The Trash Bag

Volume XIII, Issue 3, October/November 2010

Plastic Particles Permeate the Atlantic

Scientists find new clues about what happens to plastics in the ocean

By Dave Lawrence

(Reprinted with permission from Oceanus: The Online Magazine of Research from Woods Hole Oceanographic Institution. Originally published August 20, 2010)

Recent reports of a "Great Pacific Garbage Patch" in the subtropical waters of the North Pacific Ocean described a floating island as large as Texas—so thick that one could potentially walk on plastic debris for miles and miles. The image is misleading, and it offers false hopes of a straightforward (albeit expensive) solution: just scoop it up.

The vast majority of plastics collected by scientists in the Atlantic Ocean were not large bottles, but particles measured in millimeters. (Photo by Tom Kleindinst, Woods Hole Oceanographic Institution)

In two major studies published this week, scientists at Sea Education Association (SEA) and Woods Hole Oceanographic Institution (WHOI) analyzed plastic debris skimmed from the surface of the Atlantic Ocean over decades. They found that plastic was widespread throughout the western North Atlantic, primarily in fragments measured in millimeters, the size of pencil erasers or smaller. Chemical analysis of the debris revealed more intriguing findings:

• Debris in the surface ocean contained few particles made of certain types of plastic that are abundant on land, specifically polyethylene terepththalate, or PET, which most beverage bottles are made of. What is happening to that plastic?

• Since 1986, the global production of plastics has skyrocketed, but the concentration of plastics in Atlantic surface waters has remained about the same. If the amount of plastics entering the oceans has also skyrocketed, what processes might be removing some plastics from surface waters?

• The plastic particles showed evidence of being coated with living organisms. Are microbes or other tiny life forms digesting the plastics, causing them to sink, or are they sticking to the particles and being carried through the ocean like sailors on rafts?

For their studies, the scientists took advantage of a remarkable dataset collected in an unorthodox way. Since 1971, the nonprofit SEA organization, based in Woods Hole, Mass., has been taking undergraduate students aboard its ships every year for a 12-week SEA Semester program. Thirteen years later, it began a standard practice for its students to sample along the same track each year, towing nets along the surface twice a day to collect biological samples and ocean debris. This unprecedented effort—roughly 64,000 pieces of plastic collected by 7,000 undergraduates from 6,100 net tows since 1986—resulted in a scientific treasure trove that researchers could glean to reveal long-term trends in ocean plastics over a wide area of the Atlantic and Caribbean Sea.

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On the Web:
Visit http://marinedebris.noaa.gov/info/patch for an overview of convergence zones and garbage patches.

Editor's Note

By Karen Grainey

If you missed receiving a copy of the *Trash Bag* this summer I apologize for the large time gap between the last issue which was published in April and the current issue.

It's a bit of a challenge to catch up after such a long hiatus so this issue is a little longer than usual. The plan from now on is to resume the bi-monthly schedule and to keep the length down to a maximum of eight pages.

I would like to thank Carol Barnard, Farris Cadle, and Charlotte Dixon for making this issue possible by contributing articles and photos. Everyone who participates in Clean Coast is encouraged to make submissions to the *T-Bag*, so please don't be shy about sharing your Clean Coast experience with the rest of us.

Welcome New Members

Jonathan Brink
Daniel Grant
Anne Hux
Laurel Johnson
Kay Kinnebrew
Forest Lott
Steven McAuley
Lamar & Nancy McDonald
Sarah Merret
William & Karen O'Brian
Richard & Jill Whitfield
Larry Yawn

And Special Thanks to

The Johnson High School Biology Club
For contributing $200

And

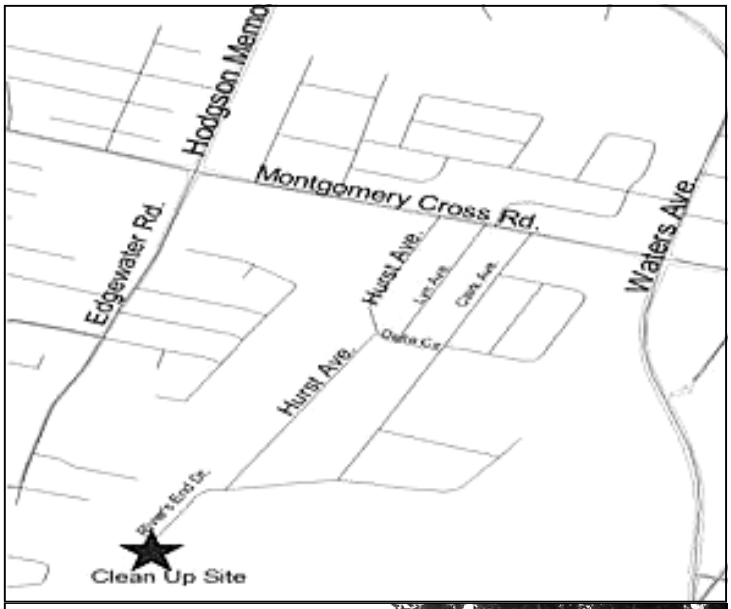
The Courtney Gaines Foundation
For contributing $2,500

Next Cleanup

Hayners Creek, October 23

This City of Savannah sponsored event is a little different from a typical Clean Coast cleanup. Instead of motoring out to a barrier island we will paddle kayaks through the salt marsh at high tide to scoop up floating trash.

The Ogeechee Riverkeeper will be providing kayaks and the City will be providing trash bags and a free lunch. All we have to do is show up at Rivers End Landing in Southside Savannah at 8:30 a.m. ready to paddle and pick-up trash. You are of course welcome to bring your own canoe or kayak.



Scene from 2009 Hayners Creek Cleanup. Photographer Unknown.

Ossabaw Island Adventure, June 5, 2010

By Farris Cadle

Photo by Farris Cadle

Visiting wild places is an essential part of my being. Its the only sane thing I do, and it's the only thing that keeps me sane! The south end of Ossabaw Island, with all its infectious natural charms, alluring vistas of Saint Catherines Sound and Santa Catalina de Guale, the smell of salt air and rotting marsh vegetation, and the ever restless ebb and flow of the tides, provided the perfect formula on this occasion.

Twenty-six enthusiastic volunteers turned out for the cleanup. Included in the force were newcomers Karen Jarrett, and Stacey Kronquest with daughter Jax. Sea captains Jerry and Julie McLean of the *Sweet Pea*, Dave Sapp of the "*Grady White*," and Lamar and Nancy McDonald of the *Neptune*, provided transport from Kilkenny to the cleanup site; while Philip skippered the skiff. Chef Karen Black worked magic in the galley and served a sumptuous feast of homemade sandwiches, potato chips, cookies, cantaloupe, grapes, lemonade, and cold, refreshing, unsalinized H2O.

I encountered a Banded Water Snake *Nerodia fasciata fasciata*, 2 ½ to 3 feet long, in tall grass, and wanted to pet it; but, being a feisty beast and suspicious of my motives, it kept raising its head to a great height and striking at me. Since I was obviously disturbing its otherwise tranquil day, I took a few pictures and left, though I very much wanted to stay and watch it.

John "Crawfish" Crawford reports that this species is non-venomous but will bite in self-defense. Since their defensive bites are damaging to the skin and hurt, they cannot be considered completely harmless. They bear their young fully developed (no eggs), and females grow larger than males. The record length is 60 inches, but the average size is much smaller. They are often mistaken for the cottonmouth moccasin, the latter of which lacks the red colored bands.

While wandering down the beach Theresa Wiegand noticed a small bit of plastic that had been overlooked by everyone else. Upon attempting to pick it up, she found it was a good deal bigger than it first appeared. Upon digging around it, it appeared to be a radio. When it was finally completely excavated, it turned out to be a large portable television. Peter Driver came along with the cart and took it away.

A partially deflated boat fender and a fully intact toy dune buggy were found on the beach. The fender will be pumped up and put to use as part of the skiff equipage; while the dune buggy was donated to charity.

Pieces of wire mesh that appeared to be from the Loggerhead turtle nesting projects were found in the trash collected. It is not known whether the wire mesh was actually taken from nesting sites or found loose on the beach. Trash picker-uppers should always bear in mind that the areas we clean contain natural things, living and dead, that are essential to the chain of life on the coast and barrier islands; there are archaeological arti

(Continued on page 10)

Blackbeard Island, July 17, 2010

By Farris Cadle

Blackbeard Island has a special appeal. It was bought by the U.S. government in 1800 as a live oak tree preserve. Live oaks were a strategic material in that day due to their utility for the ribs and decks of warships. Very little timbering was done on Blackbeard, however, because ample and more easily obtainable stock was available elsewhere. When wooden ships went out of style, Mother Nature was the beneficiary. Most of the other barrier islands that constitute nature preserves today were at least farmed at one time, and this has lingering effects on the flora and fauna that grow on them. As part of the National Wildlife Refuge System, Blackbeard is almost totally untouched.

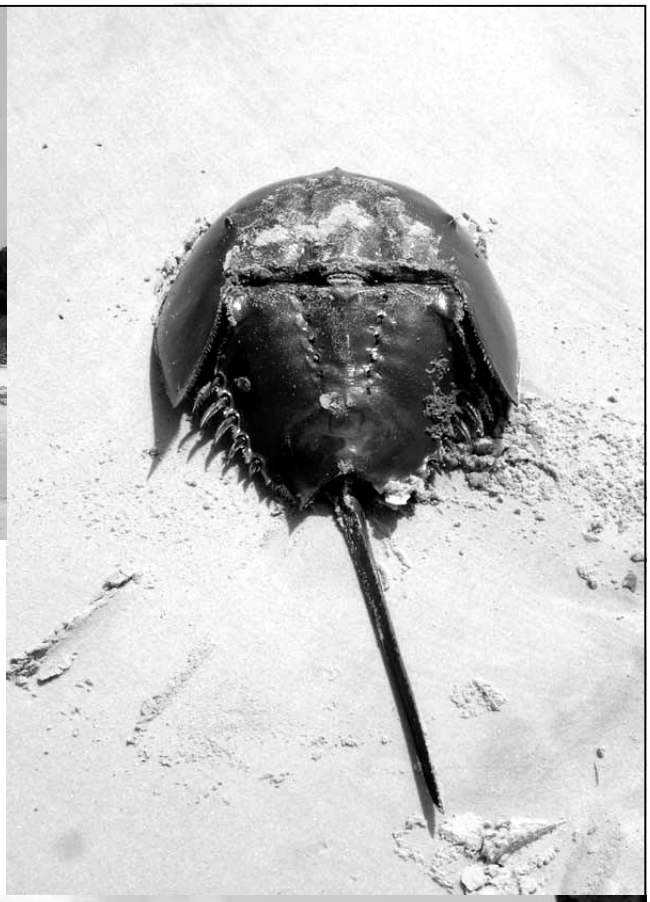
It always seemed odd to me that a place would be named for a cutthroat pirate. Anyone who does a lot of land title research, or historical research in general, is aware that place names get corrupted over time. In Watkins' *Digest of Georgia Laws*, page 541, is a 1794 act of the Georgia general assembly that refers to the island as "Black-bird island." I think that must have been the original name. There is no record of any pirate, let alone Blackbeard, ever visiting the island. However, given the romantic notions that the barrier islands of Georgia conjure up in connection with pirates, it is not difficult to see how "Blackbird" could easily have been corrupted to "Blackbeard."

We left from the Barbour Island Club and landed near the north end of the island. It was extremely hot, and the lethargy of the crew (myself included) was apparent. All we really wanted to do was hit the water and cool off. Several SCAD international students found it quite exciting to be in a boat for the first time in their lives, and they were especially enthralled to see the dolphins playing in the sound. Mark and Cindy walked the little trail that cuts off from the beach and found a red beetle, and male and female dragonflies called green pond dragonflies. The male dragonfly was blue with green eyes, and the female was green with a black and white striped tail. Inland, I encountered a couple of 'gator holes, but saw no 'gators.

A special treat was the visit to the former U.S. quarantine station and crematorium. Bill Megathlin, a retired Armstrong Atlantic administrator and U.S.F.W.S. volunteer, had researched the matter and led us to the sites. The geomorphology of the island has changed to the extent that the remains of the quarantine station are now in the marsh. The crematorium remains on high ground. With just a few minor repairs it appeared it could be put back into use.

Photo submitted by Farris Cadle

It was a joy to see Dr. Mark Lewis again. Yvetter Carr's guest Felicia came all the way from the Republic of Cameroon, and Leah Kodger came all the way from Seattle, via Fort Stewart and Iraq, to be with us. Thanks to boat captains Debbie Farmer, Rob Littman, Ron Lynch, Julie and Jerry McLean, Lamar and Nancy McDonald, and Bill Megathlin for providing both their boats and their navigational skills, and to Dave Sapp for loaning us the use of his boat. Thanks to Charlotte Dixon for supplying a gourmet meal, and to Philip and Karen for putting this thing together. The trash is abundant on Blackbeard and we managed to gather about 800 pounds of it.



Blackbeard Island, July 17, 2010
Photos by Carol Barnard

International Coastal Cleanup

Our September 18 cleanup on the north end of Wassaw Island was our contribution to the International Coastal Cleanup. In addition to picking up the trash we recorded what we found on data cards. People in over 180 countries participate in this project every September and send their data to the Ocean Conservancy.

We had a big group of volunteers including 15 members of the St. Boniface Catholic Church Youth Group. We couldn't have accommodated so many if a grand total of eight stalwart boat captains (Tom Barnard, Dennis Cusanelli, Philip Grainey, Frank Mason, Jerry McLean, Wilson Morris, Joe Powers and Chris Weber) hadn't stepped up to the plate. Thank you to everyone who helped make this event a success.

Below is a compilation of the data we reported to the Ocean Conservancy.

Shoreline and Recreational Activities
(Debris from beach-goers, sports/games, festivals, litter from streets/storm drains, etc.)
Bags: 15
Balloons: 26
Beverage Bottles (plastic) 2 liters or less: 188
Beverage Bottles (glass): 24
Beverage Cans: 75
Caps, Lids: 42
Clothing, Shoes: 18
Cups, Plates, Forks, Knives, Spoons: 131
Food Wrappers/Containers: 57
Pull Tabs: 0
6-Pack Holders: 2
Shotgun Shells/Wadding: 4
Straws/Stirrers: 2
Toys: 21

Ocean/Waterway Activities
(Debris from recreational/commercial fishing and boat/vessel operations)
Bait Containers/Packaging: 9
Bleach/Cleaner Bottles: 4
Buoys/Floats: 23
Crab/Lobster/Fish Traps: 7
Crates: 3
Fishing Line: 13
Fishing Lures/Light Sticks: 13
Fishing Nets: 0
Light Bulbs/Tubes: 6
Oil/Lube Bottles: 4
Pallets: 2
Plastic Sheeting/Tarps: 5
Rope: 14
Strapping Bands: 1

Cindy Stevens shows off an unusual beach find during the International Coastal Cleanup. Photo by Karen Grainey.

Smoking Related Activities
Cigarettes/Cigarette Filters: 2
Cigarette Lighters: 14
Cigar Tips: 2
Tobacco packaging/Wrappers: 8

Dumping Activities
Appliances: 0
Batteries: 0
Building Materials: 8
Cars/Car Parts: 1
55-Gal. Drums: 0
Tires: 0

Medical/Personal Hygiene
Condoms: 0
Diapers: 0
Syringes: 0
Tampons/Tampon Applicators: 1

Other Items of Interest
Styrofoam: 78
Steel Bucket: 1
Chair: 1
Comb: 1
Danforth Anchor: 2
Aftershave Bottle: 1

It's Time to Sign-up for the Cumberland Island Cleanup

By Charlotte Dixon

I am happy to announce that I have heard back from the good folks at Cumberland Island, and they are expecting us the weekend of November 12-14!

We are going to limit the number of participants to 20 people so that nobody has to sleep in the barrack style dorms. It will also make the transporting of people around the island much easier. As many people have repeated these trips for the last few years, priority will be given to those who have never been before- with the exception of board members, trip captains and cooks.

The plan this year is to catch the 11:45 a.m. ferry to Cumberland on Friday, November 12 and return on the last ferry leaving the island on Sunday. There can be a few exceptions for people who can't escape work on Friday (teachers for example) and they can come on Saturday. Friday afternoon will involve settling into the dorms, and reconnoitering the island. Saturday will be the hard work of cleaning beaches, and Sunday we will tour Plum Orchard-which is an extra $6 cash for the ferry.

I will be making reservations for the ferry in November as soon as I have everybody's registrations. THE ONLY WAY to reserve this trip is to email me- if you make a call to the CC voicemail or try to sign-up on the website you will be out of luck. My email address is cdixon604@aol.com. When you email me let me know if you will be coming on Friday or Saturday.

I will get back to you on food arrangements- what we have done on past trips is have everybody bring their own lunches. Phil cooks the dinners and I do the breakfasts.

We are charging a fee of $45 per person to cover the cost of the ferry and meals.

Wild turkeys who appear to be comfortable around humans abound on Cumberland Island. Photo by Melissa Freeman.

Blueberry French Toast

For those who enjoyed Charlotte's delicious breakfasts during the last Cumberland Island trip and would like to recreate the experience at home, here's the recipe for everyone's favorite dish.

Ingredients:

12 slices day-old bread, cut into 1" cubes
8 oz Cream Cheese
1 cup Fresh or frozen blueberries
1 dozen Eggs
2 cups Milk
1/3 cup Maple Syrup
1 cup Sugar
2 tablespoons Cornstarch
1 cup Cold Water
1 cup Fresh or frozen blueberries

Steps:

Place half the bread in a greased 11"x13"x2" baking dish. Cut the cream cheese into small cubes and place over the bread. Top with 1 cup fresh or frozen blueberries. Spread remaining bread evenly over the mixture.

In a large bowl, beat 12 eggs until whites are fully incorporated. Add 2 cups milk and 1/3 cup maple syrup. Mix well. Pour over the bread mixture. Cover with lightly greased aluminum foil and chill 8 hours or overnight.

Remove from refrigerator 30 minutes to 1 hour before baking. Cover and bake at 350 degrees for 30 minutes. Uncover and bake an additional 25-30 minutes more or until golden brown and center is set. Allow to rest for 5 minutes before cutting.

SAUCE: In a saucepan, mix together 1 cup sugar and 2 tablespoons cornstarch. Add 1 cup cold water and mix well. Bring to a boil and stir constantly for about 3 minutes until thickened. Stir in 1 cup fresh or frozen blueberries, reduce heat and simmer for at least 10 minutes, stirring frequently. Stir in 1 tablespoon butter until melted. Serve sauce over french toast. The sauce may be made in advance and reheated in the microwave or on the stovetop.

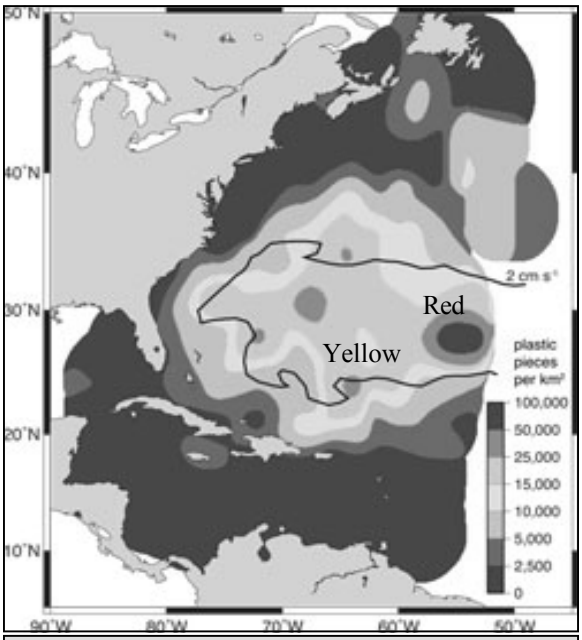
(Continued from page 1)

A brief history of marine plastics

In 1997, Charles Moore brought widespread attention to the problem of plastics in the ocean when he crossed the North Pacific Gyre in his catamaran *Alguita* on the way back home to California from Hawaii. He found surprisingly large amounts of plastic debris and became an important advocate for cleaning up the oceans. But high concentrations of plastic debris were first reported from the Atlantic Ocean, specifically the Sargasso Sea, by two WHOI scientists, Edward J. Carpenter and K.L. Smith Jr., in 1972. Aboard WHOI's R/V *Atlantis II*, they collected, counted, and weighed all the plastic pieces collected in a net with a 1-meter-wide mouth that was towed at the ocean surface.

Carpenter and Smith calculated concentrations of 50 to 12,000 plastic particles per square kilometer, collectively weighing up to 1,070 grams, per square kilometer. The highest numbers were obtained at about 34°N latitude in the Sargasso Sea. Later work showed that plastic debris was widespread throughout the northwestern Atlantic, and that densities could be much higher.

For its routine plastic sampling, SEA incorporated methods comparable to those used by WHOI scientists in the early 1970s—tow a 1-meter-wide net through the surface and collect, count, and weigh the plastic particles trapped inside. But SEA scientists standardized the speed (2 knots, or about 3.7 kilometers per hour) and duration (30 minutes) of the tows. One tow generally covers 1 nautical mile (1.85 kilometers), or 1,850 square meters. The volume of water filtered through a net during a tow is staggering—about 122,000 gallons or 2,000 bathtubs full of water.



Red and yellow areas indicate where scientists found high concentrations of plastic. About 83 percent of all the plastic debris collected was concentrated in the North Atlantic subtropical gyre, a part of the ocean bounded by a series of wind-driven currents, such as the Gulf Stream, that collectively flow clockwise around the subtropical North Atlantic. The gyre is marked by the black-line contour. Outside the contour, currents are strong; within the contour, water moves slowly, about 2 centimeters per second. (Courtesy of Chris Reddy, Woods Hole Oceanographic Institution)

By 1987, one SEA scientist, R. Jude Wilber, wrote in *Oceanus* magazine: "It is virtually impossible to tow a … net through the surface waters of the Sargasso Sea and not catch plastic debris of some sort."

In the center of the gyre

Assessing 22 years of data collected by SEA ships (initially the *Westward* and later the *Corwith Cramer*), the researchers found that more than 60 percent of the tows contained detectable plastic debris. Average densities rivaled those reported from the "Great Pacific Garbage Patch," ranging from 1,400 pieces per square kilometer in the Caribbean to more than 20,000 pieces per square kilometer in the Sargasso Sea.

The research team—Kara Lavender Law from SEA, Skye Morét-Ferguson and Giora Proskurowski, who held joint appointments at SEA and WHOI, Emily Peacock and Christopher Reddy from WHOI, and Nikolai A. Maximenko and Jan Hafner from the University of Hawai'i—reported their findings in the Aug. 19, 2010, online edition journal *Science*. Their paper will appear in the print edition of *Science* on Aug. 26.

The plastic debris reached its highest density between about 22°N and 38°N latitude, and the highest value recorded during the 22-year period was 580,000 pieces per square kilometer at 24.6°N east of the Bahamas. The region, where 83 percent of all the plastic debris was collected, is known as the North Atlantic subtropi-

cal gyre, a part of the ocean bounded by a series of wind-driven currents, such as the Gulf Stream, that collectively flow clockwise around the subtropical North Atlantic.

The findings supported a numerical ocean model developed by co-author Maximenko, who suggests that Ekman dynamics—a net movement of water to the right of the prevailing wind direction in the Northern Hemisphere (and to the left in the Southern Hemisphere)—would tend to concentrate floating material in the center of the gyre.

Where do the plastics end up?

The *Science* study also showed that even though global production of plastic and the disposal of plastic in the U.S. municipal waste stream have both increased significantly between 1986 and 2008, "it is very surprising to find that the concentration of plastic at the surface is not increasing," Law said. If plastic entering the ocean has also increased, "this means that there must be some process removing it from the surface of the ocean." "We still haven't figured out this missing plastic problem," said Reddy. But in a first attempt to try, he, Morét-Ferguson, Law, Proskurowski, Peacock, and Ellen Murphy of WHOI analyzed the size, mass, and material composition of 748 samples of plastic collected on SEA cruises between 1991 and 2007. Their study, published online Aug. 17, 2010, in *Marine Pollution Bulletin*, offers new insights and raises new questions about what happens to plastics in the ocean.

The scientists found almost no ocean debris made from PET, although this type of plastic is found all over beaches, primarily in plastic bottles. PET (pronounced "Pete") has a density greater than seawater. "Can PET float for a little while and then sink?" Reddy asked. "Does the PET ever get off the beach? Where is all the PET going?"

The vast majority of oceanic plastic debris collected at the sea surface was made of polypropylene and polyethylene, which are less dense than water. But their densities were higher than expected based on their chemical properties alone. Chemical reactions sparked by sunlight, combined with water turbulence, likely break these plastic pieces into fragments too small to be captured by the sampling nets, and perhaps change the density of the plastic itself, causing it to sink.

There is also evidence that "there is biological growth on these plastic pieces," Law said. "It's possible that because of that growth, the plastic becomes so dense that it sinks out of the surface layer."

The researchers' chemical analyses showed that many plastic pieces have measurable amounts of nitrogen, even though nitrogen is not a component of the polymers that make up plastics such as polypropylene, polyethylene, and PET. That nitrogen could only have come from living organisms. Microbes may be taking up residence on the floating plastic debris, perhaps taking advantage of a new source of food, or perhaps using the plastic pieces as substrates on which to form novel microscopic ecosystems.

Researchers at SEA and WHOI are now investigating microbial growth on plastic samples obtained during the most recent summer SEA cruise aboard *Corwith Cramer*, which sampled a huge swath of the Sargasso Sea east of Bermuda—going halfway across the Atlantic to 40°17'W. The scientists are trying to isolate and identify microbial species on the plastics and in water samples collected during the cruise to help determine whether microscopic life uses the plastic as a food source, or merely as a raft.

A bucketful of triggerfish

As for macroscopic life, it is common to find bits of plastic debris encrusted with marine organisms, such as algae, barnacles, and other invertebrates. Some communities are composed of species normally found in the open ocean, but other times, the community surrounding the plastic debris is unexpected.

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PLASTIC PARTICLES

This past summer, for example, SEA crew members encountered a 5-gallon bucket carpeted with algae and other small organisms, but they also found an unusual community of about two dozen triggerfish that used the bucket as its base. Triggerfish are generally found in coral reef communities, but in this case, they were found more than 1,000 miles from the nearest reef. One triggerfish caught in the net along with the bucket had more than 40 pieces of plastic in its digestive tract.

Plastic debris may block food passage or accumulate in marine organisms, but what happens to it after their death is yet another scientific mystery.

"We know that the plastic is being consumed by organisms at a variety of scales, from plankton all the way up to fish and larger organisms," Law said. "But we have no idea how much they eat. We don't know what happens to it after they eat it—whether it stays in the organism itself or whether it gets eliminated with other waste."

Dating plastics

The answers to these questions may depend on developing a reliable way to measure the age of plastic debris. "We still don't know how old many of these pieces of plastic were," Reddy said. "Trying to figure out some kind of time stamp would allow us to figure out how long it takes for the plastics to get into the ocean and how long they stay there. And then, do they last forever? Or do they keep breaking into small pieces and sink down to the bottom of the ocean?"

Reddy said the two papers—in fact, the entire decades-long sampling effort—represent a substantial accomplishment for the SEA staff whose primary role is teaching, not research.

"The several thousand SEA Semester undergraduate students who helped collect and count plastic debris over the decades have been important contributors to this work," said SEA president John Bullard. "They have gained a much fuller understanding of the oceans and the role humans play both in the present and its future."

The National Science Foundation supported the research to analyze the plastic data, but Law said that collecting the necessary data and long-term monitoring of oceanic conditions are too expensive for traditional government funding sources to undertake.

"I don't believe you could have designed this in a government-funded research capacity—there simply wouldn't have been anybody willing to commit that much money to sustain a time series that repeated itself every single year for 22 years," she said. "In the end, it's tuition dollars and donor dollars that funded this research."

(Continued from page 3)

OSSABAW ADVENTURE

facts; and there is often apparatus installed for scientific research. Never remove the following: any indigenous living thing or anything that was once part of an indigenous living thing, any human-made objects that are not modern trash, and anything placed for scientific purposes. If in doubt, leave it alone.

Roughly 800 pounds of trash were collected. Most of this was hauled to the Chevis Road Transfer Station in Chatham County. Goodyear on Wilmington Island was so gracious as to take a tire that was among the debris, while about 50 pounds of aluminum cans will be recycled.

Thanks to Kilkenny Marina for launching and retrieving the skiff and other boats and otherwise putting up with our eccentricities, and to Philip and Karen for coordinating this trip.

CALENDAR

- October 4, Business Meeting, 7 p.m. at JEA
- October 23, **Hayners Creek Cleanup**
- November 1, Business Meeting, 7 p.m. at JEA
- November 12-14, **Cumberland Island** (overnight cleanup—register by sending email to Charlotte Dixon cdixon604@aol.com)
- December 6 , Business Meeting, 7 p.m. at JEA
- December 4, **South Carolina Cleanup** (location TBA)
- January 3, Business Meeting, 7 p.m. at JEA
- January ?, Annual Oyster Roast (date TBA)

You can enroll for each trip online at www.cleancoast.org. Registration closes the Wednesday before the trip. There is no need to sign-up for the monthly business meetings which are held at 7 p.m. on the first Monday (unless otherwise indicated) at the Jewish Educational Alliance (JEA), 5111 Abercorn St.

MEMBERSHIP FORM

Use this form to become a member or to renew your membership.

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DO YOU OWN A BOAT SUITABLE FOR OUR TRIPS?_____

IF YES, HOW MANY CAN IT CARRY?_____

HOW MANY LIFEJACKETS ARE ABOARD?_____

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