

SEAPLEX

Seeking the Science of the Garbage Patch

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Posted by: **Miriam Goldstein** | August 9, 2010

[“Recycled Island” not a cure for plastic trash in ocean](#)

Originally posted at [Deep Sea News](#)

As some of you may know, [my graduate research](#) is on plastic debris in the North Pacific Central Gyre. While I am deeply disturbed by the incredible amounts of plastic permeating our oceans, I also feel that taking a critical, scientific look at this issue is key to finding a solution. Misinformation on this issue is rampant – for example, I’ve waged [a personal war against this image](#), which is neither trash nor a gyre.

Which brings me to “Recycled Island.” A Dutch architecture company has proposed to take all the plastic floating in the North Pacific Central Gyre and mold it into a vast island. I first became aware of this when [renderings were published on Inhabitat](#) in April, but it has come to the forefront again with articles in [io9](#) and the [Guardian](#), and a post in [Metafilter](#). (Tip of the antennae to Adam E. & Jonathan Gitlin.)

According to the [Guardian](#) article:

Recycled Island is a plan to clean up 44 million kilos of plastic waste from the North Pacific Gyre, which stretches from California to Japan, and provide 10,000 square kilometres (3,861 square miles) of sustainable living space in the process. Solar and wave energy would provide power for islanders while sustainable fishing and agriculture could provide their food.

Great! No longer will I need expensive oceanographic cruises to study the open sea! On Recycled Island, I’ll be able to catch exotic open-ocean invertebrates from the comfort of my own recycled porch! But of course, there are a number of issues with this rather romantic plan. And as your friendly neighborhood ocean blogger (who did lead [an expedition](#) to measure plastic in the gyre last summer), it is my duty to crush my own hopes and dreams of completing my graduate studies on a luxurious and environmentally correct island, sipping tropical drinks adorned with tiny recycled umbrellas.

The main problem is this: **The vast majority of plastic bits (>90%) are smaller than a pencil eraser, and are spread out enough to be mostly invisible to the naked eye. It is therefore extremely hard to remove the plastic without catching a lot of ocean life.**

Please allow me to quote myself, from the [SEAPLEX FAQ](#):

The vast majority of the debris is tiny, hard-to-see pieces. The debris is like a thin soup, with

some big pieces like nets and bottles intermixed. It looks like [this](#).

We did not observe an island or floating landfill. [Our photos](#) are representative of what we saw – larger pieces floating by every minute or so, with the space between filled up with tiny, nearly microscopic bits.

This means that these pieces are the same size as much of the zooplankton. In fact, [most](#) of the [organizations who have](#) been out to the gyre to measure plastic have used fine-meshed nets (333 microns, for the most part) that are *designed* to catch zooplankton. When a swimming-pool sized bit of ocean is concentrated into a jar, you get a bunch of little plastic bits, but you also get a bunch of zooplankton. Here's an example from the SEAPLEX cruise last year:



Results of a zooplankton tow (using a 333 micron manta net) in the North Pacific Central Gyre, August 2009. This is NOT what the ocean looks like - this pint jar concentrates about a

swimming-pool-sized parcel of water. The colored bits on the top are plastic, the beige and black bits on the bottom are zooplankton.

The “Recycled Island” folks may be able to build a giant island out of recycled plastic – I am not an architect and I have no idea if this is feasible. (Though I hope they know that [there are hurricanes](#) in Central Pacific...) But I do know that it would be very, very difficult to remove a significant percentage of the plastic without catching a ton of zooplankton. And catching and killing tons of marine life would not be a good way to meet the criteria of the project. From the Guardian article:

Recycled Island could be a unique opportunity to save marine life. “The project should be carried out with great care so no negative influence to the environment is made,” states the project’s website. “Our ideal is to return more balance to the environment and set an example of how an environment-friendly habitat could be created.”

I could say a lot more about how little is known about the impacts of plastic in the North Pacific Central Gyre, or about the ridiculous notion that adding a giant land mass would “return more balance” to the open ocean – but I’ve got to sleep sometime. So to summarize, I do not think Recycled Island is feasible because it would be environmentally damaging to collect enough plastic in the North Pacific Central Gyre to build their enormous island.

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Posted in [Opinion](#)

Posted by: **Miriam Goldstein** | August 4, 2010

[Hunting for plastic with the SSV Seamans](#)

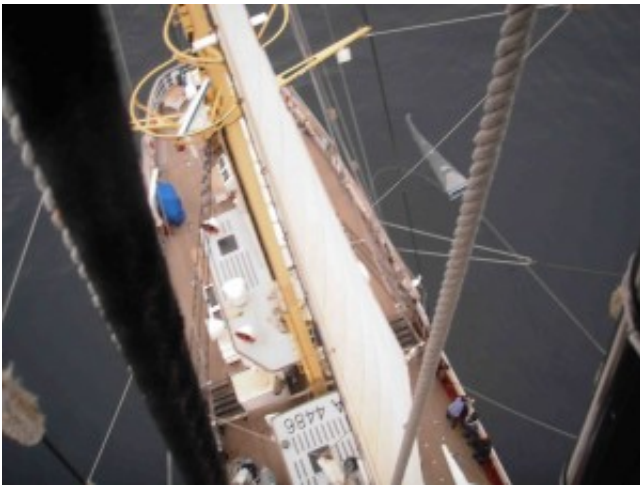


We were able to sail under the Golden Gate Bridge. We looked very, very pretty if I do say so myself.

Hello internets! [I am back](#) from a month of sailing from Hawaii to California on the tall ship *SSV Robert C*.

Seamans. The *Seamans* is run by the Sea Education Association, where undergraduate and high school students can learn oceanography, maritime history, and seamanship aboard one of [two gorgeous tall ships](#), one in the Atlantic, one in the Pacific. (The [Southern Fried Scientist](#) is an alumnus – anyone else out there?). The SEA vessels are [well-equipped for research](#) (PDF) with all the standard tools of oceanography – [CTD](#), [ADCP](#), winch & hydraulic J-frame, and so on – though it definitely is more challenging to maneuver under sail than by burning tons and tons of diesel fuel.

I was on board as a visiting researcher, continuing my work on the impact of plastic debris on zooplankton in the North Pacific Central Gyre. I did as many plankton tows as time allowed at the surface of the water, filtered lots of seawater to look for plastic particles too small to be caught by the net, and tested live zooplankton to see if they were ingesting plastic. I don't know what the results are yet – in order to make the most of my time at sea, I just preserved samples as fast as possible, and will go through them now that I am back at the lab. (Also, looking in a microscope at sea [makes me hurl](#).)



Doing a plankton tow off the SSV *Seamans*. That's me in the purple jacket. Roberto Meléndez took this photo from way up the foremast.

I was totally off the grid while at sea, so instead of trying to capture the full experience, I'm going to do a couple of posts on selected awesome moments and fantastic critters. If you want to know more, just ask in the comments – I can answer there or as an additional post. You can also check out [SEA's excellent Plastic blog](#) for more on science under sail.

Awesome Moment #1

The cruise track was great for my work – we had to sail right through the north-center section of the gyre – but not so great for sailing. After we lost the trade winds north of Hawaii, we experienced very little wind until we got into the westerlies not far from California. I'm used to motoring around and it didn't bother me much, but of course a tall ship is meant to sail, so the sailors (students as well as staff) all pined away for the wind.



It was flat, glassy calm for about two weeks, forcing us to motor along. Photo by Wei Xin.

The lack of wind did produce one glorious, wonderful moment – SWIM CALL! Swimming is strictly forbidden in the US research fleet due to a [tragic incident with a white shark](#), so I'd never been swimming in the open sea before. (No, I was not worried about sharks. We had people acting as lookouts, visibility was amazing, and shark attacks are [vanishingly](#), [vanishingly](#) rare.)

Conditions had to be exactly right to assure everyone's safety, but we were lucky and the captain decided that the flat calm sea and lack of shark sightings meant that we'd be able to swim. Here I am paddling about, nothing between me and the [giant isopods of the abyssal plain](#) except 4000 meters of water.



Swimming in the middle of the Pacific. It was GLORIOUS. Photo by Roberto J. Meléndez.

I managed to borrow a mask & snorkel to hunt for jellies. I didn't find any (though one of the other scientists did), but I did see single-celled [acanthareans](#) floating about, feeding with long pseudopods. It was incredibly cool to see these organisms alive and happy – it's easy to forget that what we see catch in a net and store dead in a jar is very, very different than what exists in the ocean.

Next: [ATTACK OF THE PTEROPODS!!!](#)

[cross-posted at [Deep Sea News](#)]

[1 Comment](#)

Posted in [Science](#)

Posted by: **Miriam Goldstein** | June 27, 2010

[SEAPLEX continues this summer](#)

[cross-posted at [Deep Sea News](#)]

The romance of the sea, at least in my mind, is tied to the Age of Sail. This might be because of the inherent beauty of tall ships, or maybe because of a wee bit obsession with [Patrick O'Brian's "Master and Commander" novels](#) (all 20 books, plus the glossary, plus the recipe book...), or maybe because I've always wanted to sing a shanty while [actually hauling on a rope](#). This summer, I'll finally get my chance.

I'll be sailing from Hawaii to California with Sea Education Association aboard the SSV *Robert C. Seamans*. (I wrote about [their plastic debris cruise](#) in the Atlantic [a couple weeks ago](#)). The primary mission of the cruise is student education, but they are very kindly letting me come aboard as a visiting researcher. In fact, I type to you from aboard the *Seamans* at the dock in Honolulu.

I'll be continuing the research I started last summer on [SEAPLEX](#), further exploring the impact of plastic debris on marine life in the North Pacific Subtropical Gyre. Since we think the highest concentrations of plastic are on the very surface of the ocean, I'll be studying with surface-dwelling (neustonic) zooplankton to see if they are interacting with the plastic debris. And I'll be continuing my studies of the fouling community – the animals that grow directly on the plastic.

So far life on the *Seamans* is much like life on any research vessel preparing for a cruise – there's a lot of securing and adjusting and last-minute runs to Home Depot. But as soon as we leave the dock on Wednesday morning, I'm going to get to learn the proper way to haul on a rope and scrub the deck. I'm very, very excited.

I don't know what the internet situation will be, but if possible I will post updates from our journey across the Pacific. You can also follow the ship's Twitter feed [@SEA Seamans](#). See you all in four weeks!

[3 Comments](#)

Posted in [Science](#)

Posted by: **Miriam Goldstein** | February 23, 2010

[SEAPLEX Outreach Materials](#)

My AGU Ocean Sciences education talk is tomorrow! It's called "Using Social Networking Tools for Low-

Cost, High-Impact Outreach: The Scripps Environmental Accumulation of Plastic Expedition (SEAPLEX).” As a supplement to that talk, I am listing the resources mentioned in my talk so interested people can easily find them. ~~After the talk I will post the slides as well.~~ Here are my slides, with the tools below.

Low/no cost tools:

- Blog – hosted on [WordPress.com](#)
- [Twitter](#)
- [Flickr](#)
- [Youtube playlist](#)
- [Interactive Google map](#)

Science social networks:

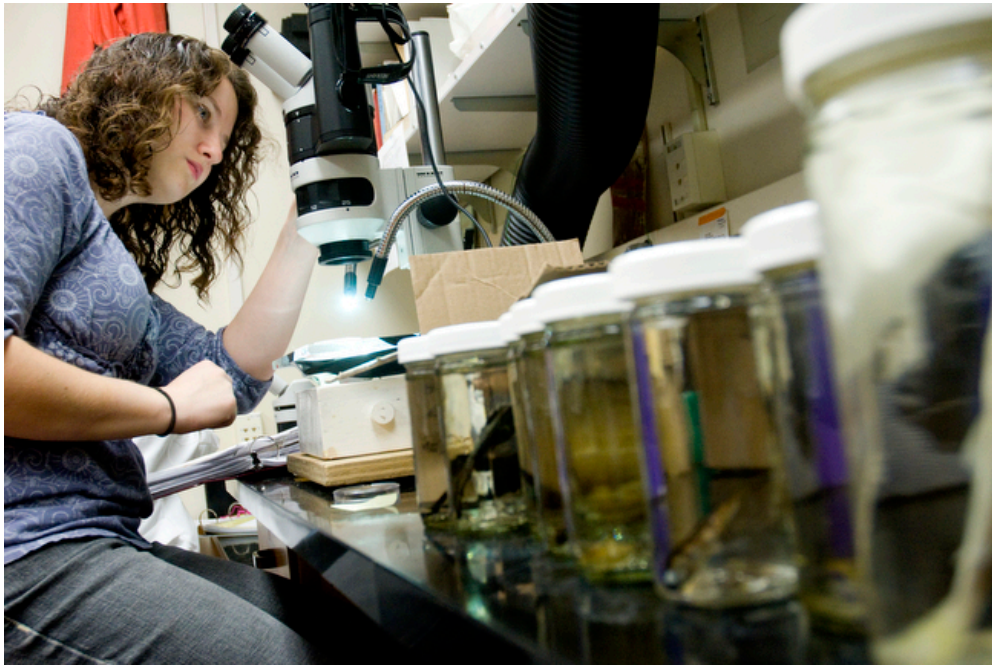
- [Carnival of the Blue](#)
- [Nature Blog Network](#)
- [Science Online 2010](#)
- And as a bonus, [Bora Zivkovic](#), the Online Community Manager for PLoS, is essentially the glue that holds a significant chunk of the science blogosphere together. Follow him to get a broad overview of Follow him on Twitter [@boraz](#).

[3 Comments](#)

Posted in [Media](#)

Posted by: **Miriam Goldstein** | February 8, 2010

[SEAPLEX Update: We're in the lab](#)



This blog has been silent for the past few months, since the SEAPLEX team has been holed up in our labs, processing samples as fast as our little fingers can go. While at sea, we grabbed as many jars of plankton and water samples and fish as we could without doing much analysis. Now we are carefully going through them to understand the impact of plastic on the oceanic ecosystem. You can get a glimpse into this process with [Rebecca Tolin's blog entry at Voice of San Diego](#).

While attending the [Science Online 2010](#) conference in North Carolina, I was inspired to try to blog more on what we are actually doing in the lab. I know a lot of people wonder why results aren't out yet, but turning a jar of plankton or a dead fish into data is really hard and time-consuming work. In the coming weeks, I will try to post photos and explanations of this not-so-glamorous but critically important side of ocean science.

[9 Comments](#)

Posted in [Media](#), [Science](#)

Posted by: **Miriam Goldstein** | November 13, 2009

[Response to NYT Article](#)

On Tuesday, the New York Times published an article on the North Pacific Gyre called "[Afloat in the Ocean, Expanding Islands of Trash](#)." Written by Lindsey Hoshaw, it was the culmination of a \$10,000 freelance journalism project* in which she visited the gyre with the Algalita Marine Research Foundation. Unfortunately, this NYT article was far below their usual standards. Not only did it [not add anything new](#) to

the discussion, but it significantly misrepresented the state of the science, presenting broad estimates & conjecture as facts.

I sent a list of corrections to the New York Times, and I am republishing them here as well. They are in the order they appear in the article. Because there are so many, I have kept each explanation brief, but please ask in the comments if you would like elaboration. Thanks to my SIO colleagues Kristen Marhaver and Mike Navarro for their suggestions!

In this remote patch of the Pacific Ocean, hundreds of miles from any national boundary, the detritus of human life is collecting in a swirling current so large that it defies precise measurement.

The gyre is not a current, but a lack of currents. Please see [Pete's explanation of convergence zones](#) for more detail.

...an area of widely dispersed trash that doubles in size every decade and is now believed to be roughly twice the size of Texas.

There is no evidence for this. There certainly is a lot of trash, but there have been no measurements of either the trash's total area or its growth rate.

But one research organization estimates that the garbage now actually pervades the Pacific, though most of it is caught in what oceanographers call a gyre like this one — an area of heavy currents and slack winds that keep the trash swirling in a giant whirlpool.

There is evidence for debris in some other areas of the Pacific, namely in the California Current, off Japan, and in the Alaskan Gyre, but there are few measurements from the southern hemisphere. A few studies have studied macrodebris – big stuff floating around or washed up on islands – but I am not aware of any microdebris studies there. And again, the gyre is defined by a LACK of currents, not “heavy currents.”

Scientists say the garbage patch is just one of five that may be caught in giant gyres scattered around the world's oceans.

This is a very poor description of oceanic circulation. There are five major gyres, but lots of minor ones (e.g., the Alaskan Gyre). There is no evidence for all five major oceanic gyres containing large amounts of trash – only the North Atlantic and North Pacific have been studied. It certainly could be the case, but we don't know yet.

Millions, billions, trillions and more of these particles are floating in the world's trash-filled gyres.

As above, there is no evidence for all gyres being filled with trash. Also, though I realize writing is trying to be poetic, we do not know how many particles there are, but there may not be “trillions.”

Scientists...say that fish tissues contain some of the same chemicals as the plastic. The scientists speculate that toxic chemicals are leaching into fish tissue from the plastic they eat.

This is highly misleading. Fish tissues may contain pollutants, but no current evidence that they contain chemicals transferred from ingestion of plastic. There is [only one study of this kind](#), and it was done on

birds in the laboratory. To be fair, the article did say “speculate,” but it should have been clearer on the current state of the science.

Fish that feed on plankton ingest the tiny plastic particles.

We do not know if significant numbers or important species of fish are ingesting plastic. We are studying this now, and it continues to be unclear.

The researchers say that when a predator — a larger fish or a person — eats the fish that eats the plastic, that predator may be transferring toxins to its own tissues, and in greater concentrations since toxins from multiple food sources can accumulate in the body.

There is no current evidence of this, particularly since food species of fish (e.g., tuna) do not inhabit the gyre. The gyre is a biological desert – it is an area of very low productivity and there are very few large fish there. Top predators certainly do accumulate toxins like methylmercury, but that is not related to plastic ingestion.

“I saw much higher concentrations of trash in the Pacific garbage patch than in the Sargasso,” Ms. Monteleone said, while acknowledging that she might not have found the Atlantic gyre.

The Sargasso Sea is in the North Atlantic Gyre, and nearly synonymous with it, so I don’t know what this means. It might be possible to be in part of the North Atlantic Gyre without seeing the [seaweed Sargassum](#), but it is impossible to be in the Sargasso Sea without being in the North Atlantic Gyre.

Water samples from February contained twice as much plastic as samples from a decade ago.

This is a very difficult claim to make without controlling for the medium- and small-scale variation of plastic abundance. Even in the same year, some areas have little plastic and some areas have a lot of plastic. Without controlling for these variations, the increase in plastic can’t be measured accurately.

—

*If you’re interested in how the story was funded, I recommend checking out [Hoshaw’s fundraising page](#) at Spot.us, as well as [Megan Garber’s critical article](#) at the Columbia Journalism Review and John Zhu’s [thoughtful blog post](#).

[31 Comments](#)

Posted in [Media](#), [Science](#)

Posted by: **Miriam Goldstein** | September 15, 2009

[SEAPLEX video, now with narration](#)

Check out footage from the SEAPLEX SIO communications team, now with narration!

[1 Comment](#)

Posted in [Media](#)

Posted by: **Miriam Goldstein** | September 10, 2009

[SEAPLEX media for download](#)

Download [high-resolution photos and video](#) free from the main SEAPLEX website. There's video footage of trash, instrumentation, and SEAPLEX scientists at work. There's also high-res photos – most of them have already been posted to the blog but there are some new ones. I'm partial to this one of gooseneck barnacles and anemones on a piece of rope.

Please feel free to use these materials in your classroom, outreach activities, or blog – that's what they're there for!



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Posted in [Media](#)

Posted by: **Miriam Goldstein** | September 3, 2009

[New SEAPLEX video!](#)

Here's another new SEAPLEX video, this one from footage taken by SIO's own Josh Jones and Mario Aguilera. You can see all the [different oceanographic instruments](#) in action, and a selection of debris laid out on deck.

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Posted in [Media](#)

Posted by: **Miriam Goldstein** | August 31, 2009

[Frequently Asked Questions](#)

We have added a Frequently Asked Questions page! Take a look [here](#).

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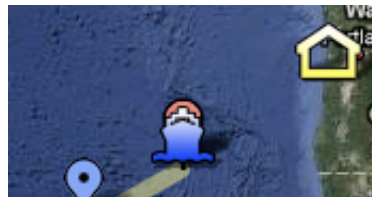
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SEAPLEX course map



After sailing approximately 3,021 miles the New Horizon made port in Newport, Ore. on Friday, August 21. You can see [the New Horizon's course](#), on Google Maps.

Recent Tweets

- Ghost net found on SEAPLEX is apparently running for office. <http://bit.ly/94KKGh> (Thx @kwing!) [2 weeks ago](#)
- Race to Midway Atoll: the first marine debris-themed game? <http://bit.ly/cOEOsZ> [2 weeks ago](#)
- How YOU can win your very own trash from the North Pacific Gyre...and more! <http://bit.ly/bAH9N4> [3 weeks ago](#)
- Frito gets rid of SunChips compostable bags because the bags are too loud. Seriously???
- Great series - the science of why there's little reason to drink bottled water. <http://bit.ly/cv1Pvb> [4 weeks ago](#)

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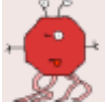
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