TASK FORCE ON REMOTE SENSING OF MARINE LITTER AND DEBRIS

Overview

Shungu Garaba
shungu.garaba@uol.de

COMMITTEE MEETING 25

04 May 2021

The problem

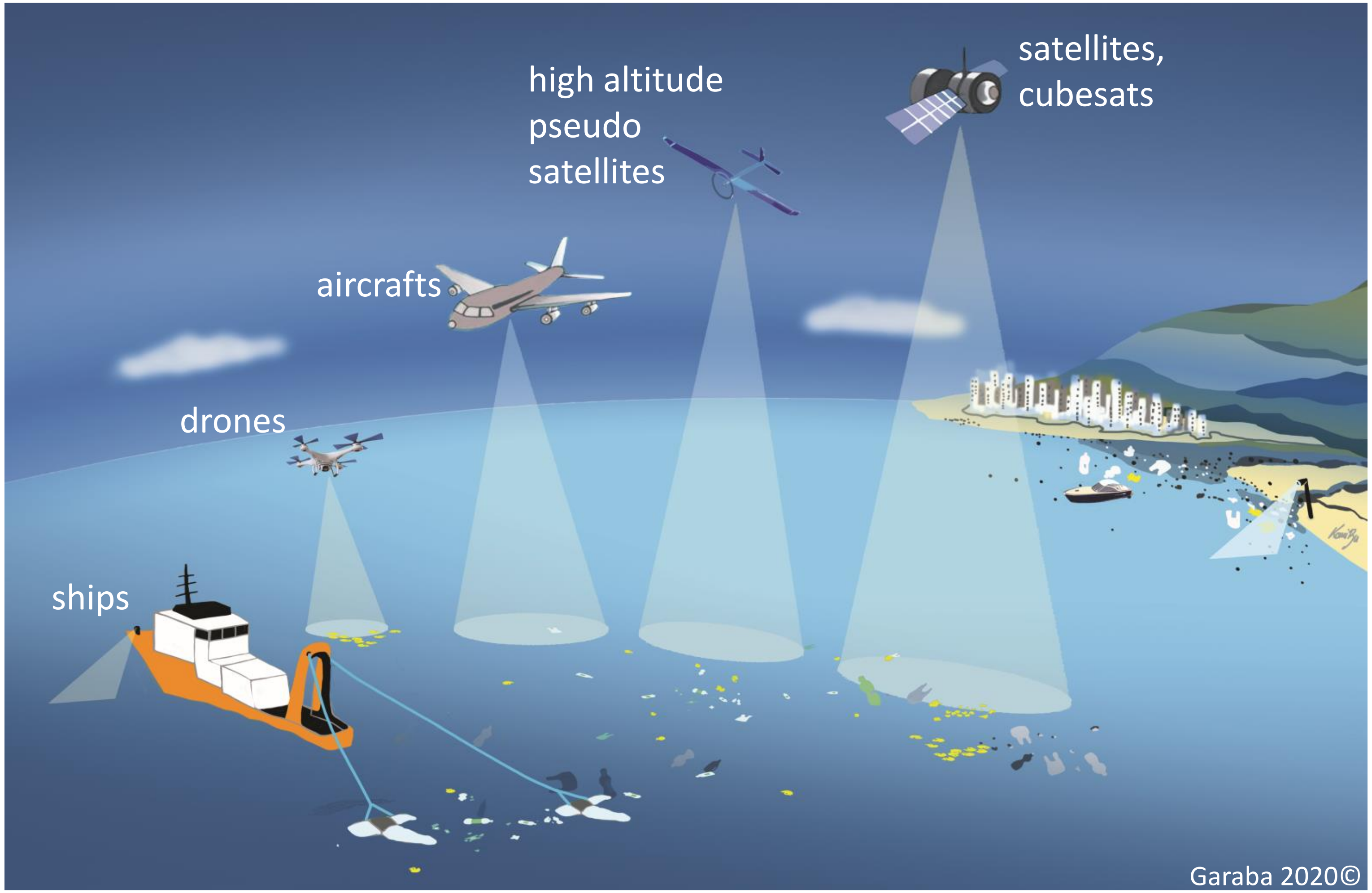
Plastics of all sizes

Microplastic beaching event in Kailua in Hawaii, USA.

Floating packaging waste in Cambodia Sihanoukville.
Courtesy of Grace Smith, Klaus Sattler and KCC

Introduction

Technologies of Interest in sensing Marine Litter and Debris

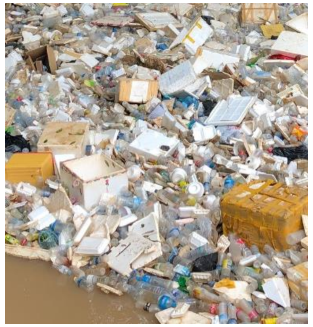


Fixed
observatories

Introduction

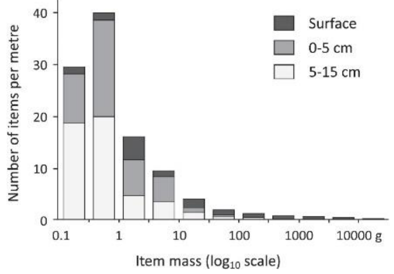
Stakeholder Expected Capabilities

- These technologies have prospects in supporting **scientific evidence-based** approaches to **detect**, **identify**, **quantify** and **track** floating plastic litter.



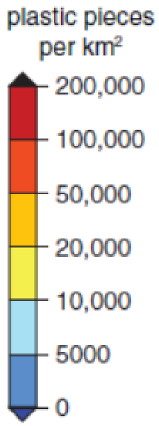
Detect
Object identification algorithms using the shape, colour, size and form descriptors in RGB true colour images.

Track
Fixed platforms or geostationary, daily imagery utilizing the detection and identification algorithms.



Ryan et al., 2020

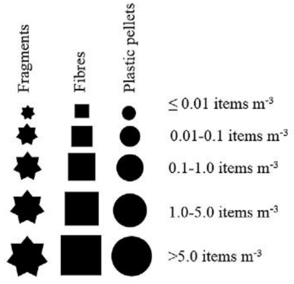
Quantify
Actual counts, pixel coverage, area coverage



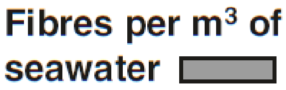
Law et al., 2010

Identify (Distinguish)
FTIR, Raman, SWIR and thermal infrared to determine polymers types.

https://www.acmeplastics.com/content/your-guide-to-plastic-recycling-symbols/



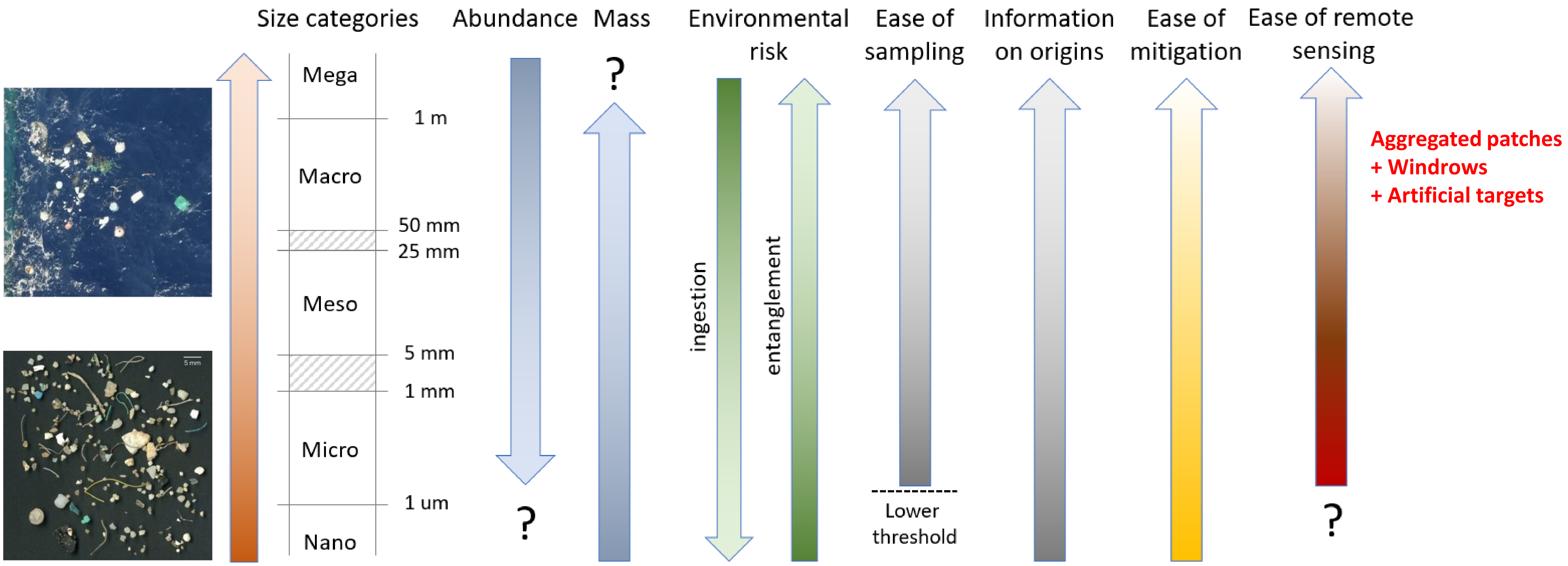
Ivar do Sul and Costa, 2014



Bergmann et al., 2015

What size class of plastics can we see from these technologies

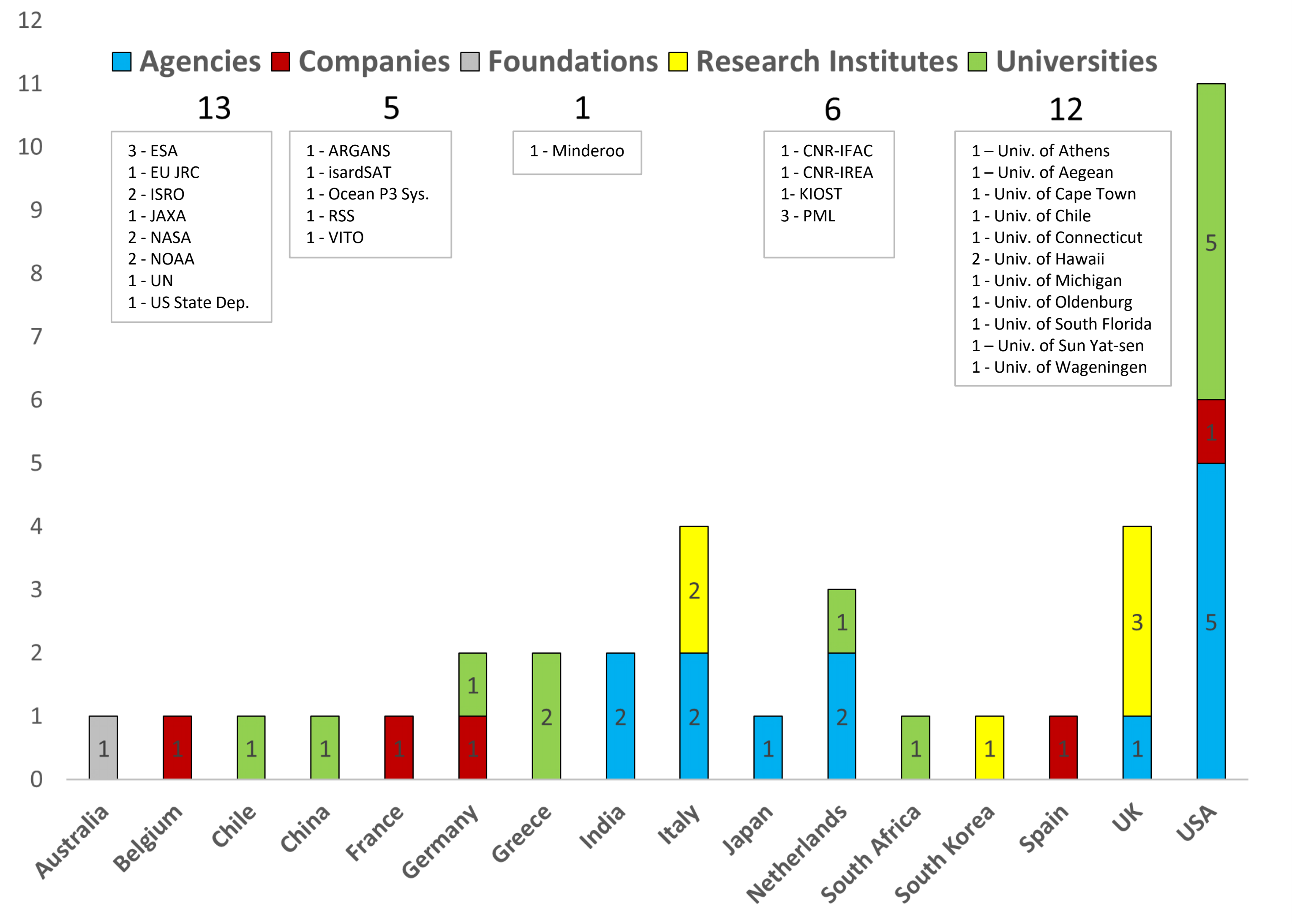
- Factors to consider as proposed by Ryan et al. (2020).

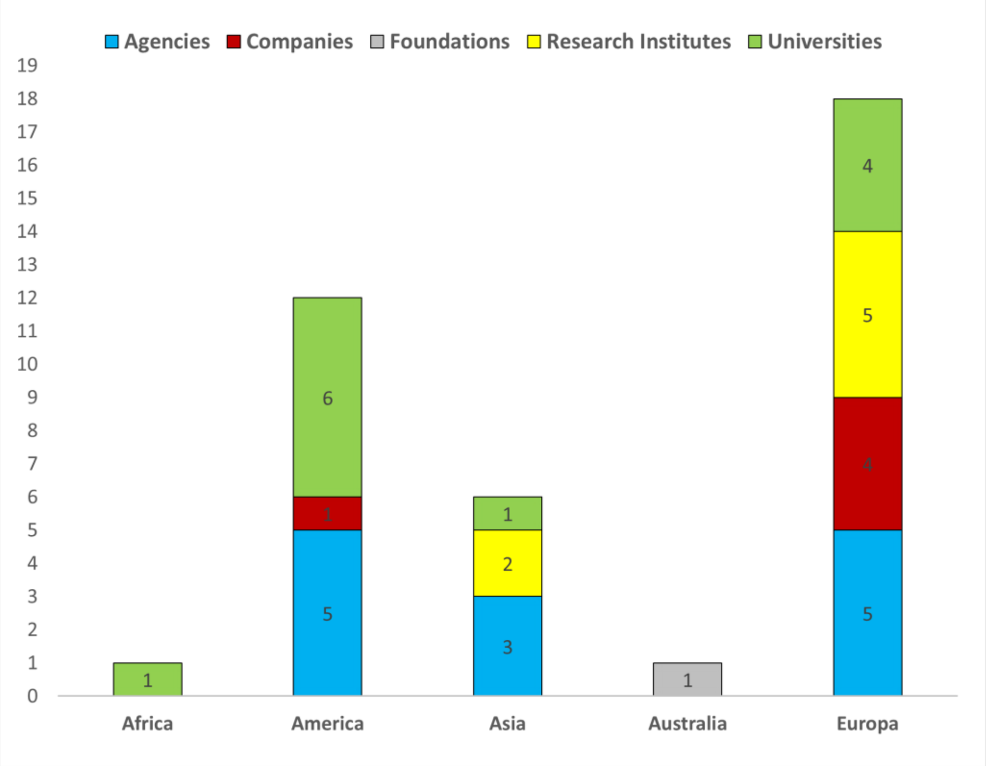


Modified after Ryan et al., 2020

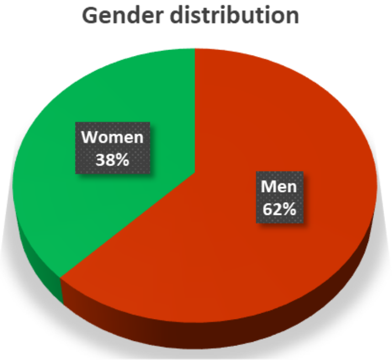
Task Force Composition

IOCCG International Ocean Colour Coordinating Group





37 Members in total
5 co-Chairs
4 CT Coordinators
29 CT members



https://ioccg.org/co-chairs-rsml/

Task Force Composition

Paolo Corradi
Agency Co-Chair
ESA

Laura Lorenzoni
Agency Co-Chair
NASA

Debashis Mitra
Agency Co-Chair
ISRO

Hiroshi Murakami
Agency Co-Chair
JAXA

Shungu Garaba
Scientific Co-Chair
CT3 Coordinator
Univ. of Oldenburg

Task Force primary goal will be to **coordinate** the advancement of current and future remote sensing technologies and techniques that have potential to provide observations of plastic litter over all aquatic environments.

Task Force Composition

Manuel Arias
CT2 Coordinator
ARGANS

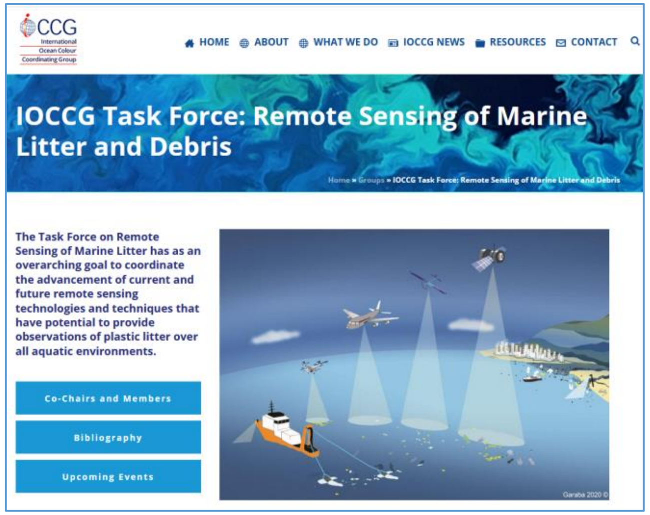
Lauren Biermann
CT4 Coordinator
PML

Francois-Régis Martin-Lauzer
Founding Member
ARGANS

Victor Martinez-Vicente
CT1 Coordinator
PML

Task Force Progress

https://ioccg.org/group/marine-litter-debris/



Big Thank you to Venetia!

February 2021

Kick Off Meeting 18 February

- **Website launched.**
- **Team members introduced.**

April 2021

First Bi-monthly Committee Meeting on 20 April

- **Co-Chairs + Coordinators + Founding members.**
- **Updates on Core Topic progress were provided.**
- **Date for first workshop was proposed 7-9 July 2021 week.**

July 2021

First Task Force Workshop

- **7-9 July 2021 week.**
- **Steering committee being formed.**

Task Force Progress

IOCCG International Ocean Colour Coordinating Group

Website - 'Living' Bibliography

- We now have 50 peer reviewed papers (May 2021) related to remote sensing of marine litter and debris.
- We also have established a dedicated Datasets Bibliography.

If you would like to view recently-published papers, just enter the current year in "Search by Keyword". You can also search using the author's last name or another key word. For papers dealing with Remote Sensing of Marine Litter and Debris use the keyword "RSMLD".

Bibliography

Search by Keyword

RSMLD

Browse by Letter

A ☐
B ☐
C ☐
D ☐
G ☐
H ☐
J ☐
K ☐
M ☐
P ☐
S ☐
T ☐
V ☐

Reset Your Selections

Acuña-Ruz, T., Uribe, D., Amézquita, L., Guzmán, C., Taylor R., Merrill, J., Martínez P., Voisin, Mattar, C. (2018). Anthropogenic marine debris over beaches: Spectral characterization for remote sensing applications. *Remote Sensing of Environment*, 217: 309-322, https://doi.org/10.1016/j.rse.2018.08.008.

Andriolo, U., Gonçalves, G., Bessa, F., Sobral, P. (2020). Mapping marine litter on coastal dunes with unmanned aerial systems: A showcase on the Atlantic Coast. *Science of the Total Environment*, 736: https://doi.org/10.1016/j.scitotenv.2020.139632

Andriolo, U., Gonçalves, G., Sobral, P., Fontán-Bouzas, Á., Bessa, F. (2020). Beach-dune morphodynamics and marine macro-litter abundance: An integrated approach with Unmanned Aerial System. *Science of the Total Environment*, 749, 141474. https://doi.org/10.1016/j.scitotenv.2020.141474

Asamoah, B.O., Uurasjärvi, E., Räty, J., Koistinen, A., Roussey, M., Peiponen, K.-E. (2021). Towards the development of portable and in situ optical devices for detection of micro-and nanoplastics in water: A review on the current status. *Polymers*, 13, 730. https://doi.org/10.3390/polym13050730

Bao, Z., Sha, J., Li, X., Hanchiso, T., and Shifaw, E. (2018). Monitoring of beach litter by automatic interpretation of unmanned aerial vehicle images using the segmentation threshold method, *Mar. Pollut. Bull.*, 137, 388-398. https://doi.org/10.1016/j.marpolbul.2018.08.009

Biermann, L., Clewley, D., Martinez-Vicente, V., and Topouzelis, K. (2020). Finding plastic patches in coastal waters using optical satellite data, *Sci. Rep.*, 10, 5364, https://doi.org/10.1038/s41598-020-62298-z

Chaturvedi, S., Yadav, B.P., Siddique, N.A., and Chaturvedi, S.K. (2020). Mathematical modelling and analysis of plastic waste pollution and its impact on the ocean surface, *JOES*, 5, 136–163, https://doi.org/10.1016/j.joes.2019.09.005

Cózar, A., Aliani, S., Basurko, O.C., Arias, M., Isobe, A., Topouzelis, K., Rubio, A., and Morales-Caselles, C. (2021). Marine litter windrows: A strategic target to understand and manage the ocean plastic pollution, *Front. Mar. Sci.*, 8, 571796, https://doi.org/10.3389/fmars.2021.571796

Datasets – Bibliography

Home » Datasets – Bibliography

The Dataset bibliography is updated periodically when new references are submitted by readers. If you would like your dataset publication included please send the details to the IOCCG Project Scientist, Venetia Stuart, using the following format:

Lastname1, Initials1., Lastname2, Initials2., etc. (Year). Full title of publication, Available online [url] from Name of Repository, DOI url

The data must meet the following requirements **'Remote sensing' AND 'Marine Litter and debris'**

Datasets Bibliography

Acuña-Ruz, T., and Mattar B., C. (2020). Thermal infrared spectral database of marine litter debris in Archipelago of Chiloé, Chile, Available online [https://pangaea.de/] from PANGAEA, https://doi.org/10.1594/PANGAEA.919536

Garaba, S. P., Arias, M., Corradi, P., Harmel, T., de Vries, R., and Lebreton, L. (2021) Concentration, anisotropic and apparent colour effects on optical reflectance properties of virgin and ocean-harvested plastics, J. Hazard. Mater., 406, 124290, *Dataset in Supplementary Material* https://doi.org/10.1016/j.jhazmat.2020.124290

Garaba, S. P. and Dierssen, H. M. (2017). Spectral reference library of 11 types of virgin plastic pellets common in marine plastic debris, Available online [https://ecosis.org] from the Ecological Spectral Information System (EcoSIS), https://doi.org/10.21232/C27H34

Garaba, S. P. and Dierssen, H. M. (2019). Spectral reflectance of washed ashore macroplastics, Available online https://ecosis.org] from the Ecological Spectral Information System (EcoSIS), https://doi.org/10.21232/ex5j-0z25

Garaba, S. P. and Dierssen, H. M. (2019). Spectral reflectance of dry and wet marine-harvested microplastics from Kamilo Point, Pacific Ocean, Available online [https://ecosis.org] from the Ecological Spectral Information System (EcoSIS), https://doi.org/10.21232/r7gg-yv83

Garaba, S. P. and Dierssen, H. M. (2019). Spectral reflectance of dry marine-harvested microplastics from North Atlantic and Pacific Ocean, Available online [https://ecosis.org] from the Ecological Spectral Information System (EcoSIS), https://doi.org/10.21232/jyxq-1m66

Knaeps, E., Strackx, G., Meire, D., Sterckx, S., Mijnendonckx, J., and Moshtaghi, M. (2020). Hyperspectral reflectance of marine plastics in the VIS to SWIR, Available online [https://data.4tu.nl/] from 4TU.Centre for Research Data, https://doi.org/10.4121/12896312.v2

Task Force Progress

IOCCG International Ocean Colour Coordinating Group

Website – 'Living' Resources

- We provide a list of online repositories and databases the community should use to make data open-access.

Online Repositories: Remote Sensing of Marine Litter and Debris

4TU.ResearchData – Science • Engineering • Design	https://data.4tu.nl/portal
EcoSIS Ecological Spectral Information System	https://ecosis.org/
LITTERBASE	https://litterbase.awi.de/
ocean scan	https://www.oceanscan.org/
PANGAEA. Data Publisher for Earth & Environmental Science	https://www.pangaea.de/
SeaBASS	https://seabass.gsfc.nasa.gov/
USGS science for a changing world	https://crustal.usgs.gov/speclab/QueryAll07a.php
zenodo	https://zenodo.org/

Open Access logo, originally designed by Public Library of Science

SCIENTIFIC DATA

Amended: Addendum

OPEN

SUBJECT CATEGORIES
» Research data
» Publication characteristics

Comment: The FAIR Guiding Principles for scientific data management and stewardship

Mark D. Wilkinson *et al.*#

Let us continue making data open-access using Ocean Best Practices and FAIR policy

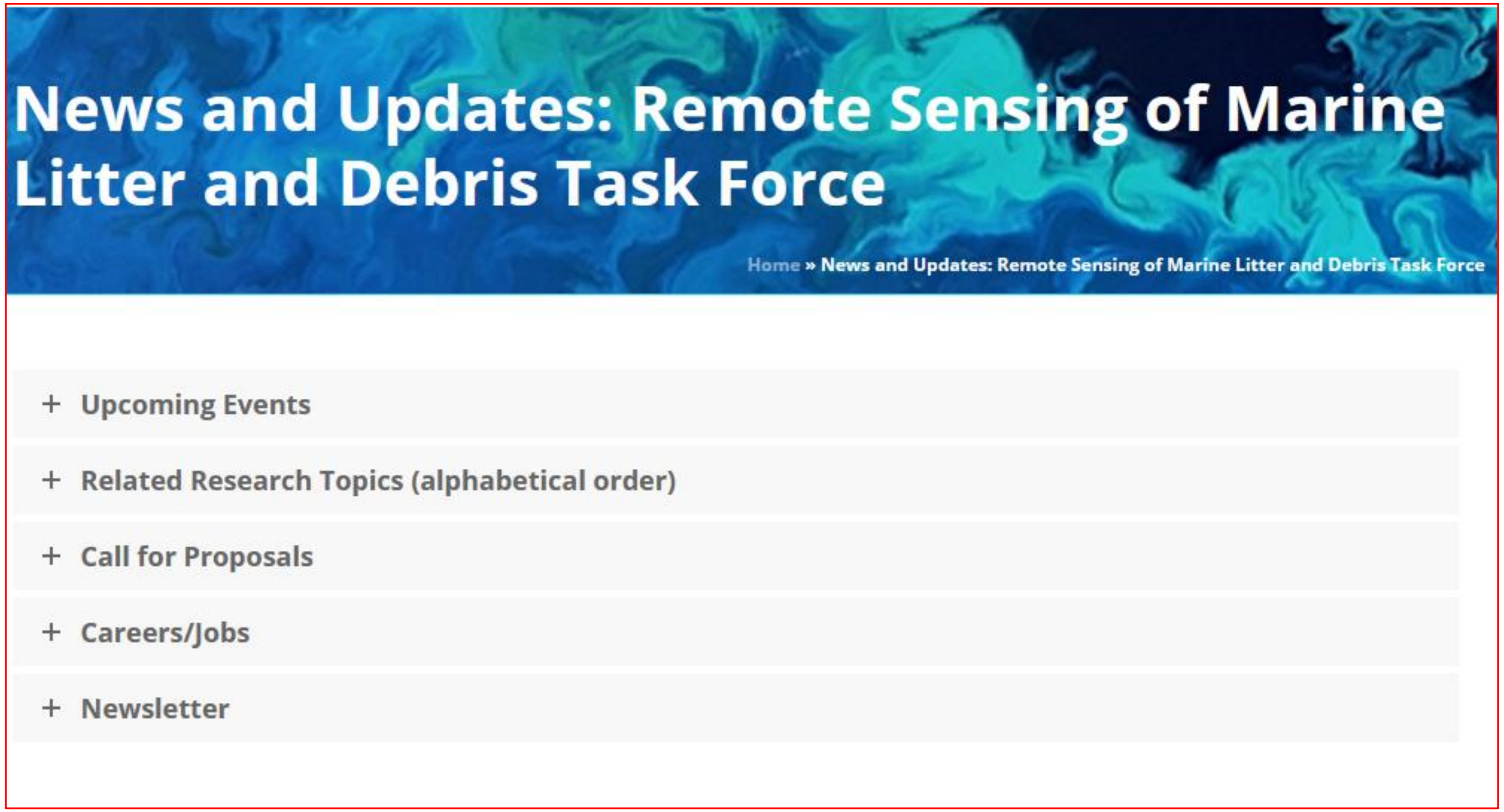
https://ioccg.org/rsmld-online-repositories/

Task Force Progress

Website – ‘Living’ Resources

- We have been compiling and updating list of upcoming events and projects related to the Task Force.

- Over **30 research** projects are ongoing funded by (e.g. ESA, EU, NASA, PSA).



Task Force Progress

Core Topics

- Each team works independently on its Topic.
- Regular (e.g. monthly, bi-monthly) meetings are conducted and **Topic Draft Reports** are in preparation.
- Team members or invited experts present during some of the meetings.

Victor Martinez-Vicente
CT1 Coordinator

Manuel Arias
CT2 Coordinator

Shungu Garaba
CT3 Coordinator

Lauren Biermann
CT4 Coordinator

Technologies

Algorithms and Applications

International Experts

Datasets

Interdisciplinary Aspects

Outlook

Space Agencies and Funding Sources

- Fund more advanced works related to remote sensing of marine litter and debris.
  - ➢ New research should build on current scientific knowledge see Task Force related projects.
  - ➢ Use the Task Force knowledge base to identify research and technology gaps.
- Pushing and exploring new initiatives i.e. airborne monitoring in synergy with other technologies,
  - ➢ Promote potential real monitoring applications at regional level.
  - ➢ Boost ground-truth collection to continue with research for higher altitude remote sensing.

Operative goal from ongoing research is expected to address or reveal

We can realistically detect X (or Y if we had a sensor Z) in order to achieve W, which is needed to effectively support K – to provide a tool to policy makers and clean-up efforts.

IOCCG International Ocean Colour Coordinating Group

Thank you!

Any questions?