Research shows where trash accumulates in the deep sea

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A discarded tire sits on a ledge 868 meters (2,850 feet) below the ocean surface in Monterey Canyon. A recent study documented the types and locations of over 1,000 pieces of marine debris on the deep seafloor in the Monterey Bay region. © 2009 MBARI

Surprisingly large amounts of discarded trash end up in the ocean. Plastic bags, aluminum cans, and fishing debris not only clutter our beaches, but accumulate in open-ocean areas such as the "Great Pacific Garbage Patch." Now, a paper by researchers at the Monterey Bay Aquarium Research Institute (MBARI) shows that trash is also accumulating in the deep sea, particularly in Monterey Canyon.

Kyra Schlining, lead author on this study, said, "We were inspired by a fisheries study off Southern California that looked at seafloor trash down to 365 meters. We were able to continue this search in deeper water—down to 4,000 meters. Our study also covered a longer time period, and included more in-situ observations of deep-sea debris than any previous study I'm aware of."

To complete this extensive study, Schlining and her coauthors combed through 18,000 hours of underwater video collected by MBARI's remotely operated vehicles (ROVs). Over the past 22 years, technicians in MBARI's video lab recorded virtually every object and animal that appeared in these videos. These annotations are compiled in MBARI's Video Annotation and Reference System (VARS).

For this study, video technicians searched the VARS database to find every video clip that showed debris on the seafloor. They then compiled data on all the different types of debris they saw, as well as when and where this debris was observed.

In total, the researchers counted over 1,500 observations of deep-sea debris, at dive sites from Vancouver Island to the Gulf of California, and as far west as the Hawaiian Islands. In the recent paper, the researchers focused on seafloor debris in and around Monterey Bay—an area in which MBARI conducts over 200 research dives a year. In this region alone, the researchers noted over 1,150 pieces of debris on the seafloor.

The largest proportion of the debris—about one third of the total—consisted of objects made of plastic. Of these objects, more than half were plastic bags. Plastic bags are potentially dangerous to marine life because they can smother attached organisms or choke animals that consume them.

Metal objects were the second most common type of debris seen in this

study. About two thirds of these objects were aluminum, steel, or tin cans. Other common debris included rope, fishing equipment, glass bottles, paper, and cloth items.

The researchers found that trash was not randomly distributed on the seafloor. Instead, it collected on steep, rocky slopes, such as the edges of Monterey Canyon, as well as in a few spots in the canyon axis. The researchers speculate that debris accumulates where ocean currents flow past rocky outcrops or other obstacles.

The researchers also discovered that debris was more common in the deeper parts of the canyon, below 2,000 meters (6,500 feet). Schlining commented, "I was surprised that we saw so much trash in deeper water. We don't usually think of our daily activities as affecting life two miles deep in the ocean." Schlining added, "I'm sure that there's a lot more debris in the canyon that we're not seeing. A lot of it gets buried by underwater landslides and sediment movement. Some of it may also be carried into deeper water, farther down the canyon."

In the same areas where they saw trash on the seafloor, the researchers also saw kelp, wood, and natural debris that originated on land. This led them to conclude that much of the trash in Monterey Canyon comes from land-based sources, rather than from boats and ships.

Although the MBARI study also showed a smaller proportion of lost fishing gear than did some previous studies, fishing gear accounted for the most obvious negative impacts on marine life. The researchers observed several cases of animals trapped in old fishing gear.

Other effects on marine life were more subtle. For example, debris in muddy-bottom areas was often used as shelter by seafloor animals, or as a hard surface on which animals anchored themselves. Although such associations seem to benefit the individual animals involved, they also

reflect the fact that marine debris is creating changes in the existing natural biological communities.

To make matters worse, the impacts of deep-sea trash may last for years. Near-freezing water, lack of sunlight, and low oxygen concentrations discourage the growth of bacteria and other organisms that can break down debris. Under these conditions, a plastic bag or soda can might persist for decades.

MBARI researchers hope to do additional research to understand the long-term biological impacts of trash in the deep sea. Working with the Monterey Bay National Marine Sanctuary, they are currently finishing up a detailed study of the effects of a particularly large piece of marine debris—a shipping container that fell off a ship in 2004.

During research expeditions, researchers occasionally retrieve trash from the deep sea. However, removing such debris on a large scale is prohibitively expensive, and can sometimes do more damage than simply leaving it in place.

Schlining noted, "The most frustrating thing for me is that most of the material we saw—glass, metal, paper, plastic—could be recycled." She and her coauthors hope that their findings will inspire coastal residents and ocean users to recycle their trash instead of allowing it to end up in the ocean. In the conclusion of their article, they wrote, "Ultimately, preventing the introduction of litter into the marine environment through increased public awareness remains the most efficient and cost-effective solution to this dilemma."

More information: Schlining, K., von Thun, S., Kuhnz, L., Schlining, B., Lundsten, L., Jacobsen Stout, N., Chaney, L., Connor, J., Debris in the deep: Using a 22-year video annotation database to survey marine litter in Monterey Canyon, Central California, USA, Deep-Sea Research

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