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Marine Litter Monitoring in the Adriatic

A review of available data and applied methods

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Adriatic IPA
Cross Border Cooperation 2007-2013

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Contents

List of acronyms& abbreviations

DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DeFishGear	Derelict Fishing Gear Management System in the Adriatic Sea
GC	Gas chromatograph
GC-ECD	Gas chromatograph with electron capture detector
GC-MS	Gas chromatograph with mass spectrometer
HCHs	Hexachlorocyclohexanes
HELMEPA	Hellenic Environment Protection Association
ICC	International Coastal Cleanup
MIO-ECSDE	Mediterranean Information Office for Environment, Culture and Sustainable Development
MSFD	Marine Strategy Framework Directive
NGOs	Non Governmental Organizations
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
pd/ha	Pieces of debris per hectare
PE	Polyethylene
POPs	Persistent organic pollutants
PP	Polypropylene
UNEP/MAP	United Nations Environment Programme/Mediterranean Action Plan

1. Introduction

The overarching aim of this report is to present a summary review of the available data on marine litter in the Adriatic Region with regards to the different environmental compartments (beach, water column & water surface, sea-floor, and biota), as well as an overview of the corresponding monitoring methodologies and approaches applied in the region.

In this respect, the 'traditional' scientific literature review has been coupled with the collection of data by the project partners. A datasheet was elaborated and distributed to the DeFishGear partnership to collect, in a systematic and comprehensive manner, information related to past and on-going marine litter monitoring studies, projects and initiatives carried out in the region. It should be noted that the scope of the data collection covers all IPA Adriatic eligible territories; however, given the fact that marine litter knows no boundaries, the geographical coverage of this exercise has been extended to include additional territories from the Adriatic-Ionian macro region area.

The compiled summary report aims to facilitate the establishment of a common understanding and holistic take with regards to scientific/research advances on marine litter in the region and to directly feed into the definition process of the assessment and monitoring methodology and strategy to be applied within the scope of the DeFishGear Marine Litter Assessment activities (WP4).

Figure 1. *Eligible Programme Area*

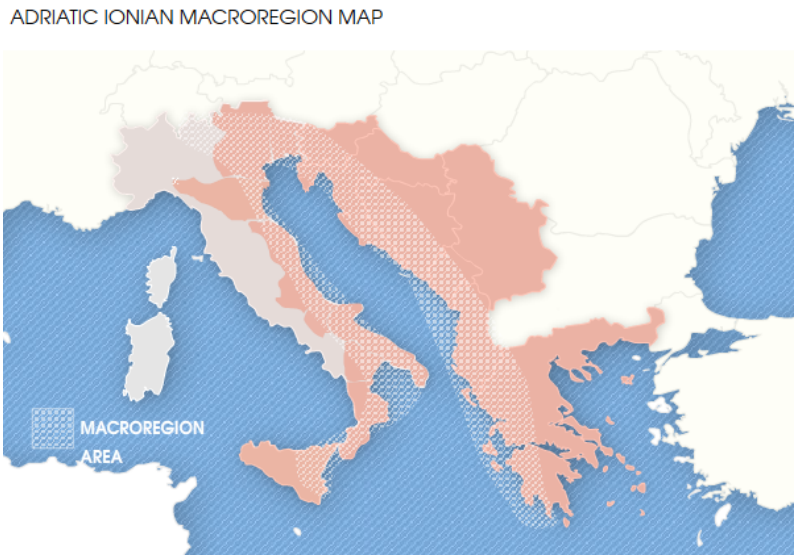

Figure 2. *Adriatic-Ionian Macro region Area.*

2. Beach litter

2.1. Availability of data

Systematic efforts to collect data on the amounts, distribution and composition of marine litter along the coastline of the Adriatic Sea are rather limited and the main source of information are clean-up campaigns carried out by environmental NGOs (such as Legambiente, WWF, MEDASSET, MEDSOS, HELMEPA, SUNCE, Green Action, etc.) in collaboration with local authorities. In most cases, data collected are reported as total quantity of marine litter collected, or amounts of litter collected by material type without any further classification of types of items.

In 2007, a 2-year marine litter survey was carried out at the island of Mljet (Croatia) in order to assess the amounts and types of litter in sixteen coves and bays. The findings illustrated that more than 80% of the litter found consists of different types of synthetic polymers, while the rest was glass, metal, rubber and wood. Predominant polymers included polyethylene terephtalate, polyethylene and polypropylene. More than 70% of the collected items originated from neighbouring countries.[1]

In Greece, in 2008 an attempt was made to collect and process marine litter data from three consequent years of implementation of the 'Clean-up the Med' campaign in 80 coastal sites of Greece, including sites in Corfu and Igoumenitsa.[2] According to these results, plastics comprise 46% of the amounts collected, followed by paper (12%), metal (16%), glass (5%), rope (6%) and construction materials (4%).[3]

The Italian Ministry of Environment, Land and Sea, in 2013, launched monitoring activities along the Italian coastline within the framework of the MSFD, however the results of the surveys have not been published yet.

In Slovenia, monthly beach litter surveys have been performed between November 2010 to September 2013 leading to a wealth of data on amounts and composition of litter items found. Preliminary results show that the majority of litter items recorded are made of plastic and originate from land-based sources.[4] The corresponding data and information have not been published yet.

2.2. Review of applied methods

The very few marine litter monitoring activities described above applied the OSPAR methodology (OSPAR guideline for monitoring marine litter on the beaches in the OSPAR maritime area).[5] In the case of the NGOs data collection efforts on marine litter, the International Coastal Cleanup (ICC) data card has been used, which has been designed to provide a "snapshot" assessment of the types and amounts of debris found during clean-up activities worldwide.

3. Floating litter

3.1. Availability of data

Information on the amounts and types of litter in the water of the Adriatic Sea is very scarce and limited to surface floating litter data from ship-based visual observations. To date, at-sea recording of litter floating on the sea surface in the Adriatic Sea has been carried out by the Hellenic Environment Protection Association (HELMEPA). Since 2008, HELMEPA has mobilized the Association's member vessels to conduct visual observations of floating litter and some of their initial findings have been reported within the framework of the 'Assessment of the status of marine litter in the Mediterranean' related report, developed by UNEP/MAP-MEDPOL in collaboration with MIO-ECSDE, HELMEPA and Clean-up Greece. The densities of floating debris recorded at the time in the Adriatic Sea were 2.74 kg/km^2 or 5.66 items/km^2. The most abundant items included buoys, clothing, plastic containers and bottles, paperboard boxes. It should be noted that these data provide just an indication of the abundance of litter items at sea, considering that these were the output of limited number of surveys, which didn't cover large areas.[6]

In Slovenia, within the framework of the MSFD, a similar methodology was applied in monitoring surveys carried out in 2011. Results showed that 90% of all litter items recorded at sea surface were made of plastics and densities recorded were 1.98 items of litter items/km^2.

3.2. Review of applied methods

The methodology applied in the above mentioned survey included visual observation from ships-of-opportunity combined with litter collection. The reporting form used facilitated the classification of marine debris found floating in the Adriatic Sea in 12 sub-categories, including fishing nets, wooden pellets, plastic packaging, ropes, plastic bags, clothing, steel drums, wooden trace, boys, paperboard boxes, plastic bottles and plastic containers. The observation transect width varied due to the differences in the ship speed, observation point height (elevation above the sea surface), observation conditions, etc. It generally fluctuated from 22 to 150 meters.

4. Litter on the sea-floor

4.1. Availability of data

Information on the deposits of macro-litter on the sea-floor in the Adriatic Sea is fragmented. The first data reported on the composition, distribution and abundance of litter on the seabed of the Adriatic-Ionian Sea was recorded in 1993.[7] The main findings indicated that sea-floor debris consisted mostly of either paint chips (44%) or plastics (36%). A more

comprehensive study on the issue, published in 2000 by Galgani et al, investigated the distribution and abundance of large marine debris on continental shelves and slopes along the coasts of the Adriatic Sea, among other European Seas.[8] According to the study's findings, the overall debris density in the Adriatic Sea was 3.78 pieces of debris per hectare (pd/ha) or 378 items/km^2, which was considerably lower in comparison to the 19.35 pd/ha (1935 items/km^2) mean concentration estimated in the NW Mediterranean by the same study. Plastics constituted the 69.5% of litter items found.

Data regarding litter on the sea-floor in the Adriatic Sea are also available from the SoleMon Project (Solea Monitoring - Rapido trawl survey in the Northern Adriatic Sea), carried out since 2005 in the Northern and Central Adriatic Sea.[9] Until 2010 only data on the total amounts of marine litter were recorded, without any type of classification of litter items. Conversely, in the last three years (2011-2013) litter data were recorded and were categorized in 45 different types of litter (e.g. cigarette buds, bottles, etc.)[10] At present, only data regarding total amounts of marine litter have been analyzed for the period 2005-2010. The highest value was recorded in October 2005 (34 ± 12 kg/km^2), while the lowest in October 2006 (5 ± 1 kg/km^2). Due to the high variability of values among years and the short time-series actually available the monitoring results haven't been considered statistically reliable to draw a trend.

In addition, within the framework of a project carried out in Montenegro in 2009, investigating the trawling impacts on benthic communities, material was collected in depth ranging from 48 m to 746 m. The collected material was brought on board and measured. The inorganic fraction, mainly marine debris, in the different catches varied from 6.49% to 58.39% and was dominated by car tires and plastic bottles.[11]

Additional information on debris on the seabed of the Adriatic Sea region is restricted to anecdotal findings of underwater visual observations/surveys with SCUBA/snorkelling performed within seabed clean-up actions, organized along the coastlines of Montenegro (Boka Kotorska Bay) and Croatia (Zapara bay, Port of Sali, Zadar Channel).[12]

In Slovenia, an initial assessment of debris on the sea-floor near the coast was performed in 2013 within the framework of the MSFD implementation. The Slovenian sea is shallow (up to 25m of depth) so scuba diving and snorkelling techniques were used to assess sea-floor litter quantity and types. Initial results showed that 55% of litter items were made of plastic, 37% of metal, the rest were made of glass, textile, wood and paper.[13]

Last but not least, there have been a few studies investigating macro-debris on the sea-floor in the Ionian Sea and specifically in the Gulf of Echinades. In 1999, Stefatos et al reported that the concentration of marine debris on the sea-floor of the Echinades Gulf was 89 items/km^{2}and plastic materials dominated the composition of the debris found, with a mean abundance of 79%.[14] 47.5% of the plastics was beverage packaging, 43% other packaging, 5.5 % food packaging, while clothing and fishing gear accounted for an overall 3.8%. Another study in the Gulf of Echinades, conducted in 2008, came up with similar findings and reported a marine debris density on the sea-floor of 72 items/km^2, with plastics found as the dominant material (~55%).[15] In 2013, Sánchez et al recorded in the Gulf of Echinades an average debris density of 17.12 pd/ha (1,712 items/km^2), 25.18 pd/ha (2,518 items/km^2), 27.00 pd/ha (2,700 items/km^2), in sites with high, medium and low fishing activity, respectively. The extremely higher debris densities than those recorded in previous studies maybe attributed to the different sampling sites (closer to the coast) and/or sampling conditions (mesh net size, speed, etc.). The plastics fraction accounted for 76.11%, 91.67% and 87.50% respectively in the above mentioned sites.[16]

***Table 1**: Densities and abundance of plastics among benthic marine litter in the Adriatic and Ionian Seas (Gulf of Echinades).*

Location	Item/km^2	Plastic %	Reference
Adriatic Sea	378	69.5	*Galgani et al, 2000*
Ionian Sea	89	79	*Stefatos et al, 1999*
Ionian Sea	72	55.9	*Koutsodendris et al, 2008*
Ionian Sea	2300	76.11-91.67	*Sánchez et al, 2013*

4.2. Review of applied methods

Investigation of macro-litter loads on the seabed in the Adriatic and Ionian Seas has been mainly conducted using trawl surveys. This approach is the most adequate method to date, although quantities of litter are underestimated.[17] The general sampling strategy to monitor litter on the sea-floor is similar to the one applied for benthic fauna studies. The findings of such surveys refer to the abundance and types of litter items found. The sampling conditions in the aforementioned surveys varied with regards to the mesh net size, number of hauls and haul duration, speed, sampled area and depth, etc. In general, litter items were classified in material types (plastics, metal, glass, rubber, wood) but other sub-categories were used too. Underwater visual observations/surveys with SCUBA and/or snorkelling were restricted to very few clean-up activities organized by NGOs, local authorities, etc.

5. Riverine inputs of marine litter

Currently, there is no data published on riverine inputs of litter in the region, however some information on Po's litter inputs to the Adriatic are expected to be delivered by the end of 2014 within the framework of the EU funded research project on "Identification and Assessment of Riverine Input of (Marine) Litter in Europe's Seas.

6. Impacts of litter on marine biota

6.1. Availability of data

There is very limited data available on the ecological impacts of litter on marine wildlife in the Adriatic Sea. Evidence of harmful effects of marine debris in wildlife in the (sub)region is mostly restricted to observations on individual specimens of cetaceans, fish and turtles that have ingested litter items. Most of the reported data refer to few individuals collected on each occasion, making it hard to draw robust conclusions and presenting only a snapshot of the impacts occurring unseen at sea.

The first report on the deleterious effects of plastic debris ingestion on marine species in the Adriatic Sea was published in 1999.[18] It brought to light the case of a dead female striped dolphin, *Stenella coeruleoalba,* found near the island Krk, in the North Adriatic Sea. The cause of death was ingestion of plastics, indicated by the findings of the necroscopy, according to which the entire volume of its stomach was occluded by different kinds of plastic materials, such as garbage bags, rubber glove, cellophane wrappings, etc. The blubber layer of the specimen was extraordinary thin, indicating starvation. A similar report recorded the death of a Cuvier's beaked whale, *Ziphius cavirostris*, found in the Croatian part of the Adriatic Sea, which was induced by plastic bags.[19]

A study on the occurrence and impacts of marine debris ingestion by logger head sea turtles, *Caretta caretta*, in the foraging habitats of the eastern Adriatic Sea (Slovenia and Croatia), revealed that marine litter was present in 35.2% of turtles, with plastic being the most frequent debris recorded.[20] The types of litter items encountered in the gastrointestinal tract of 54 specimens found stranded or captured incidentally dead by fishermen, included soft plastics (mainly remains of plastic bags and wrapping foils), ropes, styrofoam and monofilament lines found in 68.4%, 42.1%, 15.8% and 5.3% of loggerheads that had ingested debris, respectively. Although marine debris was found in about one third of loggerhead sea turtles from the Adriatic, its occurrence is lower than recently recorded in specimens from the western and central Mediterranean (75.9% and 48.1%, respectively)[21,22], but similar to the occurrence of marine litter in this species in the central north Pacific (34.6%)[23] and in the leatherback turtles (*Dermochely scoriacea*) worldwide.[24]

In addition, in 2011 a study was published including information on the stomach contents of three sperm whales stranded on the Adriatic coast of Southern Italy.[25] Inorganic remains comprised mostly items related to human-induced activities, including fishing gear and hooks, ropes, and several plastic objects. No evident obstruction or perforation of the alimentary tract however was noted.

A recent study carried out in the Eastern Ionian Sea, near the Island of Cephalonia, sheds some light on the impacts of debris on deep-water ecosystems and particularly on fish populations. This study documents the occurrence of marine debris in five deep-water fish species (*Galeus melastomus*, *Pteroplatytrygon violacea, Squalus blainville, Etmopterus spinax, Pagellus bogaraveo*) out of the twenty six species collected.[26] From the 1,504 specimens caught in the deep-water long-line surveys, plastic debris was found in 24 individuals (3.2%). The occurrence of debris among their food was infrequent. Ingested debris consisted primarily of plastics (86.5%), including fragments of hard plastic materials (56.0%), plastic bag fragments (22.0%), fragments of fishing gears (19.0%) and textile fibers (3.0%). Among the species with ingested debris, *G. melastomus* swallowed all debris categories; *P. violacea* and *S. blainville* ingested plastic bag fragments, whereas pieces of hard plastics were found in *E. spinax* and *P. bogaraveo*. The occurrence of marine debris in these species was lower than the one observed in another study focusing on feeding strategies and trophodynamic requirements of deep-sea fishes, which recorded higher litter frequency in *E. spinax*, *G. melastomus*, *Hoplosthethus mediterraneus* and *H. dactylopterus* caught near the Kyllini port in the south eastern Ionian Sea, an area closer to the coast and with higher shipping traffic.[27]

An interesting insight on a rather less known impact of marine litter on marine life, the facilitation of alien species invasions is provided by a study on the vulnerability of marine habitats to the invasive green alga *Caulerpa racemosa* investigated in the National Marine Park of Zakynthos (Ionian Sea, Greece).[28] According to the observations made, it is not uncommon to observe *C. racemosa* fragments attached to small 'hard' objects such as marine litter suggesting that litter items act as anchoring points of drifting *C. racemosa* fragments and facilitate their dispersal.

6.2. Review of applied methods

The methods applied to monitor the impacts of litter on marine wildlife in the Adriatic Sea focus on the assessment of the occurrence, abundance by number or mass and composition of litter items ingested by individual marine species. General necroscopy is performed on individuals, followed by the isolation either of the whole digestive tract (esophagus, stomach and intestines) or parts of it (mostly the stomach) and ingestion of debris is quantified as the

frequency of occurrence (incidence) and/or percentage of dry mass of gut content of each animal. Classification of debris items follows expressed in incidence and abundance by number per litter category.

It is noteworthy mentioning that sea turtles and, particularly, the loggerhead sea turtle *Caretta caretta*, is considered as a good candidate to act as an ingestion indicator in the Mediterranean addressing two marine compartments, as it feeds in the water column and at the sea-floor.

7. Micro-litter

7.1. Availability of data

There is very limited data related to micro-litter in the Adriatic Sea.

In 2012, a preliminary monitoring survey on micro-plastic particles (≤1 mm, S-MPPs) was carried out in a transitional environment along the north-eastern Italian coasts (the Lagoon of Venice) and sediments were collected from 10 sites.[29] Micro-plastics (S-MPPs) were recovered from all samples indicating their extensive distribution throughout the Lagoon. Total abundances varied from 2175 to 672 micro-particles/kg dry weight, higher concentrations generally being observed in landward sites. Of the ten polymer types identified, the most abundant, accounting for more than 82% of total S-MPPs, were polyethylene and polypropylene. The most frequent size (93% of observed micro-plastics) was in the range 30-500 mm. Total S-MPP values were significantly correlated with the finer sediment fraction and with the metal pollution index.

In 2013, the Italian Ministry of Environment, Land and Sea initiated monitoring of micro-litter, as a start up activity within the scope of the MSFD monitoring programs. The first results of this activity are expected to be published by 2014.

In Slovenia, an initial sampling for micro-plastics was performed on sea surface using epi-neuston net throughout the years 2011 and 2014. In all samples micro-plastics were found, however the findings have not been published yet.

7.2. Review of applied methods

In the micro-litter samplings performed in Italy a “manta” trawl is used with a mesh size of 330 µm. This instrument is specifically designed to sample plankton (and therefore also micro-litter) in the first half meter of the water column. Manta trawl is towed at a speed of 1-2 knots for about 20 minutes, and the boat speed must not be greater than 3 knots. Sampling occurs along transects perpendicular to the coastline. The Manta is equipped with a flowmeter to calculate the volume of water sampled. Data collected are recorded in specific sheets. Micro-litter samples are transported to the laboratory where they are analyzed through with the stereomicroscope, separated and classified. Concentration of micro-litter in each sample is expressed as the number of items per m^3 of sea water.

In Slovenia micro-plastics were sampled with an epi-neuston net having a mesh size of 300 µm. The net was towed on the side of the boat, which had a speed of maximum 3 knots for 20 minutes. A similar process, as the one described above, was followed for the analysis of the samples.

8. Marine litter and toxic chemicals

8.1. Availability of data

Marine litter, specifically plastics and micro-plastics, have the potential to adsorb chemicals and act as passive samplers of environmental pollutants.[30] There are no published data in the Adriatic region focusing on this aspect of marine litter, with the exception of a study on plastic pellets carried out within the framework of the International Pellet Watch programme.[31] Plastic pellets - a favourable medium for persistent organic pollutants to absorb to - were collected from beaches in the area of Kato Achaia in the Gulf of Patras. The collected samples were analyzed for PCBs, DDTs, HCHs, and PAHs. The main findings of this survey indicated that the level of pollution of this site in comparison to data from other studies around the world was rather low.

8.2. Review of applied methods

The collected pellets were sorted by near-infrared spectrometer into PE, PP, and other polymers. Among the PE samples, yellowing pellets were selected by naked eye by comparison with the reference pellets whose yellowness had been determined by a Handy Colorimeter. These yellowing PE pellets were then subjected to the chemical analysis since these were proven to accumulate higher concentrations of PCBs. Pellets were extracted with hexane by maceration. The extracts were purified by silica gel column chromatography. PCBs, PAHs and DDE were measured by gas chromatograph equipped with ion-trap mass spectrometer on MS/MS mode. DDT, DDD and HCHs were measured by GC equipped with an electron capture detector (GC-ECD).

ANNEX I

Summary tables of marine litter monitoring data in the Adriatic Sea (based on the datasheet completed by the DefishGear partners)

Table 1. *Availability of beach litter monitoring data in the Adriatic Sea*

Methodological description	Organization running the surveys	Study area, location	Country	Survey time scale	Survey frequency	Quantification of litter	Citation
Beach litter; transect survey	Republic of Slovenia Ministry of the Environment and Spatial Planning	Slovenian cost	SI	01/2009 – 01/2010	monthly	---------	*Galgani et al, 2011*[26]
Beach litter	ARPA ER	Garibaldi, Foce Bevano, Cesenatico, Rimini	IT	05/2013 – 12/2013	biannually	items	*ARPA ER*
Beach litter	Association Legambiente "Delta del Po"	Comacchio, Lido degli Scacchi,	IT	05/2013 – 09/2013	quarterly	items	---------
Beach litter,	Association Legambiente "Circolo Matelda"	Lido di Dante, Foce Bevano, Foce Fiumi Uniti	IT	06/2010 – 05/2013	annually	volume	---------
Beach litter, OSPAR method	---------	Island Mljet	HR	01/2009-05/2010	biannually	items	*Kwokal et al, 2011*[32]
Beach litter, OSPAR method	---------	Adriatic islands,	HR	2000-2009	annually	items	*Kwokal et al, 2011*[33]
Beach litter, ICC	SUNCE. Association for Nature, Environment and Sustainable Development	Prva voda, Split, Croatia	HR	10/2012	one off	weight	---------

Beach litter	Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras	Ionian Sea	GR	2006 - 2007	annually	items	*Cordella St, 2008*[2]
Beach litter	University of Nova Gorica , Faculty of Environmental Sciences	Slovenia	SL	05/2007-09/2007	monthly	items	*Palatinus A, 2008*[34]
Beach litter	Institute Ruder Boskovic	Croatia	HR	2000-2009	---------	items	*Cukrov N, Kwokal Ž, 2009*[35]
Beach litter, Clean Coast Index method & OSPAR method	Ministry of Agriculture and Environment, Proposal for MSFD	Slovenian coasts	SI	5/2007-09/2007, 11/2010-03/2012	monthly	items	*Peterlin et al, 2013*[32]

Table 2. *Availability of water surface litter monitoring data in the Adriatic Sea*

Methodological description	Organization running the surveys	Study area, location	Country	Survey time scale	Survey frequency	Quantification of litter	Citation
Surface litter; visual ship survey	HELMEPA	Adriatic Sea	IT, GR	2/2008 – 4/2008	one off	items, weight	*UNEP/MAP MEDPOL, 2008*
Surface litter; visual ship survey	Institute for Water, Slovenia	Slovenian waters	SI	11/2011	weekly	Items	*Peterlin et al, 2013*[32]

Table 3. *Availability of sea-floor litter monitoring data in the Adriatic Sea*

Methodological description	Organization running the surveys	Study area, location	Country	Survey time scale	Survey frequency	Quantification of litter	Citation
Sea-floor litter; trawl surveys	IFREMER	Adriatic Sea	---------	03/1998	one off	items	*Galgani et al, 2000*
Sea-floor litter; trawl surveys	Israel Oceanographic and Limnological Research, National Institute of Oceanography; Forschungsinstitut Senckenberg	Adriatic & Ionian Sea	IT	05/1993	one off	items	*Galil et al, 1995*
Sea-floor litter; scuba surveys	University of Zagreb, Faculty of Science, Department of Biology	Vis, Sali & Zadar; Adriatic sea	HR	2011	one off	items	*Petricioli et al, 2012*
Sea-floor litter; trawl surveys	Institute of Marine Sciences, Barcelona	Ionian Sea	GR	05/2009 - 06/2009	one off	items	*Sanchez et al, 2013*
Sea-floor litter; scuba surveys	Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras	Ionian Sea	GR	11/1997 - 05/1998	annually	items	*Stefatos et al, 1999*
Sea-floor litter; scuba surveys	Laboratory of Marine Geology and Physical Oceanography, Department of Geology, University of Patras	Ionian Sea	GR	10/2000 - 05/2003	annually from May to October	items & weight	*Koutsodendris et al, 2008*
Sea-floor litter; trawl surveys	Project "Biological resources, edible and non-edible, in trawling fishing at Montenegrin coast"	Adriatic Sea	MN	Summer 2009	---------	items	*Petovic et al, 2013*
Sea-floor litter; trawl surveys	SoleMon trawl survey	Northern and central Adriatic	IT	2011-ongoing	annually	weight	---------
Sea-floor litter; trawl surveys	Institute of Water, Slovenia	---------	SI	2008-2009	annually	Items & total weight	*Peterlin et al, 2013*[36]

Table 4. *Availability of monitoring data on impacts of litter on marine biota in the Adriatic Sea*

Methodological description	Organization running the surveys	Area Description	Country involved	Survey time scale	Survey frequency	Quantification of litter	Citation
Ingested litter in sea turtles	Department of Biology, University of Zagreb	Eastern Adriatic Sea	HR	06/2001 - 11/2004	incidentally	items	*Lazar B & Gračan R, 2011*
Ingested litter in whale	Faculty of Veterinary Medicine, University of Zagreb	Dubrovnik, Korcula	HR	4/2001 - 2/2002	incidentally	items	*Gomerčić et al, 2006*
Ingested litter in fish	Institute of Marine Biological Resources and Inland Waters, HCMR	Cephalonia Island, Ionian Sea	GR	Summer &autumn 2010	incidentally	items	*Anastasopoulou A, 2013*
Ingested litter in dolphin	Department for Marine Research, Institute Ruder Boskovic	Krk Island, North Adriatic	HR	June 1998	incidentally	Weight	*Pribanic et al, 1999*
Facilitation of alien species invasion; scuba divers	Institute of Marine Biological Resources, Hellenic Centre for Marine Research	Zakynthos, Ionian Sea	GR	October 2009	---------	---------	*Katsanevakis S et al, 2010*

Table 5. *Availability of micro-litter monitoring data in the Adriatic Sea*

Methodological description	Organization running the surveys	Study area, location	Country	Survey time scale	Survey frequency	Quantification of litter	Citation
Sea surface microplastics; epineuston net	Institute for Water, Slovenia & University of Nova Gorica, Slovenia	Slovenian waters	SI	11/2011-04/2012	Two times	Items	*Peterlin et al, 2013*[32]
Sea surface microplastics; epineuston net	Institute for Water, Slovenia & University of Nova Gorica, Slovenia	Slovenian waters	SI	12/2012-05/2013	Two times	Items	*Peterlin et al, 2013b*

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