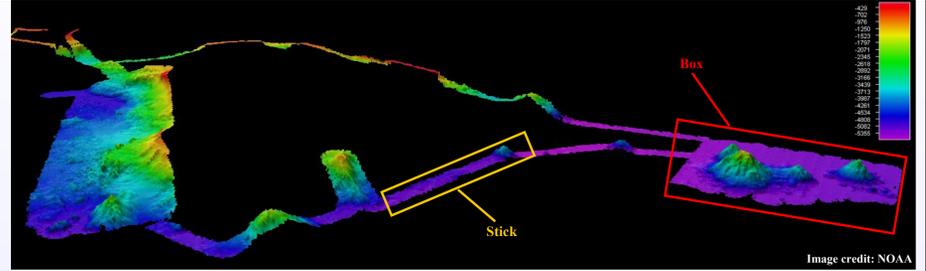




Portraying the Pursuit of Plankton and Plastic in the Pacific

Research Aboard the *Okeanos Explorer* in Transit from Hawaii to California 2010

The Approach: The *Okeanos Explorer*, NOAA's commissioned ship for ocean exploration, sometimes utilizes a survey model known as "sticks and boxes". Priority areas of the ocean are put forth by the scientific community, and the *Okeanos Explorer* travels to these "boxes" to explore them using tools such as multibeam sonar mapping and ROVs. Transit cruises between "boxes" represent "sticks", and create the opportunity for further exploration. Sampling for plankton and plastic were two "surveys of opportunity" conducted during the transit cruise from Oahu, Hawaii to San Francisco, California from October 19th to October 30th, 2010.



Above: Image showing multibeam bathymetry collected offshore Hawaii's Big Island during the *Okeanos Explorer*'s 2009 field season. The long skinny lines represent "sticks" in the *Okeanos*' exploration model, whereas the larger areas represent "boxes".

The Continuous Plankton Recorder (CPR):



The continuous plankton recorder (CPR) was towed behind the *Okeanos Explorer* during the Oahu, Hawaii to San Francisco, California transit in October 2010. Because oceans make up most of the earth, and the ocean itself is under-sampled, the CPR is able to provide data on the density and species diversity of plankton to contribute to understanding to how the open ocean system operates. The CPR uses a silk screen to capture plankton near the sea surface, including zooplankton and phytoplankton. The silks pass through a formaldehyde chamber to instantaneously preserve the specimens collected. The device was towed at a depth of about 10 meters below the sea surface and 70 meters behind the ship, for a total distance of about

Left: Stephanie Oakes, CPR technician, loads the silk screen capturing mechanism into the CPR device aboard the *Okeanos Explorer*.

Right: Image of the CPR that was towed behind the *Okeanos Explorer*.



Image credit: NOAA

Right: Images of copepods, a type of zooplankton, that can be found in the Pacific Ocean and captured with the manta net and CPR.



Image credit: Pêches et Océans Canada

Image Credit: Evergreen Natural History Database

Image Credit: Albert Calbet, ASLO

Image Credit: Florian Hantzche

Manta Net Towing:



Above: Image of the Manta net towed off the *Okeanos Explorer* that collected debris, plastic and plankton.

During the transit from Hawaii to California, the *Okeanos Explorer* passed through the Pacific Ocean "Garbage Patch," an area in the North Pacific Ocean containing a high concentration of marine debris. Most of the debris is thought to be small plastic particles that float at the surface of the water, but relatively little data on the location, density and area of the patch, and its effect on marine life have been collected. The manta net was towed off the side of the ship three

times daily, (one tow at 6:00am, two tows at 12:00pm and one tow at 6:00pm) with each tow lasting 15 minutes to filter an area of an Olympic-sized swimming pool. The manta net's buoyant wings allow it to glide half above the sea surface and half below the sea surface to collect debris, plastic particles and plankton larger than 1/3 of a millimeter.

Right: Miriam Goldstein, manta tow technician, examines the cod end of the manta tow, where plankton, plastic and debris are trapped.



Image Credit: NOAA

Reasons for Towing the Continuous Plankton Recorder and Manta Net:

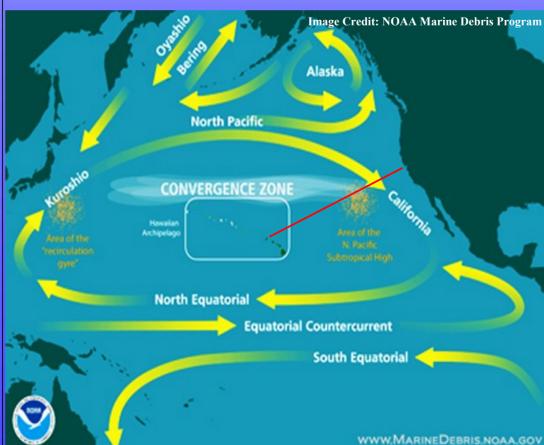


Image Credit: NOAA Marine Debris Program

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Above: Map of the North Pacific Ocean showing ocean currents and features. These systems have helped concentrate marine debris and large quantities of plastic in certain areas, especially in the Area of the N. Pacific Subtropical High. The red line shows the transit of the *Okeanos Explorer* during October 2010 that passed through this zone to systematically sample marine life and plastics.

data will give insight into the types of species that live in this area and their possible ingestion of plastic micro-particles, which could affect marine life and human's consumption of it.

Specimens and plastic particles collected from the manta net were

sent back to a laboratory at Scripps Institution of Oceanography for the plastic particles to be sized and counted. This data will provide information on the concentration and distribution of the sizes of these plastic particles inside the Great Pacific "Garbage Patch". Sea water from this area was also filtered to capture plastic particles too tiny to be caught by the manta net. Findings could provide information on plastic particles that might be found in the guts of plankton, which would give insight on the degree to which plastic may be entering the marine food web.

Although plastics themselves are contaminants, chemicals and other toxic substances, such as DDT and pesticides, may adhere to their surfaces. The plastic particles were tested for these toxins by NOAA to provide information on the toxicity present in the Pacific and the possible ingestion of these particles by fish and other marine life.

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Image Credit: NOAA

Above: Stephanie Oakes examines pieces of plastic covered in barnacles collected in the manta tow net.



Image Credit: NOAA

Above: Marine crab found alongside a piece of plastic in the manta net aboard the *Okeanos Explorer*.