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Status of NIS in the Mediterranean and Roadmap for the elaboration of Baseline at national and regional levels

UNEP/MAP
Athens, 2020

Note by the Secretariat

At their 19th Ordinary Meeting (COP 19, Athens, Greece, 9-12 February 2016), the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) and its Protocols adopted the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP).

The IMAP foresees in its initial phase of implementation (2016-2019) the development of a baseline assessment of the extent non-indigenous species (NIS) (EO2) that will provide a reference point against which the success of future actions could be measured. After this baseline data has been gathered during the initial phase of IMAP, it will be possible to set reference levels, following the assessment criteria set out in the Integrated Monitoring and Assessment Guidance (UNEP(DEPI)/MED IG.22/Inf.7). In addition, the Contracting Parties requested the Secretariat to develop citizen survey guidance for NIS, to enable them to use this additional cost-efficient methodology, which also strengthens public awareness and participation.

At their 20th Ordinary Meeting (COP 20, Tirana, Albania, 17-20 December 2017), the Contracting Parties endorsed, in Decision IG.23/6, the key findings of the 2017 Mediterranean Quality Status Report (the MED QSR Decision), that captured the sporadic inventories of NIS and the importance of assessing their pathways and impacts, and highlighted the increasing trend of new introductions of alien species into the Mediterranean.

SPA/RAC has started the process of the elaboration of the 2019 baseline of NIS introduction in the Mediterranean. The Contracting Parties to the Barcelona Convention were asked to designate national experts that will establish the inventory/baseline of NIS at national level. This 2019 baseline will be used as a reference point for new introductions of NIS during the forthcoming assessments (2023) that will be made within the Ecosystem Approach process and the IMAP.

The 2019 baseline is being developed in synergy with the EU Marine Strategy Framework Directive (MSFD), where each European Member State has already established its own baseline since 2012. A common template was agreed to be used in close collaboration with the Joint Research Centre (JRC) of the European Commission to avoid duplication of work.

Completed templates received from the Contracting Parties will be uploaded to the Marine Mediterranean Invasive Alien Species Database (MAMIAS). It is an online platform created by SPA/RAC, in the framework of the Action Plan concerning Species Introductions and Invasive Species in the Mediterranean Sea, and dedicated for the collection, exploitation, and dissemination of information on marine biological invasions in the Mediterranean Sea.

This document is based on the analysis of data received from the Contracting Parties and inserted in the MAMIAS database. It provides a preliminary analysis and a roadmap for the elaboration of a baseline at national and regional levels.

The present analysis is submitted to this Integrated CORMON Meeting on Biodiversity and Fisheries, Pollution and Marine Litter, and Coast and Hydrography for consideration. The updated analysis will be examined by the SPA/BD Focal Points Meeting in June 2021 and the Ecosystem Approach Coordination Group Meeting in September 2021.

Status of NIS in the Mediterranean and Roadmap for the elaboration of Baseline at national and regional levels

1. Introduction

1. In the context of the Barcelona Convention, a common indicator is an indicator that summarizes data into a simple, standardized, and communicable figure and is ideally applicable in the whole Mediterranean basin, or at least at the level of sub-regions, and is monitored by all Contracting Parties. A common indicator is able to give an indication of the degree of threat or change in the marine ecosystem and can deliver valuable information to decision makers.

2. The common indicator in relation to non-indigenous species (NIS) is the Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species in the water column and seabed, as appropriate).

3. Regarding the assessment of EO2[1], to be able to specify further Good Environmental Status (GES), it is important to understand which NIS are present within the Mediterranean marine region and sub-regions. A baseline assessment of the extent of NIS would provide a reference point against which the success of future actions could be measured. After this baseline data has been gathered during the initial phase of IMAP, it will be possible to set reference levels, following the assessment criteria set out in the Integrated Monitoring and Assessment Guidance (UNEP(DEPI)/MED IG.22/Inf.7).

2. Methodology

4. Information (spatial and non-spatial) on NIS is generally scattered across various sources (scientific literature, online and offline databases, reports, etc.). Addressing this challenge, Marine Mediterranean Invasive Alien Species Database (MAMIAS) developed by the Specially Protected Areas Regional Activity Centre (SPA/RAC) offers a single aggregation point of non-indigenous species data, which are standardized, harmonized and integrated. Consequently, MAMIAS was chosen as the primary source of data for compiling the present overview on NIS.

5. In a second step phase, the Contracting Parties were invited to appoint national experts to establish the list of NIS at country level. To this end, a common template was agreed with the Joint Research Centre (JRC) of the European Commission to avoid the duplication of efforts in collecting data and to collect data in a standardized way from both Mediterranean European and non-European countries.

2.1 The use of MAMIAS as a data source

6. As mentioned above, MAMIAS aggregates scientific information and spatial data on NIS from several sources and offers flexible web services for searching NIS introduced in the Mediterranean Sea. A key component of the MAMIAS is the "MAMIAS Catalogue": a comprehensive list of NIS in the Mediterranean, currently including information on about 1594 marine taxa. For each taxon, information is available on the year and country of the first observation in the Mediterranean, alien status (alien, cryptogenic, questionable), native range, taxonomy, synonyms, pathways, vectors and impact.

7. The initial MAMIAS Catalogue was compiled collating information from scientific literature, and online and offline databases and reports. All collected data were harmonized, standardized and integrated. Since its previous release in 2016, the MAMIAS Catalogue has been updated, revised and validated, in 2019. This was made through a process which included several steps allowing to pursue high quality standards, and involving qualified external experts.

[1] Ecological Objective 2: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

8. Information on pathways of introduction is included if known. MAMIAS will gradually align its pathways categorization to the one proposed by the Convention on Biological Diversity (CBD) in 2014)[2] , aiming at achieving synchronization and harmonizing of information on alien species pathways.

9. MAMIAS includes information on the occurrences of the alien species contained in its Catalogue. This spatial data was collected through scientific literature screening and retrieving of geo-referenced data, the Contracting Parties' surveillance systems established to comply with the Decision on IMAP, or from the active network of Mediterranean scientists working on the topic. Data collected is then shown in the form of occurrence maps for each species of the catalogue when existing.

10. MAMIAS is a Data Partner of the European Alien Species Information Network (EASIN), managed by the JRC. This allows the Mediterranean database to benefit from mutual data exchange, and gain increased visibility and networking possibilities.

2.2 Contribution of the Contracting Parties

11. The Contracting Parties were invited to compile their lists of NIS as baseline data at country level, and to supplement this with additional needed data following the agreed template. The final aim was to promote a consolidated Mediterranean baseline of marine NIS.

12. The agreed template includes the following data:

- **The scientific name** verified through the World Register of Marine Species (WoRMS), to get the accepted name, the taxonomy and verify synonyms;
- **Date** of first observation in the country;
- **Pathways of introduction**[3] : categories are aligned to the ones proposed by the Convention on Biological Diversity (CBD, 2014). Five pathways are associated with human activity either as commodities (**release** and **escape**), **contaminants** of commodities, **stowaways** on modes of transport and opportunists exploiting **corridors** resulting from transport infrastructures. The sixth category highlights alien species that may arrive **unaided** in a region as a result of natural spread (rather than human transport) following a primary human-mediated introduction in a neighboring region;
- **Certainty level of pathway**: A certainty level was given to each assigned pathway for every NIS, based on the scheme used by Tsiamis *et al.* (2018)[4], as follows: (i) **High**: there is direct evidence of a pathway; (ii)**Medium**: a likely pathway can be inferred; the NIS appears for the first time in a locality where a pathway is known to operate. This applies to many species introduced e.g. by shipping ballast (Transport – Stowaway: ship/boat ballast water) or as aquaculture contaminants (Transport – Contaminant: contaminant on animals – except parasites, species transported by host/vector); (iii) **Low**: NIS cannot be convincingly ascribed to a single pathway; usually, two or more possible pathways can be inferred.
- **Status of the species**: (i) (NIS) Species non-native to the ecosystem (introduced outside its natural distribution range); (ii) Cryptogenic: Species with no definite evidence of their native or introduced status according to Carlton (1996)[5]; (iii) Debatable: species with an unresolved taxonomic status.
- **Establishment success of the species**:
    - **Established**: a species with at least a self-maintaining population currently known to occur in the wild;

[2] Pathways of introduction of invasive species, their prioritization and management. UNEP/CBD/SBSTTA/18/9/Add.1, Montreal, Canada, 23-28 June 2014, 18 pp. doi: https://www.cbd.int/doc/meetings/sbstta/sbstta-18/official/sbstta-18-09-add1-en.pdf.

[3] Guidance for interpretation of the categories of introduction pathways under the Convention on Biological Diversity. CBD/SBSTTA/22/INF/9, Montreal, Canada, 2-7 July 2018, 100 pp. doi: https://www.cbd.int/doc/c/9d85/3bc5/d640f059d03acd717602cd76/sbstta-22-inf-09-en.pdf.

[4] Tsiamis K., Zenetos A., Deriu I., Gervasini E. and Cardoso A.C., 2018. The native distribution range of the European marine non-indigenous species. Aquatic Invasions (2018) Volume 13, Issue 2: 187-198. doi: http://www.aquaticinvasions.net/2018/AI_2018_Tsiamis_etal.pdf.

[5] James T. Carlton (1996). "Biological invasions and cryptogenic species". *Ecology*. Ecological Society of America. 77 (6): 1653–1655. doi:10.2307/2265767.

- **Casual**: a species from which only a single or few specimens have been recorded;
- **Invasive**: an established species that is spreading rapidly, with documented impacts on the ecosystem and its services;
- **Questionable**: a species whose presence in the country/area is questionable and needs to be confirmed (re-examination of material if available);
- **Unknown**: mainly for old records whose recent population status is not reported/published as well as for newly reported species.

13. By end of August 2020, only 11 Contracting Parties[6] had submitted feedback concerning the baseline of the NIS at country level.

3. Results

14. According to MAMIAS, more than 1199 non-indigenous species have been reported in the Mediterranean Sea (excluding vagrant species and species that have expanded their range without human assistance through the Straits of Gibraltar), 513 of which are considered as established. Of those established species, 107 have been flagged as invasive.

15. Among the four Mediterranean sub-regions, the highest number of established alien species has been reported in the eastern Mediterranean, whereas the lowest number was recorded in the Adriatic Sea (Fig. 1).

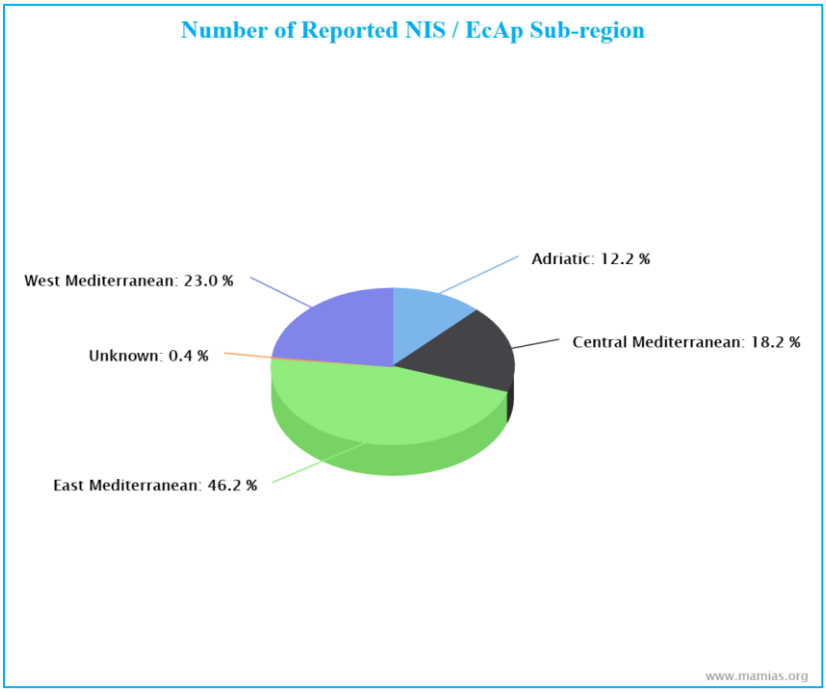

Fig. 1. *Percentage of reported established non-indigenous species by sub-region in the Mediterranean*

[6] Albania, Algeria, Egypt, Greece, Lebanon, Libya, Morocco, Slovenia, Spain, Tunisia, and Turkey.

16. New introductions of non-indigenous species in the Mediterranean Sea have an increasing trend (Fig. 2.a). However, this increasing trend in the rate of new introductions mainly reflects new introductions in the Eastern Mediterranean basin, and may also reflect the efforts made by a given country to record and monitor NIS introductions in their waters (Fig. 2.b).

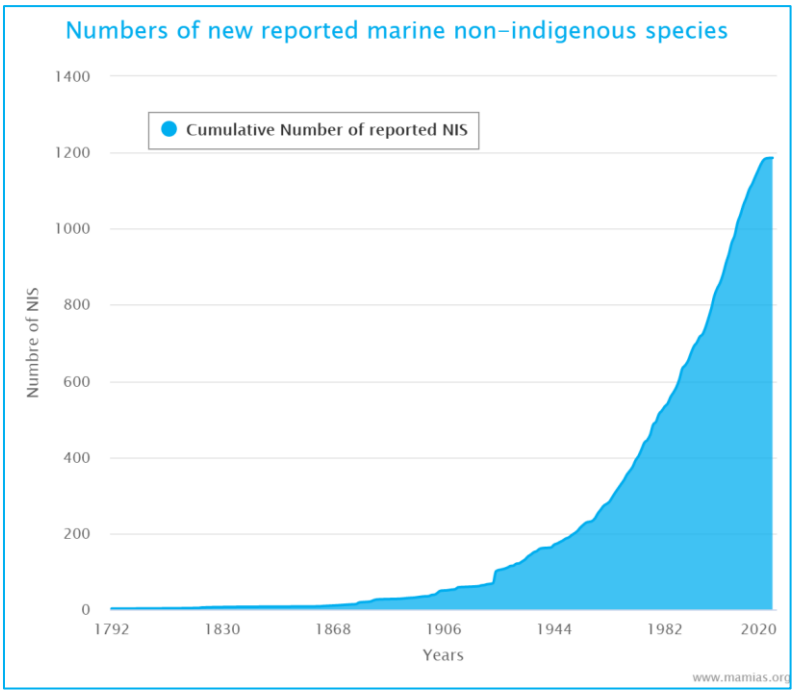

Fig. 2.a. *Cumulative number of reported non-indigenous species in the Mediterranean*

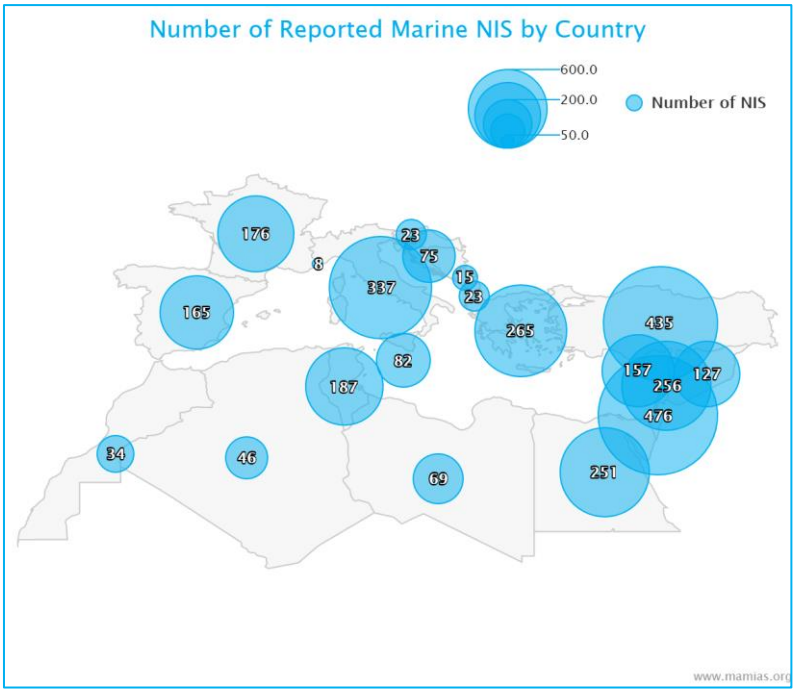

Fig. 2.b. *Map of geographical distribution of reported numbers of non-indigenous species in the Mediterranean by country*

17. Fig. 3 below show the temporal variability in numbers of newly reported marine non-indigenous species in the Mediterranean. The decreasing numbers of new introductions in the last decade can be due to an artefact, caused by the delay (often several years) between the date of introduction, observation

and reporting of the species. Thus, the downwards tendencies of the last years cannot yet be firmly asserted.

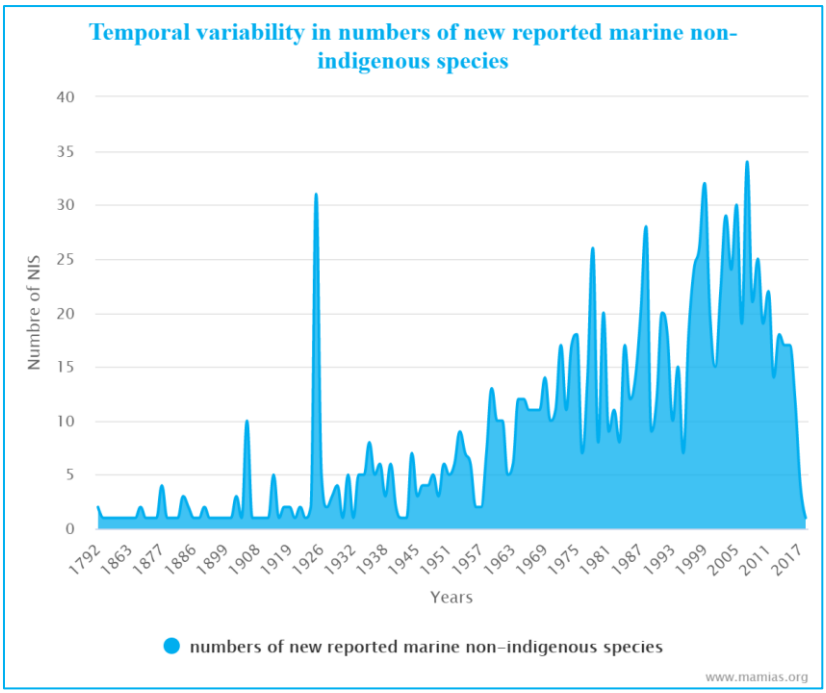

Fig 3. *Temporal variability in numbers of newly reported non-indigenous species in the Mediterranean*

18. NIS in the Mediterranean Sea are linked to four main pathways of introduction: the corridors, shipping (ballast waters and hull fouling), aquaculture, and aquarium trade. Overall, in the Mediterranean, corridors are the most important pathway of introduction (33.7%) followed by shipping (29%) and aquaculture (7.1%) (Fig. 4).

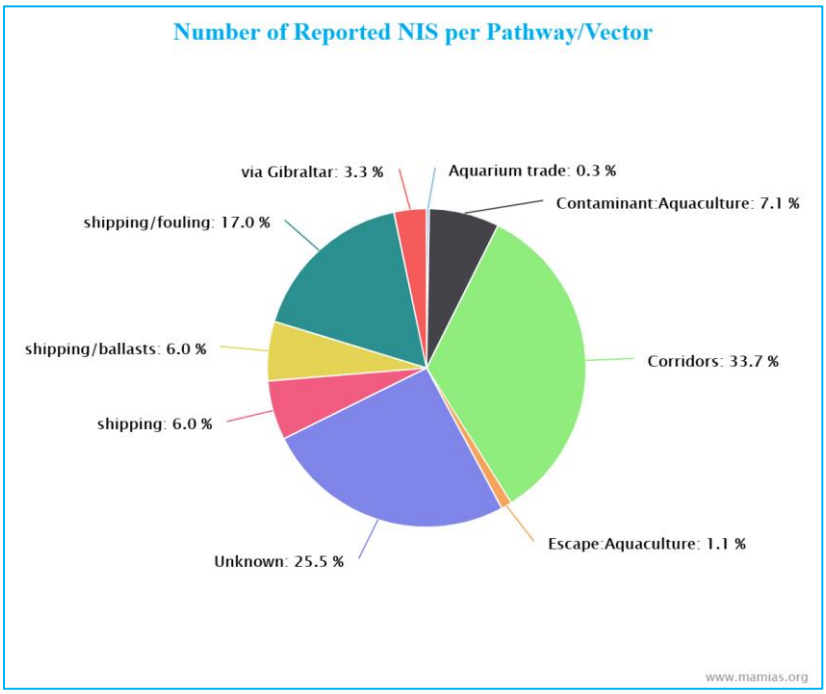

Fig. 4. *Percentage of reported non-indigenous species in the Mediterranean per pathway/vector of introduction*

19. The origin of NIS may be sometimes difficult to determine and for some particularly invasive species the route of invasions may be complex. The latest areas of origin have been highlighted in Fig 5. Knowing the latest area of introduction helps to develop the management measures against further invasions. The vast majority of Mediterranean marine NIS have their native distribution in the Western and Central Indo-Pacific and Red Sea, being mostly associated with introductions into the Mediterranean Sea through corridors (Fig. 5).

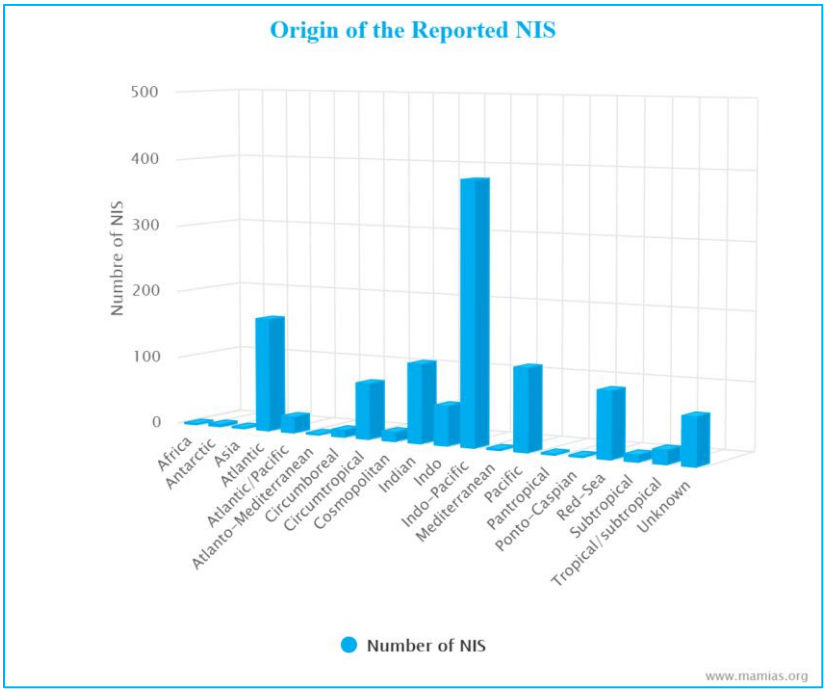

Fig. 5. *Histogram of the origin of reported non-indigenous species in the Mediterranean*

20. In terms of alien species richness, the dominant functional group is Zoobenthos (42.2%), followed by Demersal fish (14.4%), Benthic Plants (11.9%), and Demersal Crustacea (8.5%) (Fig. 6).

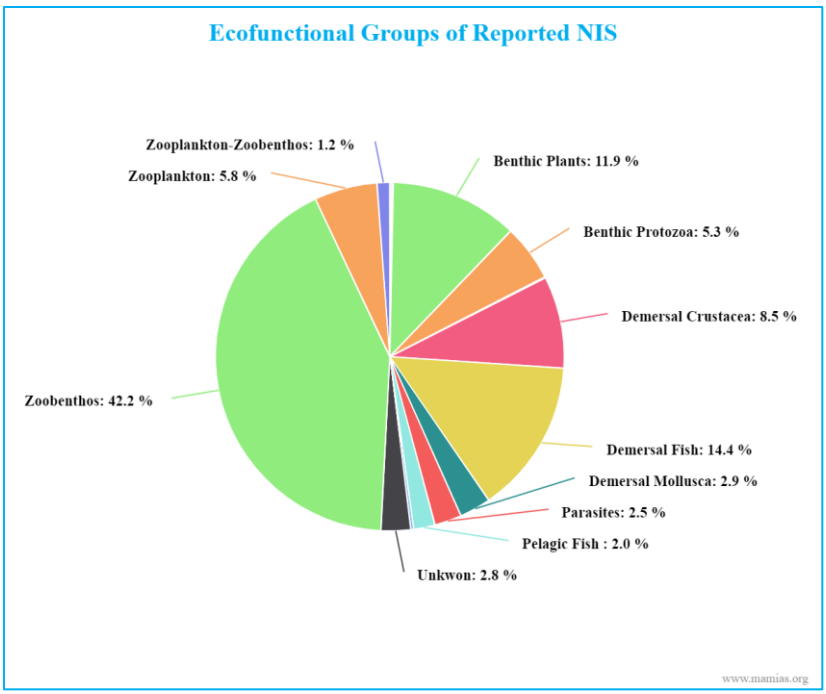

Fig. 6. *Percentage of reported non-indigenous species in the Mediterranean per eco-functional group*

4. Proposed workplan for the elaboration of Baseline on NIS at national and regional levels

21. IMAP defines GES for Common Indicator 6 (CI6) as the decreasing abundance of introduced NIS in risk areas and proposes CI6 target as "abundance of NIS introduced by human activities reduced to levels with no detectable impact", but with no clear thresholds. Baseline information is still limited, particularly knowledge on the state of environment before Invasive Alien Species (IAS) introduction, as a starting point for any further impact assessment.

22. Moreover, as provided for in the IMAP and based on existing regional databases, such as the Marine Mediterranean Invasive Alien Species Database (MAMIAS), and the European Alien Species Information Network (EASIN), each Contracting Party will determine the list of IAS to be monitored within its national monitoring programme during the initial phase of the IMAP, and will start collecting data regarding these species. To this end, SPA/RAC developed Guidance on developing invasive alien species national and sub-regional[7].

23. In the framework of the IMAP monitoring activities, among which the 2019 NIS baseline elaboration, the Contracting Parties have agreed, as a general approach, that data and information will be collected at national level and "shared in a manner that creates a compatible, shared regional pool of data, usable by each Contracting Party" and allowing to deliver the IMAP products. Table 1 hereafter resume the main planned activities and their timeline, in view to develop the 2019 baseline of NIS in the Mediterranean.

24. The 2019 baseline of NIS in the Mediterranean will be presented for discussion during the next CORMON meeting on biodiversity and fisheries (March 2021, TBC), the SPA/BD Focal Point meeting (June 2021, TBC) and the EcAp Coordination Group meeting (September 2021).

[7] http://rac-spa.org/nfp13/documents/02_information_documents/wg_431_inf_14_eng.pdf.

Table1: Planned activities and timeline for the elaboration of the 2019 baseline of NIS in the Mediterranean Sea

Planned activities		**Timeline**											
		December 2020		**January 2021**		**February 2021**		**March 2021**		**April 2021**		**May 2021**	
1) Reception of the filled templates of NIS by the Contracting Parties to the Barcelona Convention based on the latest scientific findings about NIS at national level:	The Contracting Parties to the Barcelona Convention are requested to submit the filled template of NIS recorded in their waters before the end of December 2020. In the framework of 2017 MED QSR, the reference lists related to CI6 considered data from the MAMIAS, database developed under UNEP/MAP SPA/RAC.												
2) Preliminary analysis of data received / Elaboration of sub-regional and Mediterranean lists of NIS:	Define a list of IAS of particular interest for the Mediterranean region under the IMAP process. These IAS will represent a reference for assessments of abundance, distribution and later adverse impact on biodiversity components.												
3) Development of the 2019 baseline of NIS in the Mediterranean Sea and methodology to establish thresholds:	Establishment of baseline is still limited, particularly the knowledge on the state of environment before IAS introductions, as a starting point for future impact assessments. Prepare a clear proposal of thresholds for EO2 CI6, based on a more detailed overview of NIS in the Mediterranean.												
4) Non-indigenous species baseline inventories: a synthesis in the context of the Barcelona Convention:	Scientific publication about NIS status in the Mediterranean Sea												