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Expert Consultation on Marine Litter National Source Inventories

Initial assessment of existing relevant data

March 26, 2019
UN Environment HQ
Nairobi, Kenya

Emily Smail, Ph.D.

GEO Blue Planet Initiative Coordinator

University of Maryland Earth Science Interdisciplinary Center

NOAA/NESDIS Center for Satellite Application and Research

GEO Blue Planet

GEO Blue Planet works to ensure the sustained development and use of ocean and coastal observations for the benefit of society by promoting collection of continuous ocean observations, processing of data into information and linking this information with societal needs.

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Assessment of existing relevant data

- Under GEO Blue Planet, an IEEE/OES funded working group on marine litter is investigating the sources, distribution and impact of marine debris, and supporting mitigation measures, policies and regulations to reduce it.

IEEE Oceanic Engineering Society OES

WWF

- White paper for UN Environment that will cover the available data and technologies available for observing and monitoring marine litter and recommended indicators.

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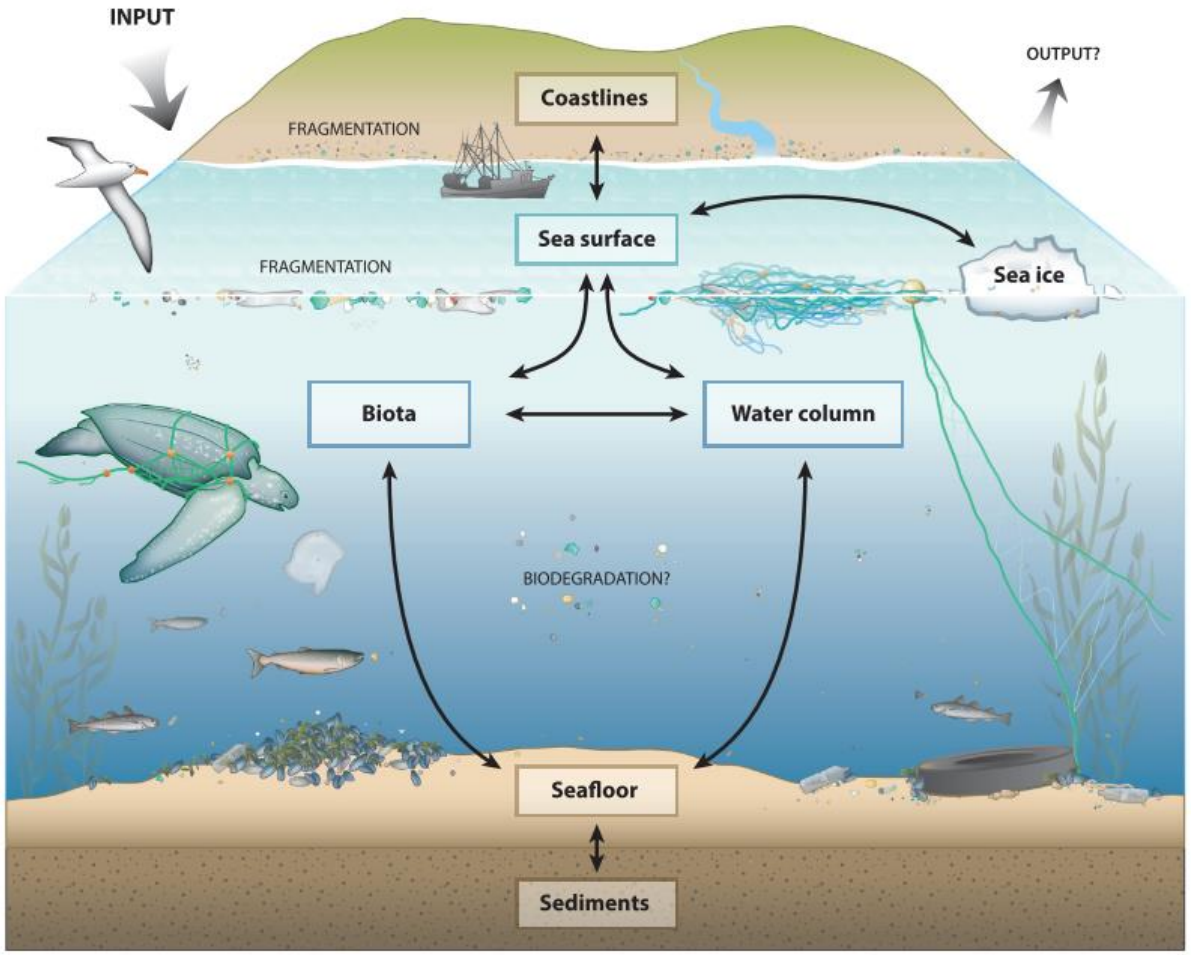
Assessment of existing relevant data

- Beach/shore line data
- Floating marine litter
- Marine litter in the water column
- Seafloor marine litter
- Ingested marine litter
- Sources of marine litter



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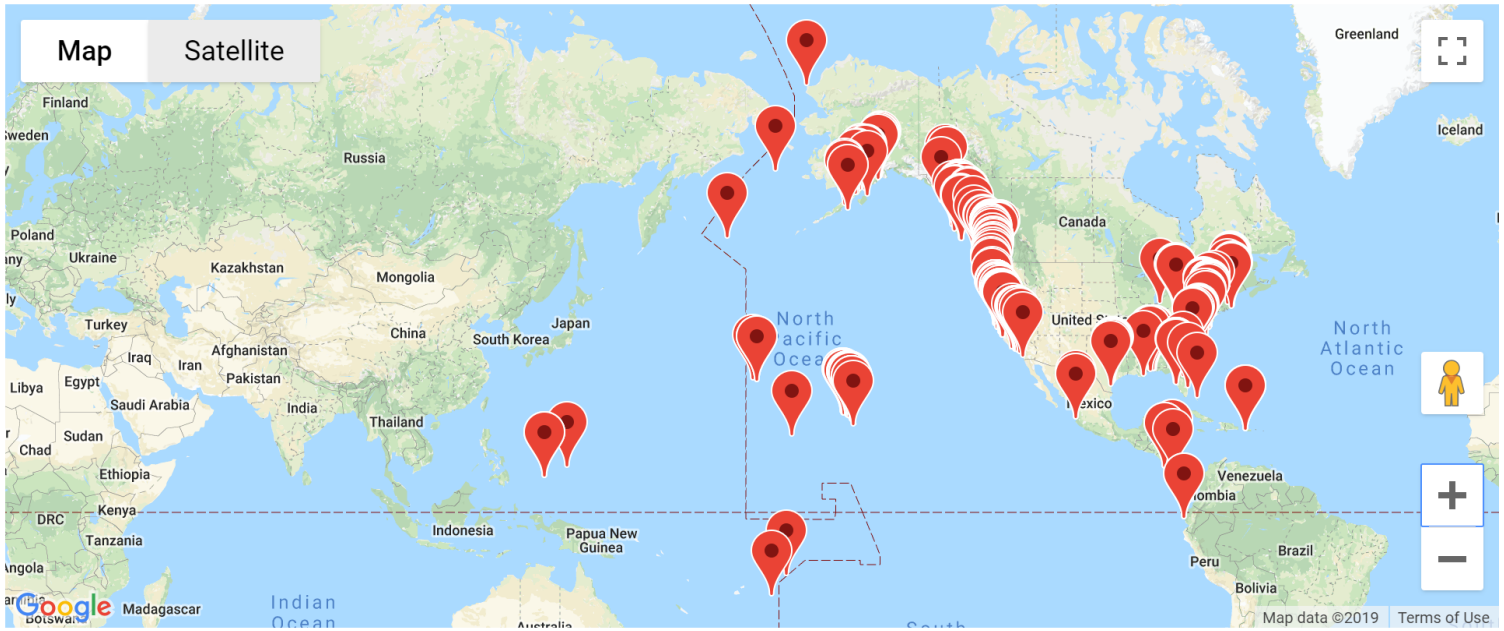
Beach/shoreline data

NOAA Marine Debris Monitoring and Assessment Project



Goal of monthly surveys submitted to NOAA's MDMAP Database

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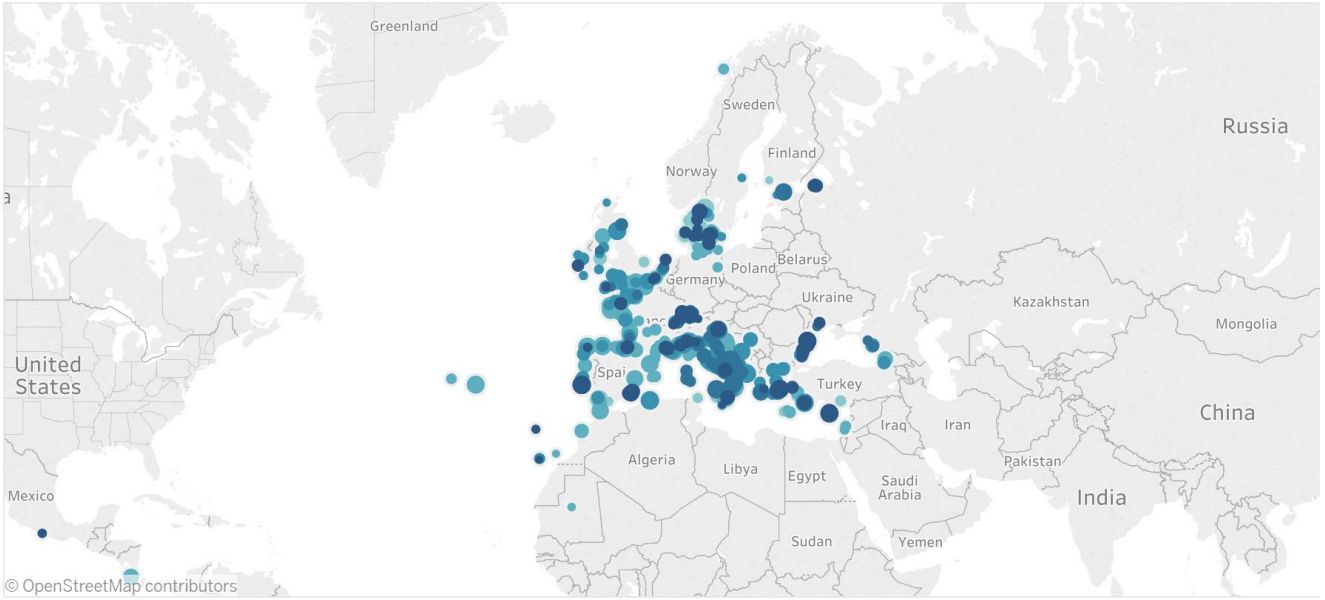
Beach/shoreline data

European Environmental Agency Marine Litter Watch



Marine litter data viewer:

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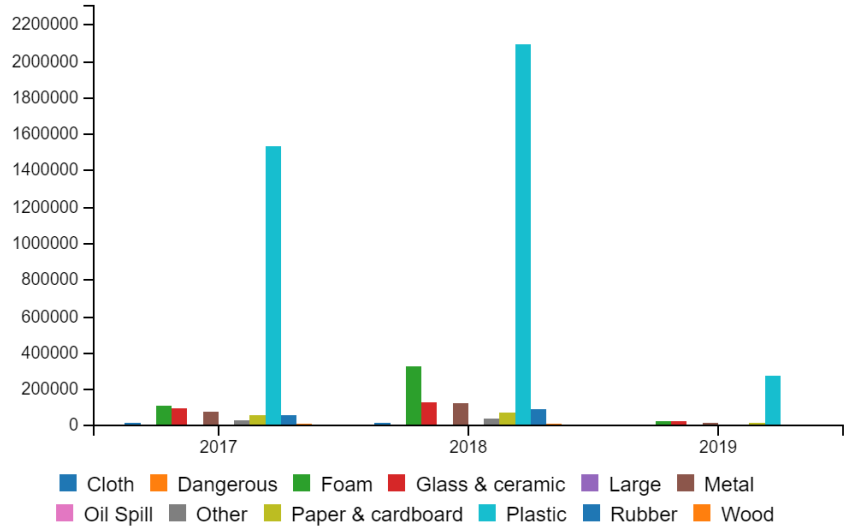
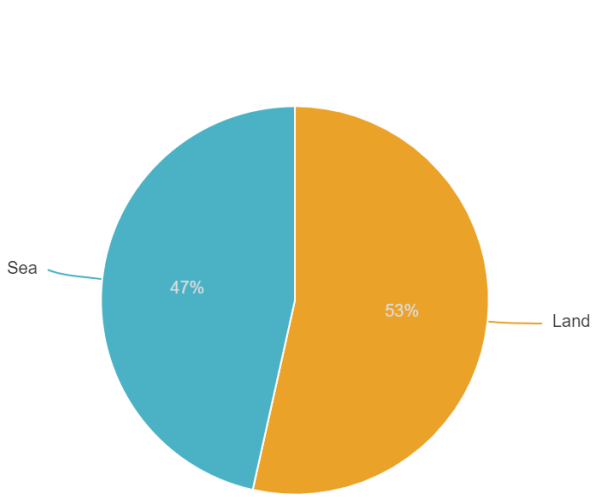
Beach/shoreline data

Australian Marine Debris Database





Data from beach clean ups

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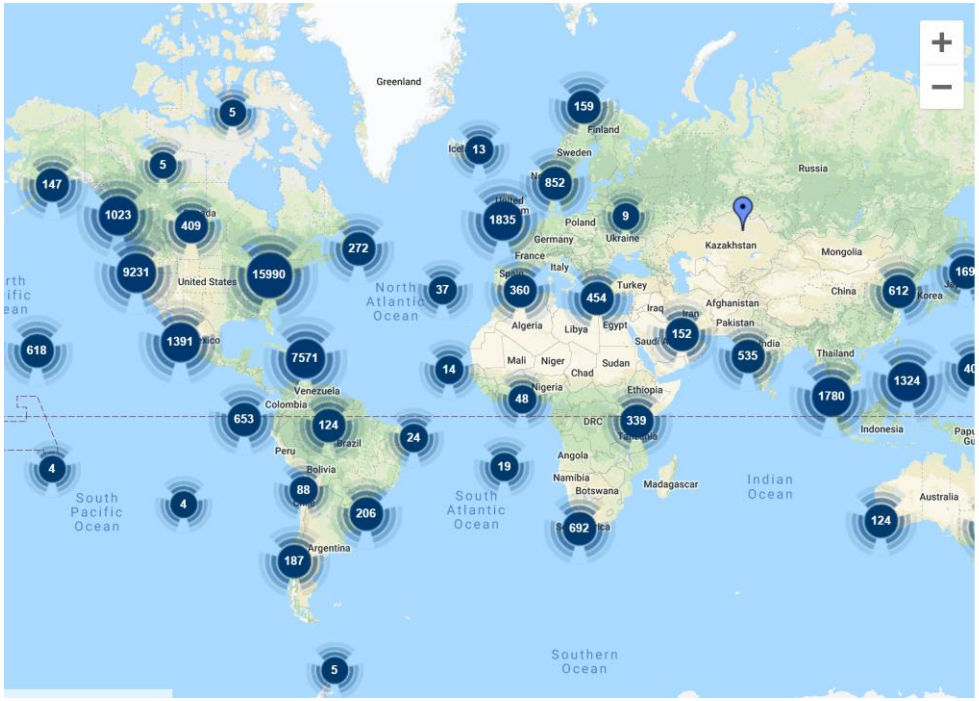
Beach/shoreline data

Ocean Conservancy TIDES data system



Collected during the annual International Coastal Cleanup and by users of Clean Swell, Ocean Conservancy's ocean trash data collection app

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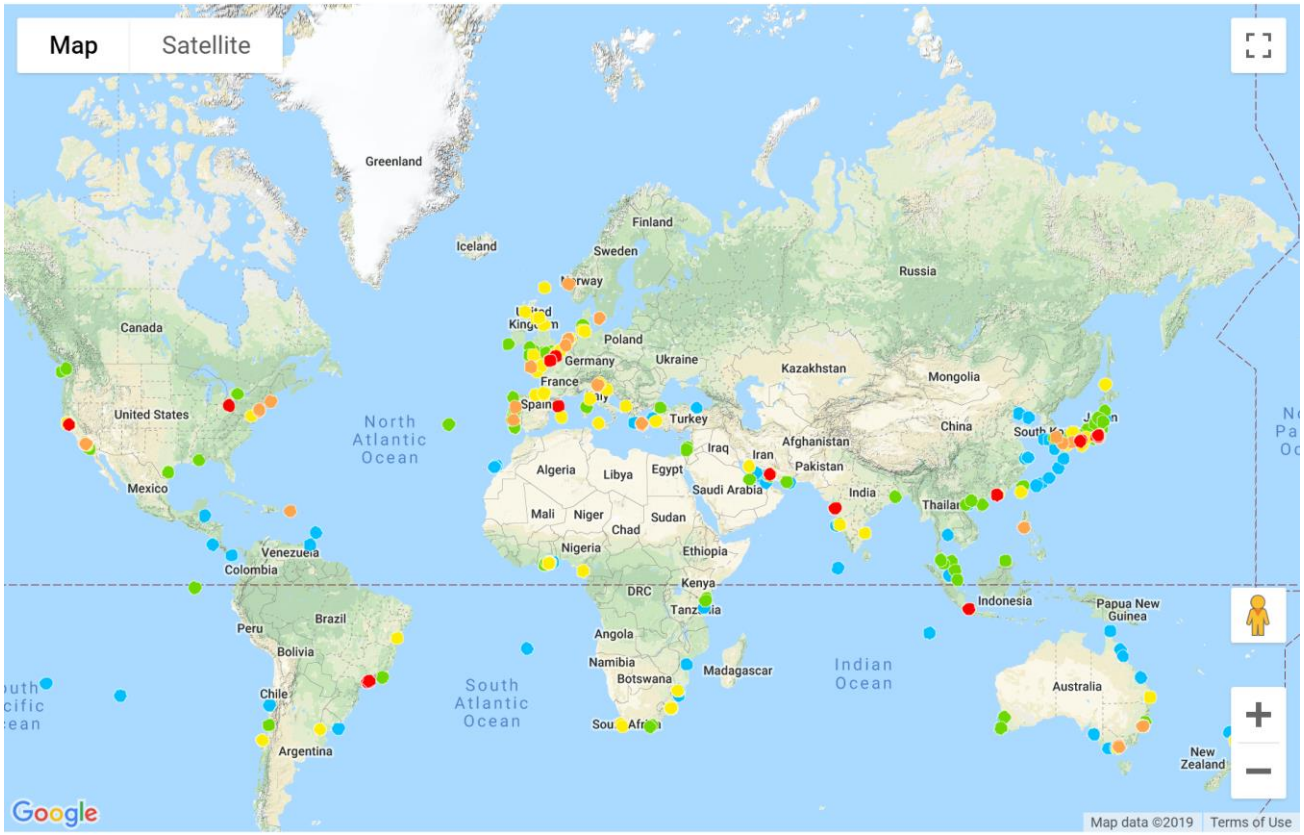
Beach/shoreline data

International pellet watch



Plastic resin particles

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Beach/shoreline data summary (2015)

Chapter 2: Global Distribution, Composition and Abundance of Marine Litter *in* Marine Anthropogenic Litter

Table 2.1 Comparison of mean litter densities from recent data worldwide (non-exhaustive list)

Region	Density (m^{-2})	Density (linear m^{-1})	Plastic (%)	References
SW Black Sea	0.88 (0.008–5.06)	24 (1.7–197)	91	Topçu et al. (2013)
Costa do Dende, Brazil	n.d.	9.1	75	Santos et al. (2009)
Cassina, Brazil	n.d.	5.3–10.7	48	Tourinho and Fillmann (2011)
Gulf of Aqaba	2 (1–6)	n.d.	n.d.	Al-Najjar and Al-Shiyabet (2011)
Monterey, USA	1 ± 2.1	n.d.	68	Rosevelt et al. (2013)
North Atlantic, USA	n.d.	0.10 (0.2)	n.d.	Ribic et al. (2010)
North Atlantic, USA	n.d.	0.42 (0.1)	n.d.	Ribic et al. (2010)
North Atlantic, USA	n.d.	0.08 (0.2)	n.d.	Ribic et al. (2010)
South Caribbean, Bonaire	1.4 (max. 115)	n.d.	n.d.	Debrot et al. (2013)
Bootless Bay, Papua New Guinea	15.3 (1.2–78.3)	n.d.	89	Smith (2012)
Nakdong, South Korea	0.97–1.03	n.d.	n.d.	Lee et al. (2013)
Kaosiung, Taiwan	0.9 (max. 3,227)	n.d.	77	Liu et al. (2013)
Tasmania	0.016–2.03	n.d.	n.d.	Slavin et al. (2012)
Midway, North Pacific	n.d.	0.60–3.52	91	Ribic et al. (2012a)
Chile	n.d.	0.01–0.25	n.d.	Thiel et al. (2013)
Heard Island, Antarctica	n.d.	0–0.132	n.d.	Eriksson et al. (2013)

Ranges of values are given in parentheses

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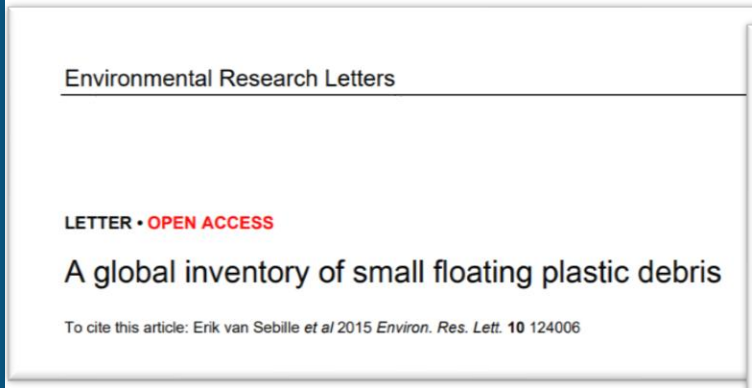
Floating, water column and seafloor

Most data currently in reports and publications



Environmental Research Letters

LETTER • OPEN ACCESS

A global inventory of small floating plastic debris

To cite this article: Erik van Sebille *et al* 2015 *Environ. Res. Lett.* **10** 124006

Marine Pollution Bulletin 141 (2019) 205–214

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Spatio-temporal monitoring of coastal floating marine debris in the Balearic Islands from sea-cleaning boats

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Poniente s/n, 07015 Palma de Mallorca, Spain

d. Naorte, Bl.2-Ps.2-Pt.3, C. Valldemossa, km 7,4, 07121 Palma de Mallorca, Balearic

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/269107181

The vertical distribution of buoyant plastics at sea

Article *in* Biogeosciences Discussions · November 2014

DOI: 10.5194/bgd-11-16207-2014

Marine Pollution Bulletin 127 (2018) 774–780

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Marine Pollution Bulletin 115 (2017) 225–232

Contents lists available at ScienceDirect

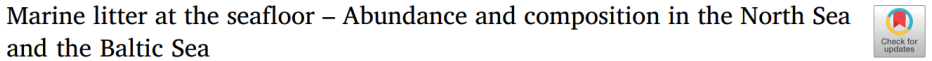
Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Floating Marine Debris in waters of the Mexican Central Pacific

Evelyn R. Díaz-Torres [a], Christian D. Ortega-Ortiz [a,*], Lidia Silva-Iñiguez [a], Alejandro Nene-Preciado [b], Ernesto Torres Orozco [a]

[a] Facultad de Ciencias Marinas, Universidad de Colima, Km 20 Carr. Manzanillo-Barra de Navidad, C.P. 28860, Manzanillo, Col., Mexico



Marine litter at the seafloor – Abundance and composition in the North Sea and the Baltic Sea

Ulrike Kammann*, Marc-Oliver Aust, Horst Bahl, Thomas Lang

Thünen-Institute of Fisheries Ecology, Hamburg, Germany

Floating debris data summary (2015)

Chapter 2: Global Distribution, Composition and Abundance of Marine Litter *in* Marine Anthropogenic Litter

Table 2.2 Comparison of mean litter densities on the sea surface from worldwide data (non-exhaustive list)

Region	Density (item km^{-2}) (max)	Size range (cm)	Plastic (%)	References
North Sea	25–38	>2	70	Thiel et al. (2011)
Belgian coast	0.7	n.d.	95	Van Cauwenberghe et al. (2013)
Ligurian coast	1.5–25	n.d.	n.d.	Aliani and Molcard (2003)
Mediterranean Sea	10.9 → 52 (194.6)	>2	95.6	Suaria and Aliani (2014)
North Sea	2 (1–6)	n.d.	n.d.	Herr (2009)
Kerch Strait/Black Sea	66	n.d.	n.d.	BSC (2007)
Chile	10–50 (250)	>2	>80	Hinojosa and Thiel (2009)
West of Hawaii	0.5	0.08 (0.2)	n.d.	Matsumura and Nasu (1997)
British Columbia	1.48 (2.3)	n.d.	92	Williams et al. (2011)
South China Sea	4.9 (0.3–16.9)	<2.5–10	68	Zhou et al. (2011)
North Pacific	459	2	95	Titmus and Hyrenbach (2011)
Strait of Malacca	579	>1–2	98.8	Ryan (2013)
Bay of Bengal	8.8	>1–2	95.5	Ryan (2013)
Southern Ocean	0.032–6	>1	96	Ryan et al. (2014)

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Seafloor data summary (2015)

Chapter 2: Global Distribution, Composition and Abundance of Marine Litter *in* Marine Anthropogenic Litter

Table 2.3 Comparison of litter densities on the seafloor from recent data worldwide (non-exhaustive list)

Location	Habitat	Date	Sampling	Depth (m)	Density (min-max)	Plastic (%)	References
Southern China	Benthic	2009–2010	4 trawl (mesh not available)/1 dive	0–10	693 (147–5,000) items km^{-2}	47	Zhou et al. (2011)
France-Mediterranean	Slope	2009	17 canyons, 101 ROV dives	80–700	3.01 km^{-1} survey (0–12)	12 (0–100)	Fabri et al. (2014)
Thyrenian Sea	Fishing ground	2009	6 × 1.5 ha samples, trawl, 10 mm mesh	40–80	5,960 ± 3,023 km^{-2}	76	Sanchez et al. (2013)
Spain-Mediterranean	Fishing ground	2009		40–80	4,424 ± 3,743 km^{-2}	37	Sanchez et al. (2013)
Mediterranean Sea	Bathyal/abyssal	2007–2010	292 tows, otter/Agassiz trawl, 12 mm mesh	900–3,000	0.02–3,264.6 kg km^{-2} (incl. clinker)	n.d.	Ramirez-Llodra et al. (2013)
Malta	Shelf	2005	Trawl (44 hauls, 20 mm mesh)	50–700	102	47	Misfud et al. (2013)
Turkey/Levantin Basin	Bottom/bathyal	2012	32 hauls (trawl, 24 mm mesh)	200–800	290 litter (3,264.6 kg km^{-2})	81.1	Güven et al. (2013)
Azores, Portugal	Condor seamount	2010–2011	45 dives	185–256	1,439 items km^{-2}	No plastic/89 % fishing gear	Pham et al. (2013)
Goringe Bank, NE Atlantic	Gettysburg and Ormonde seamounts	2011	4 ROV dives (124 h video, 4,832 photographs), total distance of 80.6 km	60–3,015	1–4 items·km^{-1}	9.9/56 fishing gear	Vieira et al. (2014)
US west coast	Shelf	2007–2008	1,347 sites (total, trawling, 38 mm mesh)	55–183	30 items km^{-2}	23	Keller et al. (2010)
	Slope	2007–2008		183–550	59 items km^{-2}	n.d.	Keller et al. (2010)
	Slope/bathyal	2007–2008		550–1,280	129 items km^{-2}	n.d.	Keller et al. (2010)
Mediterranean Sea, France	Shelf/canyon	1994–2009 (16 years study)	90 sites (trawls, 0.045 km^2/tow, 20 mm mesh)	0–800	76–146 km^{-2} (0–2,540)	29.5–74	Galgani et al. (2000) and unpublished data

(continued)

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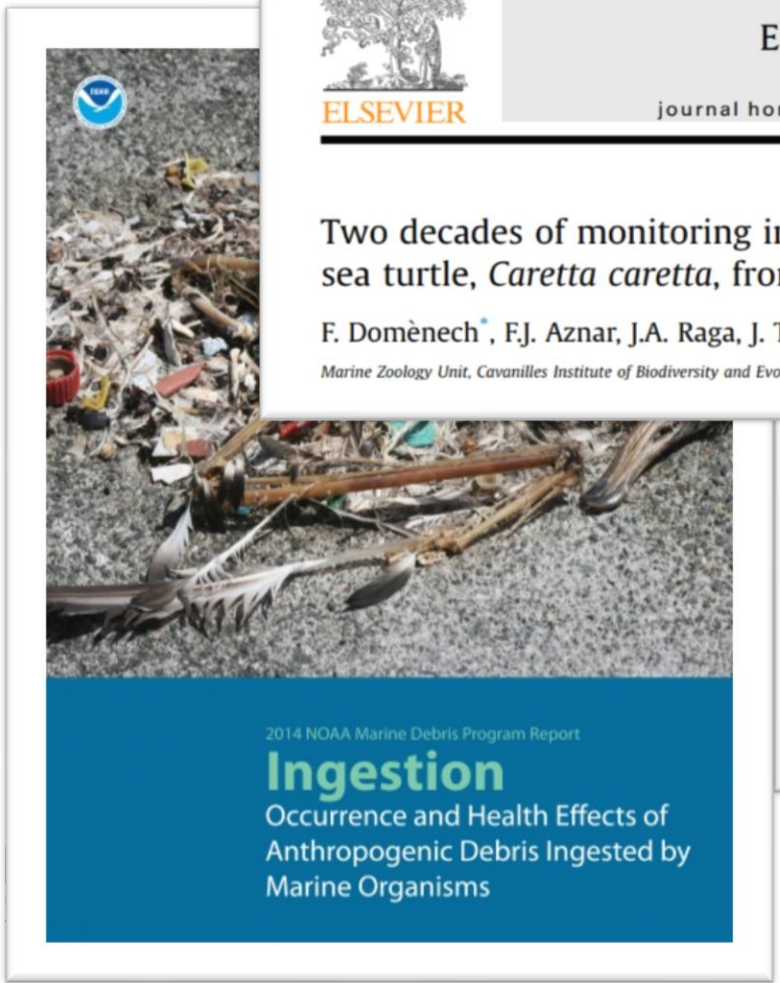
Ingested marine litter

Most data currently in reports and publications



Environmental Pollution 244 (2019) 367–378

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Two decades of monitoring in marine debris ingestion in loggerhead sea turtle, *Caretta caretta*, from the western Mediterranean☆

F. Domènech*, F.J. Aznar, J.A. Raga, J. Tomás

Marine Zoology Unit, Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Valencia, Spain

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Review

Towards the suitable monitoring of ingestion of microplastics by marine biota: A review☆

Charlotte Wesch [a, b, *], Katja Bredimus [a], Martin Paulus [a], Roland Klein [a]

[a] *Department of Biogeography, Trier University, Universitätsring 15, 54286 Trier, Germany*

Sources of marine litter

Example sources that could be tracked (from JRC Technical Report: Identifying Sources of Marine Litter

Table 1: Examples of sources, means of release, geographic origin, pathways and transport mechanism for a few marine litter items found on the Northern coast of Germany.

	SOURCE	MEANS OF RELEASE	GEOGRAPHIC ORIGIN	PATHWAY	TRANSPORT MECHANISM
COTTON BUD STICKS	Consumers / General Public	Improper disposal down the toilet	Households	Sewage systems and/or rivers	Sewage, rivers, ocean currents and tides
PLASTIC BAGS	Coastal tourism & recreation	Littering (e.g. on beach)	Local (e.g. coastal town or beach nearby)	Direct entry (if at beach) or e.g. windblown (if town nearby)	Wind and tides
	Consumers / General Public	Littering (e.g. on street, from car, in natural area)	e.g. Distant (inland town)	Distant - Wind (blown) and/or rivers	Wind, rivers, ocean current and tides
	Waste management at beach	Overflowing open bin	Beach	Direct input	Wind, tides and currents
	Fisheries	Discard or unintentional loss over board during net repair work at sea	E.g. Local fisheries, regional fisheries or distant fisheries	Direct entry - nets get washed or thrown overboard	Winds(drift), currents and tides

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Sources of marine litter

Example sources that could be reported (from JRC Technical Report: Identifying Sources of Marine Litter

Table 1: Examples of sources, means of release, geographic origin, pathways and transport mechanism for a few marine litter items found on the Northern coast of Germany.

NETS AND PIECES OF NETS	Fisheries	Discard or unintentional loss over board during net repair work at sea	E.g. Local fisheries, regional fisheries or distant fisheries	Direct entry - nets get washed or thrown overboard	Winds(drift), currents and tides
	Fisheries	Loss of nets and pieces of net during fishing (snagging)	E.g. Local fisheries, regional fisheries or distant fisheries	Direct entry - nets get snagged on wrecks, rocks etc. ripped off pieces of net remain attached to objects underwater or are released into the water column (ghost nets)	Winds (drift), currents and tides
	Fisheries and/or harbours	Discard or unintentional loss during net repair work on land or/and runoff from harbours	E.g. local fishing harbours	Direct entry - nets washed, blown or thrown (swept) into harbour basins and washed out to sea	Winds (blow-off), tides and currents
INJECTION GUN CARTRIDGE (Grease)	Shipping including fisheries	Discard or unintentional loss overboard at sea	Local (cartridges recorded on beaches are not fouled, not battered)	Direct entry from ships at sea	Winds (drift), currents and tides
TAHITIANS **(Plastic sheeting to protect mussel cultures)**	Aquaculture	Unintentional loss or discard after use	Distant – International - Northwest France/Atlantic coast of France	Direct input	Winds, currents and tides

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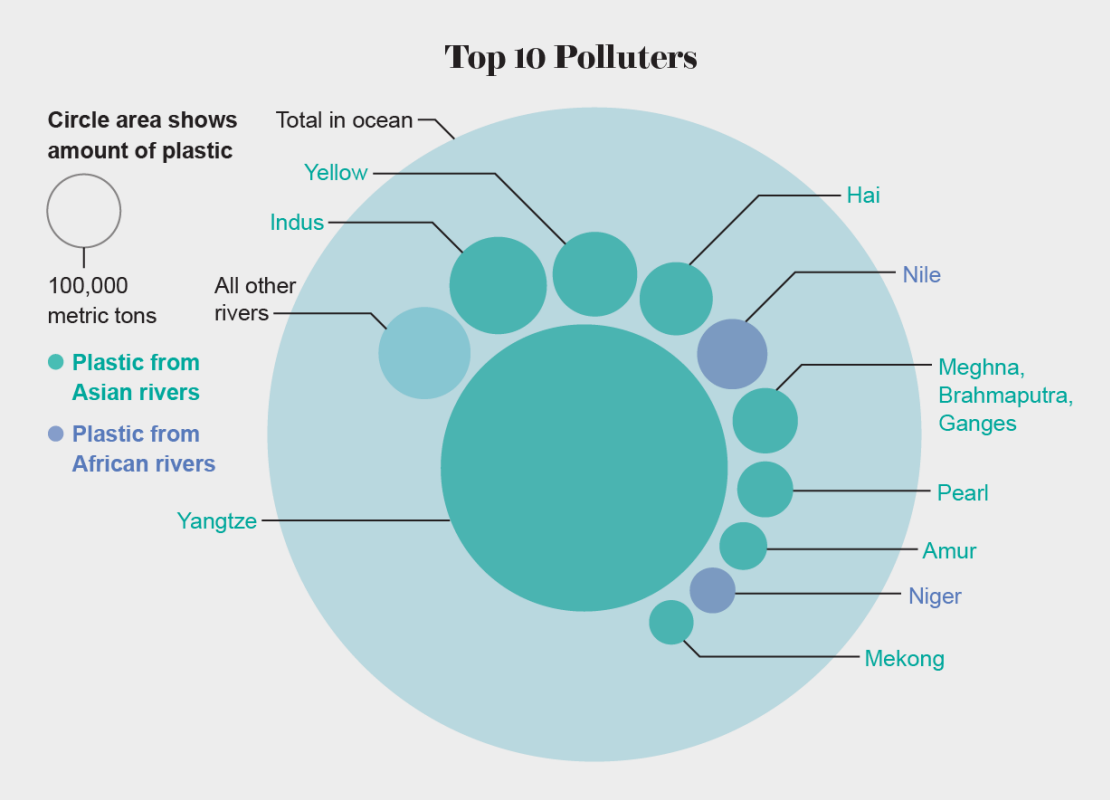
Sources of marine litter

Data on rivers as a source of marine litter

Up to 90% of riverine plastics originate in 10-20 of the world's rivers.



Source: Amanda Montañez; Source: "Export of Plastic Debris by Rivers into the Sea," by Christian Schmidt et al., in Environmental Science & Technology, Vol. 51, No. 21; November 7, 2017

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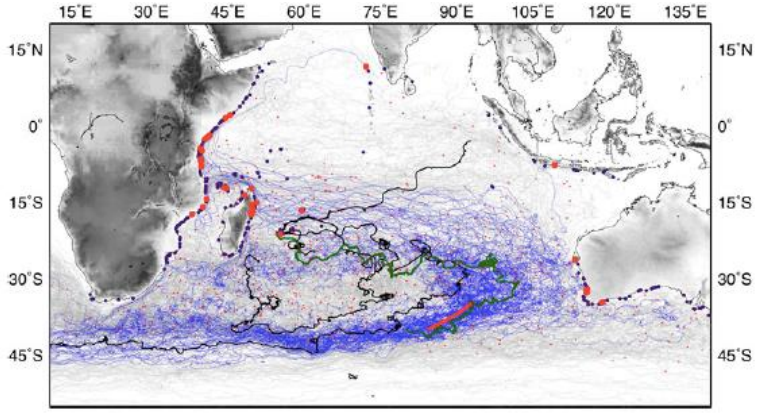
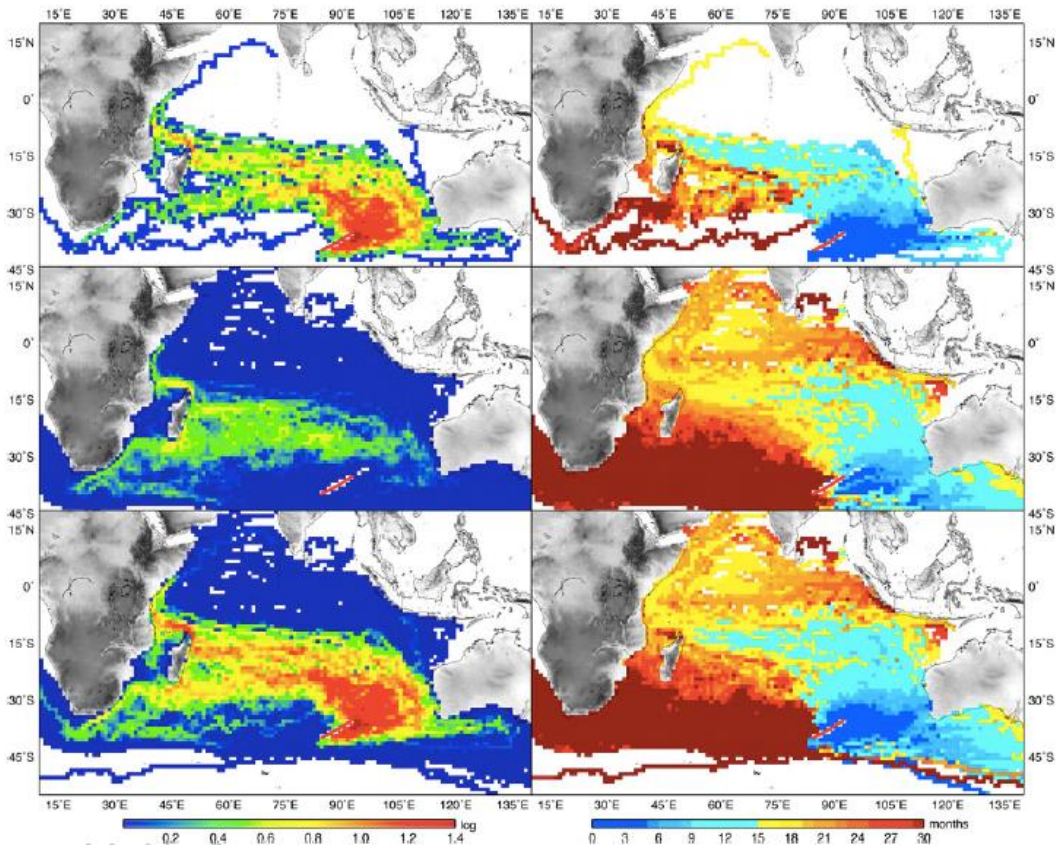
Data from modeling

Hindcast/forecast of marine litter from models





Methodology published in JOO (Trinanes et al, Analysis of flight MH370 potential debris trajectories using ocean observations and numerical model results)

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Example of data integration

Study includes data from trawls, aerial imagery, numerical modeling

www.nature.com/scientificreports

SCIENTIFIC REPORTS

OPEN

Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic

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Published online: 22 March 2018

L. Lebreton[1,2], B. Slat[1], F. Ferrari[1], B. Sainte-Rose[1], J. Aitken[3], R. Marthouse[3], S. Hajbane[1], S. Cunsolo[1,4], A. Schwarz[1], A. Levivier[1], K. Noble[1,5], P. Debeljak[1,6], H. Maral[1,7], R. Schoeneich-Argent[1,8], R. Brambini[1,9] & J. Reisser[1]

Ocean plastic can persist in sea surface waters, eventually accumulating in remote areas of the world's oceans. Here we characterise and quantify a major ocean plastic accumulation zone formed in subtropical waters between California and Hawaii: The Great Pacific Garbage Patch (GPGP). Our model, calibrated with data from multi-vessel and aircraft surveys, predicted at least 79 (45–129) thousand tonnes of ocean plastic are floating inside an area of 1.6 million km^2; a figure four to sixteen times higher than previously reported. We explain this difference through the use of more robust methods to quantify larger debris. Over three-quarters of the GPGP mass was carried by debris larger than 5 cm and at least 46% was comprised of fishing nets. Microplastics accounted for 8% of the total mass but 94% of the estimated 1.8 (1.1–3.6) trillion pieces floating in the area. Plastic collected during our study has specific characteristics such as small surface-to-volume ratio, indicating that only certain types of debris have the capacity to persist and accumulate at the surface of the GPGP. Finally, our results suggest that ocean plastic pollution within the GPGP is increasing exponentially and at a faster rate than in surrounding waters.

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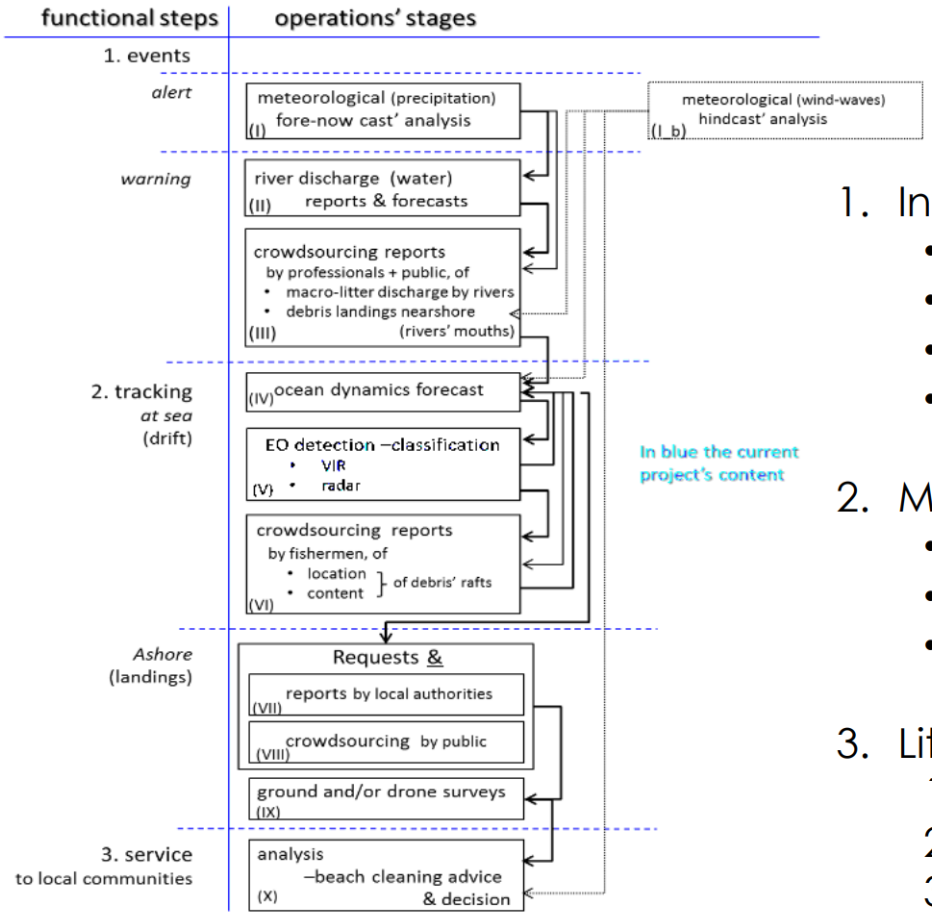
Example of data integration from CMEMS

Courtesy of Manuel Arias, Anne Vallette et al.

CMEMS LitterTEP / ESA EO Track

The Large Picture



1. Integration of ML by different agents:
   - Citizens (SIMPLEX mobile app)
   - NGOs
   - Fishermen
   - Proxies (e.g. flooding events)
2. Monitoring via remote sensing:
   - Public satellites
   - Drones
   - Commercial satellites
3. Litter hindcast/forecast through models
   1. Identification of sources
   2. Landing areas estimation
   3. Identification of risks levels
4. Automatic reporting and analysis

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cics-md

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

UNIVERSITY OF MARYLAND
18 56

Thank you

Emily.Smail@noaa.gov