FIXED LINE TRANSECT USING FERRIES AS PLATFORM OF OBSERVATION

MONITORING PROTOCOL II : Marine litter & Marine macro fauna Protocol

Allegato tecnico II Protocollo per Rifiuti marini & macro fauna marina della CONVENZIONE PER LO SVOLGIMENTO DI ATTIVITA' DI 'FIXED LINE TRANSECT USING FERRIES AS PLATFORM OF OBSERVATION FOR MONITORING MEGA AND MACRO MARINE FAUNA AND MAIN THREATS'

Technical Annex II Marine litter & Marine macro fauna Protocol for the AGREEMENT 'FIXED LINE TRANSECT USING FERRIES AS PLATFORM OF OBSERVATION FOR MONITORING MEGA AND MACRO MARINE FAUNA AND MAIN THREATS'

PROTOCOL FOR MONITORING BY VESSEL OF FLOATING MARINE MACRO LITTER AND MARINE MACRO FAUNA ALONG A FIXED TRANSEPT WIDTH

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INTRODUCTION

The term marine litter indicates any solid material persistent, which has been manufactured or processed by man and after its use has been discarded, deleted, lost or abandoned in the marine and coastal environment. The marine litter consists therefore in objects constructed and used daily by man and then abandoned or lost along the coastline and at sea, including those materials which, scattered on the mainland, reaching the sea through rivers, wind, water runoff and urban waste. Fall into the categories of waste even fishing gear.

The marine litter can consist of plastic, wood, metal, glass, rubber, etc., while not including semi-solid residues such as mineral and vegetable oils, paraffins and other chemicals. It has an important impact on the environment that can be classified into three main categories:

- Ecological: causes lethal or sub-lethal effects on animals and plants due to trapping phenomena, of accidental ingestion (especially in toothed cetaceans and turtles), accumulation of harmful substances in the tissues and facilitation of dispersal of alien species through transport.
- Economic: the presence of marine litter in areas of high landscape value causes a reduction in the value of the land, and hence tourism, may cause mechanical damage to boats and fishing equipment as well as reducing the catch. The remediation costs for the removal of marine litter are very high.
- Social: reducing the aesthetic value of the environment and public use.

Marine litter is asked to be monitored within the descriptor 10 of Directive 2008/56 / EC (Marine Strategy Framework Directive), which provides for the achievement of good environmental status for all marine waters by 2020. The definition of an acceptable level for the environment of this descriptor, and then to a good environmental state, is the one in which the properties and quantities of marine litter should not cause harm to the coastal and marine environment. To this end should be evaluated trends in quantities of litter in the various sectors of the marine environment (sea bed, sea surface, water column, coastal line), and the effects on marine organisms and problems related to degradation (microplastic) as well as the social and economic aspects related to it. Of course, the level of litter to cause effects on the environment, depends on both the type and the quantity of litter considered and the specific environment sector we are referring to. This underlines the importance of a detailed monitoring of the quantity and quality of marine debris on a large scale, with particular attention to the identification of the type of waste and its origin. A method already used in the context of international programs for monitoring / research of marine debris (UNEP-MAP / HELMEPA; NOAA, Day & Shaw 1987 Matsumura & Nasu. 1997 Ailani et al. 2003, Thiel et al 2003, Shiomoto & Kameda 2005, Hinojosa & Thiel 2009, Arthur et al. 2011, Suria & Aliani 2014 Vaclhogianni et al. 2014) is to use boats as a medium or large observation deck of marine litter on the surface of the sea.
The reference methodology for this programme is the one set during the MEDSEALITTER project in coordination with the working group of the JRC (2019). References are:

- Floating Marine Macro Litter Workshop Minutes_Rome February 2019_final https://medsealitter.interreg-med.eu/what-we-achieve/deliverable-database/detail/?tx_elibrary_pi1%5Blivrable%5D=6757&tx_elibrary_pi1%5Baction%5D=show&tx_elibrary_pi1%5Bcontroller%5D=Frontend%5CLivrable&cHash=cee318a8721b458d35a03618bb747bcb.
- MEDSEALITTER Final shared monitoring protocol. 31-03-2019. https://medsealitter.interreg-med.eu/what-we-achieve/deliverable-database/detail/?tx_elibrary_pi1%5Blivrable%5D=6774&tx_elibrary_pi1%5Baction%5D=show&tx_elibrary_pi1%5Bcontroller%5D=Frontend%5CLivrable&cHash=3a505bc70229244a185e86ddb84f1fed

- Arcangeli A., David L., Aguilar A., Atzori F., Borrell A., Campana I., Carosso L., Crosti R., Darmon G., Gambaiani D., Di-Méglio N., Di Vito S., Frau F., Garcia-Garin O., Orasi A., Revuelta O., Roul M., Miaud C., Vighi M., 2020. Floating marine macro litter: Density reference values and monitoring protocol settings from coast to offshore. Results from the MEDSEALITTER project. Marine Pollution Bulletin 160 (2020) 111647.

Below some indication about the methodology, detailed information, materials and tools can be found in the previews indicate references.

MATERIALS AND METHODS

The activity of sampling is performed by an experienced observer positioned on one side of the vessel in the vicinity of the bow (for example on the bridge, in the case of large ships), to have the best possible visibility of the strip of the sea by avoiding the monitor turbulence generated by the bow itself.
The necessary equipment consists of: binoculars, GPS, measuring stick, digital camera and recording data sheet. The observation is made mainly to the naked eye and binoculars is used to confirm the sighting of debris larger than 20 cm. Monitoring is carried out with weather ≤ 2 on the Beaufort scale.
At each opening of the transect, the observer defines *a priori* the width of the strip monitored from the route of the ship up to a maximum of 50 m: the basic assumption of this method is defining a strip such that the observer has the ability to observe, to the naked eye, all the waste surface, larger than 20 cm passing through. It 'important to score on the board, for the purposes of calculating the density of objects, the width of the strip. These distances are calculated using a stick range finder: a "ruler" designed to measure distances, calibrated on the height of the observer, the length of his arm (distance eye-hand) and the height of the bridge of the vessel where the observer is positioned. The measurement can have an initial calibration with known distance in the port or from a known point of the ship itself. Along the way, it is recommended to repeat the measurement of the distance in order to assure consistency in the monitored strip.
The strip can from the very edge of the ship (if it were visible) or from the first point detectable by the observer; the distance of the inner edge and the outer edge of the strip to the route is indicated on the data collection sheet. The speed of the vessel should not exceed 27 knots. The side to be sampled is the one with greater visibility, for example with fewer reflections on the water and the sun behind. The GPS is used to record the track of the monitored transect, to mark the opening and closing of the transect and the waypoints that indicate the position of the objects sighted.
The observer uses the data collection sheet to note the characteristics of the debris observed, such as: composition: the main materials (first level) are: plastic (polymer artificial), glass, wood, metal, rubber, paper and fabric (in line with OSPAR, UNEP and TSG_ML); for each type of material it is then identified a category more detail (general name or second level). In case of sighting that does not fall into the categories that are scored as OTHER and describes the type by observer. For the plastic material, there is also a third level for Envelopes, Polystyrene and bottles. If you detect a FAD its components floating (plastic) shall be noted in the main board, while his description occurs in the back of the data sheet. It also notes the presence of organic material on the surface, such as logs or seaweed that can provide information on current and combinations of materials of the study area.

- source: the observer noted, when possible, the probable origin of the debris observed, indicating whether the source is "from land", "from sea" or (more likely)" indeterminate", and at what industry is linked. For a plastic bottle, for example, is unspecified, since you cannot know if it has become waste ground (abandoned on the beach or from a river) or by sea (thrown from a boat) while for a box of Styrofoam can trace, presumably, to the fishing industry or dairy.

- buoyancy: defined as positive when the detritus emerges whole or in part from the surface; negative, when the debris is completely submerged; absent when the debris is aligned to the surface of the sea. dimensions: the main assumption of the protocol (every item that goes inside the strip has to be seen) the minimum size of the items are more than 20 cm (one of the three sides of the object). The size classes used are those suggested by TSG. The class within which is located an object can be known in advance (for example a bottle for beverages 50ml is in the class E, between 20 and 30 cm) if there are uncertainties between the limits of the classes can be used classes widened as G> 50 cm or X> 20 cm.
- It is also recorded the presence within the strip (strip) sea turtles and other marine organisms larger than 20 cm (or in aggregations larger than 20 cm eg jellyfish-gelatinous plankton).

The collected data are stored on excel sheets dedicated, useful for the analysis of the results, while the data recorded by the GPS will be processed with a program of georeferencing.

Objective and data analysis

The ultimate goal of monitoring is the quantitative evaluation of marine litter. This means the formula already used in the international literature (Thiel et al., 2003, Shiomoto and Kameda, 2005, and Matsumura and Nasu, 1997) to calculate the density of marine litter surface:

$$D = n/(w \times L)$$

n: number of items observed; **w:** width of the strip; **L**: length of the strip (Km).

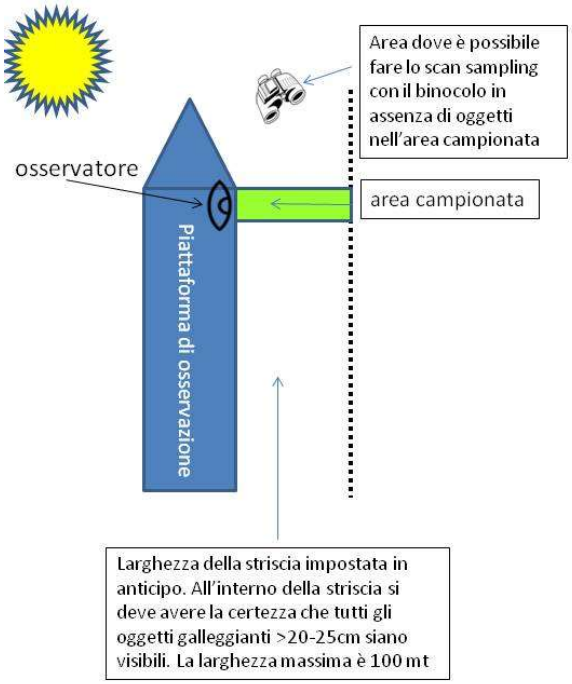
The total density of the debris is calculated, but also the density of the various types of waste. All collected data are entered into a Geographic Information System (GIS), as well as data on marine variables. They are use to calculate the relative abundances (%) between the materials of the first level and within the plastic.

Statistical analytical: e.g. the differences between samples can be evaluated with standard statistical tests (eg ANOVA, Kruskal-Wallis). Through the GAM (Generalized Additive Models) it could be checked whether the spatial distribution is influenced by geographic variables considered (eg distance from the coast). Geographical analysis: e.g. analysis Kernel for areas potentially suitable for the presence of litter according to data collected by achieving a constant probability curves (isopleth).

ADVANTAGES OF THE METHOD

Among the main advantages of this method we identify:

- The low costs in relation to the effort in nautical miles monitored through the use of opportunistic observation platform, which dramatically decreases the cost of shipment (especially if it's ferry line of affiliated companies) and does not include the expenditure necessary to crew of vessels dedicated (specific courses, boat license, insurance, liability in case of accidents at sea).
- The ease in the organization of the outputs through the use of a "great vessels" which then carry out in every case the navigation.
- The ability to perform the sampling activities on a weekly basis for long periods.
- The reduction of errors due to environment heterogeneity. In fact, monitoring along fixed transect keep fixed some parameters such as depth, distance from the coast, type of seabed and, for some periods of the year, also sea currents. Furthermore, the possibility to replicate the collection of data along a fixed route allow to obtain the most significant temporal sequences.
- The ability to compare data collected on marine litter with data collected on the monitoring of cetaceans, turtles and large pelagic carried out in parallel with the same ships allows to create risk maps for biota.
- Do not need expensive equipment or specific laboratory tests



Esempio:
(n) oggetti galleggianti rilevati 22,
(d)striscia larga 100 m,
(l)percorso on effort considerato 50 km

La densità sarà pari a:
n/dl
22/(0,1*50)=4,4 oggetti per Km²

Particular specifications:

- Fragments: means always larger than 20-25 cm
- FAD: (Fish Aggregating Device) means of accommodation with floats that are used to attract fish beneath their surface. To achieve them can be used natural elements (palm leaves) or totally artificial structures made mainly with plastic float.

Annex DATASHEET

Date	Observer	Type of platform
Speed	Sea State	Platform name

COD Effort	BEG (lat-long)	Time:
Minimum Item size class considered	END (lat-long)	Time:

Strip width	Position of observation: left / right; side / front
Height of observer eye (deck + observer height)	
Sector(s) of measurements of marine litter's size: limits of the sector(s) in degree _____ A _____....° _____ B _____....° _____ C _____....°	
For observation on the side	Angle(s) in degree for set strip width
For observation on the front	Width of strip at the window / Distance eye-window (m)

Cod GPS	**Buoyancy**	**Material Level 1**									**Use Level 2**	**Most common items Level 3**										**Specific item & Note**	**Organic**		**Size**[4]	**Color**	**State**
For pause specify: P-cod/time ; R- cod/time	**+ 0 -**	**ARTIF. POLYMER**	**GLASS /CERAMIC**	**PROC. WOOD**	**PAPER /CARTBOARD**	**METAL**	**CLOTHES/ TEXTILE**	**RUBBER**	**CHEMICAL**	**FOOD WASTE**	**A**griculture **Fi**shing/Aquacult. **M**aritime Food Clothes **S**anitary **CO**smetic Construction rel. **S**mok. related **PAc**kaging **OTHER**	Towel*	Bags*	Polystyrene box*	Bottle*	Net - Lines*	Packaging*	Cigarette butt	Caps - Lids	Cotton buds	Buoy*	Tableware*	• Specify item (refer to the MSFD Joint-list • Changing on weather condition, speed, sea state, cloud cover, observer • Pause STOP – START P-cod/time ; R-cod/time • PATCH – please specify 2 most important material and indicate a raw number of items observed	**Seaweed/Seagrass**	**Logs/terrestrial plant**	**Cm:** **B** 2,5-5 **C** 5-10 **D** 10-20 **E** 20-30 **F** 30-50 **G** 50-100 **H** >100	**O**paque **T**ransp. Color* **specif*	Entire - **Fr**agment

[4] *For measuring the exact size of items from large vessels use the Practical Guide 2 or the reference items for class size reported in the protocol*

SYSTEMATIC MACRO FAUNA MONITORING

During systematic monitoring of marine litter, data on marine macro-fauna is collected each time it occurs within the assessed monitored strip. Potential macro-fauna data collected regards the species listed in table 3.

Table 3 List of potential other species of marine mega fauna to be recorded.

##Other Species names##	Eng name	It name
Caretta caretta	Loggerhead sea turtle	Tartaruga marina
Mola Mola	Ocean Sunfish	Pesce luna
Mobula mobular	Devil fish	Manta
Xiphias glaudius	Swordfish	Pesce spada
Thunnus ssp	Tuna	Tonno
Fam. Istiophoridae	Marlins	Marlin, pesce vela
Shark	Shark	Squalo
Jellyfish*	Meduse	Jellyfish
Puffinus yelkouan	Yelkouan Sh (or Levantine shearwater)	Berta minore
Calonectris diomedea	Scopoli's Shearwater	Berta maggiore
Other		

BIRDS IDENTIFICATION:

Scopoli's Shearwater *(Berta maggiore)*	Similar in size to a yellow-legged gull, brown upper parts and white under parts, yellow bill. Direct and powerful flight, low over water, slow beats alternated to long glides. In windy conditions almost no beats and may raise high on water with body rotated 90° degrees respect to sea surface. Floating groups similar to small ducks and to other shearwaters (see under yelkouan shearwater). It can be mistaken with immature yellow-legged gulls. *Dimensioni confrontabili a quelle di un gabbiano reale, parti superiori brune e inferiori bianche, stria biancastra sul groppone alla base della coda, becco giallo. Volo rettilineo, di norma con battute lente alternate a lunghe planate, col vento si può innalzare di molto sulle onde e mantiene le ali immobili anche per lunghi periodi. Per gli stormi posati vedi berta minore. Può essere scambiata con immaturi di gabbiano reale.*	
Yelkouan Shearwater *(Berta minore)*	Similar in size to a pigeon, sharp contrast between almost black upper parts and white under parts, black bill, feet projecting out of the tail profile. Direct and rapid flight, low over water, fast beats alternated to glides with rigid wings. In windy conditions glides are longer and may raise higher on water. Floating groups similar to small ducks and to other shearwaters (check bill colour and size difference with yellow-legged gulls - if present). *Dimensioni confrontabili con quelle di un colombo, marcato contrasto fra le parti superori quasi nere e le inferiori bianche, becco nero, piedi sporgenti oltre la coda. Volo dritto e rapido, basso sull'acqua, alterna veloci battute a planate anche prolungate in condizioni di vento teso. Solo con vento forte si innalza periodicamente di alcuni metri sulle onde. In stormi posati, visti a distanza, ricordano piccole anatre e sono difficilmente distinguibili dalle berte maggiori (occorre notare il colore del becco e quello delle parti superiori, nonché la differenza dimensionale con eventuali gabbiani posati nei pressi).*	

JELLYFISH IDENTIFICATION:

Refer to: Boero, F. (2013). Review of jellyfish blooms in the Mediterranean and Black Sea. Food and Agriculture Organization of the United Nations. Rome http://www.fao.org/docrep/017/i3169e/i3169e.pdf

Pelagia benovici, new species: blooms of this species was recorded for the first time in northern Adriatic in 2013, probably arrived through ships; not anymore recorded during the wormer seasons.

SPECIES	Cod GPS	TIME GPS	Number of individuals	Orientation/Direction	Behaviour (1)	Size (2)	Other
Turtle							
JELLYFISH (3)			**Abundance (4)**	**Longitudinal strip/Patch (5)**	**Distance between individuals (6)**		
Other species (5)			**Number of individuals**				

R) Resting; **T**) Travelling; **O)** Other
(2) Size classes: **I**) 20- 30 cm; **II**) 30 - 70 cm; **III**) > 70 cm
(3) name of the species.
(5) **L**) longitudinal strip (Langmuir current); P) patch
6) **I**) single individual; **II**) individuals at a great distance from each other; **III**) within close distance; **IV**) swarm (compact individuals)