Science Briefing for eXXpedition Caribbean 2016

Projects as of 14/8/2015:

1. **Manta Trawl Sampling and visual observations for plastic pollution**. Microplastics larger than 333 microns to be collected. Physical data analysis to take place on board, data to be sent to 5 Gyres, SEA and entered into Marine Debris Tracker. Marine Debris Tracker App to be downloaded by crew before expedition.

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2. **Water sampling for persistent organic pollutants (POPs)** - Dr Anna Karrman Orebro University.

Sampling Instructions for sea water onboard Sea Dragon
10 samples from xx to xx

The bucket
It has been cleaned before shipment and transported in a closed PE bag. If contamination is suspected during the expedition, please clean with methanol* (a small amount is included).
Sampling containers
Please label the containers with sampling date and GPS coordinates, labels and pens are included.
Sampling
Take up a full bucket of sea water. Pour it into the plastic sampling bottle. Swirl around and throw it away. Take a fresh new sample and this time fill the bottle, seal it and label it.
Fill in the colored columns in the sample protocol (attached).
Storage
Samples. Store cold but not frozen, the fridge (+4°C) is preferred but the forepeak is totally fine.
Bucket. Store it in the PE bag it came in.

*Discard the methanol in a “waste” bottle

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3. **Nano plastic sampling** - Jenna Jambeck, University of Georgia.

   Based upon our work of annual mass flows of plastic into our ocean compared with what has been found in the ocean, there are millions of tonnes of plastic in unknown locations. In order to understand potential impacts, it is important to try to determine the location and form of this plastic. In our environment, plastic physically degrades into smaller fragments and pieces, called microplastic, that can both transport organisms (including invasive species) and host their own microbial communities. Plastics also absorb persistent organic pollutants and have been shown to transfer contaminants to fish. Plastic debris continues to be found all over the world, and the average size of plastic particles in the ocean appears may be decreasing, but we currently don't know much about the mechanisms of fragmentation. In addition, open ocean sampling published in the literature has consisted of trawl collection of plastic samples 333 um and above. We are investigating, in the laboratory, the mechanisms of fragmentation from exposure to UV, temperature, and mechanical mixing. We are analyzing these samples for particle size distribution down to the nanoscale level. We also think it is important to sample the open ocean for particles smaller than 333 um to see if they exist in the natural environment. Therefore the open ocean bucket sampling procedure outlined (below/in this section) is critical to better understanding the fate of plastic in our oceans.

Sampling for micro- and nano-scale plastics in seawater samples

To sample:

1. Lower a stainless steel bucket over the side of the boat and pull up about 5-7 L of seawater (**Image 1**).
2. Record the date/time and GPS coordinate of sampling location (can use Marine Debris Tracker for this).
3. Pour 1000-4000 mL of sample through a series of mesh screens in a small (2.5 cm diameter) filtration device. The screens decrease in size from 333um to 110um to 20um (**Image 2**).
4. The water that passes all three screens is captured in another bucket.
5. The quantity of filtered water is recorded (measure each pour in a 100mL graduated cylinder).
6. A sub-sample of the seawater in the bucket is taken in a jar and 2-5mL of alcohol is added.
7. Each screen in the filtration device is rinsed off with alcohol into a 20mL vial to get all particles caught on the screen into a vial.
8. All samples are brought to or shipped to the Environmental Engineering Laboratory overseen by Dr. Jenna Jambeck at the University of Georgia, Athens, Georgia, USA

9. Follow this same sampling method for at least one blank sample (clean water). Do not wear fleece garments when sampling or have them covered up, if possible, to avoid any fiber contamination.

Image 1: Bucket sampling.

Image 2: Filtration

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4. **Mercury sampling** - Oksana Lane, Biodiversity Research Institute, Portland, ME USA

   Hair samples from team to be collected on board and from coastal communities where possible during the expeditions. A waiver will need to be signed by each participant and we will collect information on gender, age, travel, and fish consumption. Fish tissue and feather samples may also be collected depending on resources and permits.

   Standard protocols for the collection of human hair samples are included below. It is important that all steps are followed carefully to ensure the data collected is of the highest quality. For each sample, the questionnaire provided in Appendix 2 must be completed and signed by the sample subject.

   - The collector should wear a new pair of Nitrile examination gloves when collecting and handling each sample.
   - Use an alcohol wipe to clean the cutting surfaces of the stainless steel scissors.
   - Grasp a bundle of hair approximately the diameter or a pencil eraser (approximately 30 strands of hair) in the occipital region of the head (i.e., near the nape of the neck). An adjacent area may be used if hair length is limited. See Figure 1 below.
   - Cut the bundle of hair as close to the scalp as possible
   - Secure the hair sample with a small self-adhesive label using an arrow to indicate the direction of the scalp.

- Place the hair sample in a small Ziploc bag
- Identify the sample by placing a unique sample label on the bag. DO NOT write subject name or any other personal identifiers on the bag. BRI will destroy all such samples without testing.
- Complete the questionnaire (we will provide this separately)

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5. **Indigo V expeditions** - A Citizen Oceanography project (led by Amazon crew member Barbara Drigo from University of Queensland) collecting water samples for microbiological analysis of bacterioplankton samples. The objective is to put data collection in the hands of every ocean-going yacht sailing the world today and use cutting edge molecular biology tools to monitor the structure and function of microbial communities in the world's oceans. The goal is to improve our knowledge base about ocean health at a cost that is 20x cheaper than traditional oceanographic methods. This research will result in data models that will be used to raise public awareness and assist policy-makers to pass scientifically informed laws that will lead to the protection of our seas for generations to come. The data will also help us characterize and better understand pre-conditions at the bottom of food webs that might lead to fishery collapses. Exxpedition is planning to use a prototype sampling device, OSMO, an automated microbial sampling and communication device that can be deployed on private sailboats that will avoid batch effects due to different people collecting the samples. If there are any delays with the OSMO production, we will collect samples using the manual protocol
   Facebook
   Read this journal paper in PLOS Biology.

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6. **Air Quality Sampling** - http://www.mytzoa.com

   TZOA is a portable environmental sensor to measure air quality (PM2.5 and PM10), temperature, humidity, atmospheric pressure, ambient light and UV (sun) exposure all in one device. By connecting TZOA to a smartphone, we can download our measurements. The purpose of the device is to help put people in touch with their environment, according to Kevin Hart, Tzoa's co-founder. Users are encouraged to get outside and map air pollution in their communities. These data can then be shared with other Tzoa users via the company's app, "By crowdsourcing data on to public maps, we can locate chronic issues in our communities and take action against sources of harmful issues," Hart said. "Overall, we believe that awareness leads to advocacy, which leads to action — and that will perpetuate green technologies." EXXpedition is part of Tzoa's ambassador program, an effort that promotes environmental stewardship in communities across the globe.

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7. **Roseate Tern sightings and behavioral observations** - The Roseate Tern (*Sterna dougallii*) breeds in Canada, US, Caribbean, Ireland, England, France, and the Azores.

The species is in extreme danger of extinction. The entire population spends 4 months of the year nesting in the north and 8 months of the year on its winter habitats in Brazil. Until 1995 the location in Brazil was unknown. It is suspected that a significant percentage of the birds feed on fish along the coast of the state of Bahia, but the whereabouts of most of the birds is still unknown. Of interest is where the birds are finding food and spending the day. It is possible they catch most of their food far out at sea where there are tuna and come to shore at sunset to rest on sandbars. The known sandbars so far are found primarily in Bahia, at Mangue Seco, Ilha da Saugra, Alcobaca, Itubera, Cacha Prego. A few birds have also been found to the north near Fortaleza and Ceara. It is possible that many of the birds are killed at locations in Ghana, Suriname, French Guiana, and Brazil. They may also be unable to find enough food if the blue fin tuna and other fish are in serious decline in Brazil and there is some evidence (crossed bills) they may be experiencing effects from bioaccumulation of contaminants from the fish they eat. There is a need for aerial surveys of the entire coast of Brazil starting with Bahia, followed by other states where they have been seen. The best source of locations is a Brazilian website for bird photographers called WikiAves. Exxpedition Ascension 2015 and Amazon 2015 will be working with avian ecologist, Scott Hecker to identify and observe roseate terns off the coast of Brazil using binoculars, identification keys, and data collection forms (either hard copy or electronic). Instructions pending

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8. **Passive sampling of EDCs and eDNA of marine species** - Jan Brant', CEFAS crew member on Ascension 2015. Passive sampling will be conducted by hanging a silicon rubber sheet over the stern of the boat (about 20 cm long and 5 cm wide, weighs about 600 mg,. These passive samplers absorb and adsorb a variety of contaminants and can be deployed for a few days to concentrate low levels of a chemical over time. Concentrations are expressed as litres per day. Samples are frozen for later analysis It is also possible to use the extracts from these samplers in bioassays for example the YES assay that gives an indication of the estrogenicity of a water sample. .

   eDNA sampling requires taking a water sample and filtering it, then freezing for analysis later. An objective for this project is meta-barcoding. Rather than sequencing entire genes (which you can do, but only for species that have already been sequenced), we can look at markers that will indicate a higher taxonomic level ie genus level, so we can look at density and diversity of species. This could be linked to contamination detected in water samples- what is potentially being exposed. Additionally, we may be able to determine how far from Ascension some of its indigenous species are distributed..

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9. **Biomonitoring (Body Burden) with the UN funded initiative 'Safe Planet' to assess personal exposure to known toxic substances -** analysis by Dr Anna Kärrman, Örebro University, Sweden

5 ml Blood serum to be tested according to UNEP Safe Planet Protocols for:
14 fluorinated compounds

14 PCBs (PCB #74, #99, #118, #105, # 153, #138, #156, #157, #180, #170, #189, #194, #206, #209),
5 pesticides (HCB, cis-klordan, trans-klordan, trans-nonaklardan, p,p-DDE),
2 PBDEs (PBDE #47, #153)
1 dioxin (OCDD)

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10. **iNaturalist and Great Nature Project (National Geographic Society POC Carrie Seltzer) -** Ascension2015 POC Tegan Mortimer

The Great Nature Project uses the infrastructure of iNaturalist to allow people who are out exploring nature to add their georeferenced images of fish and wildlife to a database, almost like a biodiversity "scavenger hunt", some of which may be loaded up to global biodiversity databases. http://www.inaturalist.org/projects/national-geographic-great-nature-project

EXXpedition will create a collection of observations of marine life and birds from voyages that would be highlighted on the website (example: http://greatnatureproject.org/collections, http://www.inaturalist.org/people/bodaciousdream) these will be especially valuable because information from the open oceans is rare. From time-to-time we will upload special creature images while out on the sea, but most images will be uploaded when in port.

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11. Observations of fisheries vessels between Senegal and Ascension Island. This work will consist of recording with camera and text information that identifies fishing boats for use in tracking illegal fishing. The work is in cooperation with Duncan Copeland. Ascension 2015 POC Jan Brant and Tegan Mortimer.