



Marine citizen science: Divers survey marine litter in the seabed of the Israeli Mediterranean

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Introduction

Marine litter is a growing global problem, posing a great threat to both marine ecosystems and humanity. Debris tend to become trapped in areas of low circulation where sediments are accumulating (Galgani et al. 1996; Schlining et al. 2013; Pham et al. 2014; Galgani et al. 2015). These are also the locations where large amounts of derelict fishing gear accumulate and cause damage to shallow-water biota and habitats (Dameron et al. 2007; Kühn et al. 2015). However, knowledge on marine litter, especially on the seafloor is very limited. Visual observation of marine litter is an efficient tool for quantifying debris mainly in shallow coastal water, where it may be caught in structures on the seabed, such as rocks and reefs. Such assessments are an important tool in managing and protecting sensitive habitats (marine reserves, areas of reproduction, etc.). Many recreational divers are enthusiast of marine conservation and can thus contribute to marine litter data collection which doesn't require high scientific skills. The Society for the Protection of Nature in Israel together with The Israeli Diving Federation established the divers volunteer program "Mishmar Hayam" (Sea Guard), which supports marine conservation through citizen science. The divers are trained in marine ecology and survey methods, to conduct independent surveys and lead underwater cleanups.



Marine litter survey: litter is documented underwater along a 100*4 m transect line.



Underwater cleanups: litter is collected (a), removed from sea (b), weighed (c), sorted and documented (d) on land.

Methodology

Volunteer divers conduct surveys which quantify and categorize marine litter using UNEP standards (Cheshire et al., 2009), in belt transects of 100 m by 4 m in the shallow coastal water. Surveys were conducted in five different sites, in the northern part of Israel. Additional data was collected during five supervised underwater cleanups. As cleanups area is not measured, comparison between data obtained in surveys and cleanups is based on relative percentage and not on absolute data.

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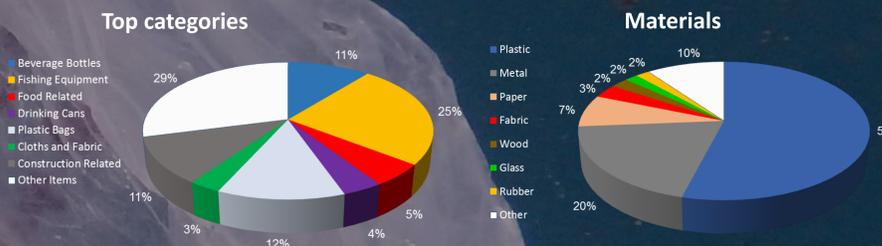
Cool items found



Results and Discussion

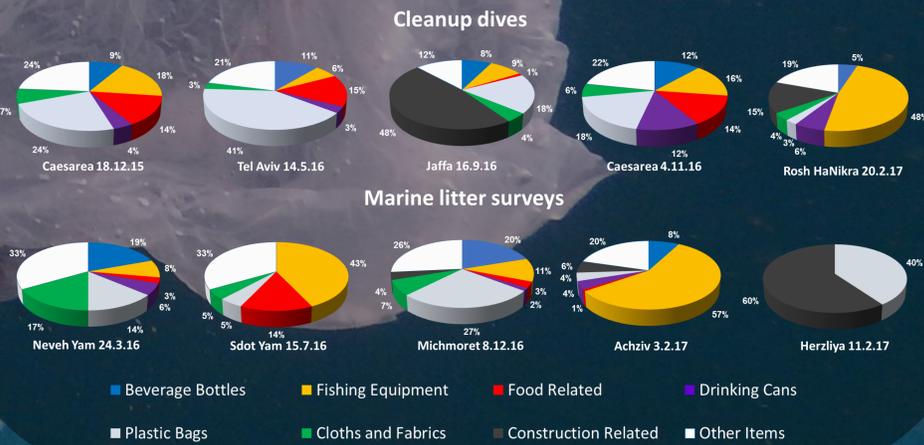
Marine litter data (surveys and cleanups) collected to date, indicate that fishing equipment was the most abundant category (25%) on the shallow seabed, followed by plastic bags (12%) and beverage bottles (11%). Analyzing debris by materials, plastic is the most common material found on the bottom of the coastal water of Israel, with an average of 52% and a maximum of 84% found in Tel Aviv. Plastics are present in large amounts on the seabed of all seas and oceans (Galil et al. 1995; Galgani et al. 2000; Barnes et al. 2009; Galgani et al. 2015). Metal is the second most abundant material with an average of 20%, comprised mostly of lead fishing sinkers.

Fig 1: Marine litter in shallow waters along the Israeli coast



Analyzing debris for each site separately, we found a strong correlation between coastal usage and litter found in the adjacent seabed. Fishing equipment was the most abundant category in Achziv (57%), Rosh Hanikra (48%), Sdot Yam (43%) and Caesarea (16-18%). All four sites are popular recreational fishing sites. In Giv'at Aliya - Jaffa, previously used as a dumping site for building materials, 48% of the debris was construction materials. Popular bathing beaches, like Tel Aviv and Michmoret, had a high rate of plastic bags (41% and 27% respectively).

Fig 2: Top litter categories in different sites along the Israeli coast



Conclusions

- Plastic is the dominant material in marine litter in the Israeli coastal seabed (up to 84%), followed by metals. These materials pose threat to the marine environment and efforts should be made to prevent their entrance to the sea, and to remove them.
- There is a strong correlation between the coastal use and marine litter recorded in the adjacent seabed, suggesting that most marine litter is local, i.e. originates from the adjacent coast. This correlation highlights the public responsibility to the marine litter problem, and can serve as educational tool to improve awareness and selecting different methods to reduce marine debris arrival in different sites along the Israeli coast.
- Fishing equipment (fishing hooks, lines, sinkers, lures and rods) is the dominant marine litter category in recreational fishing sites. Targeted actions within the fishermen's community should be taken to reduce their litter, by collecting their damaged equipment, and not leaving entangled lines and nets.
- Marine citizen science is a powerful way to collect data on marine litter. The information collected by the divers help map the extent of marine litter along the Israeli coast, and is crucial to understand its origins and the personal responsibility in its arrival to the sea and for finding solutions to the problem.
- Citizen science has important added values in raising awareness and increasing responsibility among the general public to a problem threatening the marine environment.

Acknowledgments

We would like to thank all our volunteering divers for their time and dedication. To the Society for Protecting Nature in Israel, The Israeli Diving Federation, the diving instructors team: Dr. Asaf Ariel, Eraz Shoham, Tal Idan, Omri Liram. Diving centers : Old Caesarea, Octopus Tel Aviv, REEF Herzliya and Putsker Nahariya.

