Marine litter quantification – a pilot assessment

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Problem

✓ Various programs and organizations (IMO, UNEP, IOC-UNESCO, FAO) and recently the EU MSFD (Descriptor 10) recognized marine litter (ML) as an issue of global threat from environmental, economic, human health and safety, and aesthetic aspect

✓ About 6.4 million tons of debris are disposed in the ocean each year (UNEP, 2005)

✓ Some 8 million items are dumped every day, approximately 5 million of which (solid waste) are thrown overboard or lost from ships, over 13 000 pieces of plastic litter are floating on every km2

✓ Lack of knowledge on the amounts, sources pathways and distribution trends and impacts of marine litter, due to limited systematic regional measurements

✓ Studies of ML in the Black Sea region are very scarce and fragmented, limited to the Regional Activity on Marine Litter(BSC, 2009, UNEP, 2009) and campaigns focusing mainly on beach/shoreline assessments

✓ municipal waste/sewage and landfills, marine transport, ports, tourism and recreational activities and unregulated fishing are considered as important sources of ML

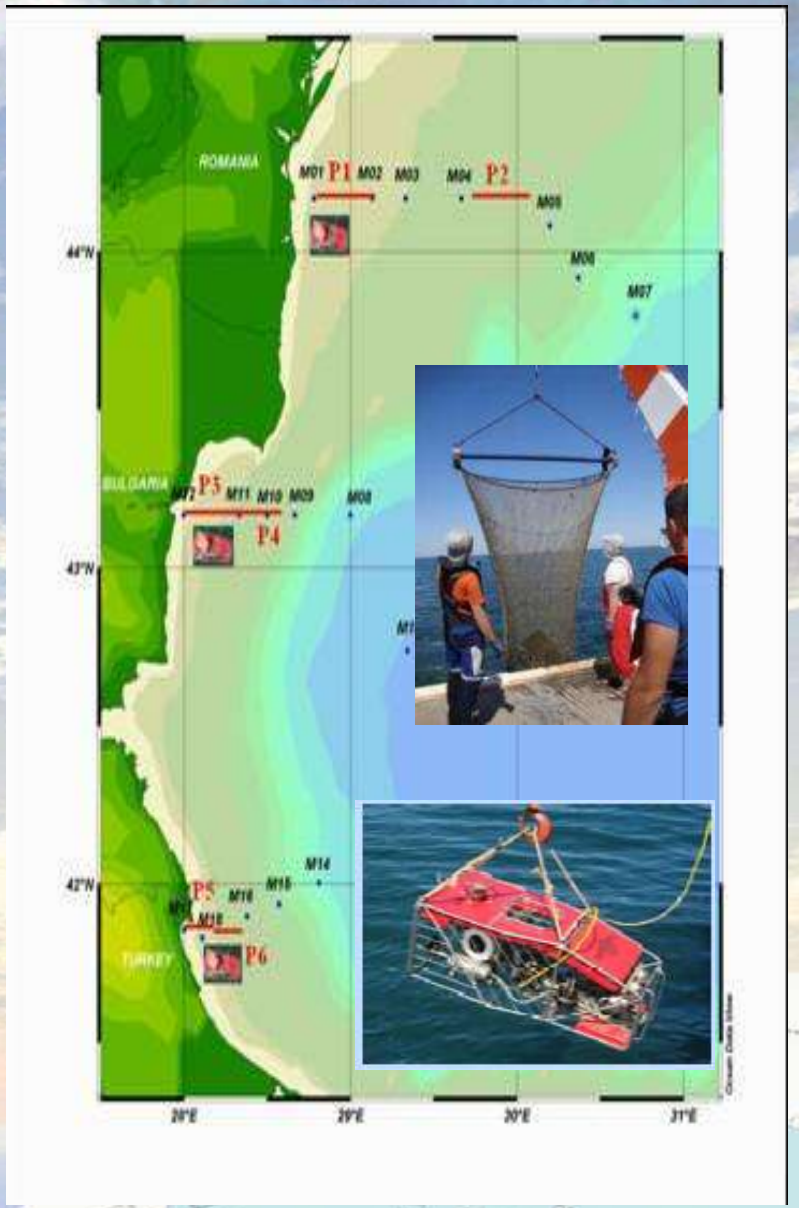
MISIS Project Joint Cruise

- Joint survey was conducted in July 2013, investigation of seabed ML was one of the tasks among the multidisciplinary measurements in the cruise program.

- The aim of the study was a pilot quantitative assessment of bottom ML in the Black Sea coastal and shelf areas and testing the applicability of Remote Operational Vehicle (ROV) available at IO BAS, applying the methodological MSFD GES Guidance (2013) elaborated by the Task Scientific Group on ML

Study area and methods

- Along 3 transects in the North-Western Black Sea (Romania, Bulgaria and Turkey) at 6 polygons , comprise areas with uniform substrate, representative for generating/accumulating litter
- The methodology was in compliance with MSFD GES TSG-ML Monitoring Guidance (2013) for large scale evaluation and monitoring of sea-floor ML
- ML was collected by a beam trawl (2.5 m width and mesh size aperture 5 cm) at a speed of 2.5 – 3 knots; a depth stratified scheme was in the coastal (23 – 35 m) and shelf bottom (depths within 40 – 69 m)
- Collected items were measured on board, sorted by type of the material and size , corresponding to the classification system in the Monitoring Guidance (2013)
- In addition to trawling, in the coastal bed (depth of ~ 40 m), the ROV (Remote Operating Vehicle) “Diablo” (Mariscope) was deployed in order to test its applicability to quantify marine litter

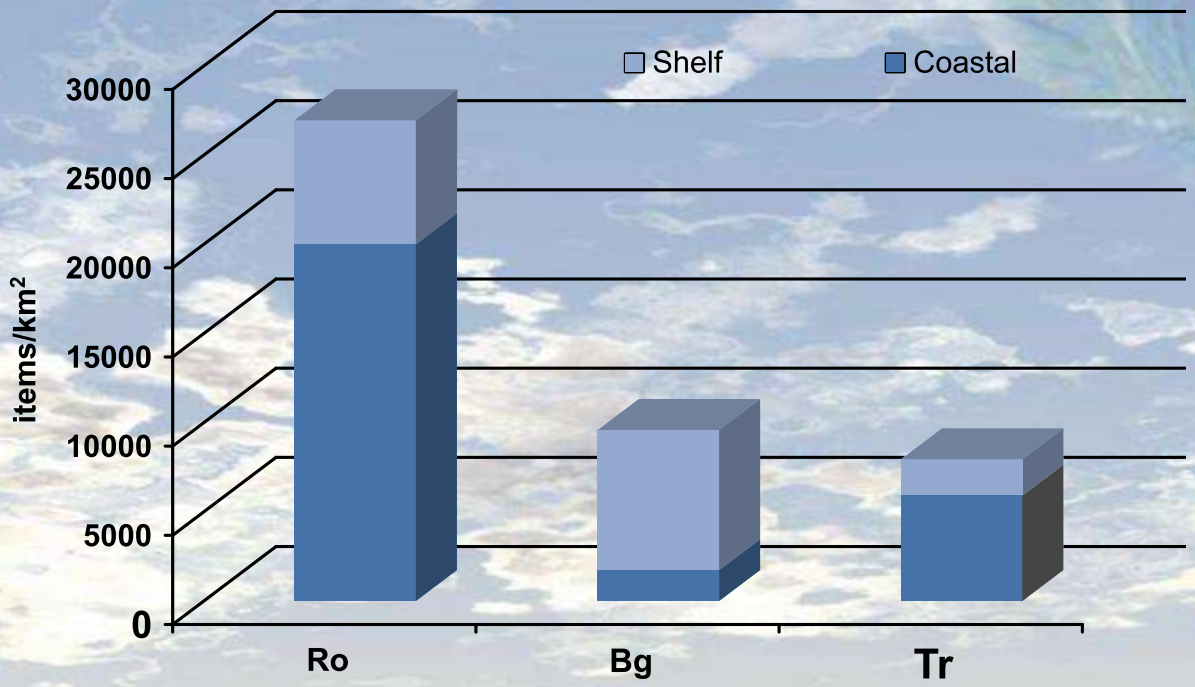


Litter by material and related size categories according to ML Monitoring guidance, 2013.

Size categories	
A	< 5 * 5 cm = 25 cm²
B	<10*10 cm= 100 cm²
C	<20*20 cm= 400 cm²
D	<50*50 cm= 2500 cm²
E	<100*100 cm= 10000 cm²= 1 m²
F	>100*100 cm = 10000 cm²= 1 m²

Litter categories
Plastic
Metal
Rubber
Glass/Ceramic
Natural products/Clothes
Miscellaneous

Trawl survey



Coastal –shelf distribution of marine litter integrated by transects in the NW Black Sea

Marine debris were found on all transects with densities ranging from 304 to 20 000 items/km^2. The number of items decreased from north to south with maximum in front of Romanian coast , and were approximately 3 times less in front of Bulgaria (9598 items/km^2) and Turkey (7956 items/km^2).

The marine debris at the coastal area (9234 items/km^2) exceeded about two times shelf density (5603 items/km^2) with exception of the observed area in front of Bulgaria

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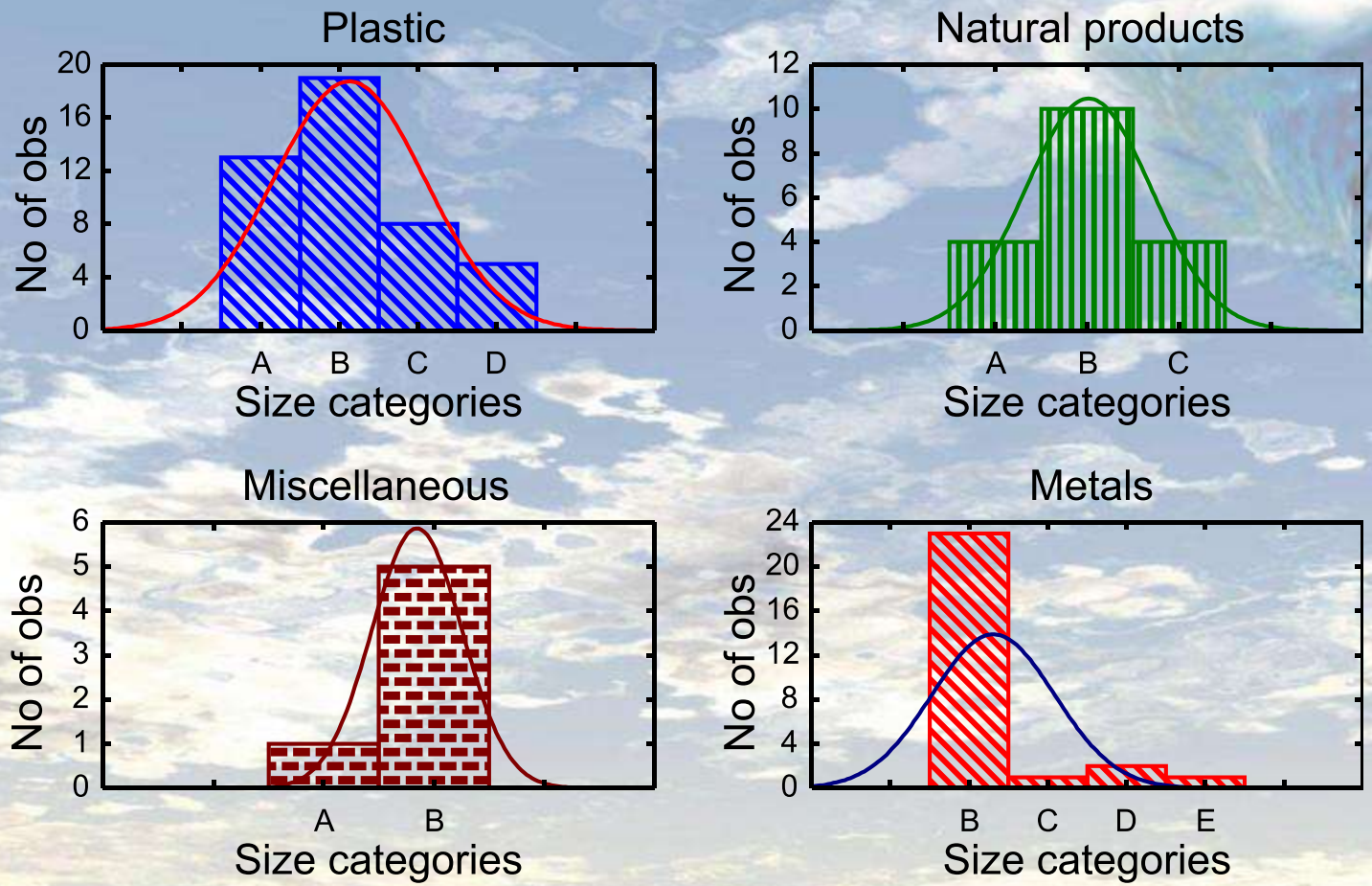
Litter sorting

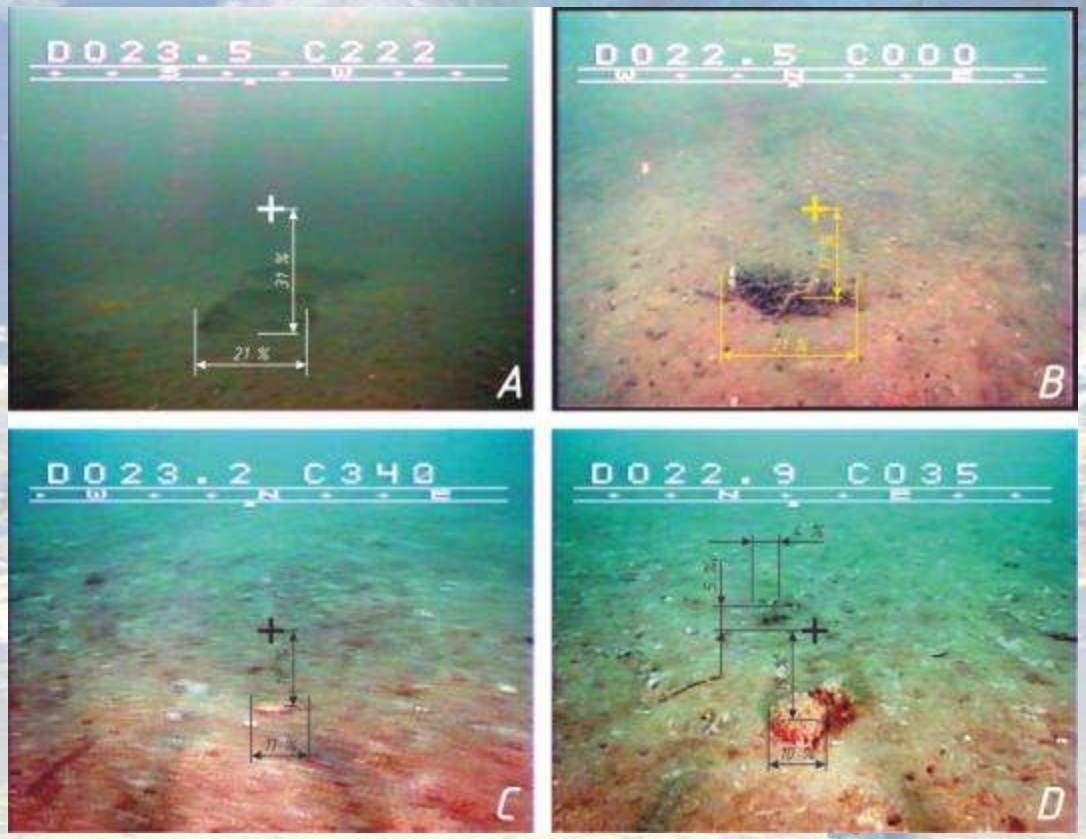


Histograms of ML size distribution by material

"B" size (100 cm^2) fragments of marine debris were the most common size fraction (67 %) found in the study area. Plastics dominated in all categories between A-D, while the large (E) size class was represented by metal .

Remote Operating Vehicle (ROV) test

Although ML were not identified during the observation, advantages and disadvantages of ROV were outlined:



Advantages

- ROV operational time is virtually unlimited
- deep water surveys (under air-breathing diving limit of 50 m) are possible
- operational cost is low relative to other methods such as diving surveys
- direct operating control allows detailed observations and prolonged expositions
- method is not destructive to the sea bottom environment
- although ROV survey is a visual method, it is possible to estimate objects dimensions

Disadvantages

- ROV is power source dependent and non-autonomous
- distance limitation due to the cable connection
- strongly dependent of water currents and turbidity
- its maintenance is expensive, complex and delicate

Conclusions and Recommendations

- Plastic was the most common debris material found in the study (68 %) which is quite in line with the global findings.

- The marine debris at the coastal area exceeded about two times shelf density related most likely to the proximity to land-based sources, active human activities in the coastal marine domain and accumulation on the bottom due to weaker currents

- The high ML density observed in the Bulgarian shelf polygon could be associated to the intensive fishing and shipping in this particular area (Initial Assessment report, 2013).

- Estimation of ML distribution and density could be achieved only in the context of a broader regional management framework ensuring a large-scale integrated monitoring across countries and environments (beaches, water column and sea floor) complemented by adequate understanding of the hydrodynamic features and bottomscape of the marine environment.

- Monitoring programmes for demersal fish stock assessment combined with on-going monitoring of benthic communities if using an harmonized protocol may provide consistent support for monitoring litter at the Black Sea basin-wide scale on a regular basis and within the MSFD framework at relatively low cost.

Thank you for your attention!