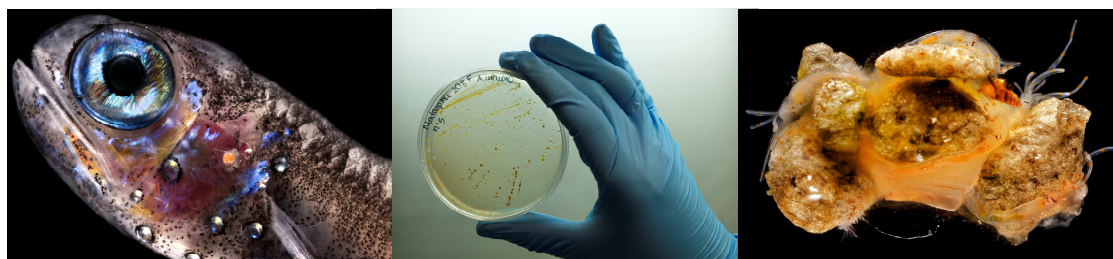


Barcelona. Tuesday, September 16th 2014

The Malaspina Expedition confirms that pollution reaches even the most remote areas of the ocean

- About 80 researchers meet in a conference that puts an end to the largest project in history about global change
- Samples collected in 2011 by Hesperides and Sarmiento de Gamboa vessels will provide data in for decades
- Researchers have already proved that there are five large accumulations of plastic waste in the open ocean



Three years after the Hesperides vessel returned to Spain culminating the around the world of the Malaspina Expedition, researchers have an increasingly clear picture of how the global ocean works and what is its health condition. Specifically, the input of pollutants from the atmosphere is not limited to coastal areas, but also occurs in the most remote areas of the planet, and it is already affecting the ocean ecosystem.

This and other findings are presented this week in CSIC Residence for Researchers in Barcelona, in a congress that ends the largest interdisciplinary project in history about global change. About 80 researchers will participate in lectures, which will deepen the impact of global change on marine plankton, the effects of temperature increase, the rate at which heat is transported, or the consequences of ultraviolet radiation increase.

The mark of global change

The expedition has generated, for the first time, a database that compiles the levels of organic pollutants in all the oceans. Researchers have managed to determine how the dioxins, chemical compounds generated during combustion of organic waste, are globally distributed.

Jordi Dachs, CSIC researcher at the Institute of Environmental Assessment and Water Research and one of the authors of the work that also confirms that these pollutants have begun to affect phytoplankton and zooplankton, states: "Concentrations are larger near the continents than in the central areas of the ocean, a circumstance that is explained by the degradation processes during transport as they are directly deposited into the ocean from the atmosphere.

CSIC researcher and Malaspina coordinator, Carlos Duarte, states: "We noticed that pollutants enter directly into the ocean through the atmosphere, reaching the most remote areas of the planet, with contributions that are already affecting the ocean ecosystem".

In addition, during the project, the largest database of polycyclic aromatic hydrocarbons (PAHs) in the ocean has been generated. PAHs are found as part of the fossil fuels and they are also generated during the combustion of oil and coal. Dachs asserts: "We have found that the concentrations of PAHs are higher near the continents than in the central areas of the ocean, and that a diffuse input of PAHs from atmospheric deposition occurs. This input is greater than the arrival of oil spills in the ocean and occurs in all oceans, but its impact is still unknown".

Researchers have already shown, from samples collected on board, that there are five large accumulations of plastic waste in the open ocean, coinciding with the five major circulation turns of oceanic surface water. According to these results, the problem of plastic waste pollution has a global character. Duarte emphasizes: "Only a global expedition as Malaspina could obtain these results and evaluate the overall abundance of plastic pollution".

Understanding the ocean ecosystem

Duarte states: "The Malaspina Expedition has meant a leap forward in understanding the ecosystem of the global ocean, particularly in the waters below the exposure to sunlight, where we discovered a fish biomass up to 10 times higher than previously thought".

Researchers have already begun to sequence the genome of the global deep ocean,



using more than 2,000 samples of microorganisms collected in the Atlantic, Indian and Pacific Ocean during the expedition. This collection of marine microbial genomics, the world's first at a global scale, will provide new keys to a reservoir of unexplored biodiversity, as it could mean the finding of tens of millions of new genes in the coming years.

The sequencing works, framed in the Malaspinomics project, focus on the viruses, bacteria and protists that inhabit the ocean to 4,000 feet deep. Preliminary results of Malaspinomics reveal a wealth of previously unknown species of microorganisms in the deep ocean. Specifically, 60% of the bacterial species detected by deep-ocean massive sequencing techniques are unknown.

A unique expedition

The project coordinator adds: "The Spanish oceanography had never led a project with such an international dimension, with more than 18 countries involved. In addition to marking a before and after for scientific advances, has managed to break traditional boundaries and suspicion between scientific groups. It has also been able to approach the Spanish oceanographic to society".

The *Hesperides*, a vessel of the Spanish Armada, departed on December 15th 2010 in Cadiz, with stops in Rio de Janeiro (Brazil) and Cape Town (South Africa). After Perth (Australia), it passed through Sydney (Australia), Auckland (New Zealand), Honolulu (Hawaii), and Cartagena de Indias (Colombia). Another vessel, the *Sarmiento de Gamboa*, belonging to the CSIC, returned in April 2010 from Santo Domingo (Dominican Republic), where it arrived after exploring the Atlantic for nearly two months.

The *Malaspina Expedition* is a Consolider-Ingenio 2010 project managed by CSIC and funded by the Spanish *Ministry of Economy and Competitiveness*. Malaspina comprises about 50 research groups, including 27 Spanish groups from CSIC, the *Spanish Institute of Oceanography* (IEO), 16 Spanish universities, a museum, the research foundation AZTI-Tecnalia, and the *Spanish Navy*. The total funding, in which CSIC, IEO, BBVA Foundation, AZTI-TEcnalia (as well as several Spanish universities and public research organizations) have collaborated, is about 6 millions euros. The first part of Malaspinomics has been funded by the *Ministry of Economy and Competitiveness*.

Laura Morales, Jordi Dachs, Belén González-Gaya, Gema Hernán, Manuela Ábalos, y Esteban Abad.

Background Concentrations of Polychlorinated Dibenzo-p-Dioxins, Dibenzofurans, and Biphenyls in the Global Oceanic Atmosphere. *Environmental Science & Technology*. DOI: 10.1021/es5023619.

Belén González-Gaya, Javier Zúñiga-Rival, María-José Ojeda, Begoña Jiménez, y Jordi Dachs. **Field Measurements of the Atmospheric Dry Deposition Fluxes and Velocities of Polycyclic Aromatic Hydrocarbons to the Global Oceans.** *Environmental Science & Technology*. DOI: 10.1021/es500846p.

Andrés Cózar, Fidel Echevarría, Juan I. González-Gordillo, Xabier Irigoien, Bárbara Úbeda, Santiago Hernández-León, Álvaro Palma, Sandra Navarro, Juan García-de-Lomas, Andrea Ruiz, María L. Fernández-de-Puelles, and Carlos M. Duarte. **Plastic debris in the open ocean.** *PNAS*. DOI: 10.1073/pnas.1314705111.