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Volunteering for the future – Geospatial excellence for a better living

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Mapping the Plastic – confronting the global plastic 'pandemic'

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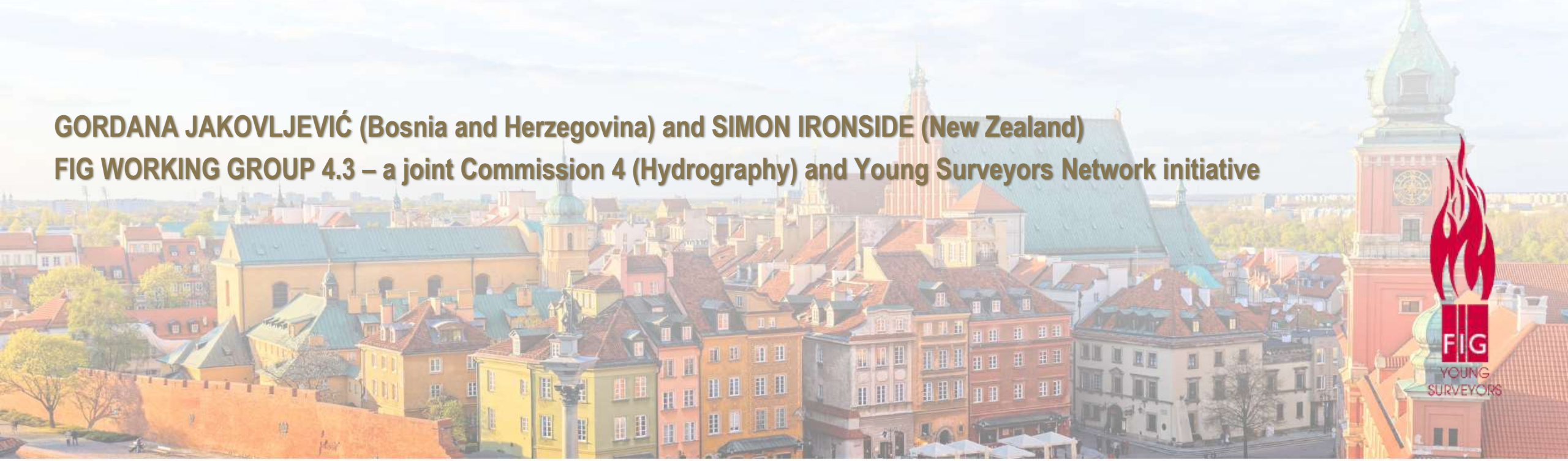
FIG WORKING GROUP 4.3 – a joint Commission 4 (Hydrography) and Young Surveyors Network initiative



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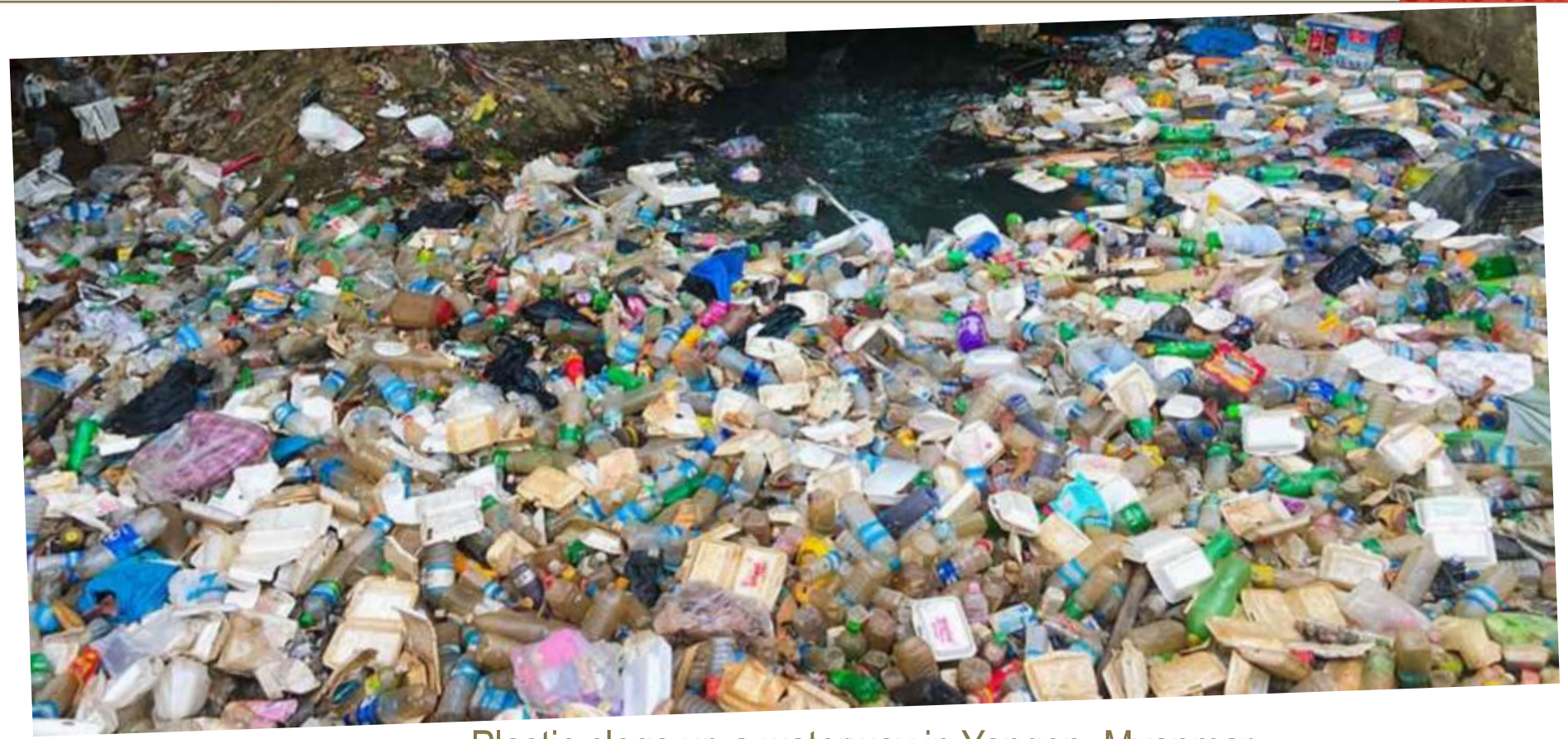


Plastic clogs up a waterway in Yangon, Myanmar.

courtesy of Global New Light of Myanmar, 5 June 2018

Some confronting statistics...

- Almost every piece of plastic ever made is still on our planet in one form or another
- 75% of all the plastic produced since 1950 is now waste, with most of it discarded into landfills or dumped into marine environments.
- 8 million tonnes of plastic ends up in our oceans every year…
- Which equates to 15 tonnes of plastic entering our oceans every minute.
- Eighty per cent of all litter in our oceans is now made of plastic

By 2050 WWF estimates there will be more plastic in the ocean than fish, by weight

The problem with plastic...

- Only 9% of plastic waste is recycled as it is difficult to recycle
- It breaks down into microplastics that enter the food chain, causing harm to animals and, potentially, humans
- There is an estimated 14 million tonnes of microplastics residing on the sea floor
- The average person ingests roughly 5 grams of microplastics each week, much it from drinking water, but also from shell fish, beer and salt
- The production and transportation of plastic to their point of sale is fossil-fuel intensive, with significant climate change impacts

Plastic in the ocean…

- Once in the ocean, plastic and other marine debris is at the mercy of ocean currents
- The large and permanently rotating ocean currents known as gyres have the most impact on plastic/marine debris
- The five major gyres are
  - the North and South Pacific Subtropical Gyres
  - the North and South Atlantic Subtropical Gyres
  - the Indian Ocean Subtropical Gyre

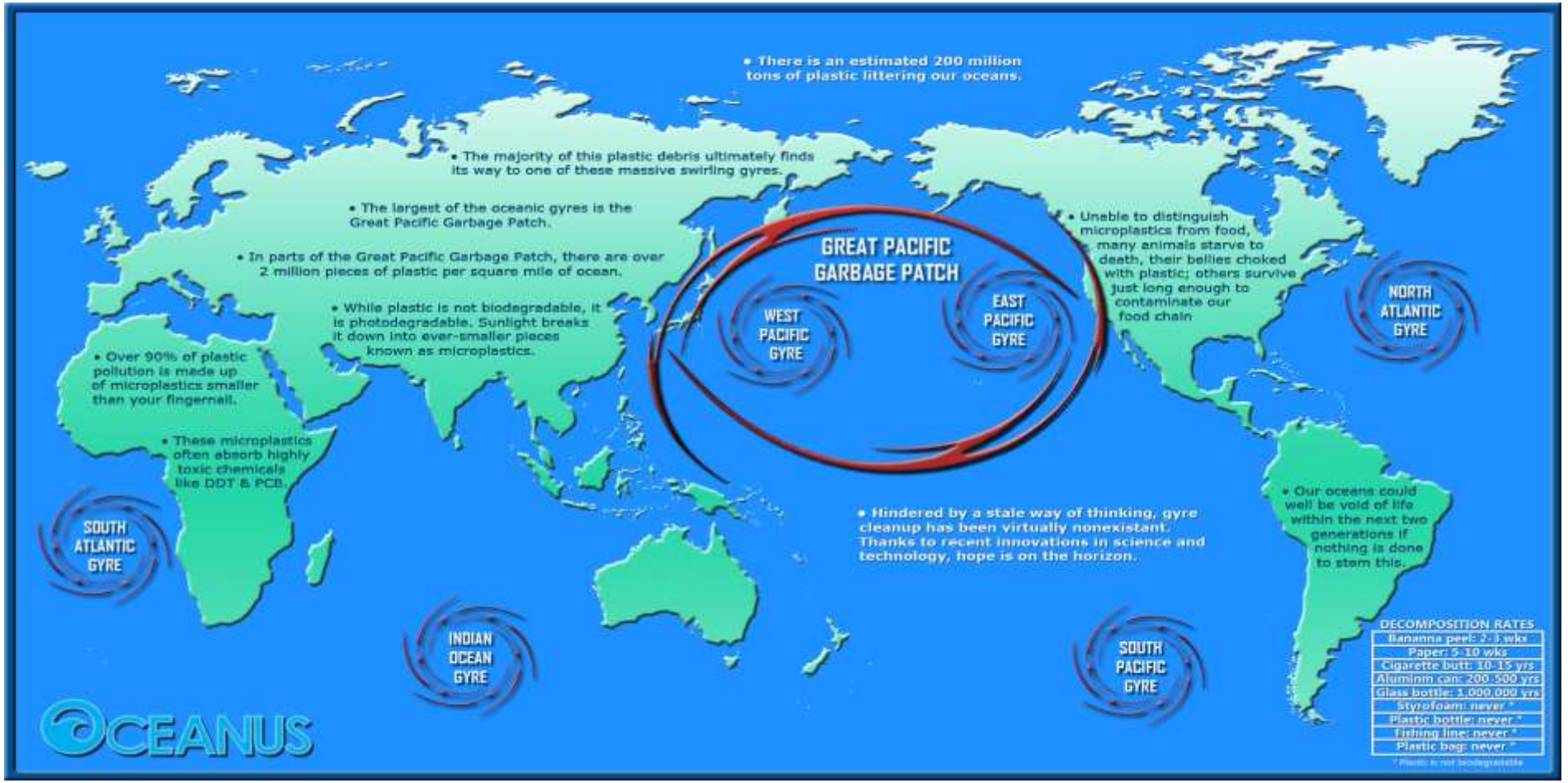


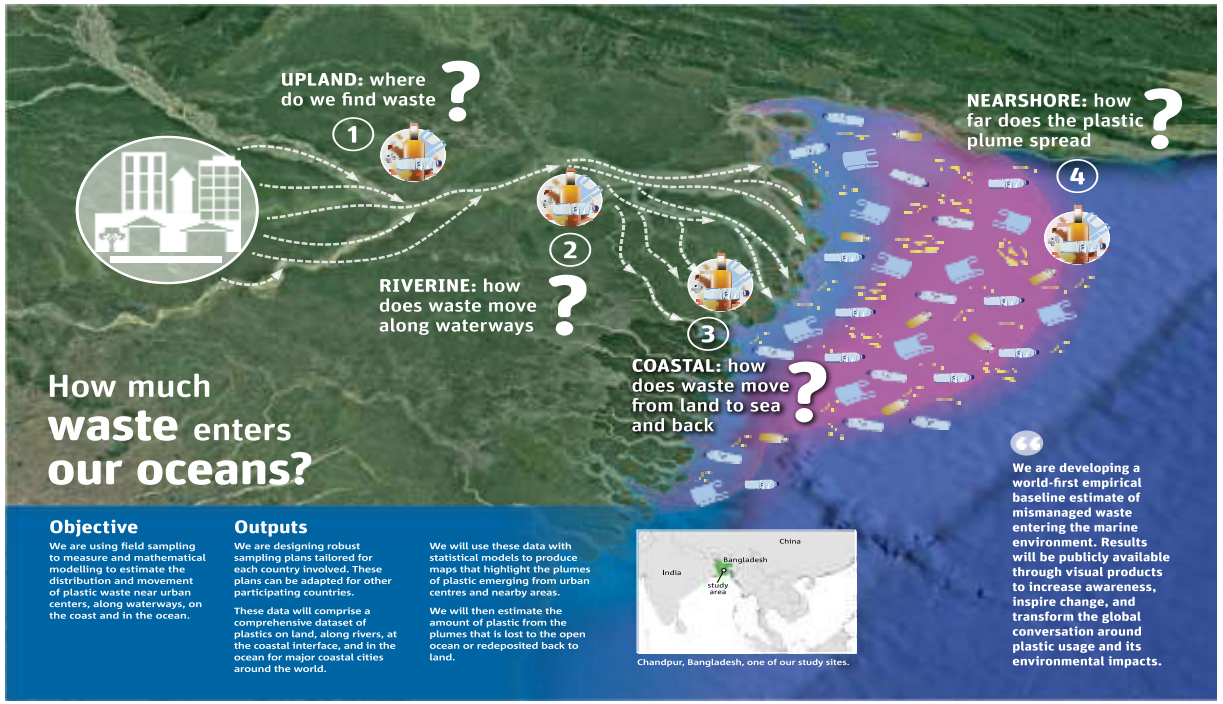
Photo: projectoceanus.wordpress.com

Gyres…

- The term is often used to refer to the collections of plastic and marine debris found in higher concentrations in the 5 subtropical gyres
- These accumulation zones are the result of diminished winds and currents occurring in latitudes synonymous with continental deserts
- Plastic is trapped within these currents, taking at least 10 years to cycle out – if it doesn't get eaten by marine life first or sink to the ocean floor
- These concentrations have been dubbed 'garbage patches'
- Most large debris in the Great Pacific Garbage Patch is made up of inexpensive fishing nets.

Plastic waste transportation (waterways)

courtesy of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia



Top 10 river systems contributing to ocean plastic

- Yangtze River, Yellow Sea, Asia
- Indus River, Arabian Sea, Asia
- Yellow River (Huang He), Yellow Sea, Asia
- Hai River, Yellow Sea, Asia
- Nile, Mediterranean Sea, Africa
- Meghna/Bramaputra/Ganges, Bay of Bengal, Asia
- Pearl River (Zhujiang), South China Sea/East Sea, Asia
- Amur River (Heilong Jiang), Sea of Okhotsk, Asia
- Niger River, Gulf of Guinea, Africa
- Mekong River, South China Sea/East Sea, Asia

Export of plastic debris by rivers into the sea - Authors: Christian Schmidt, Tobias Krauth, Stephan Wagner, *Reprinted with permission from Environmental Science & Technology 2017, 51, 21, 12246-12253. Copyright 2017, American Chemical Society.*


95% Of Plastic Polluting The World's Oceans
Comes From These 10 Rivers
Amur
Hai He
Nile
Yellow
Indus
Yangtze
Ganges
Pearl
Niger
Mekong
Data source: Schmidt - Export of Plastic Debris by Rivers into the Sea (2017)

Export of plastic debris by rivers into the sea

- While ocean plastic remains a daunting problem, this could be good news for the quest to control it.
- These 10 waterways contribute between 88 and 95 percent of the total plastic load that oceans receive via rivers and would be good places to focus on better waste management.
- The high fraction of a few river catchments contributing the vast majority of the total load implies that potential mitigation measures would be highly efficient when applied in the high-load rivers
- Reducing plastic loads by 50 percent in the 10 top-ranked rivers, would reduce the total river-based load to the sea by 45 percent.

Photograph by Ray Boland, NOAA/NMFS/PIFD/ESOD. This file is licensed under The Creative Commons Attribution 2.0 Generic License.

The Great Pacific 'Garbage Patch'

image courtesy of https://blogs-images.forbes.com/scottsnowden/files/2019/05/GreatPacificGarbagePatch.jpg (768×474)

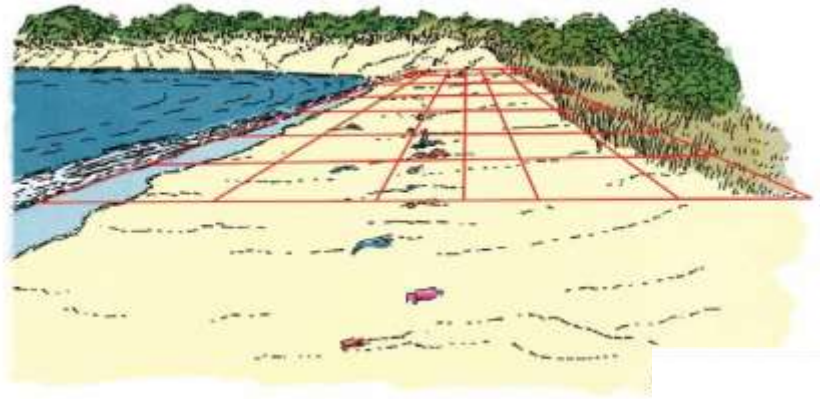
Field survey methodology – beach sites

Before arriving at site

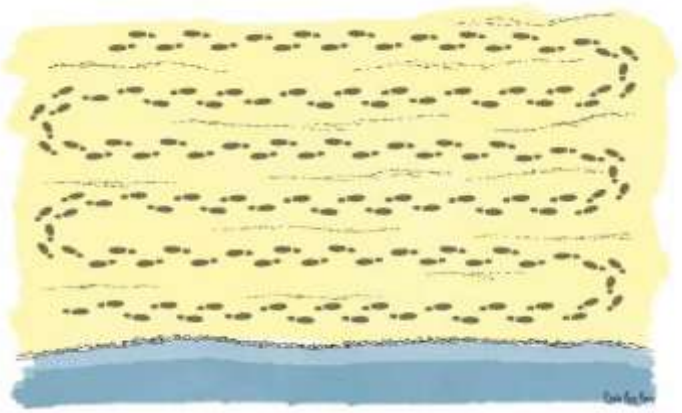
- Surveying should take place at low tide.

Sample collection

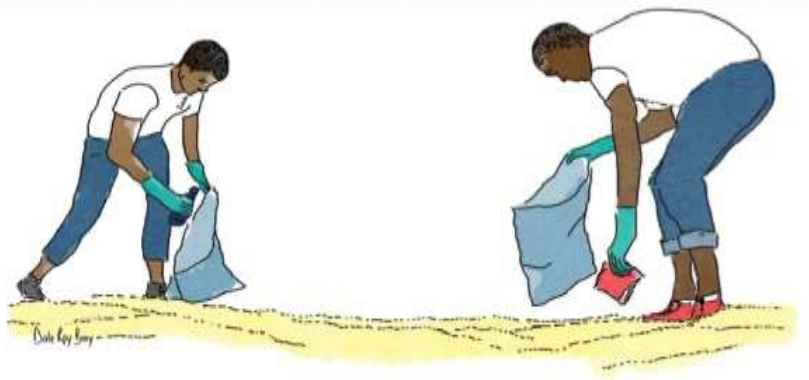
- Fill out the site characterization sheet
- Identify a section of 100m in each beach. Each 100m-section is divided into 20 equally divided sections, each with a width of 5m and perpendicular to the shore.
- Select 4 random divided sections on the beach (each 5m wide).
- Proceed to collect plastic waste samples, recording of number and weight for items
- Enter the data collected into data sheet.



Identify a section of 100 m



Parallel walking pattern



Collect waste

Photo source: (WIOMSA, n.d)

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Field Survey Methodology – River Sites

Select quadrat:

- **In the selected area, a one-square metre quadrat ($1m^2$x 0.3m depth) is placed every few (10 to 20) metres where digging is possible (for example: tidal flooded areas, periodic flooding, close to creek outlets). The earth inside the quadrat is analyzed for macroplastic (pieces larger than 2.5cm) to a depth of 30cm.**
- **Collect waste in the quadrat, clean, tally, weigh the waste collected and enter the data.**

Tally, weigh items collected and enter data

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Beach survey classification standards

- CSIRO - minimum debris class size 0-1cm
- OSPAR - minimum debris class size < 2.5cm
- UNEP/IOC – plastic litter classification framework has 29 material composition types. Focus is on count/density and weight of each composition type rather than debris class size
- NOAA - minimum debris class size 2.5cm

http://econews.com.au/wp-content/uploads/2013/06/CSIRO-beach-rubbish-research.jpg

UAV plastic surveys - planning considerations

- Site selection
- Survey specifications
- Site specific survey methodology, involvement of the local community
- Proximity of control (GNSS), evaluation of UAV hazards
- Categorisation of the plastic waste found to an agreed international standard – UNEP GESMAP, CSIRO, OSPAR
- Rapid release of preliminary results for each site surveyed
- Final report release including an evaluation of the cleanliness of coastal sites - CCI

Networks and Alliances

- FIG
- Commonwealth Clean Ocean Alliance
- CSIRO
- GreenHub
- Aotearoa Plastic Pollution Alliance
- Plastic Whale
- The Ocean Cleanup
- Trimble
- Algalita South Pacific
- Sustainable Coastlines
- OpenOceans Global

Where to from here…

- Ensure a sustainable income stream to enable us to be part of the solution
- Assist government and non-government agencies to better understand their problems
- Continue our ground-breaking research
- Strengthen relationships with everybody!
- Understand the stresses and strains of plastic pollution at regional, national and local levels
- Raise awareness by publicising our work
- What can we do to assist in your country/region? – please let us know

Thank you, on their behalf!

http://poopy.org/land-pollution/seal-trapped-in-plastic-pollution/

https://www.fredfoundation.org/work/albatross/

https://www.economist.com/science-and-technology/2020/03/12/plastic-rubbish-smells-good-to-turtles