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For a Litter-Free Adriatic and Ionian Coast and Sea

**Methodology for Monitoring Marine Litter
on the Seafloor (Shallow coastal waters (0–20m)
Visual surveys with SCUBA/snorkeling**



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Derelict Fishing Gear management system in the Adriatic Region
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The IPA-Adriatic funded DeFishGear project aims to facilitate efforts for integrated planning to reduce the environmental impacts of litter-generating activities and ensure the sustainable management of the marine and coastal environment of the Adriatic-Ionian macroregion. The DeFishGear activities are implemented by a multi-disciplinary team comprising academia, research institutes, national and local authorities and NGOs from all seven countries of the Adriatic and Ionian Seas, reinforcing and strengthening cooperation and fostering joint and harmonized actions towards a litter-free Adriatic and Ionian Coast and Sea.

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1. Introduction

Underwater visual surveys with scuba diving/snorkeling is the most commonly used method to estimate marine litter density in shallow coastal areas. According to the 2013 report of the EU MSFD Technical Group 10, these surveys are best based on line transect surveys on the sea-floor in shallow or coastal environments.

2. Site selection

Sites should be selected to ensure that they:

- ✓ Consider areas that might accumulate litter;
- ✓ Avoid areas of risk (presence of munitions and other hazardous waste), sensitive or protected areas;
- ✓ Do not exert impacts on any endangered or protected species;
- ✓ Avoid areas with strong currents or waves;
- ✓ Avoid navigation routes of vessels that might put divers in danger.

Sites should be chosen following a two-fold approach: (i) selecting sites that meet certain criteria (e.g. are close to ports, river mouths, cities, etc.); (ii) choosing randomly from a large number of sites.

3. Survey area & sampling unit

The survey area is defined by the transect width and length. Surveys are conducted through two (2) line transects for each sampling site. The line transects are defined with a nylon line, marked every 5 meters with resistant paints, that is deployed using a diving reel while SCUBA diving. Distances should be determined either by laying out a 100m tape measure or alternatively by laying a 100m length of weighted rope across the bottom. The start and end point of each transect should be identified with marker buoys and recorded using a GPS.

The length of the line transects could vary between 50m-200m and the width from 4m-8m, depending on the depth, the depth gradient, the turbidity, the habitat complexity and the litter density (see table 1). In this methodology 2 line transects with 100m length and 8m width are proposed.

Debris Density	Environmental Conditions	Sampling Unit (length x width)
0.1 – 1 items / m ²	Low turbidity & high habitat complexity	20 m x 4 m
0.1 – 1 items / m ²	High turbidity	20 m x 4 m
0.01 – 0.1 items / m ²	In every case	100 m x 8 m
< 0.01 items / m ²	In every case	200 m x 8 m

Table 1. Suggested dive survey transect lengths and widths based on environmental conditions and debris concentration (Katsavenakis, 2009).

4. Frequency and timing of surveys

At least two surveys, one in autumn and one spring should be carried out. The proposed survey periods are:

- ✓ Autumn: September-October
- ✓ Spring: April

5. Size classes to be surveyed

The following size range classes should be reported for each recorded litter item:

- A. $< 5 \text{ cm} \times 5 \text{ cm} = 25 \text{ cm}^2$
- B. $< 10 \text{ cm} \times 10 \text{ cm} = 100 \text{ cm}^2$
- C. $< 20 \text{ cm} \times 20 \text{ cm} = 400 \text{ cm}^2$
- D. $< 50 \text{ cm} \times 50 \text{ cm} = 2500 \text{ cm}^2$
- E. $< 100 \text{ cm} \times 100 \text{ cm} = 10000 \text{ cm}^2 = 1 \text{ m}^2$
- F. $> 100 \text{ cm} \times 100 \text{ cm} = 10000 \text{ cm}^2 = 1 \text{ m}^2$

6. Identification of litter

When conducting underwater visual surveys with a self-contained underwater breathing apparatus (scuba), lighter litter items should be collected (while larger items should just be marked), brought ashore and entered in the 'Benthic Litter Monitoring Sheet for shallow waters'. When conducting underwater visual surveys by snorkeling, digital photos should be taken for all items with an underwater camera and subsequently should be entered in the 'Benthic Litter Monitoring Sheet' once identified. On the sheet, each type of item is given a unique identification number. The identification and correct categorization of litter items should be facilitated by the 'Photo Guide'. Unknown litter, or items that are not on the survey sheet, should be noted in the appropriate "other item box". A short description of the item should then be included on the survey sheet.

7. Quantification of litter

The unit in which litter should be recorded is number of items and it should be expressed as counts of litter items per square kilometer (litter items/km²).

8. Additional considerations

Before the monitoring survey begins, the scuba divers should be briefed on the surrounding environments and conditions of the monitoring sites.

9. Equipment

The following items are necessary to carry out seafloor litter surveys:

- ✓ Scuba/snorkeling gear and equipment: diving suit, buoyancy control device, regulator, air tank, compass, pressure gauge, fins, gloves, knife, and boots, etc;
- ✓ Supplies: mesh sack, rope, ruler, cutter, dive flag, dive slate, float tube, and pelican float;
- ✓ Underwater digital camera;
- ✓ Lift bag;
- ✓ Floating fence;
- ✓ GPS;
- ✓ Comprehensive first-aid kit;
- ✓ Recording sheets and pencils.

10. Safety

For any diving activities or other use of compressed gas as a breathing medium (e.g. surface supplied air), safety is the number one priority and divers must be trained to a level commensurate with the type and conditions of the diving activity being undertaken. Project leads are responsible for understanding all aspects of diving safety regulations and required trainings and must ensure that their organization has the capacity to oversee all planned diving activities (e.g., appropriate insurance, safety policies, etc.).

At least two divers should work together as a team to prevent any possible incidents as entanglement with fishing nets or ropes, and to ensure safety during the survey. When litter items are heavy or hazardous to collect, just record its locations and types. Use rope or a lift bag to pull up marine litter when it is hard to put in the mesh sack.

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Monitoring Marine Litter (Macro) on the Seafloor

Data Sheet

Location name	
Location ID	
Country	
Surveyor Name	
e-mail address	
Date of survey	

SITE DETAILS			
Latitude/longitude start 100m			<i>Recorded as nnn.nnnnn degrees at the start of the sample unit</i>
Latitude/longitude end 100m			<i>Recorded as nnn.nnnnn degrees at the end of the sample unit</i>
Latitude/longitude start 8m			<i>Recorded as nnn.nnnnn degrees at the end of the sample unit</i>
Latitude/longitude end 8m			<i>Recorded as nnn.nnnnn degrees at the end of the sample unit</i>
Depth			<i>Record depth in m</i>
Coordinates system			<i>Datum and coordinate system employed</i>
Start time/end time			<i>Time over which the survey took place</i>

ENVIRONMENTAL PARAMETERS - OBSERVATION DETAILS		
Wind speed		<i>Recorded in (Beaufort)</i>
Wind	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Tick more than one boxes e.g. for SE wind</i>
Sea state		<i>Expressed in accordance with the Douglas Sea Scale (0-9)</i>
NOTES		
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.....		
SITE CHARACTERISTICS		
Nearest river name		<i>Name of nearest river</i>
Nearest river distance		<i>Distance to the nearest natural input (river or stream) (kilometers)</i>
Nearest river position	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of river mouth in relation to survey area</i>
Nearest major fishery		<i>Name of the nearest major fishery (named by type)</i>
Nearest major fishery distance		<i>Distance to the nearest major fishery (kilometers)</i>
Nearest major fishery position	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of the nearest major fishery in relation to survey area</i>

Nearest town		<i>Name of nearest town</i>
Nearest town distance		<i>Distance to the nearest town (kilometers)</i>
Nearest town position	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of the nearest town in relation to survey area</i>
Population size of this town		<i>No of inhabitants</i>
Additional features of the town	<input type="checkbox"/> Residential <input type="checkbox"/> Tourist <input type="checkbox"/> Residential & tourist	<input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Autumn <i>Indicate the main characteristic of the town, residential or touristic town; in case of the later indicate the high season peak</i>
Name of the nearest beach		<i>Name of the nearest beach</i>
Distance to nearest beach		<i>Distance to the closest coastline (kilometers)</i>
Position of the nearest coast	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of the closest coastline in relation to survey area</i>
Nearest shipping lane distance		<i>Distance to the nearest shipping lane (kilometers)</i>
Estimated traffic density		<i>Recorded in number of ships/year</i>
Vessel type		<i>Indicate the type of vessels that mainly use it e.g. merchant ships, etc.</i>
Position of the shipping lane	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of shipping lane in relation to survey area</i>
Name of the nearest harbor		<i>Name of nearest harbor</i>
Harbor position	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of the nearest harbor in relation to survey area</i>
Type of harbor		<i>Based on the types of vessels visiting the harbor</i>
Size of harbor		<i>Record the number of ships that reach the harbor per year</i>
Nearest discharge of waste water distance		
Position of nearest discharge point	<input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	<i>Position of nearest discharge points in relation to survey area</i>
NOTES		
.....		
.....		

RESULTS		
Total weight of litter collected		<i>Record litter weight in Kg</i>
Total weight of artificial polymer materials		<i>Record litter weight in Kg</i>
Total No of items of artificial polymer materials		<i>Record number of items</i>
Total weight of rubber		<i>Record litter weight in Kg</i>
Total No of items of rubber		<i>Record number of items</i>
Total weight of cloth/textile		<i>Record litter weight in Kg</i>
Total No of items of cloth/textile		<i>Record number of items</i>
Total weight of paper/cardboard		<i>Record litter weight in Kg</i>
Total No of items of paper/cardboard		<i>Record number of items</i>
Total weight of processed/worked wood		<i>Record litter weight in Kg</i>
Total No of items of processed/worked wood		<i>Record number of items</i>
Total weight of metal		<i>Record litter weight in Kg</i>
Total No of items of metal		<i>Record number of items</i>
Total weight of glass/ceramics		<i>Record litter weight in Kg</i>
Total No of items of glass/ceramics		<i>Record number of items</i>

