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Athens, Greece, 15 September 2025

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

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Athens, 2025

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Athens, Greece, 17-19 June 2025

Agenda Item 5: **(b) Enhanced Integrated Monitoring and Assessment Programme (IMAP) (Pollution and Marine Litter cluster, Common Indicators updated fact sheets, assessment criteria/thresholds)**

Updated Baseline Values (BV) and establishing Threshold Values (TV) for IMAP Candidate Indicator 24 UNEP/MED MAP WG.626/7)

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 and a second review iteration took place during the Joint CORMON Pollution - Marine Litter Meeting (27-28 May 2025, Anavyssos, Greece).

Further to the conclusions and recommendations of the Joint CORMON Pollution - Marine Litter Meeting (27-28 May 2025, Anavyssos, Greece), the following changes were applied:

a) The data included in Table 1 have been proof checked;
b) Retain the approach used for ingestion to exclude individuals with zero stomach content in the calculation of TV;
c) To use the 15th percentile approach for entanglement applied to the total number of samples;
d) Add an explicit reference in the document that the resulted values will be subject to update for the next iteration of the Mediterranean Quality Status Report.

The Secretariat worked in revising Working Document UNEP/MED WG.626/7 considering the aforementioned elements and a new, revised version is presented under the present Information Document WG.627/Inf.10, whereas the updated values have been reflected in Table 17 of WG.627/5/Rev.1 (Annex I – Part II)

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 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 2760 data submissions were initially received containing 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, including a total of samples/specimens; 290 specimens present both ingestion and entanglement.(Table 1) and 510 specimens described as bycatch and unknown were excluded from this analysis (Table 2).

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

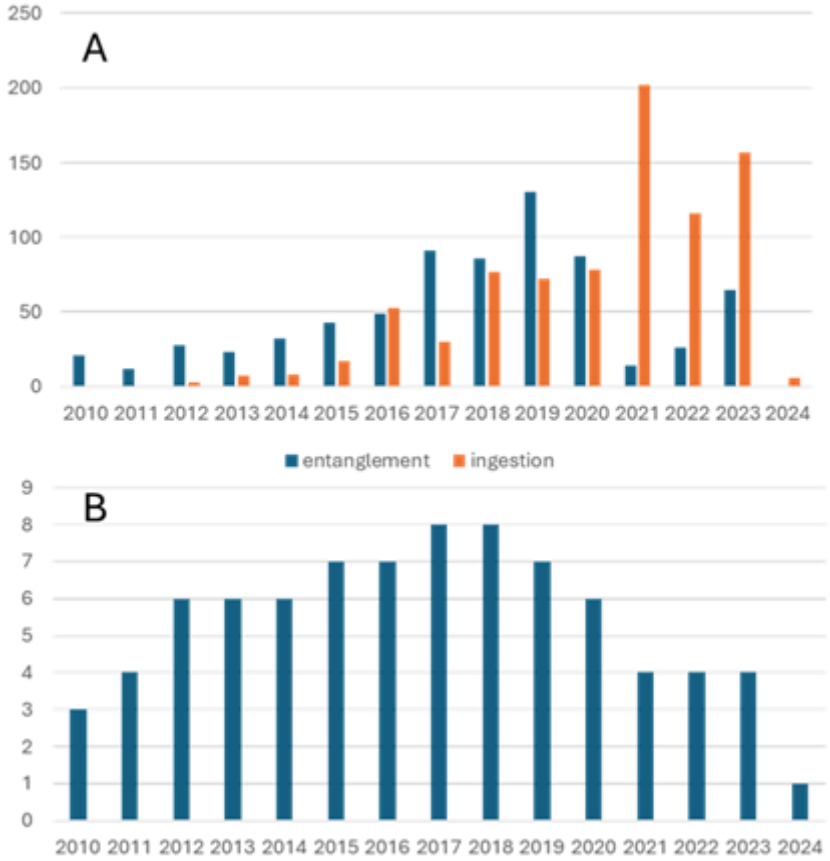


Figure 1: Data received by year (A), number of countries (B)

Table 1: Number specimens reported as affected by ingestion and/or entanglement by the Contracting Parties (2010-2020):

Country	Ingestion	Entanglement*
Cyprus	-	4
France	64	6
Greece	32	115
Israel	4	309
Italy	476	75
Lebanon	-	-
Malta	-	17
Spain	-	32
Tunisia	-	5
Türkiye	4	22
Total	**580**	**581**

* *Bycatch and unknown were excluded from this analysis.*

6. Over the total number of reported specimens, 91% corresponds to the species *Caretta caretta,* 8,6% to *Chelonia mydas* and 0,4% to *Dermochelys coriacea* (Table 2). Only *Caretta caretta* specimens were considered for the analysis as other species *(C. mydas and D. coriacea)* have different feeding and behaviors.

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

Species	Number of Specimens	Entanglement	Ingestion	Other*
Caretta caretta	1255	24%	37%	39%
Chelonia mydas	120	35%	53%	12%
Dermochelys coriacea	5	0%	0%	100%
Unknow	1	-	-	-
TOTAL	1381			

*Other = bycatch and specimens without information about entanglement and ingestion.

7. For the *Caretta caretta* specimens reported on the ingestion form (total: 464, Table 2), 16% corresponds to samples where total dry weight ingested was zero (i.e., total dry weight ingested = 0), whereas the total number of specimens which were taken into consideration for the ingestion analysis is 391.

8. 24% of the *Caretta caretta* specimens sampled were reported by entanglement[2] (301 , Table 2), 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 (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.

4. 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 ingested litter 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. Considering that the number of items may be biased by different enumeration methodologies, (Matiddi et al., 2019), only the total dry weight assessed over the entire digestive tract has been proposed for the calculation of BV and TV.

18. For the calculation of BV and TV from the data of ingested marine litter, those specimens with information on the dry weight of the organic fraction and the dry weight of the ingested marine litter were considered, excluding specimens with a total ingested dry weight of zero (N=391 specimens).

19. A second sample with those specimens that had information on the units of the marine litter categories (N=44 specimens) was also analyzed.

20. The TV analysis was established for each specimen and then the specimens 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 baseline value for ingestion under CI24.

21. 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.

4.1. Determination of Baseline and Threshold Values for Ingestion

22. 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 9 particles and 13,22 gr of marine litter (Table 3). However, due to a very high standard deviation and a non-normal distribution of the sample (Figure 2), the median value is 3 particles and 0.07 gr, it should be considered more representative (Table 3).

Table 3: Descriptive statistics parameters (total sample: 345)

	Average	Standard Deviation	Median	Perc 10	Perc 15	Perc 20
Nº ML items	9	21	3	2	2	3
Weight ML (gr)	13,22	118,51	0.07	0.007	0.009	0.01

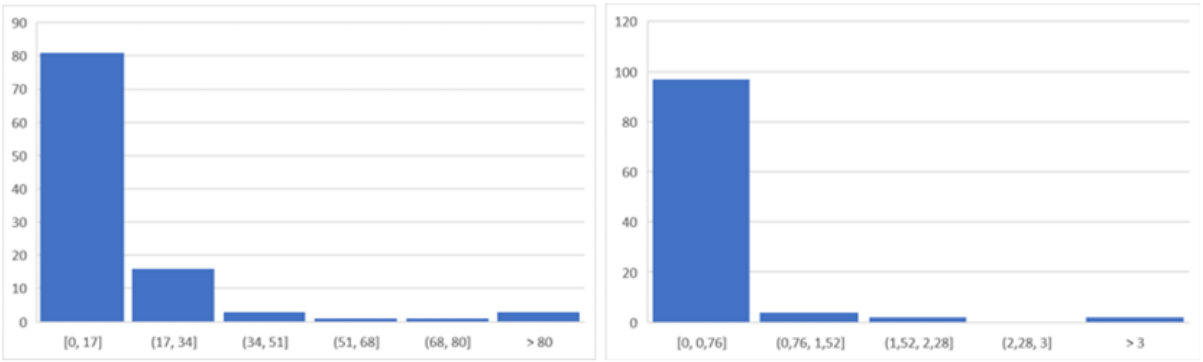


Figure 2: Frequency Histogram (Left: Item Number; Right: Marine Litter Dry Weight)

23. The analysis based on the dry weight of ingested marine litter is considered more appropriate than the one based on number of items due to the possibility of fragmentation of the pieces during the turtle feeding process ((Matiddi et al. 2019).

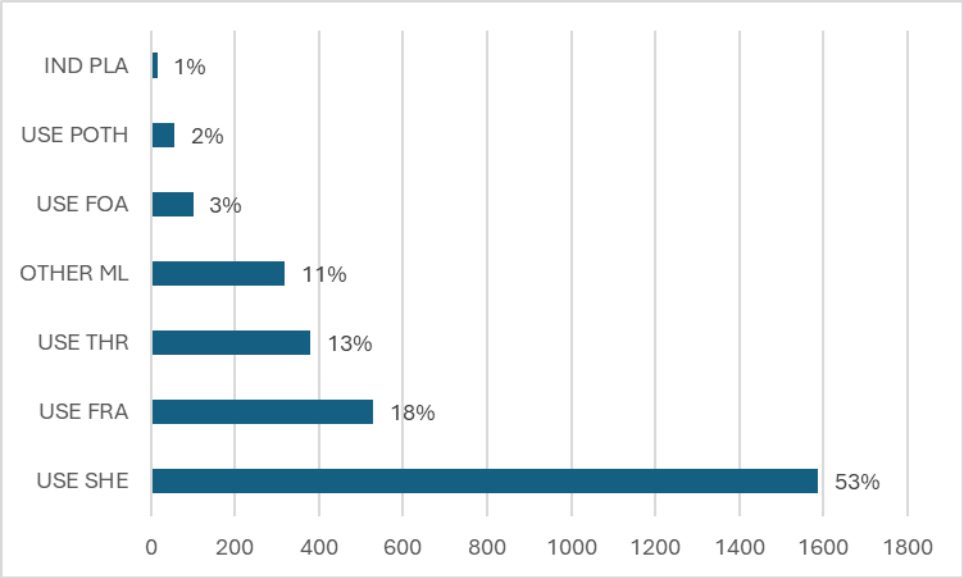
24. Based on these results, the **BV can be set at a dry weight of marine litter ingested of 0.07 gr**. To calculate the TV, the 15th percentile of the sample is proposed, as for other marine litter indicators (i.e., IMAP EO10 CIs 22 and 23) and thus the **TV can be considered a dry weight of 0.009[3] gr of marine litter in the gastrointestinal tract (GI)**.

25. The proposed values (i.e., BV and TV) should be understood as a first approximation due to the limited data availability. 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.

26. 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.

[3] Rounding is proposed to 0.01 gr corresponding to 15th percentile

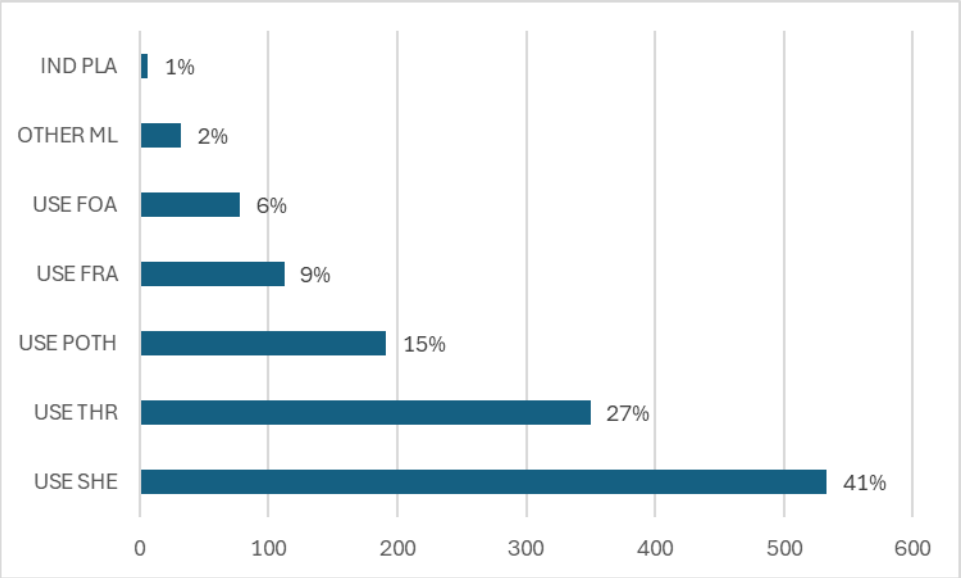
27. The most frequent item category is Remains of Plastic Sheets (USE SHE), e.g. from plastic bags, cling film, agricultural films, garbage bags, etc., which are assessed at the level of 53% (Figure 4), followed by plastic fragments (USE FRA 18%) (Figure 3).



***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.).*
***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.*
***OTHER ML:** Other marine litter.*
***USE THR:** Threadlike materials, e.g. pieces of nylon wire, net-fragments, woven clothing, etc.*
***USE FRA**: Fragments, broken pieces of thicker type plastics, can be a bit flexible, but not like sheet like materials.*
***USE SHE**: Remains of plastic sheets from bags, cling film, agricultural films, garbage bags*

Figure 3: Most frequent marine litter categories items by % of marine litter category (N=404)

28. The most frequent weight by category is Plastic Sheets (USE SHE 41%, Figure 4), 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 4).



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***USE SHE**: Remains of plastic sheets from bags, cling film, agricultural films, garbage bags*

Figure 4: Most frequent marine litter categories (% weight by marine litter category, N=404)

29. In both cases (Figures 3 and 4), 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.).

5. Entanglement

30. 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.

31. 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.

32. Data concerning entanglement has been reported by 9 countries. An analysis based on the median percentage of *Caretta caretta* affected specimens versus the total number of specimens collected is proposed as BV. The TV is the percentage of *Caretta caretta* affected specimens 15th percentile grouped by median by country and year.

33. The entangled analysis, period 2010-2020 comprising 301 specimens (Table 2) excluding individuals trapped by active fishing nets and reported as bycatch in the forms.

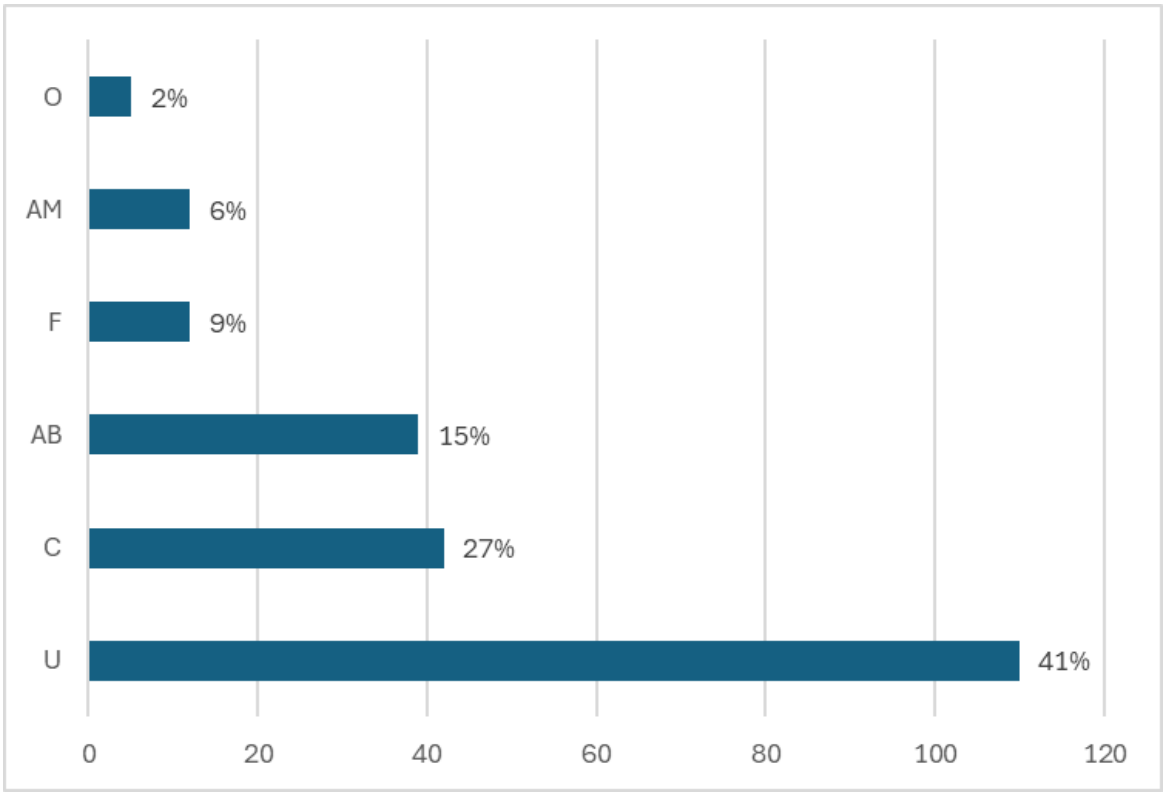
5.1. Determination of Baseline and Threshold Values for Entanglement

34. 24% of the *Caretta caretta* samples were affected by entanglement (301 specimens, Table 2). 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 during the study period, and as TV the 15th percentile.

35. The **proposed BV is 35%** of affected specimens by entanglement, whereas the best scenario in the Mediterranean is 11% (i.e. the case of France).

36. **The TV proposed is 9%** specimens affected by entanglement.

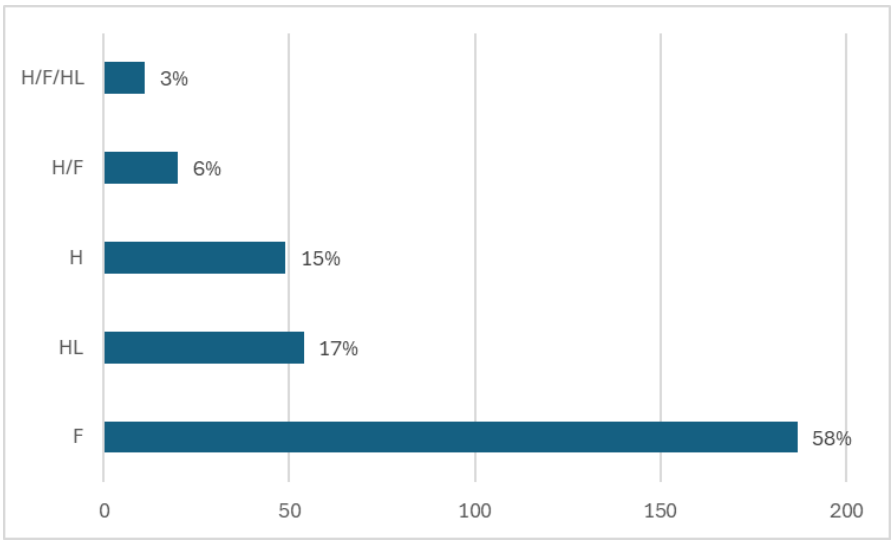
37. Most of the damaged ones were from undescribed lesion (U: 41%), cutting (C: 27%) and abrasion (AB: 15%) (Figure 5).



O: Other types of injury (infection, malnutrition, buoyancy, etc.)
AM: Amputation
F: Fracture
AB: Abrasion
C:Cutting
U: Lesion not identified or not described

Figure 5: Damages identified in the marine turtles (N=301)

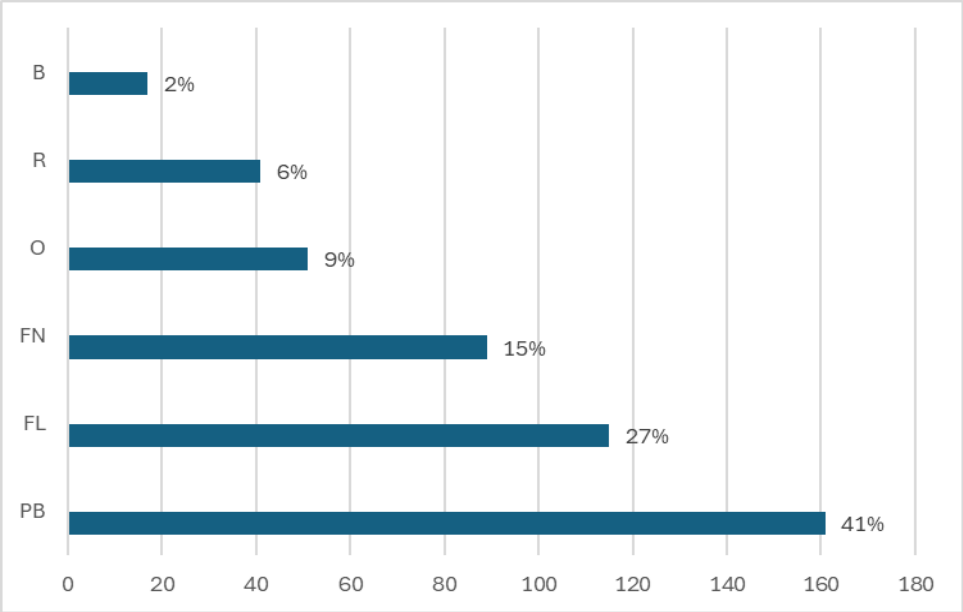
38. 58% of the entangled specimens show fin damage (F), whereas 17% of the entangled specimens show hind limbs damage (HL). (Figure 6).



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

Figure 6: Entangled body parts of marine turtles (N=301)

39. 30% 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 7).



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

Figure 7: Entangled marine litter items categories (N=301).

40. It is important to consider that approx. 65% of the data classified under the category "other materials" relates to heavy-duty sacks (Figure 7), which are usually associated with maritime transport.

41. Most abrasion and cut injuries are because of ropes (R) or fishing lines (FL), while suffocation is mainly attributed to Buoys/fenders (B) and plastic bags (PB) (Table 4).

Table 4: Damage/object relationship (N= 301):

Injuries	B	FL	FN	P	PB	R	RB
AB	13%	17%	20%	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%	34%				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.

6. Conclusions

42. For ingestion:

a) **An updated BV can be established for the presence of marine litter particles in the digestive tract of Mediterranean turtles weighing 0.07 gr of dry weight of ingested litter.**
b) **A TV can be proposed at less than 0.01 gr of dry weight of litter in the gastrointestinal tract.**

43. For entanglement:

a) **The proposed BV is 35%**, which in fact is the median percentage of *Caretta caretta* specimens affected by entanglement.
b) **The proposed TV is 9%** of *Caretta caretta* specimens affected by entanglement **.**

Table 5: Proposal for updating the BV and establishing TV for IMAP Candidate Indicator 24 (for *caretta caretta)*

IMAP Indicator	Updated BV	Proposed TV
Common Indicator24: Ingestion	0.07 gr dry weight ML ingested	0.01 gr dry weight ML ingested
Common Indicator 24: Entanglement	35% affected sample	9% affected sample

44. Recent research highlights that the availability of natural foods can alter the incidence of marine litter ingestion (Matiddi et al., 2024). In this case, TVs should take into consideration not only the general distribution of data, but also the environmental context.

45. Analysis based on dry 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).

46. 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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