of deadly starfish in certain regions is a worrying. Samples collected by the Tara Oceans Expedition are currently being studied. The results will tell us if the coral can survive any future increase in temperature. The expedition also made other astounding discoveries, including one which was appalling. During the Tara’s passage through Antarctic waters in January 2011, she collected evidence of a surprising quantity of plastic in the area. The samples she collected contained between 956 and 42,826 pieces of plastic per square kilometre. These findings are of great consequence. Studies are being made into the risks that this pollution presents to the health of humans, animals, birds and marine mammals. Whether at sea or on land, on the Tara or in the lab the expedition continues.

MAJOR DISCOVERIES

MICRO-ORGANISMS: Coming soon, a new international base of data collected by the Tara to improve our understanding of how the world’s climate is regulated.

GENOMES: An unexpected diversity was discovered in the plankton genomes, especially in phytoplankton.

FERTILIZATION OF THE OCEANS: A great quantity of diverse samples were collected. These are currently being analysed using imaging and genomic methods.

CORAL MISSION: Dynamic coral populations were investigated and ten new species were discovered, notably in the Gambier Islands.
More than 200 people comprising 35 nationalities took part in the expedition.
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he’ll never give up. Nature, mankind, the planet: they are part of what she is. The sea is too... “I first went on to the water when I was 3 years old! I did a lot of sailing on old boats with my father. My son Etienne learned to sail with my father,” recalls Agnès Troublé, the heart and soul of agnès b. She loves the sea, people... and much else besides. From an early age Agnès Troublé developed a consuming passion for art, design and drawing that has never left her. She is currently working on a film, a project she has been incubating for the last decade. After giving so much of her energy to help others, such as her discreet but relentless commitment to fighting AIDS, Agnès decided to give substance, through the Tara, to her personal desire to do something for the environment. An affectionate gesture towards the Earth! “This boat is part of my family. When she left Lorient in 2006 for her Arctic expedition, I gave her hull a big hug and a kiss!” laughs Agnès. “The Tara’s phenomenal success is due to the extraordinary work of the scientists who sail on her and support her, such as Eric Karsenti, the scientific director of the Tara Oceans Expedition. ‘Neptune’, as I call him, came up with the original idea for the expedition.” In France, the Tara enjoys the support of the region of Brittany and the mayor of Lorient, Norbert Métairie (“a very enthusiastic man”) and many other private and public organizations in Europe, the United States and in Asia. “What I like best about the Tara, since the very beginning, is that it is an ideal project!” says agnès b. And to take it one step further, the agnès b. Endowment Fund was set up in 2009 and a foundation is soon to follow. Its aims are threefold: help artists whatever their particular discipline, back the Tara’s activities and support social and humanitarian projects.

In humanitarian aid alone, more than 350,000 euros were distributed in 2011. The money went to the suburbs and to charities such as France Libertés, Handicap Sans Frontières, Tashe Delek (a health agency in Nepal), Urgence Corne de l’Afrique, Médecins du Monde and the AICF... The fund has been active in Japan too. “After the tsunami of 11 March 2011, we came to the rescue of the Red Cross hospital in Ishinomaki [editor’s note: which lacked drinking water, food, and fuel for their ambulances]. Our team in Japan went on to raise 500,000 euros’ worth of aid for the victims.” Agnès Troublé intends to do more. “There are philanthropists in France, that’s true. But they are too few. We need to help, and keep helping. We must stand together. Helping others should be an automatic reflex. People with means should share more of their wealth.”
Young amphipod crustacean – zooplankton (microscopic animal)
Venus’s Girdle – zooplankton – marine organism belonging to the Ctenophora family. Note the small shrimp and the fish egg attached to the organism
Galathea, small crustacean – zooplankton (microscopic animal)
Patagonian diatom – phytoplankton (microscopic plant)
Acantharea – zooplankton (microscopic animal)
Radiolarian – zooplankton (microscopic animal)
Protista – phytoplankton
Radiolarian – zooplankton (microscopic animal)
Foraminiferal – zooplankton (microscopic animal)

In 1991 she was the first woman to sail around the world in a yacht race. Today Isabelle Autissier is a writer and commentator on French radio. She maintains an enthusiastic interest in sailing and the oceans and is a respected authority on the subject in France. Chair of WWF-France since 2009 and fan of the Tara, Isabelle shares her thoughts with us. Interview.

**Feature interview • Isabelle Autissier, sailor and chair of WWF-France**

**WE MUST REWRITE OUR APPROACH TO THE SEA**

In conclusion, yes, we should do? Of course, any ill-considered construction along the shore is a crisis waiting to happen. We saw the terrible damage caused by the storm Xynthia in my region of Poitou Charentes (France). We should, right now, be planning for a withdrawal of human activities. Some places should be defended whatever the cost while others should be left for the sea to reclaim. If we start now, it will still be expensive but it will not degenerate into a crisis and, in the long term, will cost less than if we wait for the catastrophes to happen. We must rethink our approach to the sea as well as the planet. We cannot continue to be simple predators of natural resources and use the environment as a garbage dump for carbon and chemical products. That said there is hope because we will be developing techniques, knowledge, and jobs in a responsible manner. Establishing a harmony between human activities and nature is not an option, it is the only future open to us.

You appear to be following the Tara Oceans Expedition and its results with great interest. What attracts you to the project? Yes, I have always held the Tara team dear and I salute the efforts of the crews aboard and the directors of agaie h, who made the expedition possible. A sailing ship has greater potential than a motor-ship because it is less intrusive and can remain at sea for a long time. I think it is wonderful that science is reviving the old French tradition of voyages of world discovery, with scientists and sailors working together.

Your 2009 book “Seule la mer m’en souviendra” seems to define your view of the sea’s role, that it is both the living record of our planet but also its future and salvation. Is that correct? My novel tells the story of a sailor who is not honest with himself. And yet the sea, especially when sailing solo, does not suffer dishonesty; it exposes the truth. It is perhaps a kind of passive for human behaviour. Fortunately, contrary to the anti-hero of my book, many sailors acquire this truth and harmony. Sometimes the conditions at sea give you the impression that you are experiencing what it must have been like at the beginning of the world. It is a beautiful and powerful feeling that I find very constructive. It is part of what I enjoy about sailing.

**INTERVIEW BY MICHEL TEMMANN**

—SKY FULL OF STARS

22° 22’ S - 40° 22’ E

One of my best memories on board the Tara is sailing at night with a sky full of stars and not being able to distinguish the sky from the sea. Another amazing moment was watching on TV the world soccer game between Spain and Paraguay (1-0) in Europa Island in the middle of the Mozambique Channel and seeing a huge green turtle preparing its nest and many small turtles going to the sea at night. Those moments were unique. I will never forget the great moments I spent on board on the Tara with the crew and the scientists, forgetting all the seasickness when the Tara sails the sea.

—PATAGONIA

36° 37’ 40” S - 70° 25’ 31” W

I have two marvellous memories from my three weeks aboard in Patagonia. The first was a long sail along the islands with a headwind and incessant rain. I was at last sailing on the Tara. The second was the evenings aboard the Tara. Every evening one of us would present his or her speciality or current work. Every evening was a discovery, a new voyage. Above all it was a wealth of knowledge and sharing that one rarely experiences. ÉTIENNE BOUGRAS, LIBRARIAN OF TARA EXPLORATIONS

—FRENCH POLYNESIA

17° 32’ S - 149° 35’ W

The Tara arrived in the Fakarava lagoon early in the morning, through the narrow north passage where the tide makes the water boil. And all around this hellish waterway was paradise. That morning on the Tara, everyone came on deck to share the intense experience of sailing through that passage. We went on to spend several days in the lagoon, satisfied with ourselves after four long sampling operations in two weeks around the Marquesas Islands, an exploit. We were a great team of scientists and sailors. Quite simply a pleasure. FABIEN NEV, SCIENTIST
like structure fitted with ten programmable cylinders, specifically programmed depths, Rosie is a metal cage-designed to collect up to 94 litres of water at specified locations according to geographical and ecological situations, biological constraints and weather conditions. "Our choices were also made in collaboration with spatial imaging specialists, including Sabrina Speich in Brest, Daniele Ludicone in Naples and Nick Follows of MIT," says Gaby. And not forgetting help from outer space. "We also called upon satellite guidance to provide us with instant knowledge of the situation. Colour imaging of the ocean was supplied by Acri-ST France and the short-term hydrologic forecasts by Mercator France." A light and mobile scientific endeavour. "This expedition was characterized by the need for rapid decisions and extreme flexibility," concludes Gaby Gorsky.

"Biodiversity is the History of Life on Earth"

A QUESTION FOR ÉRIC KARSENTI, MOLECULAR AND CELLULAR BIOLOGIST AND SCIENTIFIC DIRECTOR OF TARA OCEANS.

Why is biodiversity so important?

Biodiversity is essential to the proliferation and diversification of life on Earth. For example, let us suppose that just one species of microscopic algae exists and that it is suited to an environment that exists at a given moment and at a given location. Let us call it microscopic algae A and suppose it needs certain quantity of light and a temperature of 20°C to survive. Suddenly the light diminishes and the temperature rises. Algae A dies, end of story. Now let us imagine that another very similar algae, that we will call B, exists alongside algae A but does not function quite as well in the conditions preferred by A. If B is capable of surviving in the new conditions which adversely affect A, then algae B will fill the gap. Of course that is an extremely simplistic explanation but that is how ecosystems are maintained and biodiversity has increased over the last 4 billion years. It gives life on Earth its incredible robustness when faced with environmental challenges. Biodiversity is the history of life on Earth. Without this huge biodiversity which has accumulated over billions of years, and which, in a way, carries the mark of all that has happened on our planet, life would be far less robust.

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Aboard the Tara

54°48' 57" S – 68°19' 04" W

I am a young scientist. People of my age are considered beginners in the trade. Usually, in my laboratory, I feel disconnected from other scientists. On the Tara it was different. I didn’t feel like that. Aboard the Tara the head scientist was approachable and, on occasion, even allowed me to air my point of view on a given question. Everything was well prepared, planned. If the protocols couldn’t be applied, we discussed how we could adapt them. I learned how to work in a team and share knowledge.

Béatrice Le Mao, scientist

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New York

40°42’ 48" N – 74°00’ 20" W

Making landfall at the foot of the skyscrapers was a privilege. Sailing past the Statue of Liberty, Tacking under the Brooklyn Bridge, furling the sails at Manhattan, imagining a walk down Broadway in my waterproofs. We were in America.

Eric Valente, Captain
Interview with Rainer Friedrich

GONE WITH THE SAMPLES

Every time the Tara makes landfall, Rainer Friedrich, project coordinator at World Courier, has to organize the complex logistical operation of transferring the samples collected at sea to European and American laboratories. His role is essential. Interview.

What is the best way to transport samples?

The best way to ensure the success of such a demanding enterprise is to have at your disposal a dependable network of agencies, and a flow of regularly updated information. A good relationship with airlines and the authorities of the countries were the ships docks is also essential! World Courier enjoys excellent working relations throughout the world.

How much time do you need to prepare for a stopover?

To tell you the truth it all depends on the port. For example, it took us about three months to organize the Djibouti stopover because the laws there are very complicated. For most ports preparation requires one or two months.

To which ports has the Tara expedition taken you?

I've been to Barcelona, Nice, Dubrovnik, Djibouti, Male, Mayotte, Cape Town, Buenos Aires, Valparaiso, Guayaquil, Papeete, San Diego, New York, Lorient.

What was the most difficult stopover?

Without doubt it was Djibouti and Male, where we had to maintain the internal temperature of our "VIP containers" at a specific level in extremely hot weather. On the whole, the coordination of the expedition is exhausting and requires a lot of time and effort.

"We couldn't come alongside in Mayotte so I hired a barge and unloaded the samples in the middle of the lagoon."

for each stopover. If we didn't have the documents obtained by Romain Troublé, director of operations for the expedition, our work would be much more difficult (for example, he obtained a very useful document from the French authorities). I am very grateful to Romain for doing the difficult information. A good relationship with airlines and the authorities of the participating countries is also essential! World Courier enjoys excellent working relations throughout the world.

What is your best memory, and your worst?

My best memory must be Mayotte. The Tara couldn't alongside a dock because the rates set by the Comoran French authorities were prohibitively high at 4,000 euros a day. So I hired a barge and unloaded the samples in the middle of the lagoon! It was one of the most beautiful experiences of my life, and much easier than I had expected.

Cape Town was also a magical moment. The Tara was moored alongside the V&A Waterfront and we had a magnificent view of Table Mountain. The site, and the efficient World Courier team based in Cape Town, made sure the stopover and our logistics went perfectly! Even the last minute requests ("Sorry, we've got another package for you") didn't change my positive view of this stopover.

My worst memory was when I got very ill in Djibouti. Luckily Major Schuber, a military doctor in the German Army, was staying in the same hotel as me. He saved my life! Another time we were in Male in the Maldives and didn't have enough dry ice. The flight on to which I had booked the seawater samples was cancelled and I had very little time in which to book another flight to Europe if the samples were to be preserved in perfect condition.

The stopover in Guayaquil was unfortunate too! The place chosen for unloading the samples was not satisfactory for our logistics so I had to find another reliable port as quickly as possible, and one with a suitable infrastructure for protecting the seawater samples and unloading them in complete safety.

Which were the hottest stopovers?

Without doubt Djibouti, Male and Mayotte.

Of all the Tara stopovers, which one was your favourite destination?

That's easy: it was Randos Island in the Maldives where I took six hours off, once the job was done, to relax and recharge my batteries! And also Cape Town which is, for me, the most beautiful city in the world.

Once the samples get to Europe, what happens to them?

All the samples are sent to Frankfurt. There they are unpackaged, inspected, counted again, and repackaged depending on what they contain. Then one of our special trucks delivers them to the participating laboratories in the European towns and cities of Evry, Paris, Roscoff, Barcelona, Banyuls, Marseille, and Villefranche-sur-mer. We also dispatch them to two destinations in the United States: Tucson in Arizona and West Booth Bay in Maine.

It must be a very stressful job. How do you stay calm and keep smiling?

There's no magic formula to help you manage a huge logistical challenge like the Tara Oceans Expedition. You need to be thick-skinned, know how to make things happen and make instant decisions. That said, having a beer with the scientists and the crew of the Tara once the job is done is also a great way of relieving stress and putting a smile on my face!

Is this the first time you have been involved in an operation of this kind?

World Courier is involved in many interesting operations, such as transporting samples from space, in particular from the International Space Station (ISS-1). Most of the work in this scientific endeavour involves understanding how the organisms react in space, and the potential impact space can have on them. We also manage the transportation of urine samples collected from cyclists during the Tour de France, for the purposes of drug testing. But for me, in my twenty-four years working for World Courier, I've never worked on a project more exciting than the Tara expedition! Tara Oceania is a unique logistical challenge that I will never forget. I'll have some great stories to tell my grandchildren!

THE FIGURES / THE SAMPLE CONSIGNMENTS /

- 13 CONSIGNMENTS OF PLANKTON SAMPLES SENT TO LABORATORIES
  - 126, BORDEAUX, DOURDOS, MARSEILLE, NICE, ROYAN, NICE, ROYAN, MARSEILLE, NICE, ROYAN, MARSEILLE, NICE, ROYAN, MARSEILLE, NICE, ROYAN
  - 1,800 TO 2,200 SAMPLES UNLOADED AT EVERY STOPOVER WITH A RECORD
  - 2,500 SAMPLES UNLOADED AT OYAPIC
  - 1,200 KILOS OF PACKAGING, INCLUDING THE CONTAINER, TO PROTECT THE SAMPLES DURING TRANSPORT
  - 3 DIFFERENT TEMPERATURES FOR PRESERVING THE SAMPLES
    - (-20°, -80°, +2° TO E.8° AND +15° TO +25°)

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Rainer Friedrich of World Courier in action: the Tara’s very own 007
THE TARA VIEWED BY ARTISTS

Four artists choose a work that encapsulates their time aboard the Tara during the Tara Oceans Expedition and explain the story behind it.

1. "This drawing was done at a time when reports were coming in of Somalian pirates attacking ships in the sector adjoining ours. We were somewhere between Bombay and the Maldives, and hourly updates told us that the danger zone was extending towards us. We also learned that some of the attacks had been fatal for Pakistani fishermen. I remember that I wasn't very reassured... During the night we scrutinized the horizon hoping we wouldn't spot a couple of little silhouettes in the half-light, a sure indication that, ten minutes later, we would be at the mercy of those delightful gentlemen armed to the teeth... Hervé Bourmaud, the captain, had the good idea to get out of the area as quickly as possible. The Tara would have certainly made a fine prize for the pirates. Without this episode, my time aboard the Tara would have been a dream." 

   Benjamin Flage

2. The American artist Mara G. Haseltine poses next to her sculpture "Bohemia, a portrait of our endangered oceans". It shows a tintinnid plankton captured during her time aboard the Tara off the Chilean coast in February 2011. The artist remembers her reaction when she first saw the plankton through the microscope: "It was love at first sight! I was struck by how it resembled a little champagne glass fit for a mermaid!"

   Mara G. Haseltine

3. "It was a beautiful moment somewhere between Dubrovnik and Athens: a very calm atmosphere and I like the graphic interplay of the Tara's ropes and sails."

   Rémi Hamoir

4. “On the ship, brush, ink and water were the perfect tools for drawing fish, krill (small crustaceans) and other surprising animals. With a few days in the Galapagos, some days and nights in the rolling Pacific, and several moments of observation using the ship’s microscope—and not forgetting the research and patient explanations of my dear travelling companions—I had before me enough inspiration for a good few years to come.'

   Aurèle de la Morinerie

CAST OFF THE MOORING LINES

23° 8’ 24" S – 134° 56’ 24" W

How great it feels to cast off the Tara’s mooring lines after a busy stay Heading out to sea, getting back into the ship’s routine, adapting your movements to the rolling of the ship, enjoying the moods of the sea and the whims of the wind. These are all pleasures that turn into excellent memories when you return to the land.

Celine Blanchard, crew member

AROUND THE MARQUESAS ISLANDS

9° 30’ S – 140° 00’ W

During the STEFI experiment around the Marquesas Islands, I was leading a team on land to support the team on board with real time satellite data. While communicating with the other end of the world, due to the time difference, it often felt like spending the night on board, cruising around these magnificent islands. While during the day I was a father on holiday in Italy with my 4 year old daughter. One night, the Glider deployed in the South Pacific started to give strange signals, indicating that it was hitting the ocean floor at the island shelf. I’ll never forget the phone call to the Paris-based glider captain at about 6am. ’I think we have a serious problem...’

If we had lost the glider, we would have lost with it the Tara’s major missions.

Daniele Ludicone, scientist
EASTER ISLAND MARCH 2011 24 HOURS!

Cape of Good Hope - APRIL 2010

Lagoon of Teahurou Pinesian 2011

Ushuaia - DECEMBER 2010

Dubai - OCTOBER 2009

Cardiff Canal - NOVEMBER 2009

Ushuaia 2010
OCEANS UNDER THE MICROSCOPE

The Tara sailed two and a half years across the world's oceans to carry out the first global study of marine plankton. Not much is known of this ecosystem despite it being a crucial indicator of our planet's health.

WHAT IS THE PURPOSE OF THE EXPEDITION?

**OXYGEN**

The oceans are the lungs of our planet. They produce half of all the oxygen we breathe and absorb CO2. Variations in the climate modify their capacity to absorb carbon.

**Plankton**

It is the foundation of the food chain, ensuring the survival of fish, marine mammals and, therefore, billions of human beings. Plankton micro-organisms react rapidly to climate change and the acidification of the oceans.

**Coral reefs**

Are exceptional repositories of aquatic biodiversity but they are suffering from the effects of climate change, marine pollution and overfishing.

A CONCENTRATION OF HIGH TECHNOLOGY

The Tara is fitted with a unique microscopic imaging facility known as the "dry laboratory". Researchers use it to characterize the organisms they collect, such as their functional diversity and their complexity.

**The FlowCam**

Passes microorganisms and phytoplankton rapidly through a laser beam to count and characterize them.

**The ZooScan**

Identifies zooplankton automatically.

**The Underwater Vision Profiler**

Observes plankton during collection.

3 METHODS, MORE THAN 20,000 SAMPLES

**Nets**

There are 7 types of net ranging from 5 to 690 microns, which are lowered to a depth of up to 1,000 metres. One of them, the Manta, was designed specifically for the study of surface plastic.

**Peristaltic pump**

This device pumps water from a depth of 10 metres through a system of sieves, each finer than the next, to collect organisms of various sizes.

**The CTD rosette**

This assembly comprising 10 Niskin bottles is designed to characterize water masses. It collects information of pressure, temperature, conductivity, nitrogen, oxygen, fluorescence and more. The bottles are programmed to open and collect water at various depths.

PHOTOPLANKTON

1 TO 100 MILLIONS IN ONE LITRE OF SEAWATER

This photosynthetic plankton, micro-algae, grows under the influence of light and produces oxygen. It consumes, among other things, mineral salts and vitamins.

VIRUSES

10 TO 100 BILLIONS IN ONE LITRE OF SEAWATER

These giant viruses are the curious larger relatives of "normal" viruses. They measure up to 10 times the size of previously known viruses and possess more genes.

TRANSPORTING SAMPLES

**Stopovers**

Every 6–8 weeks the Tara stops off to unload the samples, which are preserved in nitrogen, for dispatch to the laboratories.
**FISHES LARVAE**

**OF FILTERED WATER**

**October 2011**

The Tara crosses the "plastic continent", a calm area where floating detritus, washed in by marine currents, accumulates.

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**2010**

The Tara crosses the Gulf of Aden, a very dangerous zone infested with pirates. Research has to be postponed for two weeks.

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**January 2011**

The scientists sample Antarctic waters for one month, the only polar sampling operation of the expedition.

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**Bacteria**

1 to 10 billions in one litre of seawater

The oceans are important habitats for microbes. These prokaryotes, organisms having no nucleus, help clean the oceans.

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**Viruses**

10 to 100 billions in one litre of seawater

The marine virosphere is enormous, undoubtedly greater than its land-based equivalent, and almost unknown.

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**World Courier**

The world specialist in the logistics of sensitive material sends the samples to Heidelberg (Germany) for distribution to various destinations across the world.

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**Scientists Aboard the Tara**

**Shipboard staff included:**

- 70 crew members
- 126 scientists
- 141 men
- 55 women
- 35 nationalities

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**February 2009**

The expedition gets underway with thousands of well-wishers waving goodbye to the Tara.

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**September 2009-March 2012**

50 stopovers, 30 countries

115,000 km around the world

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**Future Research**

Data produced by the Tara Ocean Expedition will be analysed and inspire research for decades.

**Medicine, Pharmacy**

Plankton is an exceptional resource of biomolecules that have a huge potential for biomedical research.

**Climate Change**

The collected data will help scientists develop mathematical models to predict how ecosystems will evolve. These models will help predict, for example, future stocks of certain fish species.

**The Biobank**

This oceanographic data bank is the only one of its kind and will not be subject to copyright. It will serve as a reference point and resource for generations of researchers.

**Genomics**

This discipline involves the study of organisms at the level of their genome and not just one single gene (genetics). More than 85% of the DNA sequences found in the protista samples are new to science.

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**Shore-based Laboratories**

20 labs throughout the world

- 8 in France
- 5 in the USA
- 2 in Germany
- 2 in Italy
- 1 in Belgium
- 1 in Ireland
- 1 in Spain

One hundred researchers

12 fields of research
A major aim of the Tara Oceans Project is to show schoolchildren, their teachers and the general public what life is like aboard the Tara, the scientific exploration and the laboratory results. Our ambition is to make young people aware of the environmental issues encountered by the expedition.

For the last three years nearly 19,000 French children have been involved in the various educational projects devised by the expedition and its partners. In that time nearly 3,500 young people from all over France have taken part in various meetings between schools, scientists and the crew of the Tara. Another 5,000 children throughout the world have visited the Tara and taken part in conferences organized wherever the ship stopped off. On top of that, it is hard to imagine the innumerable youngsters who have visited the Tara Junior website to do the fun lessons... or just to get an idea of what life aboard is like.

But these figures do not communicate the extraordinary impact the expedition has had on young people, how it has motivated them. Proof of this can be seen in the presentations made at school forums in Paris and Lorient, in the e-books made in Toulouse, the songs written in Lyon, the beautiful drawings made by the children of Rio and Portugal, and the pertinent questions sent to us by the children of Washington; it could also be heard in the silence that reigned in a room full of Palaisseau teenagers during a particular Tara Oceans presentation. It is evident that the Tara opens horizons and awakens the imagination of those in primary and secondary education, children and teenagers. A difficult subject like plankton, that key link in our fragile ecosystem, intrigues curious young minds and soon they acquire a notion of its importance. The incredible images that the Tara brings back from this hidden world inspire them. Some may well become sailors, even scientists. Others will remember that our planet is extraordinarily beautiful, that it is worth knowing, sharing, protecting...

And the adventure will not be stopping once the Tara returns on 31 March 2012, not even at the end of the school term. The Tara will be visiting the Breton ports of Brest and Douarnenez during the summer, and heading to Paris in the autumn. School visits are already on the programme until January 2013. As for the scientists, they will be returning to their laboratories to continue their explorations. They will be delving into the data, thinking up theories and writing reports. Tara Junior will be relaying all this information to schools and teachers at the start of the new school year. There will be fun and innovative educational operations so that the young – and not so young – can continue to follow this fabulous adventure.

Xavier Bouleard & Brigitte Sabarby

MISSION TARA OCEANS
Ecole Normale Supérieure d'Écoologie de l'Océan
The figures
TARA JUNIOR /

- 19,000 SCHOOLLCHILDREN HAVE FOLLOWED THE EXPEDITION THANKS TO TARA JUNIOR
- 20,000 WORKSHEETS HAVE BEEN DOWNLOADED FROM THE WEBSITE WWW.TARAJUNIOR.ORG
- 5,000 HAVE VISITED THE SHIP IN PORTS ACROSS THE WORLD
- 3,500 CHILDREN FROM ALL OVER FRANCE HAVE TAKEN PART IN EVENTS ORGANIZED DURING THE LAST THREE SCHOOL YEARS
Serving the planet for 23 years. The Tara, ex-Antarctica, ex-Seamaster, under sail, by Loulou Picasso.
**Veolia Environnement Foundation with Tara Oceans**

**UNITED WE STAND**

**Maguy Bourbigot of the business cluster Mer Bretagne is Veolia Environnement Foundation’s representative for the scientific project launched in 2009 with Tara Oceans. She tells us about the main aims and issues. Interview.**

**What is your role in the business cluster Mer Bretagne?**

Since 2006 I have been Veolia Eau’s representative at Mer Bretagne, a professional cluster of researchers and companies. Veolia Eau is one of the founding members of the cluster. My job is to develop the theme of “Environment and Coastal development” among the cluster’s network of members. I aim to strengthen the dynamic created by the network around the major issues relating to technology, the environment and society. My duties also include fostering innovation that has the potential to benefit the members and facilitating the emergence of new innovative and collaborative projects that bring together publicly-funded research and companies. The purpose is to build collective skills and to improve our capacity for attracting investment.

**How did you get involved with the scientists of the Tara Oceans Expedition and what are the issues?**

My collaboration with the Tara Oceans scientists developed from two different sources. Initially the Veolia Environnement Foundation contacted me in the spring of 2009 to present the Tara project. However the collaboration also developed naturally through the Marine Biological Station of Roscoff, was already taking part in the Tara Oceans expedition. In 2009 the Mer Bretagne cluster awarded their quality hallmark to the Poseidon project, and we are also supporting the Oceanomics 2012-2022 project in collaboration with several of the Tara Oceans scientists and some industrial partners. The aim of the Oceanomics project is to organize the archiving, referencing and sharing of the data and genetic information on marine micro-organisms that has been collected from the world’s oceans by Tara. Veolia’s Research and Innovation department is one of the project’s industrial partners. Mer Bretagne will also help promote this knowledge pool to the scientific and industrial communities. The central scientific themes of the project are perfectly compatible with our focus on “marine biological resources” and “the marine environment”.

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**Why is it important for the Veolia Environnement Foundation to support the project?**

The fact that Veolia Research and Innovation is taking part in the Tara Oceans operation shows that the group is interested in the work of the scientists. In addition to the Oceanomics project, which I’ve already mentioned, another example would be Veolia Environnement’s centre for environmental analysis which financed a post-doctorate position at the Marine Biological Station of Roscoff to set up an automatic imaging process using confocal microscopy [editor’s note: a process which uses reflected light or fluorescence to create images with a very shallow depth of field] for single-cell eukaryotic marine plankton.

**What other projects is Veolia Environnement Foundation involved in?**

Since its creation in 2004 Veolia Environnement Foundation has supported more than 1,000 projects in France and elsewhere, and has undertaken approximately 150 missions in the field. The foundation supports projects of general interest and charitable work that promote sustainable development. Focusing on solidarity, professional integration and the environment, the foundation adds an original touch to its projects by ensuring that they enjoy the support of one our collaborators. We also encourage “skills sponsoring”, the objective being to provide our partners, associations and institutions with the know-how of “Veoliaforce”, a network of enthusiastic collaborators.
THE TARA IS A SYMBOL AND AN AMBASSADOR FOR LORIENT

Since 2006 the city of Lorient (France) has become the natural home port of the grey and orange tall ship. All the inhabitants of the city and the surrounding region know the Tara's name and logo. A story of the sea, and of love. Interview with Lorient's mayor.

Norbert Métairie, chairman of the Cap l'Orient inter-council partnership

"THE TARA IS A SYMBOL AND AN AMBASSADOR FOR LORIENT"

How and why did Lorient become the Tara's home port?

There is, of course, a historical dimension to this. Our city, formerly the home port of the East India Company, has a long history of exploration, discovery and passion for the seas and the oceans. I first met the directors of the Tara project in the summer of 2005, during the Groix Film Festival. Motivated by the enthusiasm of the Cap l'Orient inter-council partnership and its interest for sustainable and fair development, the Tara expedition team chose the port of Lorient as a base for its preparations prior to the Arctic voyage in 2006. Above all they found in Lorient an appropriate infrastructure and a recognized network of skills and knowledge.

Lorient, the Tara's home port: what does that mean for you?

Lorient and its surrounding region has long been recognized as a pioneer and an example when it comes to sustainable and fair development. Lorient's maritime community? It is a very special role because the Tara is not only the city's goodwill ambassador and a powerful symbol but also a human and scientific adventure. It is a remarkable advertisement for Lorient, the redeveloped site known as “la BSM” (submarine base), and its pool of enterprises. Over the years, during the various expeditions, the people of Lorient have become greatly attached to the Tara. And next March, on the children's carnival day, we will be celebrating the return of the Tara.

A LONG TERM APPROACH TO SUSTAINABLE AND FAIR DEVELOPMENT

What in your view are the principal environmental issues affecting Lorient and, in a more general sense, the rest of Brittany and France?

There are many. In addition to preserving the environment, I am convinced that we must give greater balance to our public initiatives for sustainable development. These must take into account not only the economic and environmental aspects but also the impact on society. Implementing isolated environmental policies is not sufficient, we need to have a broader vision, look to the long term. In addition to our initiatives, we also aim to limit the environmental impact of construction projects by promoting low-energy buildings, renewable energies, car sharing, and so on.

What are your policies for dealing with this?

For many years the Cap l'Orient inter-council partnership has been developing a number of policies to promote sustainable and fair development. We participate in the integrated management of our coastal areas because the seashore is a precious and fragile resource that needs protecting. We are involved in the integrated management of our water resources to ensure that we have safe and protected them. We also get the public and professionals involved through events such as Salon Terre! and Pointenps de la Terre ! Lorient is helping to save the planet!

INTERVIEW BY ÉLOÏSE FONNAUÉ
The fourth International Polar Year (2007–2008) was a unique opportunity to rediscover the Arctic Ocean thanks to the support of modern technology, remarkable infrastructures and powerful logistical solutions. It was a year of extremes and exceptional events such as the unprecedented and unexpected shrinking of the ice-cap in September 2007, and the profound changes to the opposing pressure patterns in the Arctic atmosphere known as Arctic oscillation (AO).

After a positive phase in the period 2007–2008, Arctic oscillation became very negative in 2010. If we are to understand the probable causes of the changes that affect the atmosphere, the ice caps and the Arctic Ocean, we must first identify the chain of events that connects these three key components of the Arctic climate and the positive or negative interactions and counter-reactions that led to the 2010 situation.

Arctic oscillation alternates between positive and negative phases. Positive phases tend to be anticyclonic and result in high atmospheric pressure at sea level, low surface temperatures and greater ice formation (greater surface area and thickness of ice). The severe negative phase of AO in 2010 resulted in excessively low temperatures, more than 10°C below normal, in Europe, Russia, and North America.

Changes in the Arctic were initially noticed not in the surface area of the sea-ice but its thickness. These observations date back to the early 1990s. From an average thickness of more than 3 metres in the 1970s, the Arctic ice-cap measured less than 2 metres in the middle of the 1990s. American nuclear submarines cruising under the Arctic ice-cap were the first to raise the alarm. This shrinkage has continued in recent years and it is estimated that the current average thickness of the Arctic ice-cap is half what it was thirty years ago. In fact the old perennial ice which was more than 3 metres thick has gradually been replaced by year-old ice which is less than 2 metres thick.

AN INCREASING INTERVAL BETWEEN BREAKING UP AND REFORMING

Paradoxically, it was a reduction in the surface area of the sea-ice that attracted the attention of Arctic observers in the first decade of this millennium. In the summer of 2007 the ice-cap shrank spectacularly and by September of the same year, the surface area of the Arctic fløe had been reduced to four million square metres or half what it had been thirty years before. If we consider that both the thickness and the surface area of the ice has diminished by 50 %, that means the ice-cap has lost 75 % of its mass or volume. A huge reduction!

Some think that by the end of the summer the icecap’s loss of mass or volume will be close to 60 %. With DAMOCLES, the European scientific programme which included the Tara expedition, we studied the progressive breaking-up of the ice in the spring and the reformation of the ice-floe in the autumn. We observed that the breaking-up of the ice occurred one or two days earlier per year over the last decade, and reformation in the autumn experienced one or two days later. This growing interval between breaking-up and reformation (which is currently about one month compared to observations over the last decade) is an important way of measuring the gradual increase in the icecap’s thawing period which explains the ever more pronounced minimum values observed each September.

Another equally spectacular phenomenon that we managed to identify concerned the speed with which the sea-ice moved: it has practically doubled over the last century. The schooner Tara drifted with the Transpolar Drift Stream for 507 days between September 2006 and January 2008, from the Laptev Sea to the Fram Strait; and yet it took the Fram, a Norwegian ship carrying the explorer Fridtjof Nansen, more than one thousand days, or three years, to drift along exactly the same route a century earlier. The Russian station NP35 travelled in ten months, from October 2007 to July 2008, the same distance that the Fram covered in 2 years between 1894 and 1896. During the Tara’s 507-day transpolar drift, she was trapped between the old ice ahead of her and the young ice in her wake.

THE PEACEFUL ARCTIC OCEAN. BUT FOR HOW LONG?

Sea-ice reflects more than 80 % of the sun’s incident radiation. Once it is covered with snow this percentage, known as “albedo”, (editor’s note: the proportion of light reflected from a surface), can increase to 90 %. On the other hand, an ocean free from ice absorbs 80 % of the sun’s incident radiation and turns it into heat. This huge contrast between the albedo of ice and that of seawater goes a long way to explaining why global warming trends tend to be amplified in polar regions. We were therefore studying (in great detail) the behaviour of the ocean’s surface at a time when sea-ice and the Arctic atmosphere were undergoing profound changes.

The principal conclusions are surprising. Without calling into question the phenomenon of positive feedback linked to the very low albedo of the ocean compared to that of ice, it seems the subsurface layers of the ocean and the principal structures that feature in the vertical stratification of the Arctic Ocean are remarkably stable. We observed that relatively warm water with low salt content from the Pacific Ocean, which enters the Arctic through the Bering Strait, may be speeding up the significant thawing of the sea-ice in the Canada basin and the Chukchi Sea.

On the other hand the waters coming up from the Atlantic Ocean, which are relatively warm and saltier, circulate at greater depths than those of the Pacific and, as a result, seem to have a minimal thawing effect on the sea-ice. Thanks to the Tara Arctic Expedition’s contribution to the DAMOCLES project, we have identified a localized layer in the thermocline— at approximately 100 metres above the Atlantic water mass and straited at about 300 metres below sea level in the Eurasian Basin and 400 metres deep in the Canada Basin—where a dual convective process has developed. This produces a very unusual structure consisting of horizontal layers a few metres thick. This structure demonstrates the remarkable tranquility of the Arctic Ocean and how unlike other oceans it is, they being exposed to turbulence caused by the wind. But how long will this structure last? The Tara Arctic Expedition produced a wealth of information that has since been published in top-level articles in some of the great international scientific journals. More than twelve DAMOCLES articles are related directly to the Tara Arctic Expedition and six of these were recently published in international journals. Another twenty scientific publications related to the expedition are expected to be published in 2012.

JEAN-CLAUDE GASCARD, COORDINATOR OF THE EUROPEAN SCIENTIFIC PROGRAMME DAMOCLES.
EDF, one of the Tara Oceans Expedition’s partners, organized a special competition for its personnel. The prize was a trip to Mayotte to spend a day on the Tara during her coral mission. In May 2010 four lucky winners got to learn about the ship and the scientific equipment, talk with the researchers, eat with the crew and even dive on the sites in the lagoon. Three of the winners give us their impressions.

**Richard Tremouilles, responsible for communication**

“Thanks to the Tara Oceans competition, I was lucky enough to visit one of the most bio-diverse places on the planet. The natural wealth of the island is absolutely astounding! However my initial enthusiasm gradually gave way to concern. The more I discovered, the more people I met, the more I realized the island was living on borrowed time, defenseless against the pressures of human activity. It’s a tale of two islands: on the one hand, there’s the picture postcard destination (the turquoise lagoon, the coral, the fish, the turtles and so on); on the other, the sewage and the plastic waste that flows into the sea. The situation on the island is a condensed version of what is happening to our planet. Without doubt solutions will be implemented in good time. Let us hope that they allow the people of Mayotte to continue to play an active and responsible role in the island's economic, social and environmental future.”

**Eric Clozet, responsible for preparation**

“I was impressed by the wealth of biodiversity in Mayotte. With its forests, mangroves and lagoon, the island possesses a rare natural heritage that has been left almost untouched by industry and human activity. But its preservation is in the balance because there are no sewage treatment facilities, drinking water and electricity is not available everywhere, domestic and industrial waste disposal services are almost inexistent, there are no recycling initiatives, people put up tin shanties wherever they like, clothes are washed in the rivers which damages the lagoon and the mangroves, and the vegetation on the mountain sides is being burnt which leads to earth and waste being washed into the lagoon.”

**Didier Mortier, head of planning**

“The trip was extraordinarily rich in images and introspection. I remember, among other things, a child rolling a tire down the street with two sticks (part of the local school curriculum!); the sole supermarket on the island which was the second largest consumer of electricity; no begging on the streets; the infernal mini-roundabout in the capital Mamoudzou which connected all the main roads of the island; the efforts of local organizations to defend Mayotte’s biodiversity while there is still time; the increasing backlog of waste on the island due to the failure of the authorities; and the omnipresence of the security forces to deal with the wave of clandestine immigration from neighbouring islands.”

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**INTERACTING WITH THE OTHER PEOPLE**

Interacting with the other people on board has been just fantastic. Everybody has very different backgrounds, nationalities, interests, passions, but we are all driven by believing that Tara Oceans is doing something really unique and trendsetting. In interacting with the artists on board I have seen just how close the arts and sciences are. In Tara Oceans we are moving away from our specialized and comfortable niches and into a framework where many disciplines fuse in fact just like how the natural philosophers two centuries ago were working before a focus on biology became the thing to do. The Tara is moving forward by taking us back to another way of looking at our world.

**Chris Bowler, scientist**

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**WHEN DREAM COMES TRUE**

In 2007 I was sitting in the Cockpit restaurant at Villefrance-sur-mer, with Eric Karsenti and Christian Sardet, imagining a voyage across both hemispheres of the world, and then on 5 September 2009, I found myself aboard the Tara, immensely happy as we left the port of Lorient on the first leg of my dream voyage come true. I can’t believe that, two and a half years later, the dream of discovery has become a reality that will benefit future generations.

**Gary Gorst, scientist**
**SOUTH PACIFIC**

27° 09’ S – 109° 27’ W

South Pacific, Valparaiso to Easter Island. We sailed for days and days without encountering any trace of a human presence. Even the birds and the fish had deserted us. A desert ocean. A oceanic desert. And then early one morning an island appeared on the horizon. A black land, encircled by white foam, dominated by grey clouds. It looked like Tintin’s Black Island... In reality it was the legendary Easter Island. We stood on despite the hostile appearance and in due course made landfall. A few steps, a few yards, a few hundred yards... and there I was face to face with a moai statue. The stone giant looked me straight in the eye, a piercing gaze. In the distance the Tara was gently rocking in the waves. Living on a sailing ship, meeting a moai... What a fabulous adventure.♥

Anna Deniud, journalist on Board

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**MONACO SUPPORTS THE TARA**

Over the years Prince Albert II of Monaco has been an active defender of the polar regions and has taken a close interest in the results of the Tara Arctic Expedition. The Albert II Foundation, which is dedicated to protecting the environment and promoting sustainable development, has been supporting the expedition since 2010. Monaco Yacht Club and the scientists of Monaco’s Scientific Centre have also been greatly involved in the project.

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**TATTOO**

17° 32’ S – 149° 34’ W

I have so many unbelievable memories. I have a lasting memory though, in the form of a permanent tattoo, which will remind me of my time with the Tara in the South Pacific. Two close Tara friends talked me into getting a tattoo (and gave it to me as a birthday present). It was done in Nuku Hiva, in the jungle, by a Polynesian tattoo artist. This was at 10 in the morning after having had a beer. I’m not a beer drinker and everybody knows that. In the end it wasn’t too hard for them to convince me. It was the right time and place for a tattoo, for something special to remind me for the rest of my life of the most crazy, insane and exciting job I’ve ever done.

Steffi Kendall-Leavis, scientist

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**A GOAT ON BOARD**

11° 36’ N – 43° 10’ E

The event that most marked me, also the most unusual, was when a little goat arrived on board the ship during the Djibouti leg of the trip... We were tied up opposite a small fishing village when a local came over to us in a little boat carrying a frightened little goat. It took us a moment to understand that the animal was a gift. We gave it a bowl of milk, stroked it... but had no idea what we could do with a goat aboard. It was then that we realized we were supposed to eat it. With much diplomacy we explained to the fisherman that we were obliged to refuse and return his gift. What a culture shock.

Stephanie Reynaud, scientist

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**BETWEEN BUENOS AIRES AND USHUAIA**

54° 48’ 57” S – 68° 19’ 04” W

On the leg between Buenos Aires and Ushuaia, we experienced some very heavy weather. And we wanted to sample very specific areas. We had, therefore, to be in the right place at the right time if we were to have a favourable weather window in which to deploy our instruments. We benefited from some very precise land-based weather routing which took into account oceanographic information in real time and this was compared with the information received directly from the Tara as well as weather forecasts. We managed to get the job done and that was very rewarding. It was like playing a video game on a planetary scale.

Eric Karsenti, scientific Director

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**BRITANY**

48° 00’ N – 03° 00’ W

I awoke on 6 September 2009 on a still sea off the coast of Brittany, the magical calm accentuated only by the memory of the noisy departure the day before. Like in a dream, here we were at last at the start of a 1,000 day voyage around the world. I remember the silent jubilation I shared with Eric and Gaby, the first tentative trials of the equipment that we had assembled so lovingly, and the frantic drilling and fastening to finish the plankton laboratory. I remember too the first time that we saw the plankton parade past the flow-cam instrument, the impossible approach to Tromelin Island on our way to Madagascar, and the wonderful conversations with the children of the Indian Ocean.

Colombar de Varas, scientist

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**-Tattoo**

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Steffi Kendall-Leavis, scientist
**Ecosystems**

**RIO+20: THE OCEAN SUMMIT?**

Twenty years after the Rio Summit and ten years after the Johannesburg Conference, the protection of ecosystems is once again on the agenda with the Rio Summit 2012. Tara Expeditions will be there!

This year from 13 to 22 June, Rio de Janeiro will be once again the world’s environmental capital. It has been twenty years since the historic Earth Summit established the concept of sustainable development and secured a global commitment to a citizen’s agenda on the environment. Two decades later some progress has been made and certain objectives have been achieved, but there is still much to do if we are to attain the ambitious “millennium development goals”. On the question of the oceans and marine ecosystems some, far from negligible, progress has been made in the form of the Global Ocean Observing System which was set up during the Rio+10 conference held in Johannesburg in 2002. On the down side, less than 1% of the surface of the oceans is currently protected, marine biodiversity is disappearing at an increasing rate, the acidification of the oceans is inevitable and, especially, our understanding of primary production in the oceans is still insufficient if our societies are to prepare and adapt to these changes.

**ADAPT STATE GOVERNANCE TO THE NEEDS OF THE OCEANS.**

Even before the start of the next Rio conference the good news is that the oceans are, at last, considered to be a priority item on the agenda. The question of high seas governance will hopefully get the attention it merits at Rio. The issues are pollution, risks linked to ever deeper mining operations, increasing shipping, and illegal fishing amongst others. In the preceding months several scientific institutes, UN agencies and various civil society organizations have been drafting credible alternatives to help governments manage the oceans sustainably and, if need be, apply precautionary measures. The proposed blueprint—supported by UNESCO/IOC, IMO, FAO and the UNDP—is an example of how the convergence of knowledge and experience can benefit the common good. The blueprint proposes four major goals. One of these aims to improve our knowledge of oceanic waters and systems.

**“CIVIL SOCIETY MUST MAKE RIO 2012 A HISTORIC TURNING POINT.”**

Another proposes to adapt state governance to the current and future issues facing the oceans. During the Tara’s visit to New York in February 2012, the UN’s general-secretary Ban Ki-Moon came aboard the ship to highlight the importance of the project in the new round of negotiations on the fate of the oceans which will be launched at the Rio+20 conference. Andrew Hudson, UN Oceans coordinator at the UNDP, praised the Tara’s innovative research model. He said it was an example to be followed, reducing costs by a fifth and leaving a minimal carbon footprint. He also praised the expedition’s communications effort directed at the public, young people and politicians. It is in a spirit of dialogue, of sharing information and responsibility, that Tara Expeditions has (since the Tara’s Rio visit in 2010) been working with agencies such as UNESCO and UNDP and with universities and NGOs to present a “blue ocean citizen agenda” during the conference. The agenda will include meetings, debates, exhibitions, films and educational activities to inform and mobilize the public on the major issues affecting the oceans. These “citizen actions” will conclude with a preview of the film Planet Ocean, co-produced by Yann Arthus-Bertrand, Hope, Calt and Tara Expeditions. It will be shown on a giant screen set up in Rio’s city centre. Civil society must get involved if this summit is to be the historic turning point that usher in an era of sustainable management and global governance for the world’s oceans.

**PLANET OCEAN**

YANN ARTHUS-BERTRAND, TARA EXPEDITIONS, CALT & HOPE PRESENT

**A NEW DOCUMENTARY ABOUT PRESERVING THE WORLD’S OCEANS.**

One single ocean... three quarters of the planet. Water, just water. But also the source of everything. Climate, matter, energy and even life... The ocean connects all living species, from the smallest to the biggest, including man. Today, Planet Ocean has become the planet of mankind. But at what price? Planet Ocean is a documentary of aerial images filmed exclusively by Yann Arthus-Bertrand and underwater sequences filmed all over the world. The film explores the India that unites the human species and the sea. It is also the story of a challenge, a search for a new and more natural era that will allow us to take control of our own destiny. And save ourselves.

Planet Ocean will be shown at the next Earth Summit in Rio, June 2012. It was directed Michael Pitiot and Yann Arthus-Bertrand.

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**Don’t miss it**

On DVD and Blu-ray, four documentaries on the Tara Oceans Expedition. Directed by Michael Pitiot and distributed by Pathé Vidéo, the DVD is available in French from the website taraexpeditions.org - 19.99 €.

The Plankton Chronicles website displays beautiful videos and photos of planktonic organisms. The project was initiated by one of the expedition’s coordinator’s Christian Sauder and has received support from the CNRS and UPMC. www.planktonchronicles.org/en

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**Coming soon**

**PLANT OCEAN**
noticed the worried look of our captain. The set to work. After a few hours of sampling I
despite the cold the scientists floating ice) to look for zones suitable for
We had entered the pack (an area of
advancing ice was terrifying, unstoppable.
We quickly hauled up our equipment and
the engines were fired up. We started to
head out of the pack but the white mass of
advancing ice was terrifying, unstoppable.
Finding suitable passages through the ice
was difficult, we were losing time and
the ice was gaining. The sky was grey. Neither
day nor night, no colour, the radar screen
cluttered. Only the compass to guide us.
Suddenly the barrier of ice opened up, a few
final blocks of ice rubbed along the hull
and we were in open water. Never was a storm
so beautiful.

ALAIN GIES, CREW MEMBER

ANTARCTIC PENINSULA
68° S – 66° W

Antarctica, 9 January 2010. Fair
weather, calm sea, the barometer falling
slightly... nevertheless the most southerly
sampling operations of the Tara were about
to begin in promising conditions.
We had entered the pack (an area of
floating ice) to look for zones suitable for
sampling. Despite the cold the scientists
set to work. After a few hours of sampling I
noticed the worried look of our captain. The
48 hour operation had to be cut short. Hervé
notified the head scientist that it was time
to leave, the weather forecast was ominous...
quickly hauled up our equipment and
the engines were fired up. We started to
head out of the pack but the white mass of
advancing ice was terrifying, unstoppable.
Finding suitable passages through the ice
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the ice was gaining. The sky was grey. Neither
After an expedition lasting two and a half years the Tara is back in Lorient.

This latest voyage to study marine life has consolidated the ship’s reputation in the world of science and adventure. The schooner continues to sail in the wake of the great oceanographic vessels. Etienne Bourgois, president of Tara Expeditions, has his sights fixed firmly on the future.

The Tara seen from above by Yann Arthus-Bertrand

After a marathon expedition like this one, what does the future hold for the Tara?

The ship will remain in France this year. She will stay in Lorient for school visits and the Volvo Ocean Race before heading to Brest for the festival in July and then Paris in the autumn. Then in 2013 we would really like to return to the Arctic Ocean, which we did not study during the Tara Oceans Expedition, and pass through the North-West and North-East passages. We know very little about the biology in that region of the world. It will be an opportunity for us to apply the know-how we have developed over the last two years to the North Pole, a region rarely out of the news. We shall continue our programme to measure plastic pollution in seawater.

Returning to the pole...

Jean-Claude Gascard, who took part in the Tara Arctic project in collaboration with the European scientific programme DAMOCLLES, is once again coordinating an ambitious European programme in the Arctic: ACCESS (2011-2015). Tara Expeditions looks forward to participating. Scientists think that major changes are taking place in the Arctic and that a fresh assessment of the biodiversity there will be very important for the future.

You are also thinking about doing further coral studies…

We are currently drafting the outline of the expedition which, in 2014, will lead on from the Arctic voyage. The idea is to study coral reefs at the surface but also at greater depths. This expedition will take place in the Pacific and South-East Asia, and finish up in Hong Kong. After that we hope to prepare another Arctic drifting expedition which would start in mid 2015, starting out from the Bering Strait. The expedition would take at least two years.

Polar drifting has been very successful for the Tara…

Between the start of the first Arctic drift in 2006 and the end of the second, almost a decade will have passed. Back then, in 2006-2008, some of the biological programmes had to be abandoned. Since then the Tara has acquired a certain expertise in polar logistics which we are delighted to make available to the scientific community.

Are you looking for greater visibility?

The Tara Oceans was an exceptional expedition, and successful, but the wider public has not yet realized to what point it has surprised scientists. Everybody agrees that the expedition has shown us just how ignorant we are about the oceans. We are working on getting the message across to the public through cinema releases. Tara Oceans will keep going after the expedition.

You have also talked about studying cetaceans. It is not an official project yet but it is one I hold dear. There are so many large cities next to the sea. Two billion people are involved and the issues are enormous: pollution, global warming, access to drinking water, and desertification. Populations will be under considerable pressure. We estimate that, by the end of the century, nearly 150 million people will have been displaced because of climate change. One thing is for sure, Tara Expeditions will be continuing to work for the good of the environment.

Interview by Dino Dimou

THE FUTURE OF TARA OCEANS BY ERIC KARSENTI,
SCIENTIFIC DIRECTOR OF THE EXPEDITION

– 10 years to analyse the complex data and samples collected by the expedition. This work should produce the first complete overview of the world’s plankton ecosystem.
– Discoveries applied to research and development into a global ecology (within the framework of the Oceanomics programme).
– Considerable strengthening of the collaborative structure of the OCEANS consortium which comprises all the scientific coordinators of Tara Oceans.
– Greater political impact of our observations, in collaboration with national and international authorities such as the United Nations.
– Stronger ties between Tara Expeditions and science bodies to communicate scientific knowledge about the oceans to the wider public. These bodies include France’s National Centre for Scientific Research (CNRS), the European Molecular Biology Laboratory (EMBL) and France’s Alternative Energies and Atomic Energy Commission (CEA).