Guidelines "Use seabirds as indicators of the impact of marine pollution on biodiversity"

LIFE SeaBiL (Action B6)

Saving seabirds from marine litter

LIFE20 GIE/EN/000114

Coordinator

Beneficiaries

Financial partners

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1. Keywords and acronyms

	English	French	Spanish	Portuguese
BEE/GES	Good Environmental status (GES)	Bon Etat Ecologique (BEE)	Buen Estado Ecológico (BEE)	Boa Situação Ambiental (BSA)
DCSMM/DMEM/DQEM/MSFD	Marine Strategy Framework Directive (MSFD)	Directive Cadre Stratégie pour le Milieu Marin (DCSMM)	Directiva Marco sobre la Estrategia Marina (DMEM)	Diretiva-Quadro Estratégia Marinha (DQEM)
LIENSs	Coastal Environment and Societies laboratory	Laboratoire LIttoral ENvironnement et Sociétés	Laboratorio Medio Ambiente Costero y Sociedades	Laboratorio Ambiente Costeiro e Sociedades
UCA	University of Cádiz	Université de Cadix	Universidad de Cádiz	Universidade de Cádis

2. Warning

This document, which was planned as part of the Life SeaBiL, could not be structured due to the significant variability in the prevalence and quantity of plastics between the sites and species analysed during the project.

However, specific work to identify an indicator species was carried out by the Portuguese beneficiary. A report for Southern Europe and Macaronesia is therefore also available in addition to this document (available on the project website and in annex 1).

It is therefore a question of structuring a note to explain the initial objective, to present the results and conclusion of the Life SeaBiL (action B6) and to propose a schedule for updating the document according to the results of future analyses.

3. Purpose of the document

The objective of this document, based on the scientific results of the analyses of stranded seabirds, should make it possible to propose new indicator species of Good Ecological Status (GES) for maritime coasts where the Northern Fulmar is not found (or in quantities statistically too small to give convincing results).

4. How and why seabirds are good indicators of the impact of plastic pollution at sea

Seabirds are excellent indicators of the impact of marine litter, as their behaviour, diet and place in the food chain make them sentinels of marine pollution. They are widely exposed due to their wide geographical distribution, surface feeding and relatively long life compared to other species. This is because seabirds live and feed over large areas of ocean and are therefore exposed to the same amounts of marine litter as those found in the marine environment. For many species (such as fulmars, shearwaters and gulls), food resources are found on the surface or sub-surface, where floating plastics accumulate, making them particularly vulnerable to plastic pollution. Finally, because seabirds often return to the same breeding areas, variations in their condition reflect local and regional pollution levels around colonies.

Thus, they are affected by plastic pollution through several interactions:

- Entanglement: birds strangle themselves or get caught in nets and ropes (80% of the nests of crested cormorants in Brittany contain waste)
- Strandings: injuries or deaths related to pieces of plastic or nets.
- Ingestion: confusion with food which leads to poisoning, obstruction, perforation (94% of North Sea birds have plastic in their stomachs)

The quantity, type and size of the ingested pieces of plastic are found in their stomachs by necropsies and can thus be measured.

The Northern Fulmar is currently the indicator species used to assess good environmental status (GES) under the Marine Strategy Framework Directive (MSFD) in the North Sea (indicator D10 C3). The designation of an indicator species makes it possible to obtain information on the causes of mortality,

to highlight natural or anthropogenic impacts and, consequently, to assess the ecological status of an environment and a species.

Currently, the stomach contents of fulmars are analysed in order to quantify the mass of plastic ingested, the objective of the GES is to reach less than 10% of the Fulmars analysed containing less than 0.1g of plastic in their stomachs. The protocols and recommendations for carrying out these follow-ups are available online on the European Commission's website.

For each Fulmar collected, the number of particles and the mass of macro-waste are recorded and sorted into different categories (industrial plastic, domestic plastic, other elements of anthropogenic origin and natural elements).

An international working group has been organized, within the framework of the Life SeaBiL, to share the expertise and necropsy protocols used by the various researchers (see the report online). The stranded birds were analysed using a protocol validated by this working group.

During necropsies, each bird was measured (mass, culmen, tarsus and flattened wing cord lenghs), tissues were collected: feathers, brain, muscle, kidneys, liver, blood and the digestive track. These later were used for plastic content analyses while the other tissues (>2000 tissue samples collected over the course of the project) are stored frozen in the tissue bank set-up at LIENSs laboratory and UCA as part of the project (Action B5), to be shared with the scientific community. The database linked to the tissue bank is available at https://bird-biobank.oasu.u-bordeaux.fr/admin/login .

Digestive tracks were extracted following the protocol validate between scientifics. Suspected plastic particles were first isolated using a binocular magnifier. Each of these particles was then analysed with infrared spectroscopy (µFTIR) to confirm these were indeed plastic and to characterize the polymers. Analyses were performed by QUALYSE laboratory (La Rochelle, France), at University of Cadix (UCA). Once confirmed as plastic, each particle was measured using ImageJ software and weighted using a microscale, and the colour determined.

5. Conclusion from Life SeaBiL

The full reports are available online on the Life SeaBiL website (see here).

A large variation in the plastic contamination of stranded birds between sites and partners was observed, suggesting a large spatial variability in seabird exposure to plastics. However, the small sample sizes for some species do not allow for firm conclusions to be drawn and one or two indicator species to be proposed as originally planned.

In addition, the results obtained in the SeaBiL project contrast with a previous study where a high prevalence of plastic was found on seabird carcasses collected on French beaches (Franco *et al.,* 2019), including in some species monitored by the Life SeaBiL.

These initial analyses show the importance of going beyond the simple search for visible particles in order to obtain objective information on the contamination of seabirds by plastics.

It is recommended that these analyses be extended to a larger number of birds and to the various potential indicator species.

Therefore, we recommend extending the analyses to Atlantic puffins, kittiwakes and gannets in France, gannets and cormorants in Spain, and cormorants and Corry's shearwaters in Portugal.

6. Planned update schedule

This document is a "in progress" version, serving as a support to synthesize and promote the research carried out aimed at identifying new indicator species of the BEE for the descriptor D10 C3 of the MSFD.

It is therefore planned to amend it according to the following deadlines:

- **Update 1: March 2026**
- **Update 2: March 2027**

7. Annex 1 : South Europe and Macaronesia report about seabirds as indicators of plastic pollution

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LIFE Seabil

TECHNICAL GUIDE

Seabirds as indicators of the impact of marine litter in Southern Europe and Macaronesia

FUNDING

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Take-home message

Currently, around 95% of the Cory's Shearwaters nesting in the Berlengas and Azores archipelagos contain more than 4 plastic particles in their stomachs

These values exceed the threshold for Cory's Shearwaters *Calonectris borealis* (Cory's-TV) of 20%. In the case of the European Shag *Gulosus aristotelis*, only 4 to 8% of the nests in the Berlengas archipelago contained traces of plastic. These values reflect the abundance of suspended or floating marine litter, serving as an indication of the damage caused by marine litter.

Background

Monitoring and quantification of plastics in the stomachs of the Fulmar Fulmarus glacialis has been used by OSPAR and the countries of central and northern Europe as an indicator of the environmental quality of the marine environment (Fulmar-TV; Threshold Value). The species is known to regularly ingest marine litter, with almost all individuals containing at least some plastic particles in their stomachs. Although Fulmars feed close to the sea surface, their stomachs may also contain particles from deeper waters, or particles that have previously been ingested by their prey. Their wide distribution and great abundance in these areas were key aspects in the identification of this indicator. However, the species is rare and very infrequent in the waters of southern Europe and the Mediterranean.

At the level of the European Union, the Marine Strategy Framework Directive also defines the Fulmar as an indicator species for the contamination of marine waters by litter, following the monitoring methodologies and assessment threshold defined by OSPAR, and described above.

LIFE SeaBiL was created to identify and develop an alternative indicator to the Fulmar for the countries of southern Europe and the Western Mediterranean. Between 2020 and 2024, SPEA together with the Ligue pour la Protection des Oiseaux (LPO – France, coordinator), the Littoral Environment et Sociétés Institute (LIENSs – France), the University of Cádiz and the Sociedade Española de Ornitologia (SEO Birdlife), joined forces to collect samples from several species of seabirds and analyse their viability for use as an indicator of the environmental quality of the marine environment. Additionally, since Portugal and Spain have a significant part of their territory in the Macaronesia area, it was considered important that the indicator to be developed could also be applied in that region, in order to standardise this assessment as much as possible. In addition to these analyses, the studies carried out by other teams in monitoring the ingestion of marine litter by seabirds was compiled.

This guide presents two alternative species with their respective monitoring approaches, the Cory's Shearwater *Calonectris borealis* and the European *Shag Gulosus aristotelis*. The identification of these species follows the results of LIFE SeaBiL, the international technical workshop "Monitoring the impact of marine litter on seabird colonies" (Peniche, April 2024) http://dx.doi.org/10.13140/RG.2.2.22628.28808, and Rodríguez et al. (2024)[1].

The monitoring methodology and the identification of the assessment threshold for monitoring marine litter ingested by Cory's Shearwaters follows the approach defined for Fulmar-TV, with the changes suggested by Rodríguez et al. (2024). On the other hand, the methodology for monitoring marine litter incorporated into European Shag nests follows the approach presented in the *Guide to monitoring marine litter in European seas*[2] and subsequently developed within the framework of LIFE SeaBiL.

In the case of the Cory's Shearwater, the indicator could be expanded to the closely related species that breeds in the Mediterranean, the Scopoli's Shearwater Calonectris diomedea, and consequently expanded to all Mediterranean countries.

[1] Rodríguez, Y., Rodríguez, A., van Loon, W.M.G.M., Pereira, J.M., Frias, J., Duncan, E.M., Garcia, S., Herrera, L., Marqués, C., Neves, V., Domínguez-Hernández, C., Hernández-Borges, J., Rodríguez, B., Pham, C.K., 2024. Cory's shearwater as a key bioindicator for monitoring floating plastics. Environ. Int. 186, 108595. https://doi.org/10.1016/j.envint.2024.108595.

[2] JRC, 2013. Guidance on Monitoring of Marine Litter in European Seas. MSFD Technical Subgroup on Marine Litter. Joint Research Centre, Institute for Environment and Sustainability, European Commission. ISBN 978-92-79-32709-4

Selection of indicator species

As a first approach, the species to be selected as an alternative indicator to the Fulmar should be a species with similar ecological characteristics, ideally from a very closely related taxonomic group, i.e. from the same genus or family. Since there are no other representatives of the genus *Fulmarus* in European waters, it would be necessary to investigate the presence of other species from the same family – Procellariidae. This family includes a large number of species, some of which are quite common and abundant in the waters of southwestern Europe and the Mediterranean. Of all these, the Cory's Shearwater is the closest species, being common in the waters of Portugal (including the Azores, Madeira and Selvagens) and Spain (including the Canary Islands).

On the other hand, a sister species - the Scopoli's Shearwater - has nesting colonies throughout the Mediterranean. Both species of shearwater have a feeding behaviour similar to that of the Fulmar, feeding exclusively at sea, either in deeper areas far from the coast or in more coastal areas. Not being excellent divers, they feed up to a few metres from the sea surface. Like most species in their family, shearwaters regularly ingest a variety of marine litter, most of which is probably caught directly, either intentionally due to its similar appearance to their natural prey, or unintentionally when mixed with remains of attractive food. However, captures can also occur indirectly, for example if their prey had previously ingested litter.

In terms of the size of the particles ingested, recent data indicate that more than 90% of the particles are less than 5 mm in length, i.e. particles classified as microplastics.

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On the other hand, the European Shag, being a species with a very different ecology from the Fulmar and shearwaters, may have some advantages as an indicator species. The first is that it occurs throughout Europe, from North to South and along the entire Mediterranean, with the exception of the Macaronesia and the Baltic coast. Secondly, as it is an extremely sedentary species with movements very limited to the coastal areas around its colonies, its behaviour reflects the local and coastal environment. Unlike Fulmars or shearwaters, the European Shag builds its nest with elements that it finds around its breeding site or on the surface of the water. It normally uses remains of vegetation that it carries to the nest. However, several studies have reported the incorporation of marine litter in the construction of shag nests. Therefore, the quantification of the number of plastic particles in the nests should reflect the availability of litter in the area surrounding the breeding site.

Goal

The purposes of monitoring the abundance of plastics in the stomachs of Cory's Shearwaters and incorporated into European Shag nests are:

- To obtain an ecologically relevant measure for measuring the abundance of marine litter, plastic in particular, on the sea surface.
- To estimate the ecological damage caused by this marine litter.

Monitoring of marine litter ingested by Cory's Shearwaters

METHODOLOGY AND ASSESSMENT

Threshold

The assessment threshold for Cory's Shearwater (Cory's-TV) is proposed in this guide, following the approach defined for the Fulmar-TV threshold with the modifications suggested by Rodríguez et al. (2024). Cory's-TV is based on the amount of plastic found in the stomachs of fledgling Cory's Shearwaters that were recovered dead in the Azores. The threshold was defined as the 25% percentile value (4 plastic particles) of the 1030 samples analysed between 2015 and 2022, assuming that the number of particles below this value would be very close to zero, making the application of the indicator unfeasible. Thus, Cory's-TV establishes that no more than 20% of individual shearwaters may have > 4 plastic particles in their stomachs, based on an ideal sample size of 40 individuals per year, over at least 5 years and for each area/region. However, smaller sample sizes may be used if it is not possible to obtain such a large number of samples.

Sample collection

The carcasses of dead or accidentally killed shearwaters can be collected from breeding colonies, beaches, islands affected by light pollution or from work in collaboration with fishermen, where the birds are victims of bycatch. Ideally, these carcasses should be of juveniles in the final phase of growth. Other age stages can also be used, however, samples from adult birds during the chick-feeding period should be avoided, as they regurgitate these particles during chick-feeding, or at the beginning of the breeding season, as they mainly reflect contamination of the species' wintering areas (Rodríguez et al. 2025)[3] .

The carcasses can be collected by properly trained technicians or volunteers. Necropsies and sample processing should be carried out in specialized laboratories. Information on the date and location of the monitoring should be recorded, including the respective geographic coordinates.

[3] Rodríguez, Y., Rodríguez, A., Pereira, J.M., Pham, C.K. 2025. Plastics reset in an adult Procellariform seabird species during the breeding season. Marine Environmental Research 204:106939. https://doi.org/10.1016/j.marenvres.2024.106939

Sample size

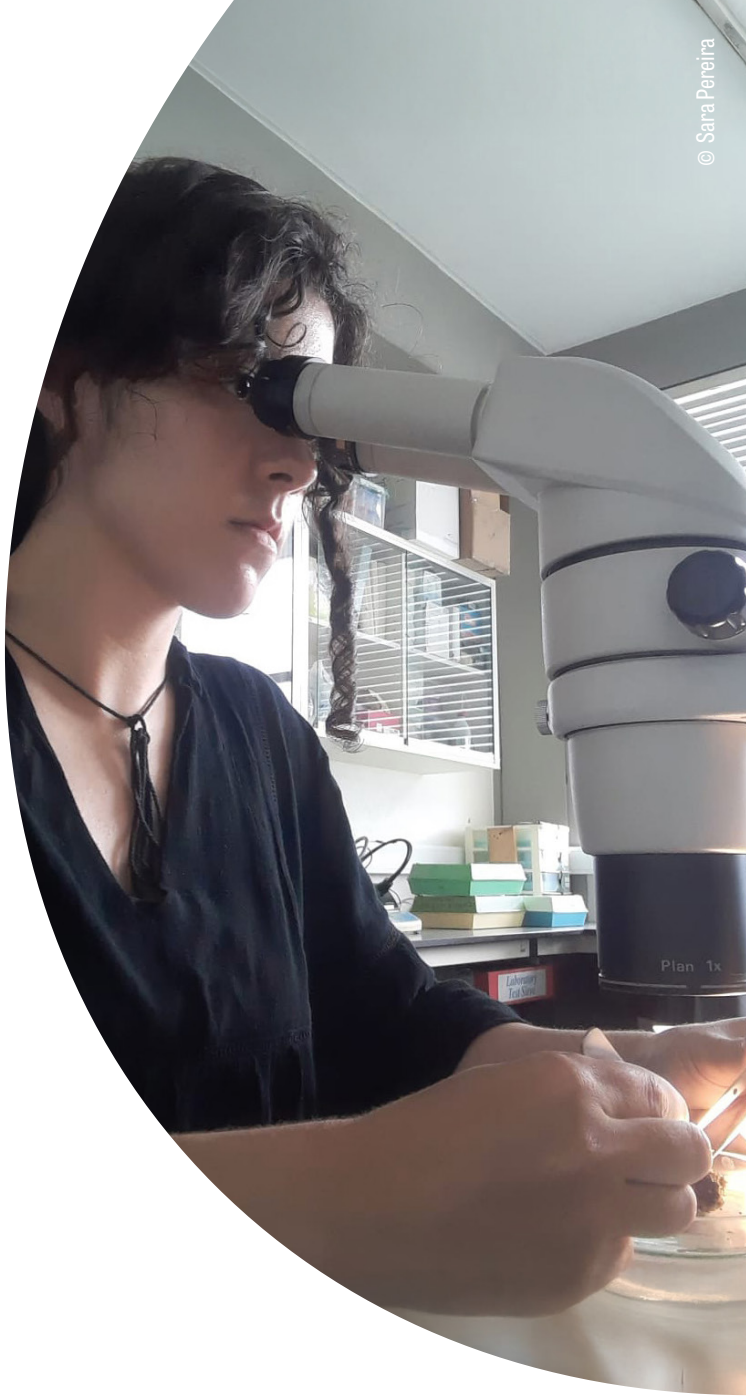
The recommended number of samples follows the indicator Fulmar and a study carried out in the Azores (Rodríguez et al. 2024)[4], indicating that a minimum number of 40 Cory's Shearwater stomachs per year constitutes an adequate sample to obtain a realistic result of the marine litter situation in a specific location in a given time period. Ideally, the different areas or countries should therefore aim to collect 40 or more shearwater carcasses annually. For some areas, this result will definitely be very difficult to achieve due to the lower abundance of Cory's Shearwaters in the area, the size or type of area, the removal of carcasses by scavengers, among others. However, as in the case of the Fulmar, it will be possible to deal with smaller samples obtained locally, by combining several locations and by evaluating data from several pooled years (5-year averages used in the MSFD and OSPAR analyses).

Laboratory analysis - necropsies

The protocol to be followed for carrying out necropsies in the laboratory follows the methodology defined by OSPAR for the monitoring and assessment of plastic particles in the stomachs of Fulmars in the North Sea area, Franeker (2004)[5] and the Protocol for Transport/ Necropsies of Stranded Seabirds - Life SeaBiL[6].

During necropsy, the age (adult or non-adult) and sex are recorded. The stomach contents (specifically those found in the proventriculus and gizzard) are carefully washed and passed through a 1 mm mesh filter, and then transferred to a petri dish for classification using a stereomicroscope. The 1 mm mesh filter is used because, below this mesh size, filters are easily blocked by mucus from the stomach wall and food remains. In addition to analyses with smaller mesh sizes being extremely time-consuming, particles smaller than 1 mm in size are very rare in the stomachs of other seabird species.

The particles are divided into two main categories following the *CEMP Guidelines for Marine Monitoring and Assessment of Beach Litter*[7] from OSPAR. Industrial plastics ("pellets") are separated from user/consumer debris (e.g. sheets, foams, fibres, rigid fragments, etc.). For each of these categories, the number of particles and the weight (in grams to the fourth decimal place) are recorded.



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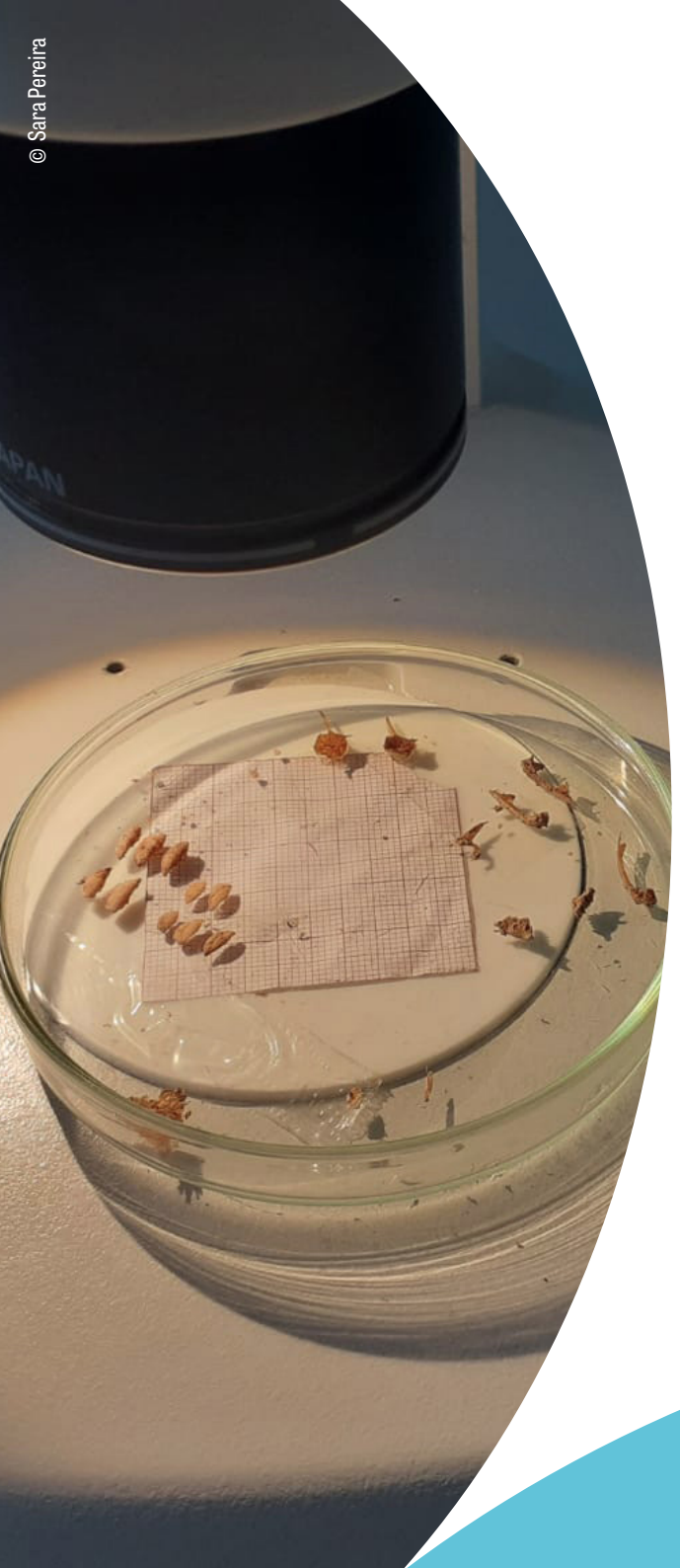
[4] Rodríguez, Y., Rodríguez, A., van Loon, W.M.G.M., Pereira, J.M., Frias, J., Duncan, E.M., Garcia, S., Herrera, L., Marqués, C., Neves, V., Domínguez-Hernández, C., Hernández-Borges, J., Rodríguez, B., Pham, C.K., 2024. Cory's shearwater as a key bioindicator for monitoring floating plastics. Environ. Int. 186, 108595. https://doi.org/10.1016/j.envint.2024.108595.

[5] Franeker, J. A. van. 2004. Save the North Sea Fulmar-Litter-EcoQO Manual Part 1: Collection and Dissection Procedures. Wageningen: Alterra. https://library.wur.nl/WebQuery/wurpubs/334786

[6] https://pt.lifeseabil.eu/wp-content/uploads/2023/07/Protocol-transportation-necropsies-Life-Seabil.pdf

[7] https://repository.oceanbestpractices.org/bitstream/handle/11329/1886/20-02e_cemp_guideline_beach_litter.pdf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Data analysis

The final assessment is based only on the total number of particles in the stomach, but plastics from industrial and consumer use have different origins, which provides very useful information for the interpretation of monitoring data and consequently for the priority policy measures to be considered. The data collected will be used to calculate the following specific parameters:

- Frequency of occurrence (%FO) as the proportion of birds with plastic in their stomachs;
- Arithmetic mean and standard error (mean ± standard error) of the number of plastic particles in the stomachs;
- Cory's-TV performance (CTV%) as a percentage of birds exceeding the limit of 4 plastic particles ingested as defined in Cory's-TV.

The reference value for the presence of plastics in the stomachs of Cory's Shearwaters (or any other marine organism) is zero, since plastic is a synthetic material created solely by humans, having been introduced into the marine environment in the mid-1900s. However, accepting that accidental losses are inevitable, we can define that "there should be less than 20% of Cory's Shearwaters with more than 4 plastic particles in the stomach (proventriculus and gizzard) in samples from, ideally, 40 birds collected annually and over at least 5 years".

The assessment of the abundance of plastics in Cory's Shearwater stomachs is thus calculated as the percentage of carcasses analysed that exceed the level of 4 particles present in the stomach (Cory's-TV%) over the most recent 5 years of the available time series.

Illustrative results

CORY'S SHEARWATER IN MAINLAND PORTUGAL *

96% of the samples (%FO) contained plastic particles

84% of the birds (CTV%) had more than 4 plastic particles in their stomachs, revealing a value well above the assessment threshold of 20%

25 samples were collected from Cory's Shearwaters from Berlenga Island breeding, in 2023

13,7% ±3,1 was the average of plastic particles found in each individual (mean ± standard error)

* Laboratory processing followed the protocol mentioned above

CORY'S SHEARWATER IN THE AZORES ARCHIPELAGO **

95% of the samples (%FO) contained plastic particles

81% of the birds (CTV%) had more than 4 plastic particles in their stomachs, revealing a value well above the assessment threshold of 20%.

626 samples were collected from fledging Cory's Shearwaters in the Azores, between 2018 and 2022

13,9% ±0,6 was the average of plastic particles found in each individual (mean ± standard error)

** Extracted from Rodríguez et al (2024)

Monitoring of marine litter ingested by European Shag

METHODOLOGY AND ASSESSMENT

Threshold

The threshold has not been defined yet. It is necessary to monitor colonies in different locations and with different levels of contamination by marine litter.

Recolha dos dados

The first step is to select a colony, or part of a colony, whose nests are easily observable from a distance, from fixed points. It is important that the boundaries of the monitoring area are clearly defined. If only a part of the colony is monitored, this should be representative of the entire colony and include at least 5 to 10% of all nests, resulting in at least 40 monitored nests. Subsampling a colony can allow the calculation of pollution present in the entire colony, but this is dependent on the frequency of litter occurrence in the nests. If this frequency is low, it will be necessary to monitor a larger proportion of nests in order to accurately monitor litter occurrence trends.

The monitoring area should be photographed and the nests should be clearly identified in the photographs, as well as the boundaries of the monitoring area. Ideally, the monitoring area should be defined by "natural" boundaries, e.g. a small island, a cliff with clearly visible boundaries, etc.

Define the monitoring dates/periods. At least 3 periods should be defined. The first monitoring should be carried out at the beginning of the breeding season, usually in mid-March. The second monitoring should coincide with the period when the maximum number of apparently occupied nests is observable, i.e. in mid-April. The third and final monitoring should be carried out at an advanced stage of the chick rearing, a few weeks before they desert the nests, i.e. early June. In addition, some intermediate or subsequent counts can be carried out in order to improve the information collected, and can be combined with the monitoring of breeding success.

Use telescope and binoculars for monitoring at distance. If it is possible to physically approach the nest, this should preferably be done at least during one of the monitoring periods, ideally during the third monitoring period, in order to minimize disturbance to the nest.

For each nest, record the number of adults, eggs and/or chicks, the unique identification code of the nest, and the number of marine litter particles. Whenever possible, also identify the type of particles (e.g. fishing line, rope, piece of fishing net, hook, wire, piece of metal, fabric, rubber, fibres, foam, etc., following the standard categorization followed in the MSFD for litter classification), the colour and the length on a qualitative scale (1 - <10cm, 2 - 10 to 25cm, 3 - 25 to 100cm, 4 - >100cm).

Record the number of birds entangled in litter, their reproductive status (breeding, if associated with a nest with eggs or chicks, or non-breeding), age (adult, immature or juvenile) and condition of the bird (dead or alive). Also record the characteristics of the litter particle, following the categorization described in the previous point. If possible, record these events photographically.

As a general rule, it is NOT recommended to collect nests after the nesting season to quantify the proportion of litter. In many cases, nests are used over several years, which means that their removal may negatively affect the reproduction of the parents of those nests and the parents of neighbouring nests, either by increasing the effort to build a new nest, by competition between neighbours for the nests left intact or for materials to build them, or by the effect of nest quality on breeding success.

Data analysis

The final assessment is based on the frequency of littered nests and the number of entangled birds, but the plastics will have different origins, which provides very useful information for the interpretation of the monitoring data and consequently for the priority policy measures to be considered.

The data collected will be used to calculate the following specific parameters:

- Frequency of occurrence of nests containing marine litter (%FO) calculated as the proportion of the number of nests with visible litter, in relation to the total number of occupied nests in the study area.

- Arithmetic mean and standard error (mean ± standard error) of the number of plastic particles per nest;

- The mortality rate due to entanglement will be calculated as the proportion of the number of dead or weakened individuals (separated by age), in relation to the total number of individuals of that same age in the monitoring area. Entangled birds that are released by human action should be considered as injured or dead birds for the calculation of the mortality rate, since that would be their likely end if there were no human intervention.

- The above parameters can be compared later with the number of breeding pairs, productivity and other relevant factors.

Although an assessment threshold has not yet been defined, in this case the reference value for the presence of plastic in the nests of shads or entangled individuals is zero, since plastic is a synthetic material created solely by humans, having been introduced into the marine environment by the mid-1900s. However, it will be necessary to monitor colonies in several locations and with different levels of contamination by marine litter.

Illustrative results

EUROPEAN SHAG IN MAINLAND PORTUGAL*

28-50 shag nests were monitored on Berlenga Island, each year from 2021 to 2024.

4-8% of nests (%FO) contained plastic particles

ZERO individuals entangled in marine litter were recorded

0,06% ±0,02 was the average of plastic particles found in each individual (mean ± standard error)

* Laboratory processing followed the protocol mentioned above

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Conclusions

This guide describes two methodologies that could be used as an alternative to the Fulmar as an indicator of marine environmental quality for southern Europe and Macaronesia – the Cory's-TV and the European shag. In the exemplary exercises that were carried out for the Berlengas and Azores archipelagos, it was demonstrated that the Cory's-TV threshold, which assumes that less than 20% of the shearwaters may exceed 4 plastic particles in their stomachs, was not reached. In 2023, 96% of the Cory's Shearwaters from Berlengas Archipelago had plastic in their stomachs, including 84% with more than 4 particles. On average, each individual contained 14 plastic particles. Very similar values were observed for the period 2018-2022 in the Azores Archipelago. In the case of the European Shags, 4 to 8% of the nests in the Berlengas Archipelago revealed the presence of plastic between 2021 and 2024. With each nest containing, on average, values well below 1 particle of plastic.

Although the results of the two indicators point to significantly different levels of plastic contamination, it is important to highlight that Cory's shearwaters and European Shags provide information from different zones. Due to its wide distribution range, the Cory's shearwater reflects contamination over a broader area, including both coastal and offshore regions, as the species covers extensive areas even during the breeding season. In contrast, the European Shag should be interpreted as an indicator of local and coastal contamination, due to its sedentary behaviour.

Nevertheless, both species are valuable for monitoring trends in marine litter and its potential effects on marine fauna.

Team

- Nuno Oliveira
- Ana Almeida
- Hany Alonso
- Joana Andrade
- Tânia Nascimento

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