Assessing the Extent of Plastic Debris in the Ocean

NS Everett Manager Takes an Expedition to Assess the Danger

PERSONNEL FROM THE environmental program at Naval Station (NS) Everett, WA, recently took a hard look at the Navy's role in reducing plastic pollution in our ocean environment.

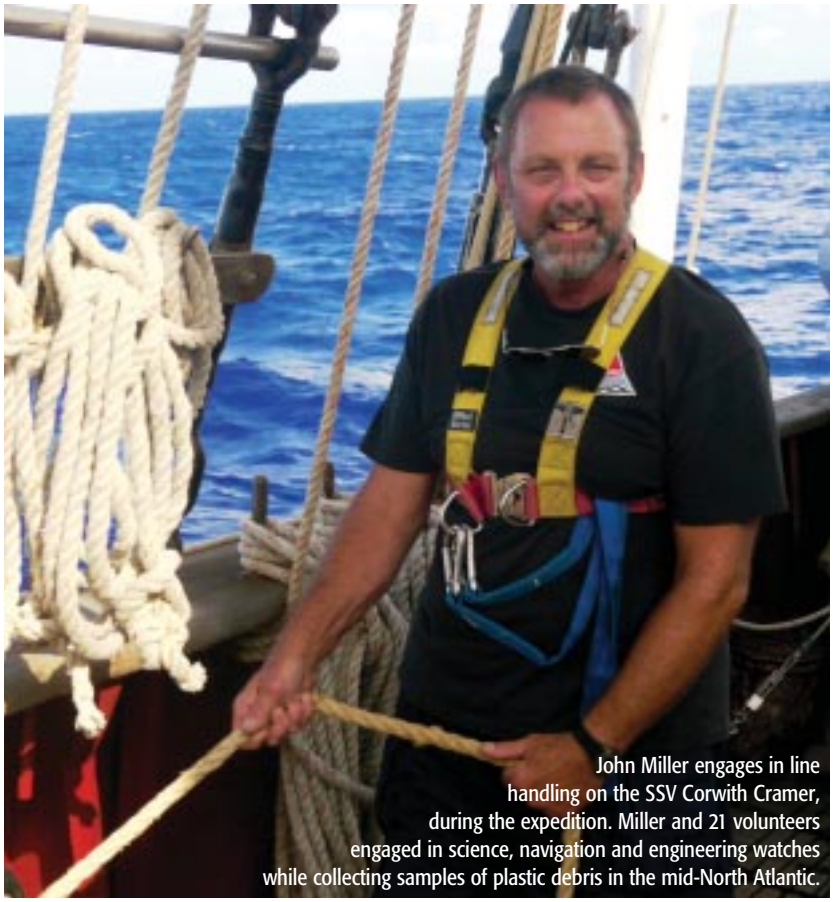
After 30 years of working with the U.S. Navy and Federal environmental agencies, John Miller, Environmental Program Manager at NS Everett decided to participate in a voyage that would provide further education on an issue he had been hearing much about—the global risk of plastic pollution at sea.

The Pacific Northwest is renowned as a major national seaport for global markets and also for its lush green landscapes. Its local citizens are likewise known for actively taking the lead on environmental protection issues.

The world's oceans and wildlife are increasingly being impacted by plastic debris. For the past 20 years, the Sea Education Association (SEA), a non-profit educational organization, has been measuring floating plastic marine debris found just under surface waters and using their findings for scientific research.

Despite Miller's familiarity with environmental programs and regulations, his experience with SEA left him with an even deeper appreciation for the lifecycle of plastic goods and understanding of where trash and plastic pollution subsequently collects in the ocean.

"Having seen the amount of debris we collected, I am so much more



John Miller engages in line handling on the SSV Corwith Cramer, during the expedition. Miller and 21 volunteers engaged in science, navigation and engineering watches while collecting samples of plastic debris in the mid-North Atlantic.

aware of the plastic we buy and dispose of on a daily basis," he said. "I thought I had good recycling habits, but now I also shop smarter."

The Journey

It all started with an opportunity to volunteer for a Plastics at Sea expedition, conducted by SEA. The 33-day sea excursion from June through July 2010 took Miller and 21 other volunteers to mid-North Atlantic waters, east of Bermuda, to observe and document plastic pollution in a remote ocean area.

During their adventure the crew took turns standing watch on a brigantine, the Sailing Ship Vessel (SSV) Corwith Cramer. Their mission involved a combination of science, navigation, and engineering aspects.

"The journey was very physical and quite exhausting," said Miller. "I was amazed though at how this diverse group of volunteers came together and efficiently gathered information on plastic pollution."

Ultimately, plastics in our oceans affect the food chain for all sea and human life. The purpose of the expedition was to gather data that would help answer questions such as 'What types of plastics are in the ocean?' and 'How does the plastic get there?'

"Initially you might think we'd come across large masses of rubbish floating around on the open sea, but actually most of the plastic we found on our trip was smaller than a pencil eraser," said Miller.

The majority of the plastic was collected in the form of small pieces by using net tows. The crew learned that once plastics enter the oceans, the material begins to break up due to ultraviolet (UV) exposure and wave action. These small pieces can then become a habitat for bacteria and other microscopic organisms, which in turn may become ingested by larger animals.

John Miller and 21 other volunteers sailed on the brigantine-rigged sailing vessel, SSV Corwith Cramer, during their 33 day Plastics at Sea expedition. Cramer is owned by the SEA educational organization and built as a research vessel for operation under sail.

John Miller

"Some animals can be attracted to the reflectivity of the plastic, but many also feed in proximity to the debris, and inadvertently take up the plastic," said Miller. "Fish, birds, turtles, and marine mammals that have been found with plastic pieces in their stomachs, further support the theory."

The ingestion of small plastic pieces is a danger for wildlife living in polluted areas. "The results of toxic consumption can lead to internal injuries,

Naval Station Everett Recycling Program

MANY RECYCLING FACILITIES today only deal with the standard plastics. However, NS Everett's recycling center is capable of processing all types of plastic (along with paper, glass and metal).

The more commonly used types of plastic are low-density polyethylene (LDPE (2)), high-density polyethylene (HDPE (4)) and polyethylene terephthalate (PET (6)). PET is the most commonly recycled plastic, and may be reused to make many new products such as polyester fiber for carpet, fabric, shoes, film, automotive parts, and containers for both food and non-food products.

In addition to processing these plastics, the Naval Station also has the special equipment necessary to process un-numbered and other miscellaneous plastic materials (except Styrofoam™). These could include plastic containers, plastic packaging, children's toys, and plastic furniture.

Common plastics are mixed together in a large horizontal baler. Miscellaneous plastics are separated and then formed into bales that weigh anywhere from 800 to over 1,000 pounds.

Holding educational programs and providing easily accessible recycling containers have assisted NS Everett in increasing the amount of plastic collected 173 percent since 2007. Recycling bins are placed conveniently in all building spaces, in each room at the barracks, and at the piers to collect plastic and other recyclable materials from home-ported ships, including the aircraft carrier USS Abraham Lincoln, USS Ingraham, USS Ford, USS Momsen, USS Rodney M. Davis, USS Shoup and U.S. Coast Guard Cutters Henry Blake and Blue Shark.

As part of the NS Everett recycling program, recycling bins are placed conveniently in all building spaces, in each room at the barracks, and at the piers to collect plastic and other recyclable materials from home-ported ships, including the aircraft carrier USS Abraham Lincoln (CVN 72).
Chief Mass Communication Specialist Eric S. Powell

This fiscal year, NS Everett is purchasing a large vehicle that will streamline pickup, and adding a conveyor to the auger compactor so that workers will be able to remove any misplaced recyclables. This will free up staff to spend more time on outreach–particularly meeting Sailors as they disembark to direct them to appropriate recycling containers.

malnutrition, and death," Miller explained. Besides posing a threat to living marine resources, another concern associated with plastic pollution is the unknown effect of the chemical release that occurs during decomposition and how it may impact water quality. These are just a few important concerns the team set out to investigate.

Members of the expedition collected water samples in addition to more than 43,000 pieces of plastic to be used for further study at various universities and research institutions. The SEA hopes to contribute to research that will help to better determine the true impacts of plastic debris pollution in the oceans.

The Source

According to the SEA's findings, even though 90 percent of today's global commerce moves by sea, much of the smaller plastic debris may actually come from plastic packing materials. The majority flows from inland streams, rivers, and waterways that connect in some way to the oceans.

"There are just too few ships traveling the oceans to account for the sheer amount of plastic we observed at sea," said Miller. "International maritime law prohibits the dumping of plastic in the oceans," he added, "although the effectiveness of the law would be hard to determine."

According to an article published by the Elsevier environmental research

During the Plastics at Sea expedition, volunteers used a Neuston Net for surface tows. The duration of each net tow was 30 minutes. During these surface tows, any plastics that were found in the nets were analyzed and identified in the research laboratory on the sailboat and stored for future analysis.

John Miller

journal in 2008, plastic prevails as one of the most common pollutants in oceans worldwide "in quantities paralleling their level of production over the last half century."

The larger solution to the problem of plastics at sea may simply start with our packing choices and how we dispose of plastics. "Primarily, we need to go back to the source of plastics pollution, and resolve the problem from there," said Miller.

Plastic debris have been accumulating since plastics usage escalated between the 1920s and the 1940s. By the 1950s and 1960s, the use of plastic as packaging materials exploded. Coincidently, the first articles documenting plastic pollution in the oceans were published in scientific journals in the sixties. With each decade, dependence on plastic packaging materials has only increased.

In addition to collecting plastic debris, volunteers sampled the seawater during each tow. The water was filtered for chlorophyll analysis, which determines the biological productivity at each tow location.

John Miller

In 2007, according to the U.S. Environmental Protection Agency, plastic made up 12 percent of 254 million tons of waste. That amounts to more than 30 million tons of plastic waste produced in one year. Organizations like the SEA believe this current rate of plastic pollution can be greatly reduced by changing the way goods are packaged and through increasing recycling efforts.

Environmental Stewardship

Like many who have witnessed the damage and future health risk caused by pollution first-hand, Miller returned from the journey motivated to take action by spreading the word back at work. He gave a presentation about the voyage to the Navy's Regional Environmental and Public Works Department and the Snohomish County Marine Resources Committee.

According to Miller, NS Everett's environmental program has already implemented several successful projects to increase the use of alternative energy, prevent pollution, and reduce waste through recycling.

The majority of plastic collected in the net tows were particles no larger than a pencil eraser.
John Miller

"The Department of Defense plays a major role in the protection and conservation of wildlife and habitat, and the Navy is an active environmental steward," he said.

The Navy maintains community partnerships with local tribes and non-governmental organizations that support local conservation efforts, including working with private industries to protect shoreline resources. Miller's department and staff are heavily involved in several of these efforts.

Environmental awareness is encouraged through new employee classes and quarterly training, Earth Day and other base events, and as well as restoration and volunteer activities to clean up litter along shoreline areas.

Denise Lesniak, Integrated Solid Waste Manager at NS Everett, acknowledged a major challenge for many communities is that people may not realize how many materials can be recycled nowadays, especially when there are several of types of plastic items and various equipment needed to process them.

"We at NS Everett are incredibly proactive when it comes to recycling plastics and various other reusable items," said Lesniak. "We also partner with departments and tenant commands to enhance environmental awareness and encourage conservation and recycling practices." The base recycles up to 51 percent of all trash from its tenants, including remote locations at Pacific Beach, Jim Creek, and Smokey Point.

The Basics About the Sea Education Association

SEA IS AN educational institution dedicated to exploration, understanding and stewardship of the oceans, and to the study of humanity's relationship with the oceans. SEA offers students an interdisciplinary curriculum, on shore and at sea aboard tall ships, that provides challenging voyages of scientific discovery, academic rigor, and personal growth.

Since 1971, SEA has been a leader in off-campus study focused on marine science, maritime culture, and environmental studies. The SEA Semester study abroad programs challenge students intellectually and physically by combining the sailing adventure with study of the deep ocean and the interactions of humans and the sea.

For more information, visit www.sea.edu.

SSV Corwith Cramer sails in the mid-North Atlantic.
Roman Shore

Volunteers on John Miller's Plastics at Sea expedition climb the SSV Corwith Cramer's rigging.
John Miller

For Miller, making the journey was a way for him to develop his knowledge and raise awareness about plastic ocean pollution. Not everyone can to go to sea on a sailing expedition, but Miller was able to share the message with others poised to make a difference in his local area.

"It all starts with education and making people aware of the impact and what they can do to help in their daily lives," he said. "The only way for pollution to become less of an issue, is if we initiate the change."

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