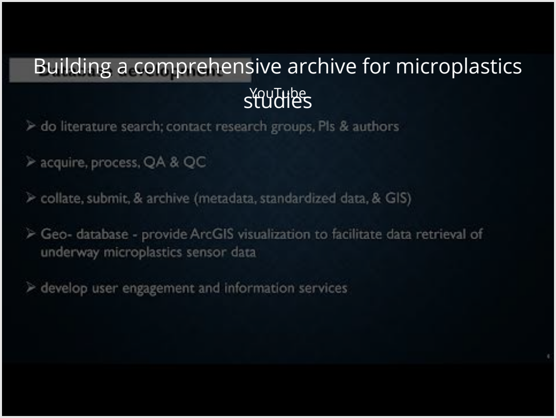
NOAA National Centers for Environmental Information (NCEI) global database on microplastics

Ebenezer Nyadjro - NOAA   Northern Gulf Institute

Zhankun   Wang, Tim Boyer, Just Cebrian, Kirsten Larsen, Jennifer Webster, Yee Lau



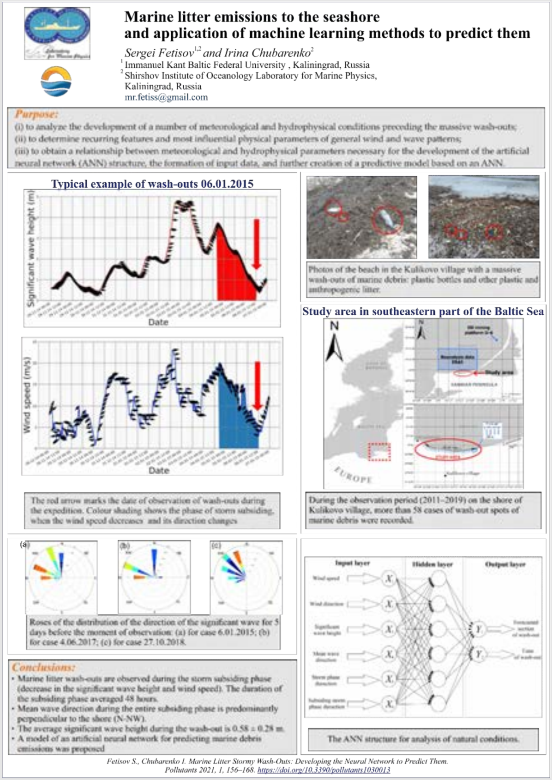
Microplastics (< 5 mm) pollution is a growing problem affecting marine ecosystems, aquatic life, and human health. Despite the growing awareness, data management of measurements of marine debris lags far behind the needs of the scientific, education, and decision maker communities. The National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), is creating a global database on microplastics. The goal is to develop a one-stop repository where data on all types of microplastics are aggregated, archived, and served in a consistent and reliable manner. This database will enable new insights in understanding of the global microplastics problems.

https://www.youtube.com/watch?v=OwrJPke_DHs

Marine litter emissions to the seashore and application of machine learning methods to predict them

Sergei Fetisov - P.P.Shirshov Institute of Oceanology RAS

Irina Chubarenko



Marine litter emissions to the seashore and application of machine learning methods to predict them

Sergei Fetisov[1,2] *and Irina Chubarenko*[2]

[1] Immanuel Kant Baltic Federal University , Kaliningrad, Russia

[2] Shirshov Institute of Oceanology Laboratory for Marine Physics, Kaliningrad, Russia

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Purpose:

(i) to analyze the development of a number of meteorological and hydrophysical conditions preceding the massive wash-outs;
(ii) to determine recurring features and most influential physical parameters of general wind and wave patterns;
(iii) to obtain a relationship between meteorological and hydrophysical parameters necessary for the development of the artificial neural network (ANN) structure, the formation of input data, and further creation of a predictive model based on an ANN.

Typical example of wash-outs 06.01.2015

The red arrow marks the date of observation of wash-outs during the expedition. Colour shading shows the phase of storm subsiding, when the wind speed decreases and its direction changes

Photos of the beach in the Kulikovo village with a massive wash-outs of marine debris: plastic bottles and other plastic and anthropogenic litter.

Study area in southeastern part of the Baltic Sea

During the observation period (2011–2019) on the shore of Kulikovo village, more than 58 cases of wash-out spots of marine debris were recorded.

Roses of the distribution of the direction of the significant wave for 5 days before the moment of observation: (a) for case 6.01.2015; (b) for case 4.06.2017; (c) for case 27.10.2018.

The ANN structure for analysis of natural conditions.

Conclusions:

- Marine litter wash-outs are observed during the storm subsiding phase (decrease in the significant wave height and wind speed). The duration of the subsiding phase averaged 48 hours.
- Mean wave direction during the entire subsiding phase is predominantly perpendicular to the shore (N-NW).
- The average significant wave height during the wash-out is 0.58 ± 0.28 m.
- A model of an artificial neural network for predicting marine debris emissions was proposed

Fetisov S., Chubarenko I. Marine Litter Stormy Wash-Outs: Developing the Neural Network to Predict Them. Pollutants 2021, 1, 156–168. https://doi.org/10.3390/pollutants1030013

Beach monitoring shows that certain storm events lead to a large algae emission to the seashore. Nowadays, such wash-outs carry a lot of anthropogenic litter. At the Baltic Sea shores, the amount of anthropogenic litter within the storm-induced spots exceeds hundred of items/sq.m, which is three orders of magnitude higher than usual contamination of these beaches. Up to now, no effective instruments for predicting the date, time, and locations of the wash-out spots are available. An approach using machine learning methods is suggested to predict litter wash-outs. It is based on in-situ observations and analysis of meteorological and hydrophysical conditions.

Drones for litter mapping: operational insights from UAS4Litter experiences

Umberto Andriolo - INESC-Coimbra - University of Coimbra

Gil Goncalves, Filipa Bessa, Paula Sobral

you can go thru the slides!

UAS4litter project operationally tested the use of drones and diverse onboard cameras to detect and map stranded litter at three beach-dune systems in the North Atlantic coast.
To categorize items on images, we explored the performances of manual and different machine learning techniques. Litter maps were coupled to environmental forcing and beach slope configuration to understand items dynamics on shore. On dunes, we identified the role played by distinct vegetation in trapping specific litter. Drone-based litter surveys are not only an alternative to traditional in situ census, but can potentially improve knowledge of litter dynamics and support modelling.
https://www.researchgate.net/project/UAS4Litter-Low-cost-Unmanned-Aerial-Systems-UASs-for-marine-litter-coastal-mapping"

BEWATS: Beach Waste Tracking System using Satellite, UAV's and Marine Dynamics Models

Fernando Martin - atlanTTic research center for Telecommunication Technologies, University of Vigo

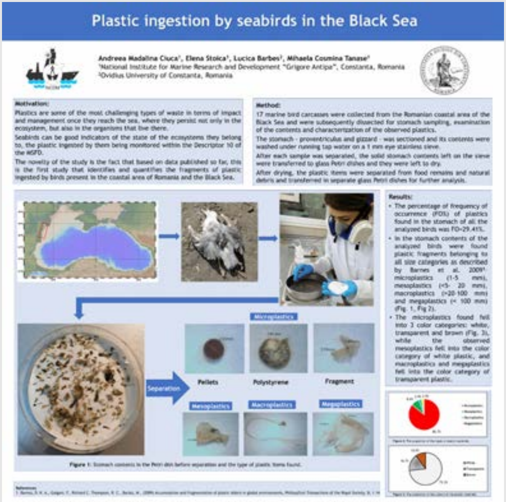
Orentino Mojón-Ojea, Omjyoti Dutta, Beatriz Revilla-Romero, Ana Mancho, Guillermo García-Sánchez, Carmen Otero-Neira, Ana Dopico Parada and Jesús López- Miguéns.

BEWATS continues Litterdrone project (https://litterdrone.aebam.org/), in which, drones were used to obtain beach images that were processed to obtain reports of marine debris. Work lines in BEWATS are: 1. Improving Litterdrone software (version 2.3 to 4.1, new options and improved debris detection). 2. New flight campaigns on beaches. PLUS, plastic targets are placed on the seashore and on water to test satellite detection. 3. Use of current data to detect waste streams. Flow detected between “Miño” estuary and “Rías Baixas”. 4. Detecting floating plastic in satellite images. Two algorithms: for small plastics (GMV) and for large masses (UVIGO). 5. Study of possible commercial application using new study methodology (ValRI). https://fundacion-biodiversidad.es/es/content/bewats-beach-waste-tracking-system

Plastic Ingestion by seabirds in the Black Sea

Andreea Madalina Ciuca - NIRMD - National Institute for Marine Research and Development Grigore Antipa Constanța

Elena Stoica, Lucica Barbes, Mihaela Cosmina Tanase

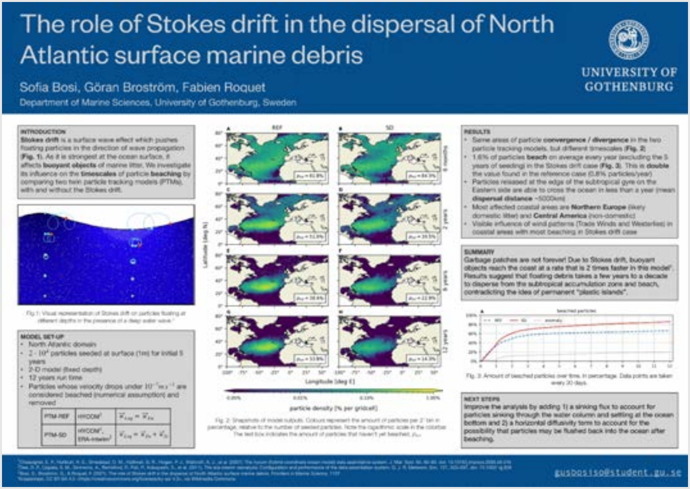


The quantity of plastic ingested by seabirds reflects the quality of their environment and is one of the MSFD goal in terms of litter ingestion. However, there is a lack of data on seabirds' plastic ingestion in the Black Sea. Here we present the first Black Sea results, obtained in 2021 at the Romanian coast. Of 17 birds, 29.4 % had ingested plastic, mostly white, transparent and brown fragments in color. Ours study emphasizes the need for setting-up of seabird litter ingestion monitoring to properly mitigate plastic pollution in the Black Sea.

The role of Stokes drift in the dispersal of North Atlantic surface marine debris

Sofia Bosi - University of Gothenburg

Fabien Roquet

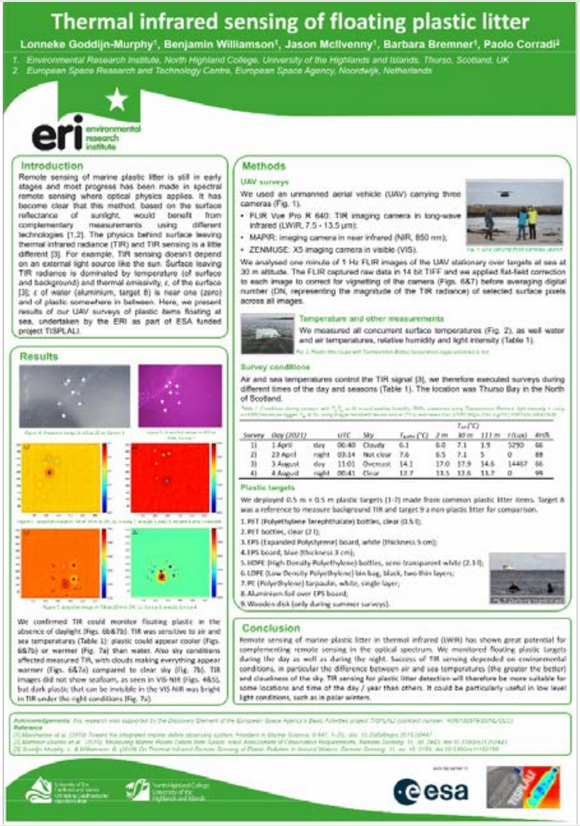


Marine plastic is often highly buoyant and thus concentrates at the ocean surface. As such, it is impacted by surface wave effects like the Stokes drift, which pushes floating objects in the direction of wave propagation. In this study, we compare two particle tracking models (PTMs) in the North Atlantic basin, one with and one without the Stokes drift, to highlight its effects on the timescales of beaching. Particles are found to beach at a faster annual rate when the Stokes drift is included. This emphasises that the idea of "plastic islands" floating at the ocean surface for hundreds of years may be a common misconception.

Thermal infrared sensing of floating plastic litter

Lonneke Goddijn-Murphy - North Highland College UHI

Benjamin Williamson, Jason McIlvenny, Barbara Bremner

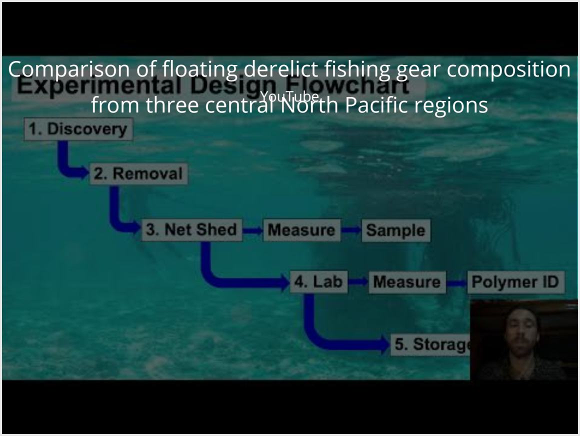


Thermal infrared (TIR) sensing can complement other remote sensing techniques for marine plastic litter. We present the results of drone surveys carrying a TIR camera over floating plastic litter targets at sea under varying conditions. These included day and night surveys during different air and sea temperatures, and atmospheric conditions. We could see plastic during the day and night while sea foam and the sea floor did not show in the TIR images. These experiments were supported by our radiative transfer model and measurements in the laboratory.

Comparison of floating derelict fishing gear composition from three central North Pacific regions

Andrew McWhirter - Hawaii Pacific University Center for Marine Debris Research

Raquel Corniuk, Hank Lynch, Cassandra Walti, Jennifer M. Lynch



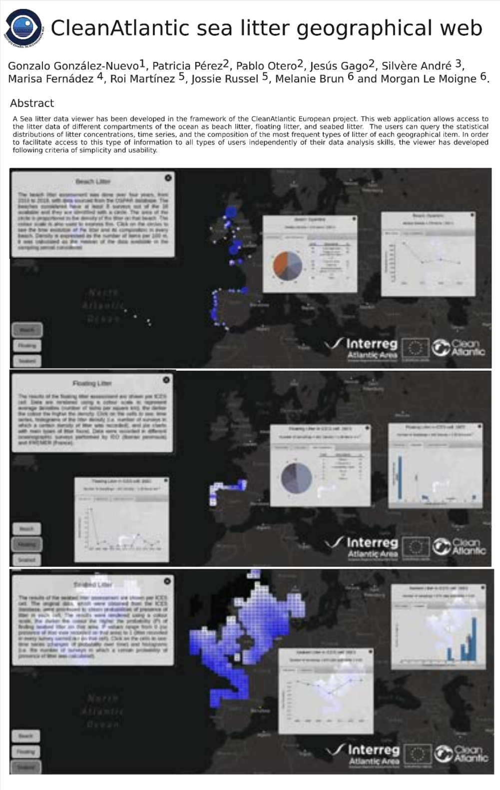
Derelict fishing gear (DFG) contributes the greatest mass of floating plastic marine debris to the global ocean. The North Pacific Ocean is disproportionately affected by DFG, which aggregates in the convergent features of the North Pacific Subtropical Gyre (NPSG). The Hawaiian archipelago extends diagonally to the northwest through the center of the NPSG and is impacted by stranding DFG year round, including damage to coral reefs and endangerment of endemic marine species. To develop effective preventative solutions to this detrimental issue, understanding the composition and sources of the DFG that is affecting the Hawaiian Archipelago and surrounding waters is crucial.

https://www.youtube.com/watch?v=C_9EUo02C0Q

CleanAtlantic sea litter geographical web viewer

Gonzalo González-Nuevo - Instituto Espanol de Oceanografia (IEO)

Jesus Gago Pineiro, Pablo Otero Tranchero, Patricia Perez Perez



CleanAtlantic sea litter geographical web

Gonzalo González-Nuevo[1], Patricia Pérez[2], Pablo Otero[2], Jesús Gago[2], Silvère André [3], Marisa Fernádez [4], Roi Martínez [5], Jossie Russel [5], Melanie Brun [6] and Morgan Le Moigne [6].

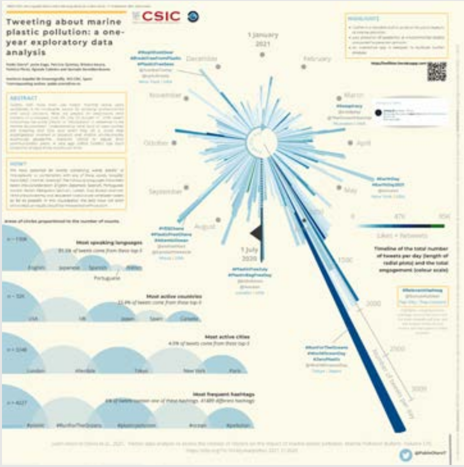
Abstract

A Sea litter data viewer has been developed in the framework of the CleanAtlantic European project. This web application allows access to the litter data of different compartments of the ocean as beach litter, floating litter, and seabed litter. The users can query the statistical distributions of litter concentrations, time series, and the composition of the most frequent types of litter of each geographical item. In order to facilitate access to this type of information to all types of users independently of their data analysis skills, the viewer has developed following criteria of simplicity and usability.

A Sea litter data viewer has been developed in the framework of the CleanAtlantic European project. This web application allows access to the litter data of different compartments of the ocean as beach litter, floating litter, and seabed litter. The users can query the statistical distributions of litter concentrations, time series, and the composition of the most frequent types of litter of each geographical item. In order to facilitate access to this type of information to all types of users independently of their data analysis skills, the viewer has developed following criteria of simplicity and usability.

Tweeting about marine plastic pollution: a one-year exploratory data analysis

Pablo Otero P. - Instituto Espanol de Oceanografia (IEO)



Twitter, with more than 330 million monthly active users worldwide, is an invaluable source for studying environmental and social concerns. Here, we present an exploratory data analysis of a one-year (July 20- July 21) dataset of ~132K tweets containing the words ‘plastic’ or ‘microplastic’ in reference to the marine environment. Understanding what kind of users profiles are tweeting and how and when they do it, could help organizations involved in research and marine environmental awareness to adjust their communication plans. A web app called Twilitter has been created to analyze these results over time.

Using data from marine protected species to guide removal and monitoring of marine debris.

Pilichowski - Hawaii Marine Animal Response

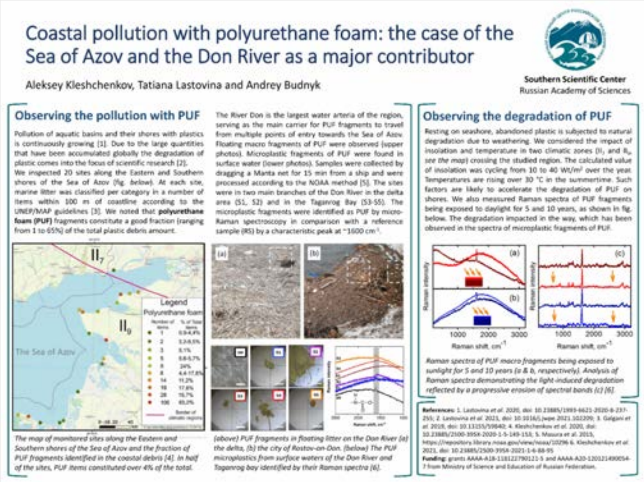
Lauren Chamberlain, Micah Brodsky

Since 2016, Hawaii Marine Animal Response (HMAR) has responded to hundreds of reports of hooked or entangled sea turtles, seabirds, and Hawaiian monk seals, on the island of Oahu, Hawaii. Data collected on marine protected species injured through fisheries interactions was used to guide in-water dive activity for survey and removal of derelict fishing gear. During the first two years of HMAR’s Marine Debris Program we have removed over 900 pounds of recreational fishing gear from 150 acres of nearshore habitat, which we monitor to enhance understanding of marine debris distribution and accumulation rates on Oahu.

Coastal Pollution with Polyurethane foam : The case of the sea of Azov and the Don River as a major contributor

Aleksey Kleshchenkov - Russian Academy of Sciences

T.A. Lastovina, A.P.Budnyk



The results of systematic observations of the spread of marine litter in coastal areas of the Sea of Azov are presented. A significant fraction of polyurethane foam (PUF) in the structure of plastic waste was noticed. The routes of PUF entry and the impact of its degradation from the insolation and the temperature were considered. Large fragments of PUF were recorded in floating debris accumulations while PUF microparticles were detected in all water samples collected in the Don River delta and Taganrog Bay. The Don River is considered a largest supplier of PUF fragments in the Sea of Azov.

Shedding light on marine plastic data to build research links between EU and US ocean research

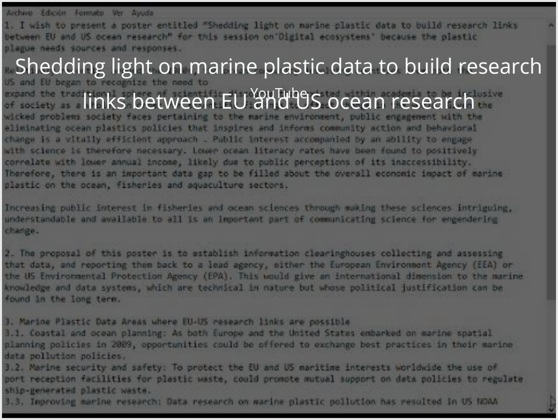
Enrique Wulff - Spanish National Research Council (CSIC)


Shedding light on marine plastic data to build research links between EU and US ocean research

Strategic aim
Ocean literacy is a practical attempt to collect marine plastic data

This poster emphasizes relevant values to build research links between EU and US within the scope of marine pollution data policies. It interprets ocean literacy in the special data case of the global risks posed by plastics (which call for citizen science based tools that can help fill data gaps relevant for policy). And it seeks to demonstrate that the effects of the US interdisciplinary and multiregional collaboration, regarding plastics data on the European partners, respond to the needs of the 21st Century paradigm concerning information. A proposal for a permanent access to marine plastic data is advanced.

https://www.youtube.com/watch?v=dJphEJ8tfFE



Archivo Edición Formato Ver Ayuda

1. I wish to present a poster entitled "Shedding light on marine plastic data to build research links between EU and US ocean research" for this session on 'Digital ecosystems' because the plastic plague needs sources and responses.

US and EU began to recognize the need to

wicked problems society faces pertaining to the marine environment, public engagement with the eliminating ocean plastics policies that inspires and informs community action and behavioral change is a vitally efficient approach . Public interest accompanied by an ability to engage with science is therefore necessary. Lower ocean literacy rates have been found to positively correlate with lower annual income, likely due to public perceptions of its inaccessibility. Therefore, there is an important data gap to be filled about the overall economic impact of marine plastic on the ocean, fisheries and aquaculture sectors.

Increasing public interest in fisheries and ocean sciences through making these sciences intriguing, understandable and available to all is an important part of communicating science for engendering change.

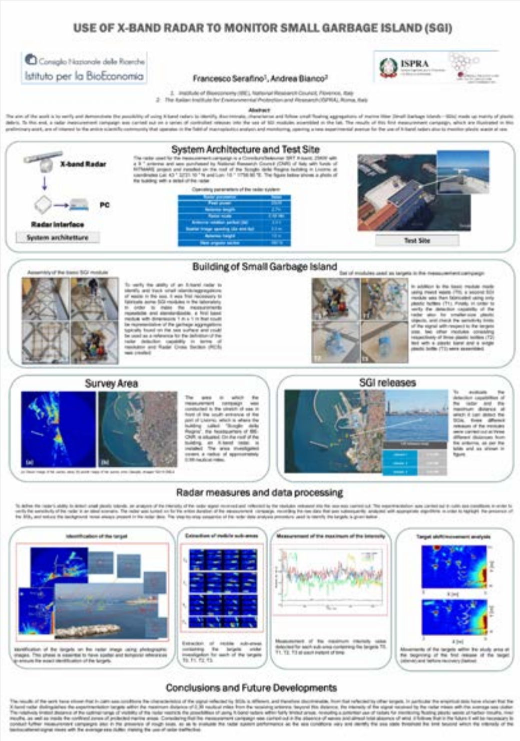
2. The proposal of this poster is to establish information clearinghouses collecting and assessing that data, and reporting them back to a lead agency, either the European Environment Agency (EEA) or the US Environmental Protection Agency (EPA). This would give an international dimension to the marine knowledge and data systems, which are technical in nature but whose political justification can be found in the long term.

3. Marine Plastic Data Areas where EU-US research links are possible
3.1. Coastal and ocean planning: As both Europe and the United States embarked on marine spatial planning policies in 2009, opportunities could be offered to exchange best practices in their marine data pollution policies.
3.2. Marine security and safety: To protect the EU and US maritime interests worldwide the use of port reception facilities for plastic waste, could promote mutual support on data policies to regulate ship-generated plastic waste.
3.3. Improving marine research: Data research on marine plastic pollution has resulted in US NOAA

Use of X-Band Radars to Monitor Small Garbage Islands

Francesco Serafino - Institute of Bioeconomy (IBE), National Research Council

Andrea Brianco

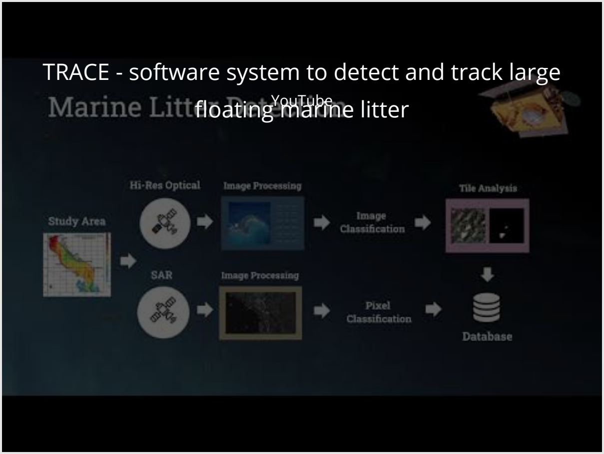


The aim of the work is to verify and demonstrate the possibility of using X-band radars to identify, discriminate, characterize and follow small floating aggregations of marine litter (Small Garbage Islands—SGIs) made up mainly of plastic debris. To this end, a radar measurement campaign was carried out on a series of controlled releases into the sea of SGI modules assembled in the lab. The results of this first measurement campaign, that are of interest to the entire scientific community that operates in the field of macroplastics monitoring, have shown that in calm sea conditions the characteristics of the signal reflected by SGIs is different, and therefore discriminable, from that reflected by other targets, opening in fact a new experimental avenue for the use of X-band radars also to monitor plastic waste at sea.

TRACE - software system to detect and track large floating marine litter

Tobias Weiss - GFZ Potsdam

Matthias Bochow, Ivan Cester, Michol Ghezzo, Christian Ferrarin, Melissande Machefer



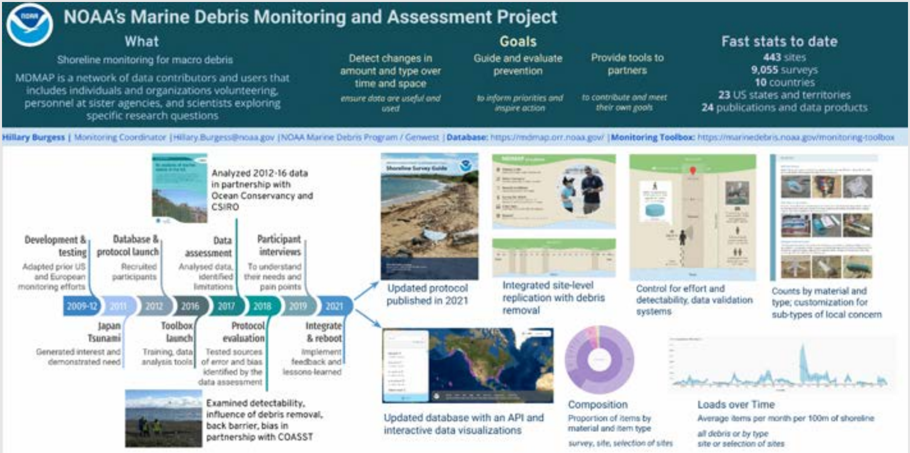
TRACE is a software system to detect and track large floating marine litter. The system consists of components for remote sensing data analysis for litter detection (high resolution optical and SAR satellite imagery) and identification (hyperspectral satellite imagery), oceanographic forecasting, GIS analysis (result evaluation, uncertainty analysis), litter tracking and a web interface for visualization and analysis purposes. The goal of our project is to obtain precise and reliable data on floating macro-litter regarding their quantity, position, accumulation zones, material properties, floating depth, and sources, which may serve as a basis for litter recovery, source elimination, and prevention of litter dispersal.

https://www.youtube.com/watch?v=w47InE5BAz4

NOAA Marine Debris Monitoring and Assessment Project (MDMAP)

Hillary Burgess - NOAA Marine Debris Program

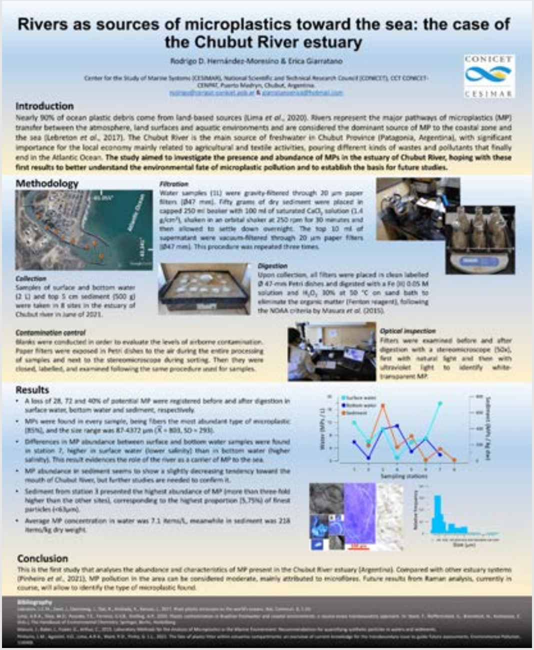
The NOAA Marine Debris Monitoring and Assessment Project (MDMAP) was established in 2011 and is run by the NOAA Marine Debris Program. Data collection follows a rigorous, well-tested protocol designed to document quantity and composition of shoreline marine debris greater than 2.5cm. The MDMAP functions as a network of volunteers, NGOs, and agency and academic personnel who contribute and use the data. The dataset is freely accessible via a browser application or API, and informs research, prevention, and management at local to regional scales. Outcomes range from improved understanding of marine debris accumulation drivers, to assessment of the efficacy of preventative legislation, to development of behavior change campaigns targeting source reduction.



Rivers as sources of microplastics toward the sea: the case of the Chubut River estuary

Rodrigo Hernandez Moresino - Centro para el Estudio de Sistemas Marinos (CESIMAR-CONICET)

Erica Giarratano



The Chubut River is the main source of freshwater in Chubut Province (Patagonia, Argentina), with significant importance for the local economy mainly related to agricultural and textile activities, pouring different kinds of wastes and pollutants that finally ends in the Atlantic Ocean. This work aims to assess microplastic concentration in water and sediment in seven stations along the estuary. Separation of microplastics was done on filtering superficial and depth water and in sediments by flotation with hypersaline solution plus supernatant filtering. An average of 200 MP/sediment and 7000/m3 water (85% fibers) emphasize the need for rational use of the river.

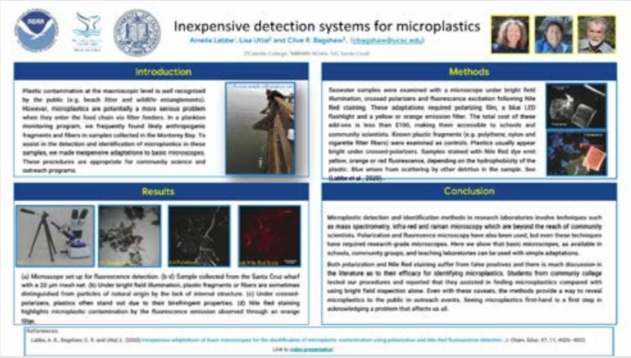
Inexpensive detection systems for microplastics

Amelia Labbe - University of California at Santa Cruz

Lisa Uttal & Clive Bagshaw

In order to identify microplastics in water samples, basic bright-field microscopes were modified for polarization and Nile Red fluorescence detection. These methods helped distinguish plastic fragments and fibers from natural material. The modifications cost less than $100, making the approach accessible to community scientists and schools. The procedures were used to bring microplastics to the attention of the public at outreach events and to provide a timely practical exercise in microscopy and environmental science for college students. https://sites.google.com/ucsc.edu/cbagshaw/outreach/mbnms-microplastics

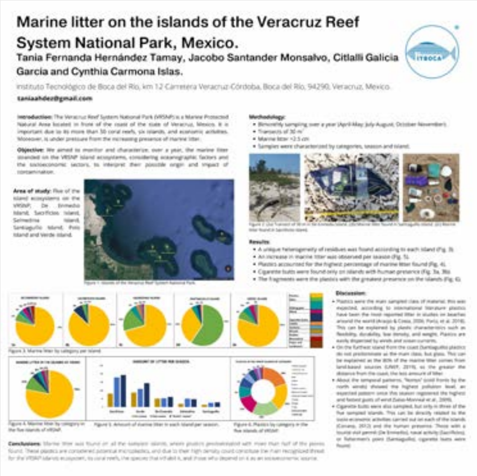
https://www.youtube.com/watch?v=utHs1gTMaII



Marine litter on the islands of the Veracruz Reef System National Park, Mexico.

Tania Hernandez - National Technology of Mexico / Technological Institute of Boca del Río

Jacobo Santander Monsalvo, Citlalli Galicia García and Cynthia Carmona Islas.

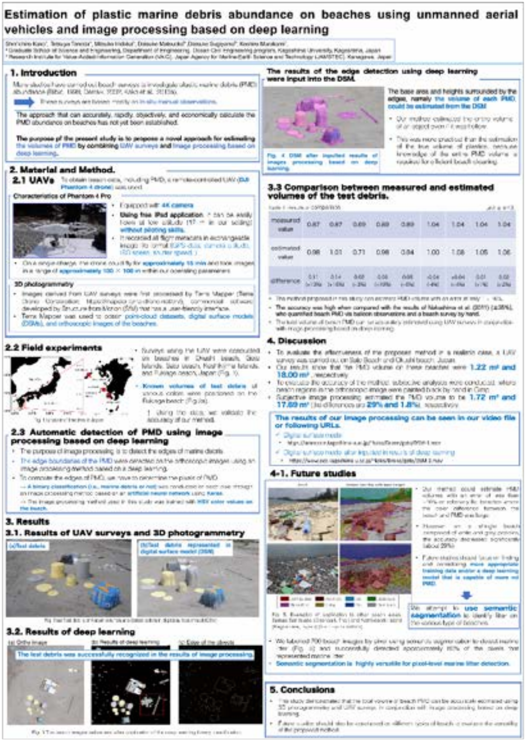


The Veracruz Reef System National Park (VRSNP) is a Natural Protected Area of 65,516 hectares with 28 reefs and six islands, located in the Gulf of Mexico. It is threatened by marine litter, recognized worldwide for its adverse impacts on biodiversity, human health and socio-economic activities. This work aims to characterize and monitor marine litter stranded on the island of the VRSNP, using quadrants, considering the oceanographic pattern, seasonality and coastal socioeconomic activities, to interpret its possible origin and impact. The main material found is plastic, but marine litter changes according to the location and management category of each island.

Estimation of plastic marine debris abundance on beaches using unmanned aerial vehicles and image processing based on deep learning

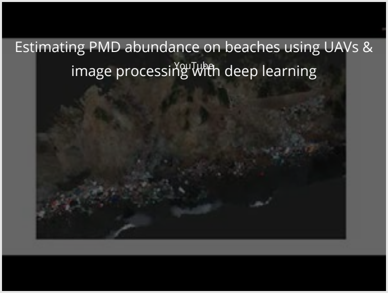
Shin'ichiro Kako - Kagoshima University

Tetsuya Tanedaa, Mitsuko Hidakab, Daisuke Sugiyamab, Koshiro Murakamib, and Daisuke Matsuokab



To help address plastic marine debris (PMD) problem, a novel approach for estimating PMD abundance using a combination of unmanned aerial vehicle (UAV) surveys and image processing based on deep learning is proposed. A three-dimensional model and orthoscopic image of a beach, constructed via Structure from Motion software using UAV-derived data, enabled PMD volumes to be computed by edge detection through image processing. Compared with subjective methods based on beach surveys, this approach can accurately, rapidly, and objectively calculate the PMD volume and can be used to improve the efficiency of beach surveys and identify beaches that need preferential cleaning.

https://www.youtube.com/watch?v=OwrJPke_DHs



The PlasticNet Project

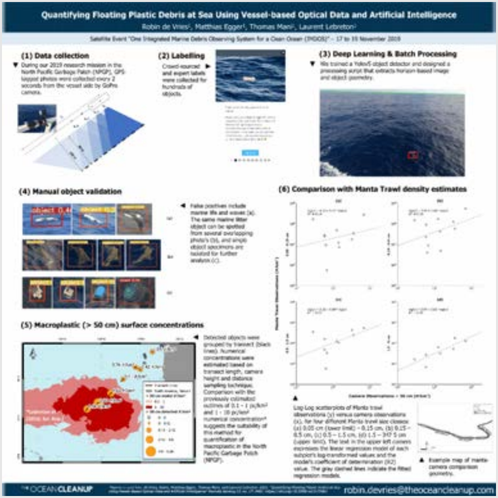
Naeem Altaf - IBM

Minsik Lee; Colin Alstad

"The PlasticNet Project is an “IBM Tech for Good” open-source project developed by the IBM Space Tech team to build a repository of AI object detection models to classify types/brands of plastics, trash on beaches, trash in the ocean, etc. We can scale this effort with the global community of developers participating and contributing towards this noble effort, with long-term goals to help with ocean cleanup and positively impact climate change."

Quantifying Floating Plastic Debris at Sea Using Vessel-based Optical Data and Artificial Intelligence

Robin de Vries - Ocean CleanUp

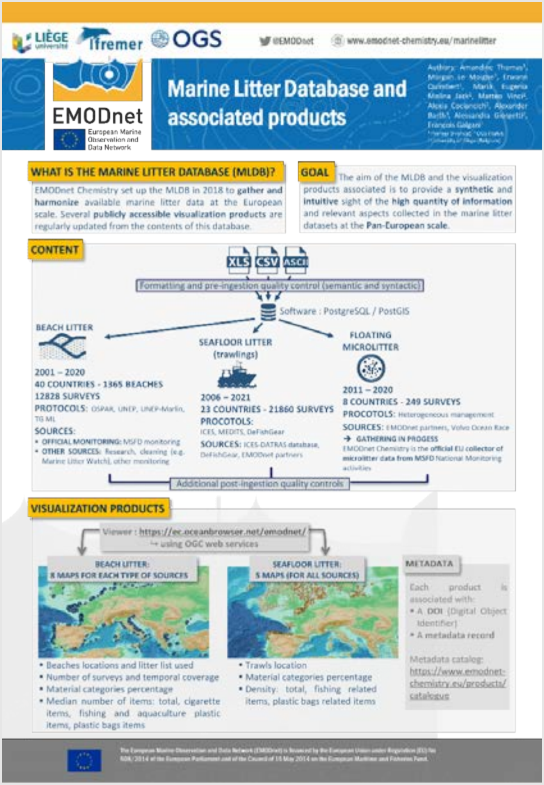


Despite recent advances in remote sensing of large accumulations of floating plastic debris, mainly in coastal regions, the quantification of individual macroplastic objects (>50 cm) remains challenging. Here, we have trained an object-detection algorithm by selecting and labeling footage of floating plastic debris recorded offshore with GPS-enabled action cameras aboard vessels of opportunity. Macroplastic numerical concentrations are estimated by combining the object detection solution with bulk processing of the optical data. Our results are consistent with macroplastic densities predicted by global plastic dispersal models, and reveal first insights into how camera recorded offshore macroplastic densities compare to micro- and mesoplastic concentrations collected with neuston trawls.

Marine Litter Database and associated products

Amandine Thomas - Ifremer

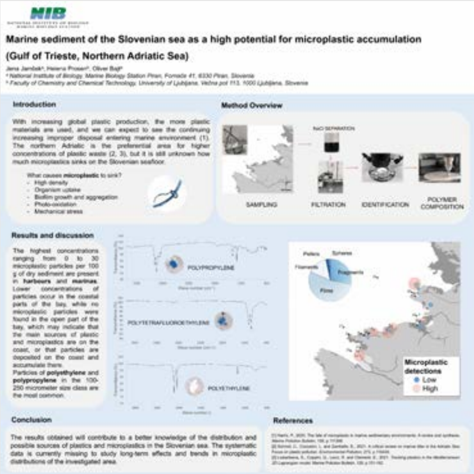
Morgan Le Moigne, Erwann Quimbert, François Galgani, Matteo Vinci, Maria Eugenia Molina Jack, Alexia Cociancich, Alessandra Giorgetti, Alexander Barth



EMODnet Chemistry set up a Marine Litter Database (MLDB) in 2018 to gather and harmonize available marine litter data at the European scale. This database contains data of beach and seafloor litter and data of floating micro-litter. Data are mainly provided by EMODnet project partners though there are additional sources from EU Member States and neighboring countries. Datasets have been collected over a long period (2001-2020), in the framework of MSFD monitoring programs, research projects or by European citizens through Citizen Science tools. Many data products, like beach and seafloor litter distribution or composition have been created from this database.

Distribution of microplastic particles in the surface sediment of Slovenian sea

Jena Jamsek - National Institute of Biology - Slovenia



The northern Adriatic is the preferential area for higher concentrations of plastic waste, but it is still unknown how much microplastics sinks on the Slovenian seafloor. Therefore, surficial sediment samples were collected using Van Veen grab. The polymer composition of the extracted particles was identified using Fourier transform infrared spectroscopy. The highest concentrations ranging from 0 to 28 microplastic particles per 100 g of sediment are present in harbours and marinas. Polyethylene and polypropylene were the most common plastic materials. The results obtained will contribute to a better knowledge of the distribution and possible sources of plastics and microplastics in the Slovenian sea.

EO based services that aim to detect marine pollution using freely available Sentinel imagery

Filipe Brandao - GMV

João Vitorino; Beatriz Revilla Romero; Omjyoti Dutta

"Marine pollution is a devastating problem that urges for new conceptual and technological solutions to help prevent, detect, monitor and mitigate the consequences of this environmental degradation. In this regard Earth Observation (EO) can contribute decisively for potential solutions. Considering this, GMV is developing EO based services that aim to detect marine pollution (plastics and marine spills) using freely available Sentinel imagery. The approaches being developed take advantage of multispectral data and machine learning to identify floating debris and spills. These services can be exploited for the identification of marine pollution hotspots, understanding flow dynamics and improve decision making."

Local community cum EO: An inclusive approach for marine debris monitoring and circularity.

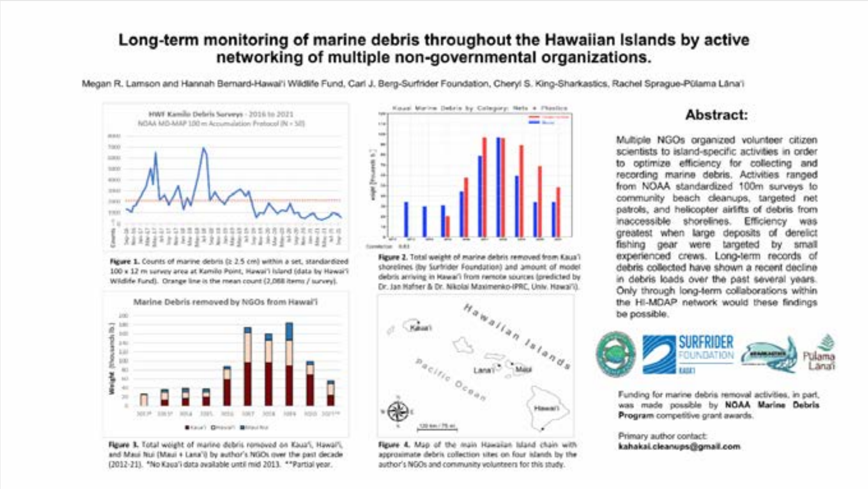
Elegbede, Isa Olalekan - Brandenburg University of Technology (BTU)
Lauren Chamberlain, Micah Brodsky

It's not again saying that marine debris is becoming a menace to humans and aquatic plants and animals. Due to these circumstances, various policies at the local, regional and global areas have been initiated. However, implementation of these regulations is yet to be actualized. This situation is caused by neglect of the local community and good use of innovative technologies. This study presents the creative use of local communities, visualized sensors, with ocean observation technologies to track ocean and coastal debris from origin to destination and connect to the circularity of the marine litter. Possibilities of ensuring inclusivity of both humans and technologies to monitor and recycle this debris for local and industrial benefits will significantly contribute to the SDG goals with the UN decade of action frameworks and secure empowerment possibilities for the local communities.

Long-term monitoring of marine debris throughout the Hawaiian Islands by active networking of multiple non-governmental organizations

Megan R. Lamson - Hawaii Wildlife Fund

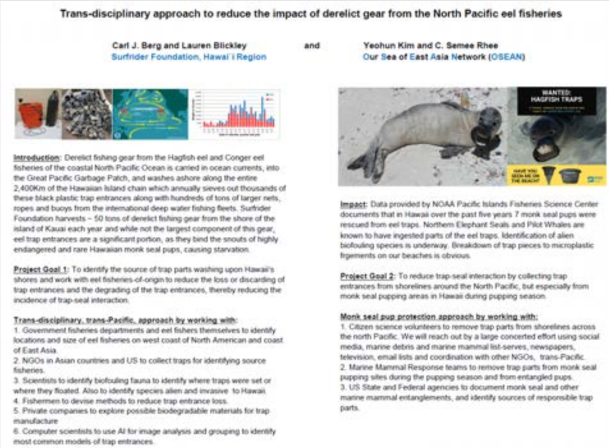
Carl Berg, Hannah Bernard, Cheryl S. King, Rachel Sprague



Trans-disciplinary approach to reduce the impact of derelict gear from the North Pacific eel fisheries

Carl J. Berg - Surfrider Foundation

Lauren Blickley - Surfrider Foundation,   Yeohun Kim and C. Semee Rhee - OSEAN



Trans-disciplinary approach to reduce the impact of derelict gear from the North Pacific eel fisheries

Carl J. Berg and Lauren Blickley
Surfrider Foundation, Hawai`i Region

and

Yeohun Kim and C. Semee Rhee
Our Sea of East Asia Network (OSEAN)

Introduction: Derelict fishing gear from the Hagfish eel and Conger eel fisheries of the coastal North Pacific Ocean is carried in ocean currents, into the Great Pacific Garbage Patch, and washes ashore along the entire 2,400Km of the Hawaiian Island chain which annually sieves out thousands of these black plastic trap entrances along with hundreds of tons of larger nets, ropes and buoys from the international deep water fishing fleets. Surfrider Foundation harvests ~ 50 tons of derelict fishing gear from the shore of the island of Kauai each year and while not the largest component of this gear, eel trap entrances are a significant portion, as they bind the snouts of highly endangered and rare Hawaiian monk seal pups, causing starvation.

Project Goal 1: To identify the source of trap parts washing upon Hawaii's shores and work with eel fisheries-of-origin to reduce the loss or discarding of trap entrances and the degrading of the trap entrances, thereby reducing the incidence of trap-seal interaction.

Trans-disciplinary, trans-Pacific, approach by working with:
1. Government fisheries departments and eel fishers themselves to identify locations and size of eel fisheries on west coast of North American and coast of East Asia.
2. NGOs in Asian countries and US to collect traps for identifying source fisheries.
3. Scientists to identify biofouling fauna to identify where traps were set or where they floated. Also to identify species alien and invasive to Hawaii.
4. Fishermen to devise methods to reduce trap entrance loss.
5. Private companies to explore possible biodegradable materials for trap manufacture
6. Computer scientists to use AI for image analysis and grouping to identify most common models of trap entrances.

Impact: Data provided by NOAA Pacific Islands Fisheries Science Center documents that in Hawaii over the past five years 7 monk seal pups were rescued from eel traps. Northern Elephant Seals and Pilot Whales are known to have ingested parts of the eel traps. Identification of alien biofouling species is underway. Breakdown of trap pieces to microplastic frgements on our beaches is obvious.

Project Goal 2: To reduce trap-seal interaction by collecting trap entrances from shorelines around the North Pacific, but especially from monk seal pupping areas in Hawaii during pupping season.

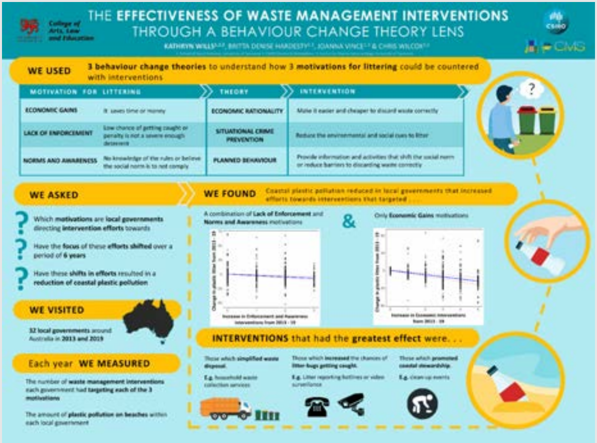
Monk seal pup protection approach by working with:
1. Citizen science volunteers to remove trap parts from shorelines across the north Pacific. We will reach out by a large concerted effort using social media, marine debris and marine mammal list-serves, newspapers, television, email lists and coordination with other NGOs, trans-Pacific.
2. Marine Mammal Response teams to remove trap parts from monk seal pupping sites during the pupping season and from entangled pups.
3. US State and Federal agencies to document monk seal and other marine mammal entanglements, and identify sources of responsible trap parts.

The eel fishing industries in the North Pacific Ocean contribute significant amounts of derelict fishing gear being washed ashore on the Hawaiian Islands. Cone-like trap entrances of derelict traps entangle and endanger Hawaiian monk seal pups and bring degrading marine plastics and alien species to Hawaii. To mitigate gear loss and the harmful impact on Hawaii's marine life, OSEAN and Surfrider Foundation are employing a transdisciplinary approach by working with citizen scientists, fishing cooperatives, governments, and relevant industry stakeholders to identify opportunities for innovative solutions to help prevent derelict gear and ultimately reduce harmful impacts on marine life and ecosystems.

Investigating the effectiveness of waste management interventions through a behaviour change theory lens.

Kathryn Willis - CSIRO Oceans and Atmosphere

Britta Denise Hardesty, Joanna Vince, Chris Wilcox



Regardless of where plastic pollution originates, management at the local level is crucial to the global success of reducing plastic pollution. There currently lacks a quantitative framework that connects local actions to measurable reductions of plastic in the coastal environment. We used three behavioural theories to characterize how local governments across the continent of Australia have targeted their waste management interventions, how those targeting interventions have changed over 6 years and identified which underlying behavioural approaches generated the greatest reduction in pollution. Interventions that encouraged stewardship of coastal areas or simplified waste disposal were correlated with reductions in local plastic pollution.

Overview of the dispersion of floating plastic debris, possible sources and hotspots points of litter accumulation on beaches and Marine Protected Areas (MPAs) on the North Coast of São Paulo State

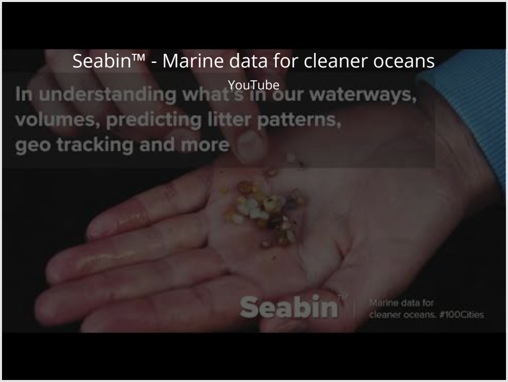
Maria Eugenia Fernandes - Asian Institute of Technology

My study aimed to provide an overview of the dispersion of floating plastic debris, possible sources and hotspots points of litter accumulation on beaches and Marine Protected Areas (MPAs) on the North Coast of São Paulo State - Brazil. A hydrodynamic numerical model and a particle dispersion model were used along with progressive and regressive vector techniques over time. To identify if there were differences with seasonal variations, the simulations were conducted considering data from January and July 2019. The results include relevant data that can be used by stakeholders to drive conservation actions for coastal and marine ecosystems, including MPAs.

Seabin Project

Solomon Wadani - Seabin Project

Mahi Paquette



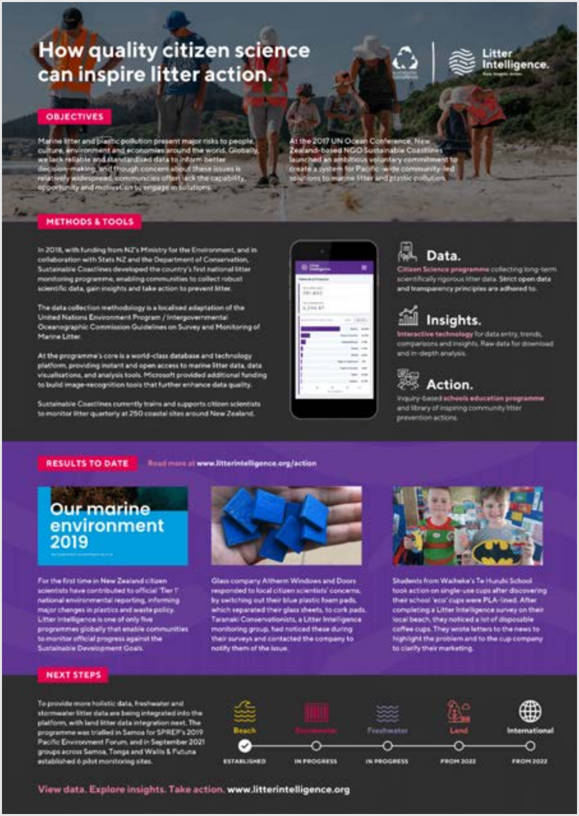
"Seabin™ is a data driven, clean tech, environmental start up that has established itself as a leading global authority in marine health monitoring, specialising in plastic pollution capture technology including micro plastics and micro fibres. Seabin™ hosts critical and detailed baseline data sets that focus on the prevalence and diversity of marine litter in metropolitan settings. Seabin™ data can therefore be used by key decision makers to facilitate policy and behavioural change to ensure healthier oceans and prosperity for our planet.

Our goal is to service 100 cities by 2050 via our scalable and sustainable model, that involves people, planet and profit.

https://www.youtube.com/watch?v=RdkTv_5GdtU

Litter Intelligence: Quality Citizen Science Inspiring Litter Action

Camden Howitt - Sustainable Coastlines

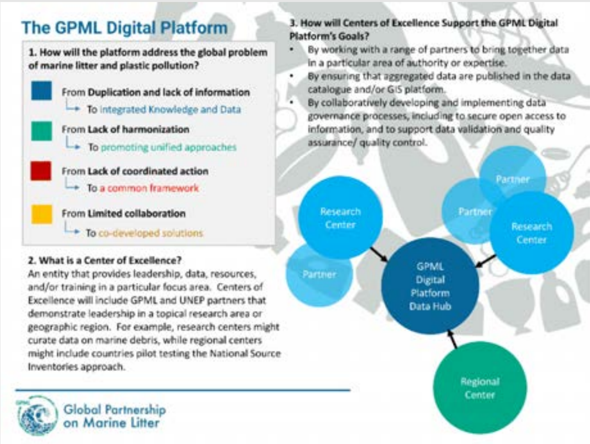


Communities want to participate in environmental monitoring that drives change, but seldom can do so with the scientific rigour that reporting programmes require. Litter Intelligence, developed by NGO Sustainable Coastlines, is New Zealand's first national litter monitoring programme, enabling communities to contribute robust scientific data from over 250 coastal sites. Designed in collaboration with the Ministry for the Environment, Stats NZ and the Department of Conservation, Litter Intelligence has already achieved major milestones, allowing citizen scientists for the first time to contribute to official 'Tier 1' national environmental reporting and informing major changes in plastics and waste policy.

The UNEP Global Partnership of Marine Litter - Digital Platform

Anne Bowser - UNEP

Heidi Savelli, Marta Ottogalli, Dany Ghafari, Saiful Ridwan, Lud Coppens, Caroline Kamau, Sarah Chitaha, and Clementine Logan



The Global Partnership on Marine Litter (GPML) Digital Platform connects and informs all actors working to address marine litter and plastic pollution through a lifecycle approach. The Platform's Data Hub provides a Geographic Information Systems (GIS) interface and API-enabled data catalogue to share open data and other relevant information related to a range of SDGs, including 6, 11, 12, and 14. As part of a larger federated ecosystem, the Platform and data hub will support and foster expert communities through a Centers of Excellence model that helps advance good practices in a range of topical areas or encourages regional coordination.

Monitoring of beached litter and microplastics in the water in the seas of Russia

Alexandra Ershova - Russian State Hydrometeorological University

Tatjana Eremina, Irina Makeeva, Yurii Tatarenko

The study presents several approaches used for monitoring of marine litter and microplastics in the Russian Federation by RSHU. Monitoring of beach litter pollution is done according to the two methods using a sieve ("frame method") and a rake ("rake method") with a mesh diameter of 2 mm in different parts of the beach from the wrack line to the vegetation line. The two methods are simple and relatively cheap and easy to use complementing each other and providing information on the visually distinguishable fraction of micro-debris (>2 mm). For water sampling RSHU has developed 2 models of the filtering device HydroPuMP (HydroPump for MicroPlastics) – a water sampling instrument with several replaceable meshes with sizes of up to 50 microns.

The Portuguese man o' war Physalia physalis, indicator of global health is threatened by plastic ocean contamination

Susel Castellanos-Iglesias

Programa de Pós-Graduação em Zoologia. Universidade Federal do Paraná

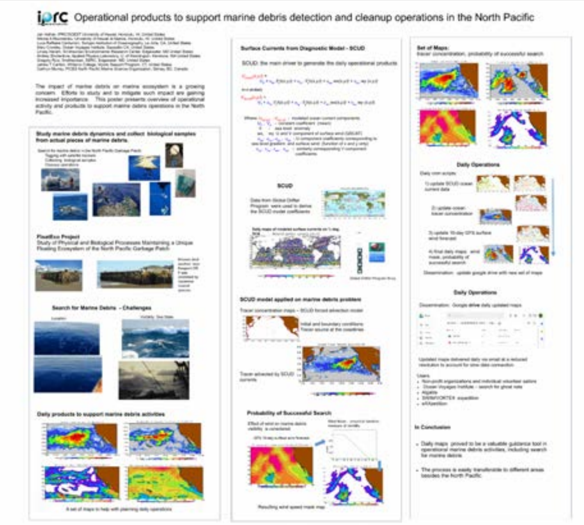
Maria Angélica Haddad, Miodeli Nogueira Júnior

Physalia physalis (Linnaeus, 1758) is one of the most toxic organisms on the planet affecting human health. Due to the presence of a gas bladder, it floats on the sea surface and depends on winds and marine currents to feed, reproduce and disperse in warm waters. The increase in reports in colder areas suggests it as a possible indicator species of climate change and as an invasive species in areas never reported. Contamination of plastic waste floating in the sea and plastic debris are threats to the ecology of this species and marine organisms that interact with it, which can affect predictions of ocean climate change and monitoring of the negative effects of ocean contamination on human health at local and global level.

Operational products to support marine debris detection and cleanup operations in the North Pacific.

Jan Hafner - IPRC/SOEST U. of Hawaii at Manoa

Nikolai Maximenko



With increased concern of marine debris there are growing efforts to mitigate its impact. To support the marine debris retrieval or location activities the following products were developed for the North Pacific Ocean:

1) daily maps of most likely concentration of marine debris

2) daily maps of probability of successful search for marine debris

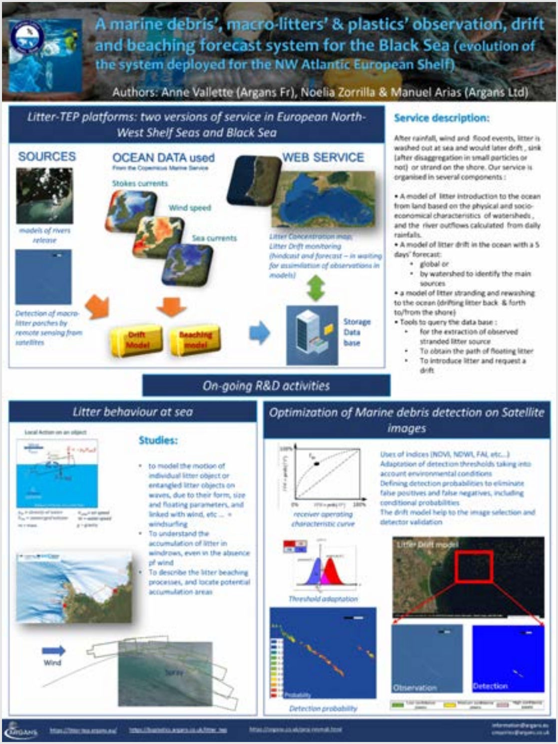
3) GFS (Global Forecast System) based 10 day wind speed forecast map

The resulting products are delivered via Google drive or individually by email to interested parties. Recently the maps were used by various organizations, e.g. Algalita, Ocean Voyaging Society,a number of volunteer sailors

A marine debris', macro-litters' & plastics' observation, drift and beaching forecast system for the Black Sea -evolution of the system deployed for the NW Atlantic European Shelf

Anne Vallette - Argans Ltd

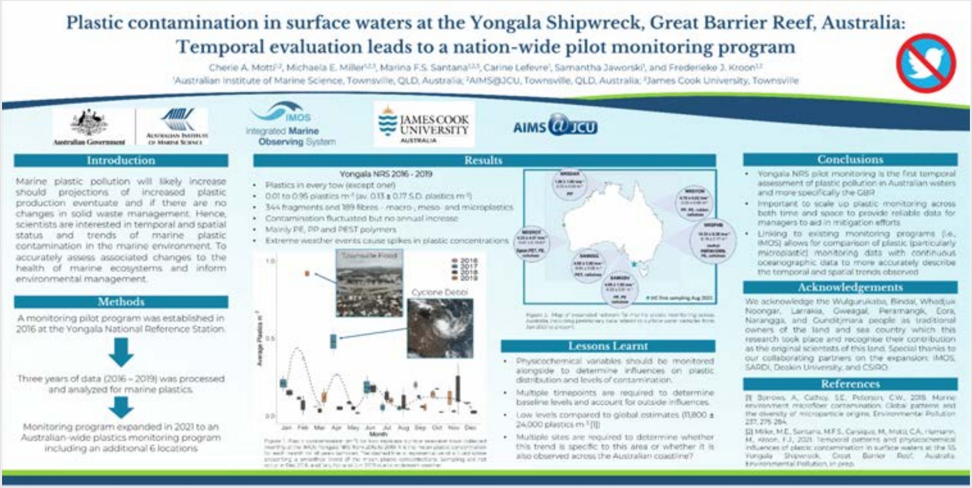
Noellia Zorilla & Manuel Arias



Further to i. a pre-feasibility study of an Earth-Observation satellite mission dedicated to the detection and mapping of marine litter presence which was conducted for ESA in cooperation with space industry, NGOs and academic research institutions (https://argans.co.uk/proj-resmali.html), and to ii. an internal research study on the sources of litter in urban and rural areas, Argans deployed iii. a generic forecast system for litter pollution spreading from the NW Atlantic European watersheds, shores and cities (https://litter-tep.argans.eu/), developed iv. macro-litter detection schemes using current operational satellites for the (pan-)European waters (NW Atlantic, the Med and the Black Sea), and v. improved the parametrization of litter drift and beaching models (https://bsplastics.argans.co.uk/litter_tep) to prepare for the assimilation of observations from space. Critical to further progress is (a) the understanding of the processes for their beaching, washing, wearing, breaking, dispersing and sinking at/near the shore, as well as (b) the calculation of the lifetime of drifting macro-litter, which needs a proper model of the way they 'sail' or 'windsurf'.

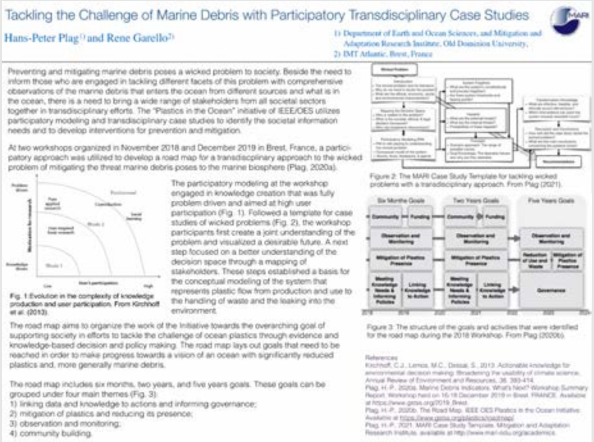
Plastic contamination in surface waters at the Yongala Shipwreck, Great Barrier Reef, Australia

Cherie A. Motti - Australian Institute of Marine Science (AIMS)
Michaela E. Miller, Marina F. S. Santana, Carine Lefevre, Samantha Jaworski and Frederieke J. Kroon



Tackling the Challenge of Marine Debris with Participatory Transdisciplinary Case Studies

Hans Peter Plag - Old Dominion University Rene Garello



Tackling the Challenge of Marine Debris with Participatory Transdisciplinary Case Studies

Hans-Peter Plag[1] and Rene Garello[2]

1) Department of Earth and Ocean Sciences, and Mitigation and Adaptation Research Institute, Old Dominion University,
2) IMT Atlantic, Brest, France

Preventing and mitigating marine debris poses a wicked problem to society. Beside the need to inform those who are engaged in tackling different facets of this problem with comprehensive observations of the marine debris that enters the ocean from different sources and what is in the ocean, there is a need to bring a wide range of stakeholders from all societal sectors together in transdisciplinary efforts. The "Plastics in the Ocean" initiative of IEEE/OES utilizes participatory modeling and transdisciplinary case studies to identify the societal information needs and to develop interventions for prevention and mitigation.

At two workshops organized in November 2018 and December 2019 in Brest, France, a participatory approach was utilized to develop a road map for a transdisciplinary approach to the wicked problem of mitigating the threat marine debris poses to the marine biosphere (Plag, 2020a).

Fig. 1 Evolution in the complexity of knowledge production and user participation. From Kirchhoff et al. (2013).

The participatory modeling at the workshop engaged in knowledge creation that was fully problem driven and aimed at high user participation (Fig. 1). Followed a template for case studies of wicked problems (Fig. 2), the workshop participants first create a joint understanding of the problem and visualized a desirable future. A next step focused on a better understanding of the decision space through a mapping of stakeholders. These steps established a basis for the conceptual modeling of the system that represents plastic flow from production and use to the handling of waste and the leaking into the environment.

The road map aims to organize the work of the Initiative towards the overarching goal of supporting society in efforts to tackle the challenge of ocean plastics through evidence and knowledge-based decision and policy making. The road map lays out goals that need to be reached in order to make progress towards a vision of an ocean with significantly reduced plastics and, more generally marine debris.

The road map includes six months, two years, and five years goals. These goals can be grouped under four main themes (Fig. 3):
1) linking data and knowledge to actions and informing governance;
2) mitigation of plastics and reducing its presence;
3) observation and monitoring;
4) community building.

Figure 2: The MARI Case Study Template for tackling wicked problems with a transdisciplinary approach. From Plag (2021).

Figure 3: The structure of the goals and activities that were identified for the road map during the 2018 Workshop. From Plag (2020b).

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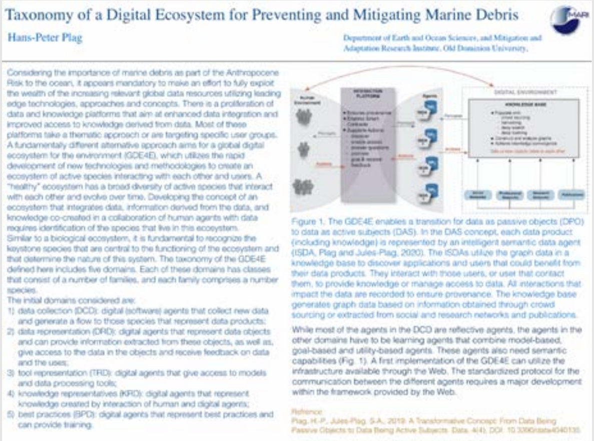
Kirchhoff, C.J., Lemos, M.C., Dessai, S., 2013. Actionable knowledge for environmental decision making: Broadening the usability of climate science. Annual Review of Environment and Resources, 38, 393-414.
Plag, H.-P., 2020a. Marine Debris Indicators. What's Next? Workshop Summary Report. Workshop held on 16-18 December 2019 in Brest, FRANCE. Available at https://www.geoss.org/2019_Brest.
Plag, H.-P., 2020b. The Road Map. IEEE OES Plastics in the Ocean Initiative. Available at https://www.geoss.org/plastics/roadmap/
Plag, H.-P., 2021. MARI Case Study Template. Mitigation and Adaptation Research Institute, available at http://www.mari-odu.org/academics.

Preventing and mitigating marine debris poses a wicked problem to society. Beside the need to inform those who are engaged in tackling different facets of this problem with comprehensive observations of the marine debris that enters the ocean from different sources and what is in the ocean, there is a need to bring a wide range of stakeholders from all societal sectors together in transdisciplinary efforts. The Plastics in the Ocean initiative of IEEE/OES utilizes participatory modeling and transdisciplinary case studies to identify the societal information needs and to develop interventions for prevention and mitigation.

Taxonomy of a Digital Ecosystem for Preventing and Mitigating Marine Debris

Hans Peter Plag - Old Dominion University



Taxonomy of a Digital Ecosystem for Preventing and Mitigating Marine Debris

Hans-Peter Plag

Department of Earth and Ocean Sciences, and Mitigation and Adaptation Research Institute, Old Dominion University.

Considering the importance of marine debris as part of the Anthropocene Risk to the ocean, it appears mandatory to make an effort to fully exploit the wealth of the increasing relevant global data resources utilizing leading edge technologies, approaches and concepts. There is a proliferation of data and knowledge platforms that aim at enhanced data integration and improved access to knowledge derived from data. Most of these platforms take a thematic approach or are targeting specific user groups. A fundamentally different alternative approach aims for a global digital ecosystem for the environment (GDE4E), which utilizes the rapid development of new technologies and methodologies to create an ecosystem of active species interacting with each other and users. A "healthy" ecosystem has a broad diversity of active species that interact with each other and evolve over time. Developing the concept of an ecosystem that integrates data, information derived from the data, and knowledge co-created in a collaboration of human agents with data requires identification of the species that live in this ecosystem.

Similar to a biological ecosystem, it is fundamental to recognize the keystone species that are central to the functioning of the ecosystem and that determine the nature of this system. The taxonomy of the GDE4E defined here includes five domains. Each of these domains has classes that consist of a number of families, and each family comprises a number species.

The initial domains considered are:

1) data collection (DCD): digital (software) agents that collect new data and generate a flow to those species that represent data products;
2) data representation (DRD): digital agents that represent data objects and can provide information extracted from these objects, as well as, give access to the data in the objects and receive feedback on data and the uses;
3) tool representation (TRD): digital agents that give access to models and data processing tools;
4) knowledge representatives (KRD): digital agents that represent knowledge created by interaction of human and digital agents;
5) best practices (BPD): digital agents that represent best practices and can provide training.

Figure 1. The GDE4E enables a transition for data as passive objects (DPO) to data as active subjects (DAS). In the DAS concept, each data product (including knowledge) is represented by an intelligent semantic data agent (ISDA, Plag and Jules-Plag, 2020). The ISDAs utilize the graph data in a knowledge base to discover applications and users that could benefit from their data products. They interact with those users, or user that contact them, to provide knowledge or manage access to data. All interactions that impact the data are recorded to ensure provenance. The knowledge base generates graph data based on information obtained through crowd sourcing or extracted from social and research networks and publications.

While most of the agents in the DCD are reflective agents, the agents in the other domains have to be learning agents that combine model-based, goal-based and utility-based agents. These agents also need semantic capabilities (Fig. 1). A first implementation of the GDE4E can utilize the infrastructure available through the Web. The standardized protocol for the communication between the different agents requires a major development within the framework provided by the Web.

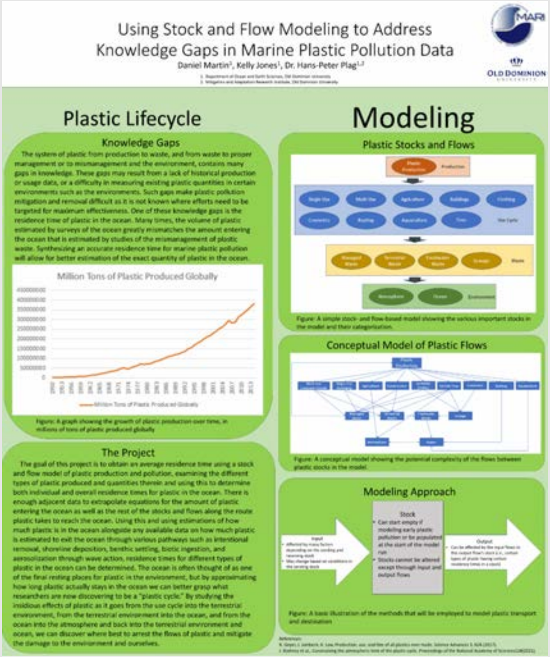
Reference:
Plag, H.-P., Jules-Plag, S.A., 2019. A Transformative Concept: From Data Being Passive Objects to Data Being Active Subjects. Data, 4(4), DOI: 10.3390/data4040135.

Considering the importance of marine debris as part of the Anthropocene Risk to the ocean, it appears mandatory to make an effort to fully exploit the wealth of the increasing relevant global data resources utilizing leading edge technologies, approaches and concepts. While the proliferation of data and knowledge platforms is enhancing data integration and improved access to knowledge, a digital ecosystem with a broad diversity of active species that interact with each other and evolve would fully utilize the information wealth. The taxonomy of the ecosystem is developed and possible approaches to the implementation are described.

Estimating Residence Times of Plastic in the Ocean

Dan Martin - Old Dominion University

Hans-Peter Plag, Kelly Jones

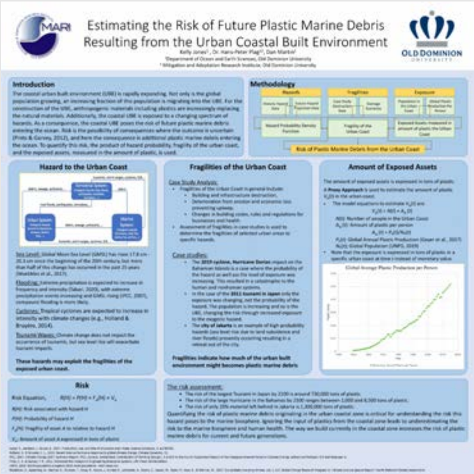


The system of plastic from production to waste, and from waste to proper management or to mismanagement and leakage into the environment contains many gaps in knowledge. One of these knowledge gaps is the residence time of plastic in the ocean. In many cases, the volume of plastic estimated by surveys of the ocean greatly mismatches the estimated amount of mismanaged plastic waste. A comprehensive stock and flow model of plastic production and pollution is used to improve estimates of overall residence times as well as individual residence times for different types of plastic in the ocean.

Estimating the Risk of Future Marine Debris Resulting from the Coastal Built Environment

Kelly Jones - Old Dominion University

Hans-Peter Plag, Dan Martin

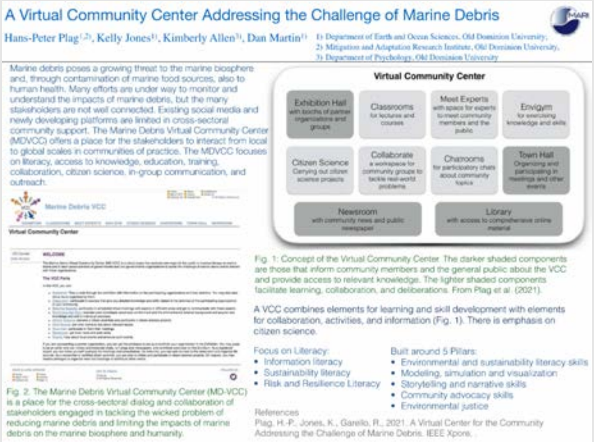


The expanding urban coast poses a rapidly growing risk of marine debris entering the ocean with unknown consequences for the marine biosphere and for current and future generations. The urban coast is exposed to a spectrum of hazards including storms, tsunamis, and sea level rise. The risk of plastic marine debris entering the ocean is quantified by the product of hazard probability, fragility of the urban coast, and the amount of plastic accumulated in the urban coast. The results indicate that the risk of future marine debris exceeds by far the amount estimated to be currently in the ocean.

A Virtual Community Center Addressing the Challenge of Marine Debris

Hans Peter Plag - Old Dominion University

Kelly Jones, Kimberly Allen, Dan Martin



Marine debris poses a growing threat to the marine biosphere and, through contamination of marine food sources, also to human health. Many efforts are under way to monitor and understand the impacts of marine debris, but the many stakeholders are not well connected. Existing social media and newly developing platforms are limited in cross-sectoral community support. The Marine Debris Virtual Community Center (MDVCC) offers a place for the stakeholders to interact from local to global scales in communities of practice. The MDVCC focuses on literacy, access to knowledge, education, training, collaboration, citizen science, ingroup communication, and outreach.

Integration of observing systems of marine debris and biodiversity

Nikolai Maximenko - University of Hawaii

Artur P. Palacz, Lauren Biermann, James Carlton, Luca Centurioni, Mary Crowley, Jan Hafner, Linsey Haram, Rebecca Helm, Verena Hormann, Cathryn Murray, Gregory Ruiz, Andrey Shcherbina, Justin Stop, Davida Streett, Toste Tanhua, Cynthia Wright, and Chela Zabin

The Ocean Plastic Webinars

Audrey Hasson (Mercator Ocean International)
Delphine Lobelle (university of Utrecht)
Ryota Nakajima (JAMSTEC)
Takunda Chitaka (University of Western Cape)

The Ocean Plastic Webinars (OPW) series is a new space created by four early-career ocean professionals (ECOPs) where scientists from different fields with an interest in the origin and fate of ocean plastics can network efficiently, share their research, and exchange ideas.

Since our first webinar in June 2020, we have already organized 15 events covering a wide range of topics from physical oceanography to biochemistry, having specialists answer a total of over 300 questions from our live viewers. Our webinars, which are available on our YouTube channel, have reached over 7,000 views in total and are mobilizing scientists from across the globe.

Visit our website for more in this webinar series:
> www.oceanplasticwebina.wixsite.com/homepage

Ocean BRIDGES

Delphine Lobelle (University of Utrecht)
Sigi Gruber (Advisor for the EU Commission)
Audrey Hasson (Mercator Ocean International)

Diversity is key for addressing the observed changes in the Ocean as it affects everyone via the sharing of global commons. Career stages are one aspect of diversity. The added value of this Working Group is therefore the two-way expertise-sharing between Early Career Ocean Professionals (ECOPs) and Experienced (mid to late career) Ocean Professionals (EOPs) working towards ocean solutions. ECOPs face challenges when working to advance knowledge, develop skills and thrive as future ocean leaders
Bridging ocean research, innovation and diversity across generations of experts and stakeholders by addressing specific challenges the global ocean is facing today.

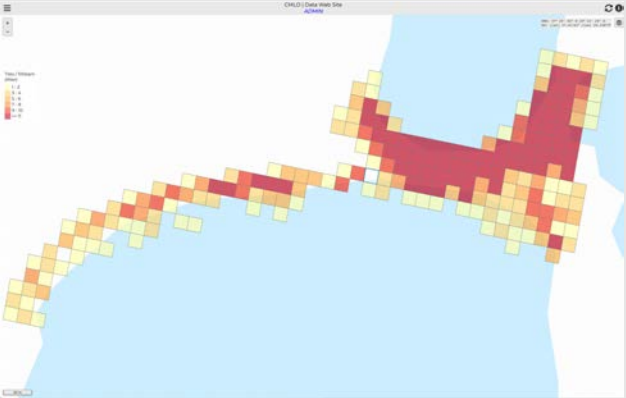
https://forms.office.com/r/KiKQqN3uCc

https://docs.google.com/document/d/1AX_bALI9mP32eTe2FmoAy5mBNcmeqVpK3hyBPp3N1m8/edit?usp=sharing

Coastal Marine Litter Observatory (CMLO)

K. Topouzelis (Aegean)

A. Papakonstantinou, A. Moustakas, M. Simos

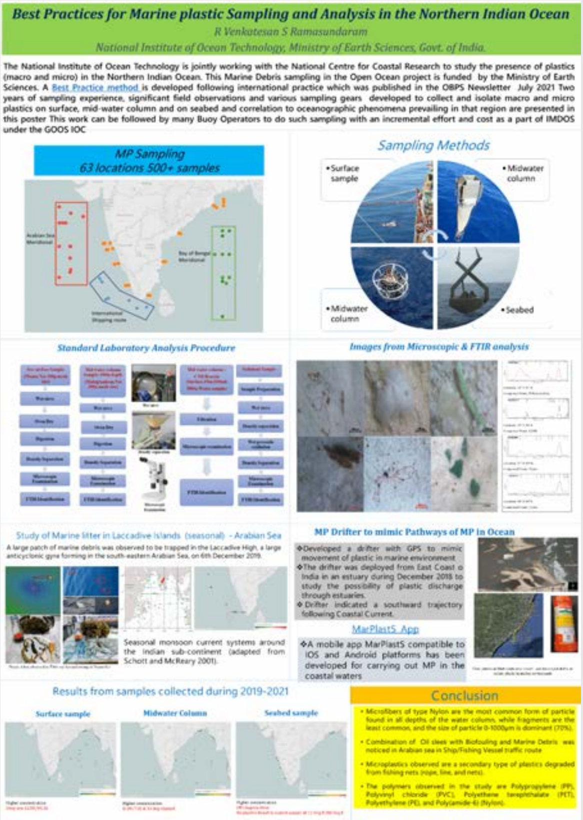


The presence of Marine Litter (ML) has been recognized as a significant environmental problem, as it can dramatically affect flora and fauna and produce severe economic impact on coastal communities, tourism, and fisheries. Existing data collection and monitoring systems are limited and unable to respond to the spatiotemporal change and the dynamics of their concentrations in the marine and coastal environment. In this context, the Marine Remote Sensing Group (MRSG), Department of Marine Science, University of the Aegean, has created the Coastal Marine Litter Observatory (CMLO) https://cmlo.aegean.gr/, which aims to detect and map the marine litter in the coastal zone with the combined use of Unmanned Aerial Systems (UAS) and machine learning methods.

CMLO aims to improve the detection and mapping of marine litter in the coastal zone . The results presented through CMLO are open through a dedicated geospatial portal. In the CMLO system, the detection of marine debris in the coastal zone is visualized as density maps. The system provides functionalities for interaction with the results of the detection for every beach that is monitored.

Best Practices for Marine plastic Sampling and Analysis in the Northern Indian Ocean

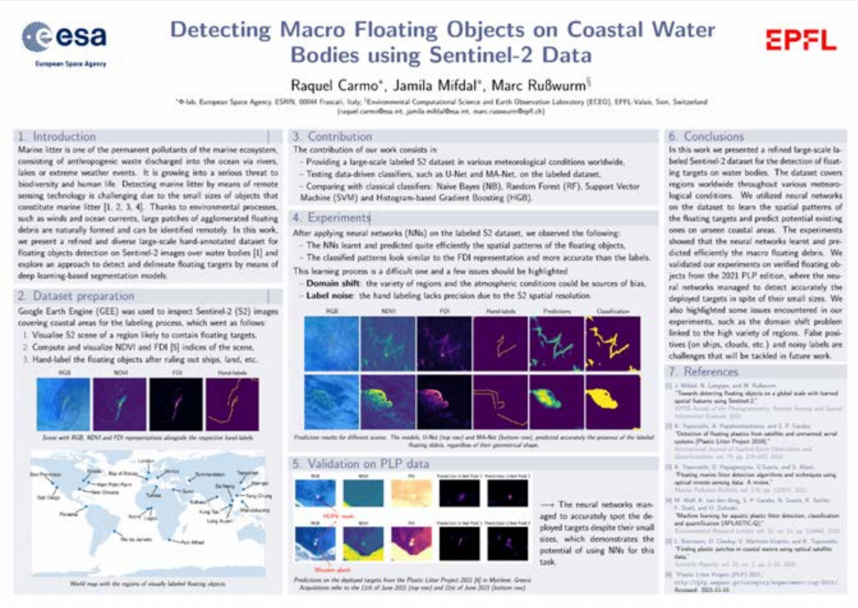
R Venkatesan S Ramasundaram
(National Institute of Ocean Technology, Ministry of Earth Sciences, Govt. of India)



Detecting Macro Floating Objects on Coastal Water Bodies using Sentinel-2 Data

Raquel Carmo, ESA Φ-lab

Jamila Mifdal , Marc Russwurm



Standardization of methods to measure plastic pollution by 2024 ?

Amy Lusher - Norwegian Institute for Water Research (NIVA)