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Agenda Item 5: Baseline Values (BV) and Threshold Values (TV) for IMAP Candidate Indicator 24

Baseline Values (BV) and Threshold Values (TV) for IMAP Candidate Indicator 24

UNEP/MAP
Athens, 2025

Note by the Secretariat

In 2016 during COP19 (Decision IG.22/10) Baseline Values (BV) were established for all IMAP Ecological Objective 10 (EO10) Marine Litter Common and Candidate Indicators.

Since then updated BVs have been agreed and Threshold Values (TVs) have been established for IMAP Common Indicators 22 (beach macro-litter) and 23 (seafloor macro-litter and floating microplastics), yet not for Candidate Common Indicator 24 (ingestion and entanglement of marine litter from sea turtles).

With the support provided from the EU-funded Marine Litter MED II Project (2022 – 2024), Data Standards (DS) and Data Dictionaries (DD) have been developed based on the agreed standardized monitoring protocols, including data quality assurance and quality control tools, to enable the reporting to the Secretariat of national data with regards to IMAP Candidate Indicator 24, through the IMAP InfoSystem. Moreover, 3 national IMAP-based monitoring programmes have been prepared for Lebanon, Morocco and Tunisia, including the data generation and submission to IMAP InfoSystem.

The aim of this document is to develop the methodology for statistical analysis for data collected by Contracting Parties, which will support the process for updating the BVs and establishing TVs for IMAP Candidate Indicator 24 at the level of the Mediterranean region.

The first iteration of this document was submitted to the Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring (CORMON Marine Litter) held on 29 January 2025. Based on the conclusions and recommendations of the aforementioned meeting, the applied methodology was endorsed whereas it was agreed for the Secretariat to further work in updating and revising this document considering the following elements:

a) Contracting Parties to provide MED POL with specific written comments on the Working Document UNEP/MED WG.601/4, by 14 February 2025 at the latest.
b) MED POL to send by 5 February 2025 a data call to Contracting Parties, through IMAP InfoSystem, setting a deadline to submit data by 28 February 2025 at the latest.
c) MED POL to invite the Online Working Group on Marine Litter (OWG-ML), led by Italy, to review the revised version of the Working Document UNEP/MED WG.601/4, for its submission to the CORMON Marine Litter Meeting, to be held in Athens, Greece, in May2025.

Further to the above conclusions and recommendations: (a) 3 Contracting Parties provided comments in writing (i.e., France, Israel and Italy); (b) 5 Contracting Parties (i.e., Cyprus, Greece, Israel, Italy and Malta) responded to MED POL's call for data submission dated 5 February 2025; and (c) and 3 Contracting Parties (i.e., France, Greece and Italy) volunteered to participate to the Online Work Group on Marine Litter (OWG-ML) which was led by Italy.

The Secretariat worked in revising Working Document UNEP/MED WG.601/4 considering the aforementioned elements (i.e., written comments and new data), which was submitted to the OWG-ML for review, including the organization of an online meeting held on 24 February 2025 during which a new round of comments was received and integrated into the present version.

The present document is submitted to the present joint CORMON Pollution - Marine Litter Meeting (27-28 May 2025, Anavyssos, Greece) for review and approval to be submitted to the Meeting of the MED POL Focal Points (Athens, Greece, June 2025)

Table of Content

1. Introduction

1. The aim of this document is to develop the methodology for providing a statistical analysis for data collected by Contracting Parties, towards providing a first proposal for updating the Baseline Value (BV) and establishing Threshold Value for IMAP EO10 Candidate Common Indicator 24.

2. Definition of Baseline Value (BV): According to the definition provided by the UNEP/MAP (UNEP/MED WG.514/7[1]), "A baseline is a description of environmental state at a specific point against which subsequent values of state are compared". It may refer to a specified level of an impact or a pressure and act as a reference against which limit can be set or trends for the assessment of GES. Baselines can be derived from reference conditions, initial assessment values, the present state, or a potential/predicted issue."

3. Definition of Threshold Values (TV): The approach elaborated and used for the establishment of TV for the needs of preparation of the marine litter chapter of the 2023 Mediterranean Quality Status Report (MED QSR), is in line with the New GES Decision (2017/848) of the European Commission (EC), which provides a definition for the Threshold Values for marine litter: "Threshold value means a value or range of values that allows for an assessment of the quality level achieved for a particular criterion, thereby contributing to the assessment of the extent to which good environmental status is being achieved."

2. Data availability

4. Data has been made available thanks to the EU-funded projects: INDICIT I and II, INTERREG MED Plastics Busters MPAs, Marine Litter MED I and II; as well as contributions by several Contracting Parties.

5. A total of 2780 data submissions were received with data on ingestion and entanglement from 10 Contracting Parties ranging from 1995 to 2024. The data submissions before 2010 are very ad hoc and do not contain details on marine litter. Considering the number of countries, number of data submissions, type and detail of the information (Figure 1), the period 2010-2020 has been selected as the most appropriate period to carry out the statistical analyses (Table 1).

[1] 8th Meeting of the Ecosystem Approach Coordination Group (EcAp CG), Videoconference, 9 September 2021.

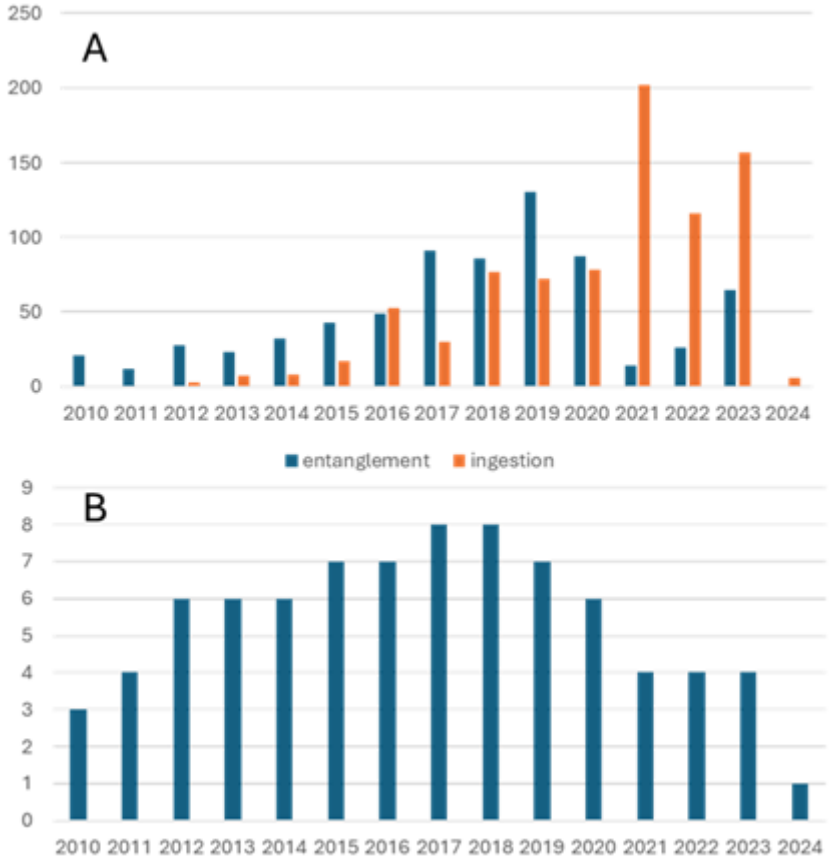


Figure 1: Data received by year (A), number of countries (B)

Table 1: Number of specimens reported from the Contracting Parties (2010-2020):

Country	Total Number of specimens	Ingestion	Entanglement*	FO (%) ING	FO (%) ENT
Cyprus	10	-	7	-	70
France	97	64	6	66	6
Greece	154	32	115	21	75
Israel	314	4	309	1	98
Italy	556	476	75	86	14
Lebanon	-	-	-	-	-
Malta	161	39	31	24	19
Spain	40	-	32	-	80
Tunisia	5	-	5	-	100
Turkey	37	4	22	11	60
Total	**1374**	**619**	**602**	**45**	**44**

* Bycatch and unknown were excluded from this analysis.

6. Over the total number of reported specimens, 89,5% corresponds to the species *Caretta caretta*, 10% to *Chelonia mydas* and 0,5% to *Dermochelys coriacea* (Table 2).

Table 2: Species and the percentage of data related to entanglement and ingestion

Species	Number of Specimens	Entanglement	Ingestion	Unknown
Caretta caretta	1367	21%	35%	44%
Chelonia mydas	137	35%	53%	12%
Dermochelys coriacea	7	0%	0%	100%
Unknow	7	-	-	-

7. For the specimens reported on the ingestion form (total: 619, Table 1), 28% corresponds to samples where no marine litter ingestion was recorded (i.e., dry weight ML = 0), whereas the total number of specimens which were took into consideration for the ingestion analysis is 443.

8. 44% of the specimens sampled were reported by entanglement[2] (602, Table 1), the specimens affected by “bycatch” and “unknown” categories have not been included in the analysis.

3. Methodology

9. Due to the mobility of marine turtles, for example loggerhead turtles can travel long distances, the transit time of ingested litter items usually is between 10 and 14 days (Valente et al., 2008; Solomando et al., 2022), and their different degree of conservation (i.e., alive, recently dead, mummified, etc.) is not considered appropriate to attribute encounters with marine litter (i.e. ingestion and/or entanglement) to the coordinates at which they were located. Although it is possible to assess the impact of marine litter on turtles at a regional scale by geolocation, the present analysis focuses globally and does not consider the location coordinates of the specimens.

10. The data collected can be used to calculate specific samples:

a) Frequency of occurrence: the proportion of turtles that have plastic in their gastrointestinal tract (also called "incidence" or "prevalence").
b) Arithmetic mean and standard deviation of the mean mass of marine litter found in the gastrointestinal tract (GI) of each specimen or the number of entangled objects. In case of a high standard deviation (non-normal distribution) the median is considered as a most appropriate value for the establishment of the baseline value (BL).
c) Threshold Value (TV): The reference level for the presence of plastics in the digestive tract of turtles (or any marine organism) is zero, as synthetic materials are exclusively man-made and were only introduced into the marine environment in the mid-20th Century (Kühn et al., 2022). However, assuming that accidental escapees of plastic (e.g. due to severe weather events, etc.) are inevitably occurring, an attempt will be made to indicate a possible TV.

11. All statistical analyses were performed with R 4.3.2 Statistical Programme (R Core Team, 2023).

[2] Considering as “entanglement” the data reported as such by the contracting countries on the form.

3.1. Ingestion

12. Since the first scientific publications on the topic, over 500 marine species have been listed for ingesting marine litter and sea turtles were among the first taxa recorded. Given their propensity to ingest litter, their wide distribution, and the large range of habitats used during their life, sea turtles, in particular the loggerhead species (*Caretta caretta*), have been chosen as indicator species for the Mediterranean basin (Matiddi et al., 2011-2017-2019).

13. A specific protocol to collect data on marine litter ingested by sea turtles has been developed and tested by ten partners in seven countries in the Mediterranean Sea and Atlantic Ocean within the European Project INDICIT (GA n°11.0661/2016/748064/SUB/ENV.C2) and harmonized with the Specially Protected Areas / Regional Activity Centre (SPA/RAC). The procedures for dead sea turtle necropsy, including the analysis of ingested litter have been specified in detail and published as a video tutorial by Matiddi et al. (2019).This protocol provides standardized methodologies for the analysis of marine litter ingested by sea turtles to support the new Commission Decision (EU)8, Criteria D10C3, and could be useful to support the IMAP Candidate Indicator CI24: “Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles”.

14. The proposed protocol used for recording ingested litter by sea turtles will be useful in gathering data on the composition and abundance of litter and assess its impact on marine environments. Moreover, collecting this type of standardized data will help to define threshold values (Matiddi et al., 2017; 2019; 2024).

15. For updating the Baseline Value (BV) for Candidate Indicator 24, the median value of the amount of macrolitter ingested by marine animals is considered as a better measurement of the central location of a value, than the average value in the case of a non-symmetric distribution (Baggelaar, Paul K. and Van der Meulen Eit C.J., 2014; Van Loon et al., 2020). This is due to the fact that the median value is less sensitive to extreme values (Van Loon et al. 2020).

16. The definition of Threshold Values (TVs) followed during the development of the marine litter chapters of the 2023 MED QSR and the EU GES assessment method for marine litter on beaches (Van Loon et al., 2020), recommend a TV equal to the 15th percentile of the total abundance of marine litter, a statistical method commonly used in assessments when accurate reference values of pristine areas are not available (Van Loon et al., 2020).

17. To analyze the ingested marine litter data, we considered a sample with those specimens with information on the weight of organic fraction and the weight of ingested marine litter, excluding specimens with ingested marine litter weight zero (N=396 specimen) and a secondary sample with those specimens that had information on the units of the marine litter categories (N=404 specimen).

18. The analysis was based on the total dry weight of marine litter and marine litter number of items in gastrointestinal tract (GI). This analysis was established for each specimen and then were grouped by year based on the median value, thus obtaining an annual value. The annual values were grouped by averaging them all to obtain the value corresponding to the baseline CI24-ingesta.

19. In addition, an analysis was carried out according to the frequency of occurrence of each type of marine litter. The results show which objects are most frequently ingested by marine organisms, specifically by sea turtles in the Mediterranean Sea.

3.2. Entanglement

20. The collected data are useful for assessing how marine litter affects/impacts sea turtles. The information can be divided into two categories:

(i) *General data* - recording by year of the number of animals affected by marine litter entanglement; and
(ii) *Individual data* - such as details on each event, the type of debris involved and its effects on specific animals - that allow analysis of the proportion of marine litter items that interact with the specimens recorded.

21. Distinguishing bycatch in fishing gear from entanglement is often challenging. When an animal is discovered entangled in fishing gear, it can be difficult to determine whether it became ensnared while the gear was actively in use, or if the gear had been abandoned or lost before the interaction occurred. Several criteria to help distinguish entanglement in marine litter from bycatch in active fishing gear are available into the Galgani *et al.*, 2023

22. Data concerning entanglement has been reported by 9 countries. An analysis based on the percentage of affected specimens versus the total number of specimens collected is proposed, excluding individuals trapped by active fishing nets and reported as bycatch in the forms

23. The entangled analysis, period 2010-2020 comprising 602 specimens (Table 1).

4. Determination of Baseline and Threshold Values

4.1. Ingestion

24. The calculation of the baseline is through the quantities (weight and/or units) found in the GI (Matiddi et al. 2024). The mean values obtained per turtle were 12 particles and 4.57 g of marine litter (Table 2). However, due to a very high standard deviation and a non-normal distribution of the sample (Figure 2), the median value is 5 particles and 0.4 g, it should be considered more representative (Table 3).

Table 3: Descriptive statistics parameters (total sample: 396)

	Average	Standard Deviation	Median	Perc 10	Perc 15	Perc 20
Nº ML items	12	24	5	1	2	2
Weight ML (gr)	4.57	16.53	0.4	0.02	0.03	0.04

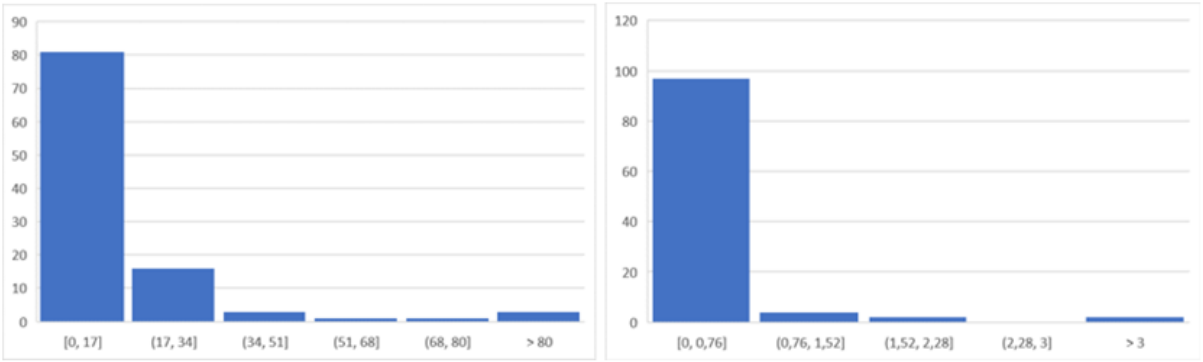


Figure 2: Frequency Histogram (Left: Item Number; Right: Marine Litter Dry Weight)

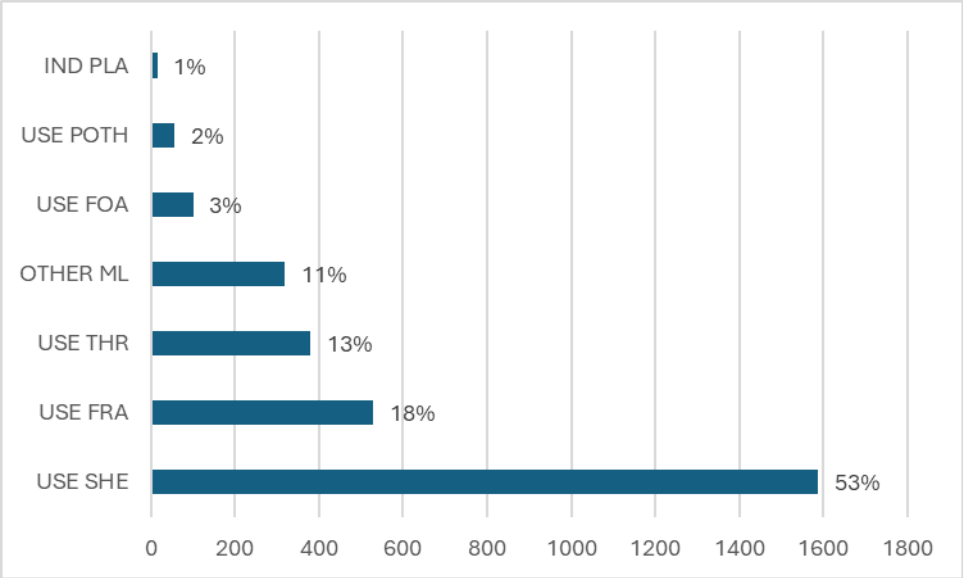
25. Based on these results, the **BV can be set at a weight of marine litter ingested of 0.4 g**. To calculate the TV, the 15th percentile of the sample is proposed, as for other marine litter indicators (i.e.,

IMAP EO10 CIs 22 and 23) and thus the **TV can be considered a weight of 0.03 g of marine litter in the GI**.

26. The proposed values (i.e., BV and TV) should be understood as a first approximation due to the limited data available. A differential statistical analysis has been applied on a small sample and the results may be affected by this, since differential statistics analysis should be done in large groups of data.

27. This type of analysis is in line with the analysis carried out for other marine litter indicators (European Commission, 2025) but for its proper application it is necessary to improve the quality and quantity of the data through the proper application of sampling and reporting protocols.

28. The most frequent item category is Remains of Plastic Sheets (USE SHE), e.g. from plastic bags, cling film, agricultural films, garbage bags, etc., which are assessed at the level of 53% (Figure 4), followed by plastic fragments (USE FRA 18%) (Figure 4).



USE SHE: Remains of plastic sheets from bags, cling film, agricultural films, garbage bags
USE FRA: Fragments, broken pieces of thicker type plastics, can be a bit flexible, but not like sheet like materials.
USE THR: Threadlike materials, e.g. pieces of nylon wire, net-fragments, woven clothing, etc.
USE POTH: Any other plastic type of plastics, including elastics, dense rubber, balloon pieces, soft air gun bullets, etc.
USE FOA: All foamed plastics e.g. polystyrene foam, foamed soft rubber (as in mattress filling), etc.
IND PLA: Industrial plastic granules, usually cylindrical but also sometimes oval spherical or cubical shapes, or suspected industrial item, used for the tiny spheres (glassy, milky, etc.).
OTHER ML: Other marine litter.

Figure 4: Most frequent marine litter categories items by marine litter category

29. The most frequent weight by category is Plastic Sheets (USE SHE 41%, Figure 5), e.g. from plastic bags, cling film, agricultural films, garbage bags, etc., followed by threadlike materials, e.g. pieces of nylon wire, net-fragments, woven clothing, etc. (USE THR 27%, Figure 5).

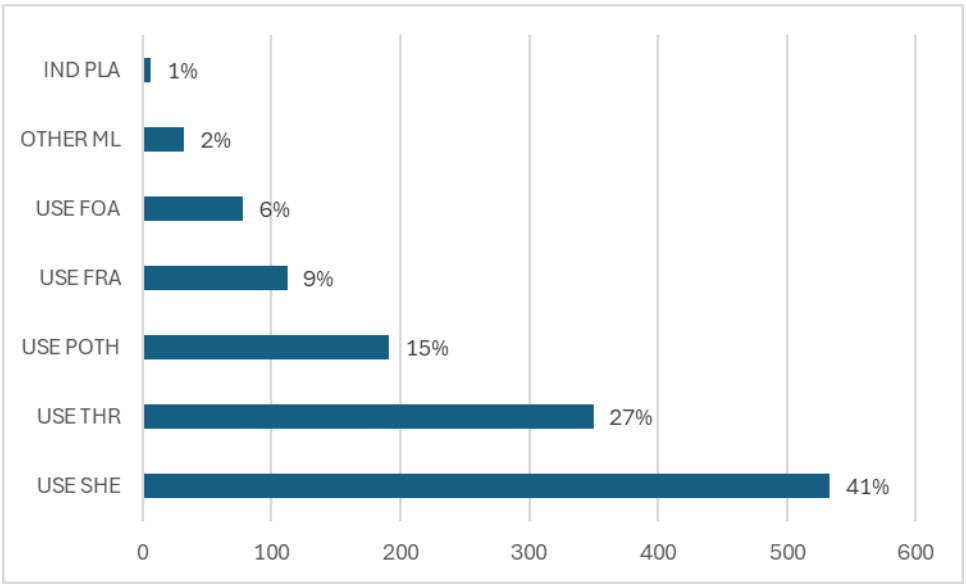


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Figure 5: Most frequent marine litter categories (% weight by marine litter category)

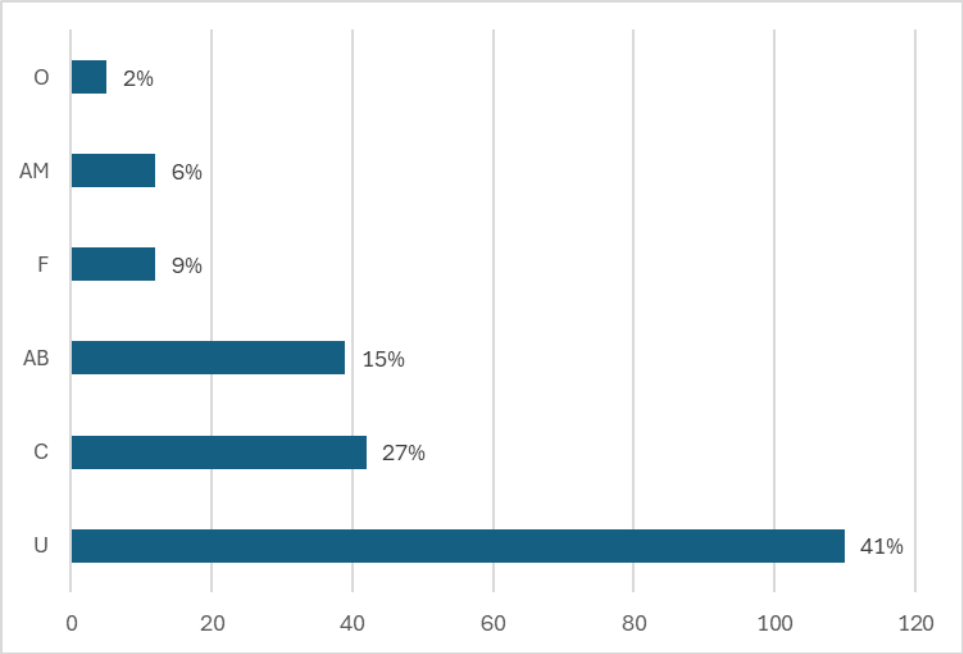
30. In both cases (Figures 4 and 5), the most frequent category, well above the other categories, is USE SHE, (remains of sheet, e.g. from bag, cling-foil, agricultural sheets, rubbish bags, etc.).

4.1. Entanglement

31. 44% of the samples (602 specimens, Table 1) were affected by entanglement. Some Contracting Parties only reported ingestion data for the period 2010-2020 or only a few individual specimens. To better approximate a frequency of occurrence value in the Mediterranean a possible approach is to use as BV the median frequency of occurrence with complete entanglement and ingestion data for the study period, and the best-case scenario as TV, using the lowest value per country, which reflects the most favorable scenario recorded in the region.

32. The **BV proposed is 36%** were affected by entanglement (N=221). **The TV proposed, best scenario in the Mediterranean, is 14%** specimens affected by entanglement.

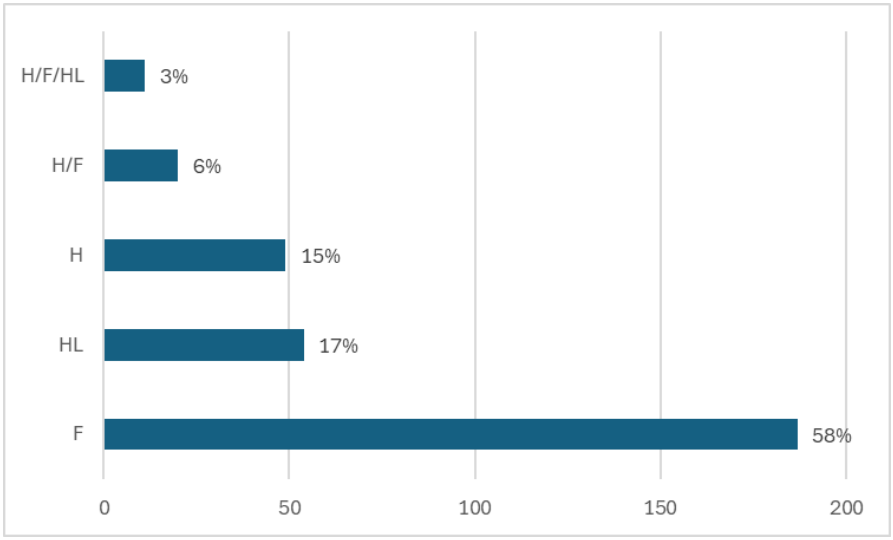
33. Most of the damaged ones were from undescribed lesion (U: 41%), cutting (C: 27%) and abrasion (AB: 15%) (Figure 6).



None: No damage,	C: Cutting
AM: Amputation	U: Lesion not identified or not described
F: Fracture	S: Suffocation
AB: Abrasion	O: Other types of injury (infection, malnutrition, buoyancy, etc.),

Figure 6: Damages identified in the marine turtles (N=602)

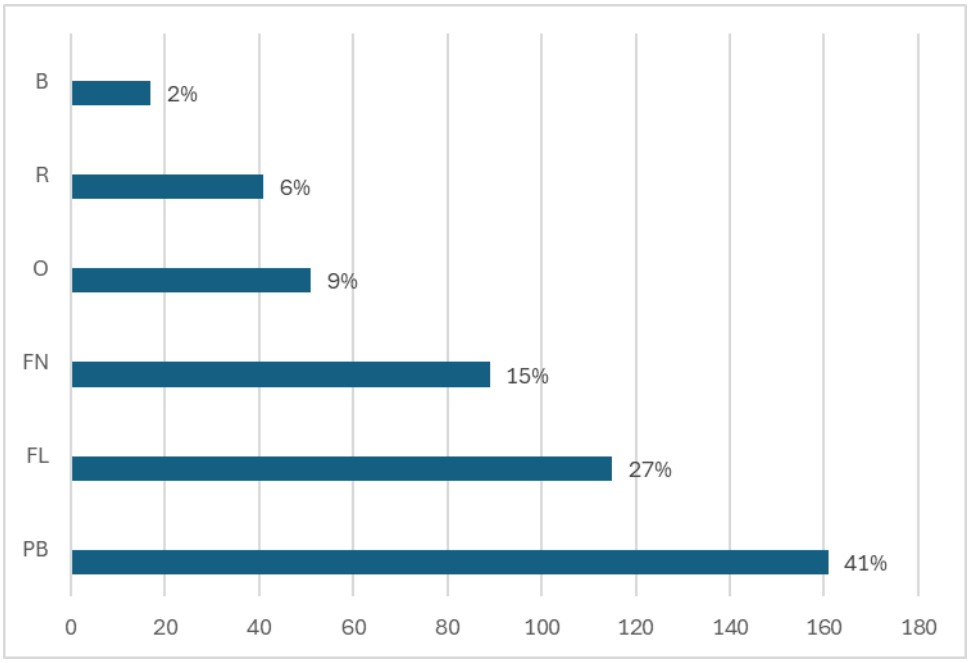
34. 58% of the entangled specimens show fin damage (F), whereas 17% of the entangled specimens show hind limbs damage (HL). (Figure 7).



H: Head; F: Forelimbs; HL: Hind limbs

Figure 7: Entangled body parts of marine turtles (N=602)

35. 31% of the turtles were classified with the presence of injury but no information relating to marine litter category. 40% of the turtles were classified with presence of injury and with information related to the source of marine litter, the main source is activities ashore and aquaculture activities (PB: 41%, FL: 27%, FN: 15%, Figure 8).



O: Other Material; FN: Fishing Net; R: Ropes.
FL: Fishing line; B: Buoys/Fenders; PB: Plastic bags

Figure 8: Entangled marine litter items categories (N=241).

36. It is important to consider that approx. 65% of the data classified under the category "other materials" relates to heavy-duty sacks (Figure 8), which are usually associated with maritime transport.

37. Most abrasion and cut injuries are because of ropes (R) or fishing lines (FL), while suffocation is mainly attributed to fishing nets (FN) and ropes (R) (Table 4).

Table 4: Damage/object relationship (N=602):

Injuries	**B**	**FL**	**FN**	**P**	**PB**	**R**	**RB**
AB	13%	17%	21%	4%	4%	42%	
AB/C	6%	29%	12%			41%	12%
AB/C/AM	50%	50%					
AB/C/AM/S						100%	
AB/C/F/AM		100%					
AB/C/S			100%				
AB/S	33%	33%				33%	
AM		50%			50%		
C	17%	42%	8%			33%	
C/F		100%					
C/F/AM		78%				22%	
C/S		50%			50%		
F/AM			100%				
S	29%	14%	14%		29%	14%	

Injuries: AB = Abrasion, C = Cutting, F = Fracture, AM = Amputation, S = Suffocation

Object: FN = Fishing net, FL = Fishing line, B = Buoys/fenders, PB = Plastic bags, R = Ropes, P = Packaging, RB = Rubber bands.

5. Conclusions

38. For ingestion:

a) **An updated BV can be established for the presence of marine litter particles in the digestive tract of Mediterranean turtles weighing 0.4 g.**
b) **A TV can be proposed** at **less than 0.03 g of marine litter in the gastrointestinal tract.**

39. For entanglement:

a) **The proposed BV is 36%**, which in fact is the percentage of specimens affected by entanglement.
b) **The proposed TV**, following the best scenario in the Mediterranean, **is 14% of specimens affected by entanglement.**

Table 5: Proposal for updating the BV and establishing TV for IMAP Candidate Indicator 24

IMAP Indicator	Updated BV	Proposed TV
Candidate Indicator24: Ingestion	0.4g ML ingested	0.03g ML ingested
Candidate Indicator 24: Entanglement	36% affected sample	14% affected sample

40. Recent research highlights that the availability of natural foods can alter the incidence of ML ingestion. In this case, TVs should take into consideration not only the general distribution of data, but also the environmental context.

41. Analysis based on weight of ML ingested is considered more appropriate than that based on number of items due to the possibility of fragmentation of the pieces during the turtle feeding process (Matiddi et al. 2019).

42. Considering that the data used for this analysis were irregular as well as that more data would yield better results, the proposed BV and TV (Table 5) should be considered as a first approximation, being necessary a continuous revision and update in the next years, certainly before the third iteration of the Mediterranean Quality Status Report (MED QSR).

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