UNITED NATIONS

EP

UNEP/MED WG.464/Inf.3

UNEP

UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

28 March 2019
Original: English

Joint Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring and ENI SEIS II Assessment of Horizon 2020/National Action Plans of Waste Indicators

Podgorica, Montenegro, 4-5 April 2019

Agenda item 3: State of Play of IMAP Implementation Related to Marine Litter (EO10) and its further Development

Assessment of the available data to propose GES targets for IMAP Candidate Indicator 24

The meeting has been organized in collaboration with the European Union funded Project ENI SEIS II South Implementation of the Shared Environmental Information System (SEIS) principles and practices in the ENP South region – SEIS Support Mechanism

For environmental and economic reasons, this document is printed in a limited number. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

UNEP/MAP
Athens, 2019

Note by the Secretariat

The Regional Plan on Marine Litter Management in the Mediterranean, adopted by the Contracting Parties to the Barcelona Convention during their 18th Meeting in Istanbul in 2013 (Decision IG.21/7) entered into force in 2014; it envisages a series of prevention and reduction measures, including a specific work plan and implementation timetable. Its overall scope is to anticipate and reduce the effects of litter on the coasts and in the marine environment in the Mediterranean.

Based on the Mid-Term Strategy 2016-2021 and the Programme of Work 2016-2017, adopted by the decisions IG22/17 and IG22/17 of COP 19, the UN Environment/Mediterranean Action Plan - Barcelona Convention and the European Union funded the Marine Litter MED project.

The Specially Protected Areas Regional Activity Center SPA/RAC, as partner to the Marine litter MED Project, is implementing a number of activities foreseen in the Project to support the implementation of the Regional Plan on Marine litter Management in the Mediterranean as well as the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP) and its 10th Ecological Objective (EO10) on Marine Litter. EO 10 consists of two Common and one Candidate Indicator. EO10 Candidate Indicator 24 is referring to the "Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles". (Decision IG22/7, COP19).

The target species for Candidate Indicator 24 is the commonest species of marine turtle in the Mediterranean, *Caretta caretta*, widely distributed throughout the basin and for which a great deal of information is available.

In order to collect more concrete data on litter ingested by sea turtles in the Mediterranean as well as on the current methodologies and measures applied by Mediterranean Countries to this respect. The report presented in the document UNEP/MED WG464/Inf.3 (Deliverable 1.4.16 of the Marine Litter MED Project) has been prepared based on accurate questionnaire disseminated through the SPA Focal Points, and the network of experts, partners and institutions working on marine turtles' study and conservation. The report aimed to:

a. assess the state of play with respect to the level of knowledge and the type of methodologies used, where applied, for the analysis of the marine litter ingested by sea turtles;
b. assess the available data related to both marine litter ingested by sea turtles;
c. evaluate eventual weaknesses, gaps or critical elements with respect to points a. and b.
d. Propose recommendation to fill the eventual gaps and weaknesses

The present documents is presented for initial discussion by the joint meeting of the Ecosystem Approach Correspondence on Marine Litter Monitoring and ENI SEIS II Assessment of Horizon 2020/National Action Plan of waste Indicators to be held in Podgorica, Montenegro, 4-5 April 2019.

Table of Contents

List of Abbreviations and Acronyms

CNEPRU-MESRS	Conservation des tortues marines des eaux cotières algérienne (Algeria)
COP	Conference of the Parties
DFMR	Department of Fisheries and Marine Research (Cyprus)
ECOQ	Ecological Quality Objective
ERA	Environment and Research Authority (Malta)
GEF	Global Environment Fund
GES	Good Environmental Status
HAS	Herpetofauna Albanian Society (Albania)
IMAP	Integrated Monitoring Assessment Programme
INDICIT	Implementation of Indicators of Marine Litter on Sea Turtles and Biota in Regional Sea Conventions and Marine Strategy Framework Directive Areas
INSTM	Institut Nationale des Sciences et Technologies de la Mer (Tunisia)
ISPRA	Italian Institute for Environmental protection and research (Italy)
LRSE	Laboratoire Reseau Surveillance Environnementale (University of Oran in Algeria)
MCPA	Marine and Coastal Protected Areas (UNDP Project in Albania)
MSFD	Marine Strategy Framework Directive
MSFD TG ML	Marine Strategy Framework Directive – Technical Group on Marine Litter
SPA RAC	Regional Activity Center for Specially Protected Areas
UNEP	United Nations Environment Programme
UNEP/MAP	United Nations Environment Programme – Mediterranean Action Plan
UNDP	United Nations Development Programme

1 Introduction

1. Our Oceans and seas, in particular the Mediterranean Sea, have often been considered as a source of unlimited raw materials capable of sustaining the industrial growth but also absorbing uncontrolled production of any kind of waste. It is a matter of fact that marine pollution, in particular marine litter, as reported by the 2015 UN Environment/MAP assessment[1], represents a severe and even more increasing threat to marine and coastal biodiversity, with proved harmful pressures on ecosystems and even lethal effects on marine fauna. In addition to the said already critical scenario, over the last years, the phenomenon of micro-plastics has been acknowledged a potential threat to human health due to the fragmentation of floating plastics that accumulate in the oceans ending up in food chains.

2. These are the reasons why marine pollution, and in particular marine litter, has achieved a central role in the environmental programmes and policies at all levels, being aware that marine litter is a common shared responsibility for all subjects involved, from the maritime industry, the tourism and agriculture sectors, NGOs and the civil society.

3. In this context, the identification of concrete and measurable targets and indicators for the effective monitoring of the presence of marine litter in the Mediterranean Sea has become crucial at all levels. In particular, considering that marine litter, as persistent, manufactured processed solid material discarded, disposed of or abandoned in the marine and coastal environment, has a widespread negative impact on marine organisms, the ingestion of litter by these animals, mostly sea turtles, has become one of the main points of reference for the said assessments.

4. The current relevant literature on the matter reveals that: about 700 species of invertebrates, fish, bird, cetaceans and sea turtles are threatened by marine litter (Gall and Thompson, 2015); many species, as fishes (Boerger et al., 2010), birds (van Franeker et al., 2011) and cetaceans (de Stephanis et al., 2013), mistakenly ingest debris such as plastic, monofilament line, rubber, aluminum foil and tar (Bjorndal et al. 1994; Derraik, 2002) while marine turtles accidentally swallow micro and macroplastic debris that is often found in their digestive tracts (Bentivegna et al. 2003; Campani et al., 2013; Lazar and Gracan, 2011). Low feeding discrimination of this species makes it especially prone to debris ingestion (Tomas et al.2002). In particular, the ingestion of plastic fragments or other anthropogenic material may be directly responsible for the obstruction of digestive tracts or cause a serious weakness because of a reduction in natural feeding and absorption of toxic compound (Bjorndal et al. ,1994; Bjorndal, 1997; Gregory 2009, Kuhn et al.2015). Furthermore, long retention times of plastic debris in the intestine may cause the releasing of toxic chemicals (e.g. phthalates, PCBs) that may act as endocrine disruptors and therefore can compromise the fitness of individuals (Teuten et al., 2009).

5. The EU Marine Strategy Framework Directive (EC 2008, 2010), to evaluate trends in the amount and composition of litter ingested by marine Mediterranean animals, considered the sea turtle *Caretta caretta* as a potentially convenient tool to monitor marine litter since this sea turtle is the most common species and widely distributed in Mediterranean, consume all sort of litter, feed exclusively at sea, retain litter for a long time in the gastro-intestinal system, integrate pollution levels over the oceanic and neritic foraging habitats (Casale and Margaritoulis, 2010; Bentivegna 2002; Lazar and Grancan, 2011; Darmon et al, 2016; UNEP/MAP,2015a). *Caretta caretta* was, indeed, chosen as the Common Indicator of the "Good Environmental Status" (GES) for marine litter, with specific reference to the Mediterranean and its bordering marine areas

6. At Regional level, the Conference of the Parties of the Barcelona Convention (COP18 , 2013) adopted the Regional Plan for the marine litter management in the Mediterranean (Regional Plan on ML) with the aim to prevent and reduce marine litter in the marine and costal environment and contribute to the achievement of the Good Environmental status. The Plan, which is the unique first legally binding regional plan on marine litter, identifies a specific set of measures as, in particular, the prevention of marine litter input to the marine and coastal environment, the assessment of the state of marine litter in the Mediterranean, and the development and implementation of the Mediterranean Marine Litter Monitoring Programme.

[1] http://web.unep.org/unepmap/marine-litter-assessment-mediterranean-2015-0

7. The Integrated Monitoring and Assessment Programme (IMAP), which was adopted subsequently, in 2016, at the 19th Conference of the Parties of Barcelona Convention (COP19), was indeed responding to the need to guarantee a quantitative, integrated analysis of the state of the marine and coastal environment, covering, among the others, pollution and marine litter. The ingestion of litter in indicator species, as identified in the Regional Plan on ML, was included in the IMAP as Candidate Indicator no. 24 "*Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles*", with special focus on the sea turtle *Caretta caretta*.

8. In this context, the 2016-2019 EU-funded Marine Litter MED project was developed. the main aim of the project is to specifically support the Contracting Parties from Southern Mediterranean/EU Neighborhood to implement the Marine Litter Regional Plan through the implementation of a number of measures envisaged in the updated NAPs endorsed by COP 19 of the Barcelona Convention and its Protocols.

9. The main achievements of the component of EU funded Marine litter MED project, coordinated by SPA/RAC was the 2017 study on the "definition of the most representative species for IMAP CI 24" (Output1, deliverable 4.14) . The study confirmed that the marine turtle *Caretta caretta* as the most reliable indicator to measure the prevalence and effects of ingestion of litter and entanglement/strangling in litter on marine fauna. It was thus recommended the development of a pilot monitoring network based on the use of this species.

10. Following the said outcome, this survey (still within Output 1 – deliverable 4.16 of the MED project), intends to further contribute to the ongoing discussions on the definition of GES targets and, at the same time, improve knowledge on and the assessment of the said IMAP Candidate Indicator 24. Its specific aims are indeed the following:

a) Assess the state of play with respect to the level of knowledge and the type of methodologies used, where applied, for the analysis of the marine litter ingested by sea turtles;
b) Assess the available data related to both marine litter ingested by sea turtles; and
c) Evaluate eventual weaknesses, gaps or critical elements with respect to points a. and b.

2 Identification and collection of available data

11. In order to collect specific information on the current methodologies in use for the analysis of marine litter ingested by sea turtles, from the Mediterranean Countries, which are Contracting Parties to the UN Environment/MAP Barcelona Convention, a simple but accurate questionnaire was prepared.

12. The questionnaire was submitted on 25 May 2018 to the SPA National Focal Points , the Regional institutions, Conventions Secretariats, the Associates and partners of the Action Plan for the conservation of marine turtles in the Mediterranean and the network of Marine turtles' experts available at SPA/RAC as well as to the partners of the MAVA project (Dekamer, WWF Greece, WWF Turkey, Archelon and MEDASSET). Answers to the questionnaire were received on July 2018.

13. The Questionnaire is made of 29 questions and is structured in three parts, which are in line with the said three goals of the work, as follows:

- Part I (Questions 1-11): To identify the subjects involved in the analysis of the litter ingested by sea turtles, to be acknowledged of the projects developed and/or ongoing and whether data obtained (publications, reports, studies, etc.) have been made available;
- Part II (Questions 12-18): To collect punctual and more precise information on typology and quantity of marine litter ingested by dead sea turtles or found in the excrements (*faecis*) of living turtles, which are under rehabilitation in rescue centers;
- Part III (Questions 19-29): To assess the criteria and methodologies used for the analysis of marine litter and identify eventual gaps.

3 Results

14. In total, over the 22 Contracting Parties to the Barcelona Convention, 11 Countries have sent their feedback to the survey as follows: Albania, Algeria, Bosnia-Herzegovina, Croatia, Cyprus, Egypt, France, Italy, Malta, Tunisia and Turkey. Among them, 7 Countries (Albania, Algeria, Egypt, Italy, Malta, Tunisia and Turkey) have properly replied to the questionnaire. The other 4 Countries (France, Croatia, Cyprus and Bosnia-Herzegovina) have contributed to the analysis by sharing the outcomes of specific projects and publication. In the present work both information deriving from the questionnaires filled up by the 7 Countries and data presented in literature as reported by the other Countries (France and Croatia) have been considered.

The table 1 below presents an overall general picture of all information collected from the questionnaires received by the 7 Countries mentioned above. In the first column all questions included in the questionnaire are listed while in the following 7 columns all answers are reported. The last column on the right reports additional relevant information to be stressed, especially in the case of those Countries as Algeria where, considering the high number of questionnaires received, it was not easy to present one single answer. When the box is white it means that no answer was provided on the question.

Table 1: General picture of all information collected from the collected questionnaires

Question	ALBANIA[2]	ALGERIA[3]	EGYPT	ITALY	MALTA	TUNISIA[4]	TURKEY	Comments
1. Are you aware of the IMAP Candidate Indicator 24 and its related elements?	Yes	No (71,4%)	Yes	Yes	Yes	Yes (Not all)	Yes	
2. Is there an already established network in your Country/area for the collection of stranded sea turtles?	Yes	Yes * LRSE - Oran	NO	Yes	Yes	Yes	Yes	*the network (LRSE) is unknown to the majority of the subjects filling up the questionnaire (9 on 14)
3. Are you involved in the analysis of marine litter ingested by sea turtles?	Yes	Yes*	No	Yes	Yes	Yes	Yes	*2 upon 14 are involved.
4. If so, in which context (for which reason)?	Ordinary Work and fishermen	No*		Ordinary work and specific project	Yes	Ordinary work and specific project	Specific Project	* one questionnaire reports about involvement through PhD project at LRSE
5. If you are involved in a specific project, please briefly indicate the name and objective of the project (whether it is a EU funded project or other).	UNDP project	Project CNEPRU-MESRS of the RSE ORAN	Conservation of Marine Turtles in Med Region	INDICIT, MedSeaLitter, Marine Strategy		INDICIT	INDICIT	

[2] Data on Albania are referred to information received from 2 questionnaires.
[3] Data on Algeria are referred to information received from 14 questionnaires.
[4] Data on Tunisia are referred to information received from 2 questionnaires.

Question	ALBANIA[2]	ALGERIA[3]	EGYPT	ITALY	MALTA	TUNISIA[4]	TURKEY	Comments
6. In your Country, are you aware of other organisations/researchers involved in the analysis and observation of marine litter ingested by sea turtles?	No	No *	Yes	Yes	Yes	Yes**	No	* Except one questionnaire ** INSTM
7. If so, could you please provide their names and contact details?	No	No	Yes**	Yes	Yes (Nature Trust Malta)	Team of		*Except one questionnaire quoting LRSE Oran **Vet collecting occasionally dead turtles.
8. For how long have you been collecting data related to marine litter ingested by sea turtles?		No*	2018	2010	2018**	2017***	2017	* Except one questionnaire quoting PhD project 2016 at LRSE** data on stranding are available from 2001 *** data on stranding are available from 2016
9. Have you made your data available?	No	No	No	Yes	No	Yes	No	
10. If so, in which way?	Orally (reported by fishermen)			International Publ.		Internal reports		
11. What kind of data related to marine litter ingested by marine turtles have you collected?	P/A	No *	P/A	Detailed analysis	P/A	P/A Detailed analysis	P/A detailed analysis	*Except one questionnaire quoting PhD project at LRSE

Question	ALBANIA[2]	ALGERIA[3]	EGYPT	ITALY	MALTA	TUNISIA[4]	TURKEY	Comments
12. Are data collected by you related to dead marine turtles?	No	No*	Yes	Yes	Yes	Yes	Yes	*Except for 3 questionnaires
13. How many dead marine turtles have you examined through necropsy so far?		No*	3	150	32	200	80	*Except for one questionnaire quoting PhD at LRSE (18 Caretta, 1 Dermochelys)
14. How many of them had ingested litter?		No*	1	68%	No data	60	35%	* Except for one questionnaire quoting PhD at LRSE (5 Caretta 1 Dermochelys)
15. Could you please indicate the detected percentage of litter, with respect to the total weight of the gastrointestinal content?		No*		More grams of plastic than food remains on 64% of individuals		No	Litter less 1gr	* Except for one questionnaire quoting PhD at LRSE (5-6%)
16. Do you have a well-equipped rescue center in your area where you can perform analysis of marine litter ingested by sea turtles?	Yes	No	No	Yes	Yes	Yes	Yes	
17. Have you observed the presence of marine litter in the marine turtles' excrements?	No	No	Yes	Yes	No	Yes	Yes	
18. If yes so, in how many sea turtles have you found marine litter in the excrements?			1	Quoting publication		20	5	

Question	ALBANIA[2]	ALGERIA[3]	EGYPT	ITALY	MALTA	TUNISIA[4]	TURKEY	Comments
19. Have you classified the different items contained in the marine litter ingested by sea turtles?	No	No	No	Yes	No*	Yes	Yes	* data available refer to marine litter in which sea turtles are found entangled.
20. Could you please indicate the percentage of the different items in your data collection?	No	No		Matiddi et al.2017	No		70% sheet 15% treated material remaining items from fragments and foam	
21. Have you adopted a specific methodology in the analysis of the marine litter?	No	No	Yes	Yes*	No	Yes	Yes	* from publication
22. If so, which one?	None	None	Matiddi et al.2017	MSFD TG ML - INDICIT	None	Yes	INDICIT	
23. Could you please specify what criteria are followed for the collection of the gastrointestinal tract from dead sea turtles as well as the procedures adopted for the analysis of its content?	None	None	Matiddi et al.2017	Grams and number of items divided in sub categories	No	INDICIT	INDICIT	
24. Do you think that the methodology applied by you in the analysis of marine litter is compliant to that one applied by other Countries or by other researchers in your own Country?				Yes	No	Not aware	Yes	
25. Have you found any difficulties in the analysis of data collected through				Yes, Data not comparable	Yes	No	No	

Question	ALBANIA[2]	ALGERIA[3]	EGYPT	ITALY	MALTA	TUNISIA[4]	TURKEY	Comments
different methodologies from the one applied by you?								
26. In your opinion, are there weaknesses or gaps in the methodologies applied by you/ your Country, if any?	Yes		No**	No		No	No	** not yet verified
27. Based on your experience do you think that capacity-building trainings should be organized?	Yes	Yes *	Yes**	Yes	Yes	Yes	Yes	* request for regional and sub-regional trainings in small groups and with no problems of language ** training at sub-regional level
28. Are you aware for the existence of any online training material for the analysis of marine litter ingested by sea turtles (e.g. online webinars, videos)?	No	No	Yes	Yes	No	Yes	Yes	
29. Would you support the development of such tools at regional level?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

4 Data collected from the questionnaires

15. In the section below a detailed "Country-profile" analysis of the answers provided by the 7 Countries., is reported and divided in three Parts (Part I, Part II and Part III) according to the typology of the relative questions.

ALBANIA:

16. The Government of Albania and a representative of the Herpetofauna Albanian Society replied to the survey by sending two questionnaires, of which are reported the common and diverging aspects.

17. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11):

- Albania is involved in the analysis of marine litter ingested by sea turtles through both ordinary work and information provided by fishermen. A network for the collection of stranded sea turtles is also reported.
- The UNDP project mentioned in the questionnaire - "Improvement of coverage and management of marine and coastal protected areas in Albania (MCPA)"[5] has the wider objective to extend the percentage of protected areas in the Albanian territory for the protection of its species as, among the others, sea turtles. Yet, no specific activities related to the analysis of marine litter ingested by sea turtles are apparently foreseen by the project.
- Data on the issue are totally absent.

18. PART II – typology and percentage of marine litter found in living and dead sea turtles (questions 12-18):

- Even if about 10 specimens of sea turtles have been examined under necropsy in Rambecy Bay, where a small dock next to its visitor center has been set up, no records on the said necropsies have been registered.
- According to the UNDP project on MCPA (see above), a rescue center in the visitor center of Rradhima has been recently set up, whose data have been shared with fishery units and marine biology experts.
- The presence of marine litter in the faecis of living sea turtles has not been recorded. Yet, according to a specific study on the *Caretta caretta* diet, conducted by the Herpetofauna Albanian Society (HAS), through the analysis of sea turtles' faecis, besides rests of food, litter has been detected (2010-2012) even if no records have been made available.

19. PART III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions 19-29):

- The methodologies to be applied for the analysis of marine litter in sea turtles are not known, as well as online methodological tools, and therefore, ad hoc trainings are strongly welcomed.

ALGERIA:

20. Algeria has replied to the survey by sending 14 questionnaires, of which 10 from the environmental "Antenne du Commissariat National du littoral", placed all along the Algerian coast

[5] UNDP project financed in its first phase by GEF and the Albanian Government and currently by the Italian Agency for Cooperation – http://www.al.undp.org/content/albania/en/home/operations/projects/environment_and_energy/protecting-albania-s-marine-and-coastal-biodiversity-phase-2-.html;

and 4 from research centers and Academic institutions (Laboratoire Réseau Surveillance Environnemental - Université d'Oran ; Université Sidi Bel Abbes ; Ecole Supérieure des Sciences de la Mer et de l'Aménagement du littoral ; Centre National de Recherche et de développement de la Pêche et de l'Aquaculture). An overall analysis considering both the information and elements shared by the majority of the questionnaires and those aspects diverging has been made.

21. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11):

- Among the subjects involved in the analysis of marine litter ingested by sea turtles stands one of the mentioned "Antenne" located in the Province of Skikda, which carries out these activities as ordinary work. The other subjects answering to the questionnaires seem not to be directly involved in the issue apart from a researcher carrying on these analysis from 2016, within a specific PhD project conducted at the University of Oran (Laboratoire Réseau Surveillance Environnementale – LRSE).
- The Laboratoire Réseau Surveillance Environnemental of the Province of Oran is the only network for stranded sea turtles reported in Algeria, even if it is not known to the majority of the subjects answering to the questionnaire (71%).
- The projects reported in the questionnaires are 3, of which 2 projects on the analysis of coastal and marine litter and its impact on fish products and, therefore, on human health ("Caracterisation des déchets cotieres et marines"6; "Surveillance des pollutions et nuisances affectant les eaux cotieres et le produit de la pêche, et evaluation de leur impact sur la santé humaine"7) and 1 project on the conservation of sea turtles in the coastal Algerian waters ("Conservation des tortues marines des eaux cotières algerienne / CNEPRU-MESRS 8). Yet, the analysis of marine litter ingested by sea turtles is not included among the specific objectives of all the said projects.
- Data on the issue are totally absent except for those reported in the context of the PhD project, which are focused on the quantitative and qualitative analysis of marine litter found in the gastro-intestinal tract through necropsy analysis.

22. PART II – typology and percentage of marine litter found in living and dead sea turtles (questions 12-18):

- The majority of the questionnaires do not report data on typology and percentage of marine litter ingested by living and dead turtles.
- The unique data reported is related to the mentioned PhD project, according to which over 18 *Caretta caretta* and 1 *Dermochelys* examined, 5 *Caretta caretta* and 1 *Dermochely*s had ingested litter with a percentage of 5-6% with respect to the total weight of the gastrointestinal content. Within the same project the items found in the turtles have been kept and identified. (peace of fishing gear, fragments of yogurt small containers and of glass). No rescue centers have been set up yet in Algeria and no one has ever observed litter in faecis of sea turtles.

[6] Caractérisation des déchets côtières et marines.
[7] Projet financé par le Ministère de l'Enseignement Supérieur de la Recherche Scientifique
[8] Projet CNEPRU – MESRS, Financé par le Ministère de l'Enseignement Supérieur de la Recherche Scientifique
https:/www.mesrs.dz/afficher/-/asset_publisher/nFmcv2fFsM1O/content/projetcnepru;jsessionid=1AE95D2E7BE163FB346608D1DEFEC803

23. PART III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions 19-29):

- The methodologies to be applied for the analysis of marine litter ingested by sea turtles are not known, as well as the online methodological tools, and therefore, ad hoc trainings for small groups, and preferably in local language, are strongly welcomed.

EGYPT:

24. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11)

- No networks for the collection of stranded turtles and no involvement in the analysis of marine litter ingested by sea turtles have been reported.
- The Marine Turtle Project/conservation of marine turtles in the Mediterranean Region9, which has been reported in the questionnaire, does not include activities related to the analysis of marine litter ingested by sea turtles.
- Yet, the questionnaire reports about the observation of marine litter on one of the three sea turtles occasionally examined under necropsy by an Egyptian veterinary. Yet, the typology and quantity of the litter detected has not been reported.

25. PART II – typology and percentage of marine litter found in living and dead sea turtles (questions 12-18)

- The collection of dead sea turtles started in 2018 (Science 2017 – From Mediterranean and Red Sea); over three sea turtles subject to necroscopy, one had ingested litter. Yet, items have not been identified or quantified. No rescue centers for the rescue and rehabilitation of sea turtles have been set up yet.

26. PART III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions19-29).

- The small number of sea turtles found so far (just 3 sea turtles) do not allow for a detailed analysis of the marine litter ingested. Yet, the only methodology for the analysis of marine litter, which is known through online tools but not applied on the territory, is the Italian one (Matiddi et al. 2017).
- Even if aware of online training materials, trainings at sub-regional level are strongly welcomed.

ITALY:

27. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11)

- Italy is concretely involved in the analysis of marine litter ingested by sea turtles in the framework of both ordinary activities and specific projects as INDICIT10, MEDSEALITTER11 and the Marine Strategy Framework Directive (MSFD – Descriptor 10).
- Since 2010, the Italian Institute for Environmental protection and research (ISPRA) is in charge of the national coordination on the collection of data on marine litter ingested by sea turtles that are available in international publications. All quantitative and qualitative data,

[9] Project co-funded by MAVA foundation - http://www.medasset.org/our-projects/conservation-marine-turtles-mediterranean-region/

[10] INDICIT project "Implementation Of Indicators Of Marine Litter On Sea Turtles And Biota In Regional Sea Conventions And Marine Strategy Framework Directive Areas", 2017-2019 – www.indicit-europa.eu.

[11] https://medsealitter.interreg-med.eu

which have been collected since 2011, relate to the detailed analysis of the gastrointestinal tract of 150 sea turtles (68% of them had ingested litter and in 64% the total weight of litter items exceeded the total weight of food rests) (Matiddi et al. 2017).

28. Part II – typology and percentage of marine litter found in living and dead sea turtles (questions 12-18)

- From the analysis of the faecis carried out in well-equipped rescue centers, marine litter has been found in 27 sea turtles over a total of 121 sea turtles examined (about 23%). (Camedda et al. 2014).

29. Part III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions19-29).

- Parts of plastic bags and other sheet fragments were the main categories in terms of abundance (85%), followed by rigid plastic fragments and threads. Grams and number of items were also divided in sub-categories.
- The methodology applied by all the subjects involved in the analysis of marine litter is the one proposed by the INDICIT project.

MALTA:

30. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11)

- Malta is involved in the analysis of marine litter only through the collection of information provided by the network for the collection of stranded sea turtles.
- All data collected from 2001 to 2017 refer to the activities carried out within the network for stranded turtles and are pretty general. Yet, from 2018, following an ad hoc agreement between the Environment and Research Authority (ERA) and the Nature Trust Malta, data are more specific and relate to necropsy activities established and officially standardized in the framework of the said agreement. In general, no official data are available on the presence of litter ingested by sea turtles even if litter has been detected in some of the 32 turtles subjected to necropsy from 2001.

31. PART II – typology and percentage of marine litter found in living and dead sea turtles (questions 12-18)

- A rescue center is present in the Country and it is run by Nature Trust Malta through an agreement with ERA and the Ministry of the Environment.
- No analysis of the faecis has been carried out yet.

32. PART III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions 19-29).

- The methodologies to be applied for the analysis of marine litter in sea turtles are not known, as well as online training tools, and therefore, ad hoc trainings are strongly welcomed.

TUNISIA:

33. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11)

- A network for the collection of stranded sea turtles exists in Tunisia and from 2006 the Institute Nationale des Sciences et Technologies de la Mer (INSTM) is involved in the analysis of marine litter both as ordinary activity and in the framework of the INDICIT project

whose data have been reported in national reports but not available for the present survey.

34. PART II – typology and percentage of marine litter found in living and dead sea turtles (questions 12-18)

- Necropsy on 200 turtles has been carried out and quantitative and qualitative data on marine litter found in the gastrointestinal tract of 60 of them (30%) have been collected.
- It is also reported by a PhD researcher of University of Sfax – Faculté des Sciences, that from the spring 2018, 20 sea turtles have been examined through necropsy, of which 5% had ingested marine litter with a weight lower than 1% of the total weight of the stomach contents.
- Marine litter has been found in the faecis of 20 turtles under rehabilitation on the rescue center even if no classification of the different marine litter items has been done yet.

35. PART III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions 19-29).

- As partner of the INDICIT project, Tunisia does apply the methodology proposed by the project itself and, as reported in the questionnaires, no difficulties have been found in its implementation. As reported by the PhD researcher of University of Sfax, some gaps are due to low number of samples and the lack of personnel adequately skilled to this type of work.
- A training at national and sub-regional level is strongly welcomed also with the involvement of NGOs considering that not all subjects involved in the analysis of marine litter are aware of online training tools.

TURKEY:

36. PART 1 – subjects involved, ongoing projects and availability of data (questions 1-11)

- Turkey is involved in the analysis of marine litter through INDICIT project aiming at developing a common approach for the monitoring of marine litter ingested by sea turtles. All data related to these activities, which started about 20 months ago, have not been made available yet but shared with the partners of the said project. Data refer to both the simple observation of presence/absence of marine litter and the detailed quantitative and qualitative analysis of the gastrointestinal tract.

37. PART II – typology and percentage of marine litter found in living and dead sea turtles (questions 12 -18)

- Out of 80 sea turtles examined under necropsy, 35% had ingested litter with a weigh less than 1 gram. The rescue center present in the Country has allowed for the analysis of marine litter in the faecis of 5 turtles under rehabilitation (70% of the items were sheets, 15% threated materials and remaining items were various fragments and foam).

38. PART III – methodologies in use for the analysis of marine litter: points of strength and/or gaps (questions19-29).

- The methodology and criteria applied in the analysis of the gastrointestinal tract are those established within the INDICIT project and therefore no difficulties have been found in its implementation. Yet, the organization of a regional training is strongly welcomed.

OTHER CONTRIBUTIONS:

39. As reported above, 4 Countries (France, Croatia, Cyprus and Bosnia-Herzegovina) have contributed to the survey by sharing the outcomes of specific projects and publications. The key elements of these works are summarized below.

40. **BOSNIA AND HERZEGOVINA** does not carry out any monitoring activity on sea turtles due to their absence in Neum-Klel bay. However, they are involved in the IPA Adriatic founded "De Fish gear" project[12], whose objective is, among other, the analysis of marine litter ingested by biota, namely fishes.

41. As reported by the Ministry of Agriculture, Rural development and Environment - Marine Environment Division/ Department of Fisheries and Marine Research (DFMR) of **CYPRUS**, no analysis of marine litter ingested by sea turtles is done.

42. **FRANCE** has transmitted the outcomes of a Marine litter EU INTERREG MED Biodiversity Protection project on enhanced monitoring and management of marine litter in coastal, offshore and protected areas, mostly MPAs[13], and **CROATIA** has reported about the publication about *marine debris ingested by loggerhead sea turtles, Caretta caretta in the Adriatic Sea* (Lazar and Gracan, 2011).

5 Comparative Analysis: Key elements

43. Involvement in the analysis of marine litter ingested by sea turtles: Italy, Tunisia and Turkey are partners of the INDICIT project and, together with France, Spain, Greece and Portugal do undertake both quantitative and qualitative analysis on marine litter ingested by sea turtles. Yet, the majority of the Countries contributing to the survey are involved in these analyses occasionally, through the simple observation of the presence/absence of litter in sea turtles or on the basis of information provided by fishermen or the network of stranded turtles, where existing. As for the Countries of southern Mediterranean, due to the lack of specific activities on marine litter ingested by sea turtles, data are not available except for those reported by a PhD researcher of the LRSE at Oran University (Algeria) conducting specific analysis on dead and living turtles in the area with detailed outcomes.

44. Network for stranded sea turtles: apart from Egypt, almost all Countries have a network for stranded turtles although, as for Algeria at the LRSE of the University of Oran, not always the network represents a point of reference recognized nationally. That means that in most cases the activities of the networks are limited geographically and most of the territory is therefore not monitored

45. Available data: At the moment, data on marine litter ingested by sea turtles are available only in those Countries joining the INDICIT project (Italy, Turkey and Tunisia) and, among these countries, only Italy has shared its data through International publications. In general there's a lack of data on the topic especially in the Countries belonging to the southern Mediterranean Region.

46. Projects: the ongoing projects in Albania, Algeria and Egypt are not specific on marine turtles. Yet, the monitoring on marine litter ingested by sea turtles may be included among their objectives and contribute, as in particular for the projects under development in Egypt and Albania, to the assessment of the entity of the anthropic pressure on the status of sea turtles populations.

[12] De Fish gear Project implemented within the framework of the IPA Adriatic Cross-border Cooperation Programme, co-funded by the European Union: http://www.defishgear.net;
[13] EU INTERREG MED Biodiversity Protection project: https://biodiversity-protection.interreg-med.eu

47. Other organizations or researchers involved: the majority of Countries, apart from Italy mentioning some scientific Institutions (National Research Center, Zoological Station of Naples) and Tunisia, quoting the INSTM team, declare to ignore the presence on their territory of Organizations or researchers involved in the analysis of marine litter ingested by sea turtles. Therefore, a really low connection between all the environmental conservation activities undertaken on the same territory is reported.

48. Dead turtles examined through necropsy: as for data reported by Algeria, Egypt, Tunisia and Turkey, 301 necropsies have been conducted from 2016 to 2018 and marine litter has been found in the gastrointestinal tract of 94 of the turtles examined, with a percentage of 31% (Tunisia and Turkey have examined 280 sea turtles while Algeria and Egypt 21). The low number of necropsies carried out in Algeria and Egypt (only 21), through PhD researches and occasional observations, together with the total absence of these practices in Malta and Albania, show the absence of specific work plans for the analysis of marine litter ingested by sea turtles in the majority of the Countries. Data collected from Italy have not been considered in the calculation of number and percentage of sea turtles with marine litter found in the gastrointestinal tract because they are not comparable with the others. The analysis of litter in sea turtles' gastrointestinal tract, indeed, started in 2011 in Italy while not before 2016 in the other Countries (Table. 2).

Table 2: Number of turtles examined between 2016-2018 through necropsy and the percentage of litter found in the gastrointestinal tract.

Country	Starting date	No of turtles under necropsy	Presence of marine litter	Percentage	Note
Albania	-	-	-	-	
Algeria	2016	18	5	27,7%	Data reported from PhD research
Egypt	2017	3	1	33,3%	Occasional observations from a veterinary
Italy	2011	150	102	68%	
Malta	2018	-	-	-	Analysis on marine litter started in 2018
Tunisia	2017	200	60	30%	
Turkey	2017	80	28	35%	

49. Presence of marine litter in the marine turtles faecis: the presence of marine litter in the faecis of sea turtles has been reported by the three Countries which are partners of the INDICIT project (Italy, Tunisia and Turkey), all having rescue centers set up. Litter has been found in the excrements of 27 turtles over 121, in Italy, 20 turtles in Tunisia and 5 turtles in Turkey over a no specified number of turtles.

50. Classification of the items ingested: the different types of items observed in the gastrointestinal tract of stranded sea turtles marine litter have been classified only by Italy and Turkey according to the "litter in Biota" protocol[14] (MSFD – TS, 2013) and correspond more or less to the same typology of items. Sheet and fragments are the major categories found in litter in terms of abundance (85% for Italy, 70% for Turkey), followed by rigid plastic fragments and threads. No reports on classification of items of litter done by the other Countries.

6 Final remarks and recommendations

51. The 2017 SPA/RAC report on the Rate of ingestion of litter by marine turtles (mainly *Caretta caretta*) in the Mediterranean, collecting 2001-2016 data from the various Countries of the Western Mediterranean, plus Turkey, has shown the absence of comparable and sufficient data on the amount of marine litter present in Mediterranean waters to be used for the measurement of the targets identified, at Regional level[15]. This gap has been further confirmed in the present survey on marine litter ingested by sea turtles where data reported in the questionnaires of 7 Countries remain low, not exhaustive and not comparable. Therefore, at the moment it is not feasible to confirm the *thesis* according to which sea turtles are to be considered target species for monitoring the presence of litter in the Mediterranean.

52. Yet, it seems relevant to outline some key elements, or better named "gaps", arisen from this survey that could contribute to the ongoing discussions on the IMAP Candidate Indicator 24 on ingested litter as well as to the development, by the Contracting Parties of the Barcelona Convention, of pilot monitoring activities in the framework of the IMAP implementation. Each of the key gaps outlined below is accompanied by recommendations or suggestions on possible action to undertake in order to overcome it:

53. **GAP No. 1 – Lack of effective networks:** The collection of stranded sea turtles is at the basis of any monitoring activity of litter ingested by these species. Generally, groups of persons (volunteers, associations, marine vigilance bodies and even research institutes), which are organized in every Country more or less officially, act for the rescuing of dead animals by transporting them, depending on the cases, either to specialized rescue centers for the analysis of turtles or to disposal. Yet, very often, these networks act locally, in a geographically limited area and, therefore, most of the national territory remains not monitored. Further, in some Countries the existing networks are more than one and do not have any relation between each other (they do not even know about the existence of the other).

54. ***Recommendations****:*

1. The network of each Country should be strengthened by creating or increasing the number of local observation centers to be placed in any strategic point along the coast and not only within the Marine Protected Areas or National Parks. In this way, all the Mediterranean coastline would be covered and monitored;
2. Each center should be equipped with skilled personnel and appropriate tools for the rescuing and transport of sea turtles to the structures being set up for necropsy operations;
3. A stronger involvement of the local actors operating on the territory should be guaranteed;
4. Each network should have a coordination structure for the monitoring of all rescuing activities occurring in the National territory. The structure should be equipped with a database system to be considered as the unique main point of reference at national level.

[14] *Protocol included in "Monitoring Guidance for Marine Litter in European Seas" report (MSFD-TS, 2013).*
[15] pending the integration of the report with new latest data about to be made available.

55. **GAP no. 2 – lack of common methodology for the analysis of the gastrointestinal content of dead turtles:** It is clear that only those Countries participating in specific projects on the monitoring of marine litter ingested by sea turtles (INDICIT, MEDSEALITTER and MSFD – Marine Strategy Descriptor 10) are aware of and apply a common methodology for the analysis of the gastrointestinal content of dead sea turtles. Besides not applying any methodology, most of the Mediterranean Countries are not even aware of the existence of the said methodologies in use, not being familiar with online tools.

56. **Recommendations:**

1. It is necessary to promote and foster specific projects on the monitoring of marine litter, at regional level, in those Countries currently non-involved in any projects of that type (Bosnia-Herzegovina, Albania, Algeria, Egypt and Malta) and, probably, also in many other Countries belonging to the southern and eastern side of the Mediterranean (Morocco, Libya, Lebanon and Cyprus);
2. The participation of the Countries not involved in specific projects on marine litter to the existing leader projects on the topic (INDICIT, MEDSEALITTER and MSFD) should be envisaged;
3. The current projects on the conservation of the environment in the Mediterranean, where existent, should include, among their objectives, the monitoring and analysis of marine litter ingested by marine species, with particular reference to sea turtles.

57. **GAP no. 3 – lack of Rescue Centers:** A limiting factor to the analysis of marine litter ingested by sea turtles in many countries, namely those belonging to the south-east side of the Mediterranean, is the lack of Rescue centers. Such a facility, with skilled personnel and appropriate equipment, allows for accurate necropsies on dead animals and for the observation of litter in the faecis of living turtles. Unlike necropsies can be carried out by skilled personnel also in veterinary laboratories, the observation of litter in faecis cannot be done in other places but rescue centers (Bentivegna and Paglialonga, 1997; Camedda et al. 2014). Further, it is reported that the material of anthropic origin can have intestinal transit times much longer compared to the material deriving from food, reaching in same cases 5 months[16]. Therefore, the analysis of sea turtles *faecis* requires longer hospitalization compared to the one necessary for its rehabilitation as well as the use of more accurate maintenance procedures (correct and careful nutrition, daily cleaning of the tanks etc.). It is also necessary to establish a protocol for the analysis of fecal pellets, which is absent at the moment.

58. **Recommendations:**

1. Promote the creation of rescue centers in the Mediterranean Countries where these facilities are absent and provide them with skilled personnel and adequate tools for the maintenance and cure of the turtles according to the SPA/RAC guidelines (2004);
2. Establish a specific protocol for the analysis of the excrements;
3. Train the personnel in charge of necropsies with specific trainings to be carried out directly in their Countries and with the tools at their disposal.

7 Conclusions

59. This survey confirms that the current data on the presence of litter ingested by sea turtles are still pretty low, mainly in the Southern Mediterranean Countries. Yet, the elements outlined in the survey do not exclude the choice of C*aretta caretta* as bio-indicator species for the analysis of the status of marine pollution in the Mediterranean waters. Focused actions aiming at the collection of a

[16] unpublished data deriving from the analysis of data on fecal pellets of the specimen under rehabilitation at the Rescue Center of the Zoological Station of Naples.

sufficient number of data on this topic is extremely urgent in order to obtain the official recognition of the said indicator, at Regional level, and, subsequently, favor the development of national monitoring plans and programs on marine litter in the Mediterranean Sea. To this purpose, it is extremely important to strengthen, on one side, the monitoring activities on marine litter which are developed in some Countries (Italy, Tunisia and Turkey) and, on the other side, support capacity building activities in those Countries still not involved in these kind of procedures (Albania, Algeria, Egypt etc.). The said activities should necessarily foresee:

- The organization of trainings at regional and sub regional levels;
- The identification of subjects, Institutes and Scientific Centers to be involved in specific projects on litter ingested by sea turtles;
- The promotion of twinning programs or collaborations between different Countries for the sharing of data and the transfer of knowledge and technology;
- The setup of Rescue centers in those Countries where these facilities are absent by ensuring the transfer of technical know-how as well as training programs for the personnel in charge of the maintenance and cure of sea turtles, in compliance with the SPA/SPA guidelines (2004);
- Guarantee a bigger availability of resources, both human and financial, for the development of all the said activities.

60. These activities will definitely favor the collection of a sufficient quantity of data on distribution, density and typology of marine litter ingested by sea turtles in the Mediterranean. A more complete set of data would guarantee the population of Descriptor n. 10 of the MSFD, on one side, as well as of those indicators identified under the Barcelona Convention (the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP) and its 10th Ecological Objective (EO10) on Marine Litter referring to the "Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles

61. As already outlined in this document, a complete and accurate framework of scientific data on the topic will help the development of national monitoring plans specific on marine litter in the Mediterranean and, as a consequence, the achievement of the Good Environmental Status in the Mediterranean Sea by 2020.

References

Bentivegna F., and A.Paglialonga (1997). Impact of Anthropic Activity on Sea Turtles of The Gulf of Naples.VI International Eropean Union for Coastal Conservation Conference. Naples 2-6 June 1997. 38-42.

Bentivegna, F., Ciampa, M., Mazza, G., Paglialonga, A. & Travaglini, A., 2003. Loggerhead turtle (Caretta caretta) in Tyrrhenian sea: trophic role of the Gulf of Naples. In Proceedings of the First Mediterranean Conference on Marine Turtles,Rome, 24^28 October 2001 (ed. D. Margaritoulis and A. Demetropolous), pp. 71^75. Nicosia: Barcelona Convention.

Bentivegna, F., (2002). Intra-Mediterranean migrations of loggerhead sea turtles (Caretta caretta) monitored by satellite telemetry. Mar. Biol. 141, 795e800

Bjorndal, K.A., (1997). Foraging ecology and nutrition of sea turtles. In: Lutz, P.L., Musick, J.A. (Eds.), The Biology of Sea Turtles. Vol I. CRC , Press Boca Raton,Fl. Pp. 199-252.

Bjorndal, K.A., Bolten, A.B., C.J. Lagueux (1994). Ingestion of marine debris by juvenile sea turtles in coastal Florida habitats. Marine Pollution Bulletin 28,154–158.

Boerger, C. G.Lattin, S.Moore, C. Moore (2010). Plastic ingestion by planktivorous fishes in the North pacific Central Gyre. Mar. Poll. Bull., 60(12), 2275–2278. doi: DOI: 10.1016/j.marpolbul.2010.08.007.

Camedda, A., Marra, S., Matiddi, M., Massaro, G., Coppa, S., Perilli, A., Ruiu, A.,Briguglio, P., G.A.de Lucia (2014). Interaction between loggerhead sea turtles (Caretta caretta) and marine litter in Sardinia (Western Mediterranean Sea). Mar. Env. Res.,100, 25-32.

Campani T., M. Baini, M. Giannetti, F. Cancelli, C. Mancusi, F. Serena, L. Marsili, S. Casini, M.C. Fossi (2013). Presence of plastic debris in loggerhead turtle stranded along the Tuscany coasts of the Pelagos Sanctuary for Mediterranean Marine Mammals (Italy), Mar. Poll. Bull., 74, 225–230.

Casale P., D.Freggi, V. Paduano, M.Oliverio (2016). Biases and best approaches for assessing debris ingestion in sea turtles, with a case study in the Mediterranean. Mar. Poll. Bull., 110, 1, 238-249.

Casale P., D.Margaritoulis (2010). Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN: Gland, Switzerland. 304 p.

Darmon G., C.Miaud, F.Claro, G.Doremus, F.Galgani (2016). Risk assessment reveals high exposure of sea turtles to marine debris in French Mediterranean and metropolitan Atlantic waters. Deep Sea Res. Part II: Topical Studies in Oceanography, online first. http://doi.org/10.1016/j.dsr2.2016.07.005

De Stephanis R., J.Gimenez, E.Carpinelli, C.Gutierrez-Exposito, A.Canadas (2013). As main meal for sperm whales: Plastics debris. Mar. Poll. Bull., 69(1–2), 206–214. doi: DOI 10.1016/j.marpolbul.2013.01.033.

Derraik, J.G.B.(2002). The pollution of the marine environment by plastic debris: a review. Marine Pollution Bulletin 44, 842–852.

Fossi M., C.Panti, C.Guerranti, D.Coppola, M.Giannetti, L.Marsili, R.Minutoli (2012). Are baleen whales exposed to the threat of microplastics? A case study of the Mediterranean fin whale (Balaenoptera physalus). Mar. Poll. Bull., 64(11), 2374–2379. doi: 10.1016/j. marpolbul.2012.08.013.

Gall S., R. Thompson (2015). The impact of debris on marine life. Mar. Poll. Bull., V92, 12, 170–179.

Gregory M. (2009). Environmental implications of plastic debris in marine settings--entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. Philos Trans R Soc Lond B Biol Sci, 364(1526), 2013–2025. doi:10.1098/rstb.2008.0265.j.marpolbul.2016.06.057.

Kühn S., E. Bravo Rebolledo, J.A. Van Franeker (2015). Deleterious Effects of Litter on Marine Life, In Marine Anthropogenic Litter, M. Bergmann et al. (eds.), Springer. Chapter IV, p75-116. doi:10.1007/978-3-319-16510-3 (B)4.

Lazar, B., R.Gracan (2011). Ingestion of marine debris by loggerhead sea turtles, Caretta caretta, in the Adriatic Sea. Mar. Poll. Bull., 62, 43-47.

Mar. Pollut. Bull. 110 (1), 238e249. http://dx.doi.org/10.1016/

Matiddi M., Hochscheid S., Camedda A., Baini M., Cocumelli C., Serena F., Tomassetti P., Travaglini A., Marra S., Campani T., Scholl F., Mancusi C., Amato E., Briguglio P., Maffucci F.,

Fossi MC., Bentivegna F., G.A. de Lucia (2017). Loggerhead Sea Turtles (Caretta caretta): a Target Species for Monitoring Litter Ingested by Marine Organisms in the Mediterranean Sea. Environmental Pollution. 230, 199-209.

MSFD TG Marine Litter: Hanke G, Galgani F, Werner S, Oosterbaan L, Nilsson P, Fleet D, Kinsey S, Thompson R, Palatinus A, Van Franeker J, Vlachogianni T, Scoullos M, Veiga J, Matiddi M, Alcaro L, Maes T, Korpinen S, Budziak A, Leslie H, Gago J, G. Liebezeit (2013). Guidance on Monitoring of Marine Litter in European Seas. EUR 26113. Luxembourg (Luxembourg): Publications Office of the European Union; 2013. JRC83985 http://publications.jrc.ec.europa.eu/repository/handle/111111111/30681.

RAC/SPA, 2004. Guidelines to Improve the Involvement of Marine Rescue Centers for Marine Turtles. RAC/SPA, Tunis.

Specially Protected Areas Protocol Regional Activity Centre (Barcelona Convention), (2017). Defining the most representative species for IMPA common indicator 24, by François Galgani, SPA/RAC, Tunis, 37 pp.

Teuten E., J.Saquing, D.Knappe, M.Barlaz, S.Jonsson, A.BjArn, A.Rowland, R.Thompson, T.Galloway, T.Yamashita, D.Ochi, T.Watanuki, C.Moore, P.Viet, P.Tana, M.Prudente, R.Boonyatumanond, M.Zakaria, K.Akkhavong, K.Ogata, H.Hirai, S.Iwasa, I.Mizukawa, U.Hagino, A.Imamura, M.Saha, H. Takada (2009). Transport and release of chemicals from plastics to the environment and to wildlife. Phil. Trans. of the Royal Soc., B, 364, 2027-2045.

Tomas, J., Guitart, R., Mateo, R., J.A.Raga (2002). Marine debris ingestion in loggerhead sea turtles, Caretta caretta, from the Western Mediterranean. Mar.Pollut. Bull. 44, 211e216.

UNEP/MAP (2015a) Litter Assessment in the Mediterranean, UNEP/MAP, Athens, 2015. 86 p.

Van Franeker J., C, Blaize, J.Danielsen, K.Fairclough, J.Gollan, N.Guse (2011).Monitoring plastic ingestion by the northern fulmar Fulmarus glacialis in the North Sea. Env. Poll, 159, 2609–2615.