Protecting and conserving the North-East Atlantic and its resources

Coordinated Environmental Monitoring Programme (CEMP) Guidelines for Monitoring and Assessment of plastic particles in stomachs of fulmars in the North Sea area

Agreement 2015-03[1]

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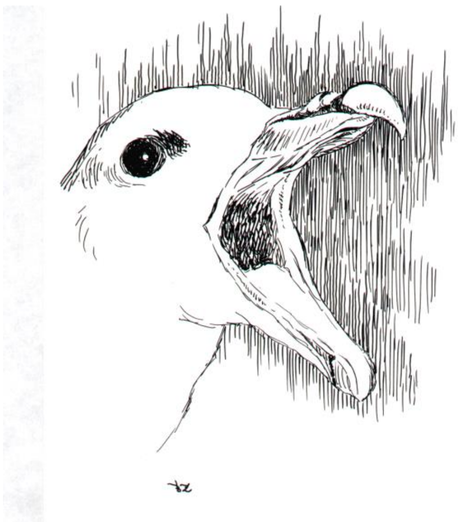
[1] As amended by EIHA 2016

CONTENTS

1 Introduction

The quantity of debris, in particular of plastics, ingested by marine organisms reflects the abundance of marine litter, the associated harm to wildlife and the marine ecosystem, and socio-economic harm. OSPAR has agreed to implement the monitoring of plastics in stomachs of seabirds (EcoQO 3.3) as a common indicator in the North Sea (OSPAR 2009, 2010a,b; 2014a,b). This has been implemented through long term monitoring of plastic abundance in stomach contents of a common seabird in the North Sea, the Northern Fulmar (*Fulmarus glacialis*), with methods and results published in regular reports (see references Van Franeker in Chpt5) and peer reviewed scientific literature (Van Franeker et al. 2011; Van Franeker & Law 2015). The Fulmar EcoQO methodology is also being used elsewhere in the North Atlantic and North Pacific areas (e.g. Provencher et al. 2009; Avery-Gomm et al. 2012; Kühn & Van Franeker 2012; Bond et al. 2014; Trevail et al., 2015) allowing wide spatial comparisons of environmental quality in European waters. The OSPAR EcoQO for the fulmar has been adopted in the European Marine Strategy Framework Directive (MSFD) in Descriptor 10 Indicator 2, which is suitable for implementation in the Greater North Sea, Arctic Waters, and Celtic Seas, and has been taken as example for other biota indicators for marine litter in other MSFD areas where no fulmars occur.

The purpose of this document is to provide guidelines for a monitoring and assessment program that allows efficient detection of spatial differences and temporal changes in marine plastic debris floating at the sea surface using fulmar stomach contents as an indicator.



2 Monitoring

2.1 Objective

The purpose of monitoring plastic abundance in stomachs of fulmars is

a) to obtain an ecologically relevant measure for the abundance of marine debris, plastics in particular, in surface waters and

b) to estimate ecological harm caused by such debris

Fulmars are pelagic seabirds that belong to the large group of the tubenoses (Procellariiformes) of which the albatrosses are the best known representatives. These birds forage exclusively at sea and never on land and even rarely close to shore. The fulmar is a poor diver, and thus feeds of what is available at or within a few meters from the water surface. Like most tubenosed seabirds, fulmars regularly ingest a variety of marine debris, probably mostly taken directly, either intentionally because resembling prey, or non-intentionally when mixed with attractive food wastes. But indirect ingestion e.g. through fish or scavenging on guts of other dead animals will also occur. Details in sizes ingested need to be assessed, but a preliminary survey suggests that roughly 90% of ingested plastic items (not threads or soft sheets) found in the first glandular stomach of fulmars is 10mm or less in size, and over 50% is 5 mm or less (Bravo Rebolledo 2011). The definition for micro-plastics as items smaller than 5 mm was introduced by an international expert workshop (Arthur et al. 2009), and this definition has been copied into particle size definitions used in the Marine Strategy Framework Directive (MSFD). MSFD defines litter smaller than 5mm as micro-particles, between 5 and 25mm as meso-particles, and items over 25 mm as macro-debris (MSFD-TSGML 2011). Thus, debris ingested by fulmars is mostly in the micro- and meso-size range. Unlike most gulls, fulmars normally do not regurgitate indigestible components of their diet, but gradually grind these in their muscular stomach (gizzard) until particles are worn or broken into sizes small enough to pass into the intestines and be excreted (which appears to happen at particle size of roughly 2-3mm (Bravo Rebolledo 2011). Fulmar stomach contents integrate litter abundance encountered during a number of days to weeks (Van Franeker & Law 2015).

Plastic ingested by the fulmar was selected as an 'ecological indicator' for trends in marine litter by OSPAR (EcoQO 3.3 (OSPAR 2009)), and as an 'impact on biota' indicator in MSFD (indicator 10.2.1 (EC 2010)), but results of fulmar monitoring have a broader additional significance:

1) both size range and location of debris monitored by fulmars is complementary to macro-debris monitored on beaches (MSFD Indicator 10.1.1) and

2) fulmar ingestion has a focus on, but is not excluded to, floating marine debris and can be seen as a functional instrument for MSFD indicator 10.1.2 (trends in litter in the water column).

3) the size range of plastics ingested by fulmars is a functional instrument for monitoring microplastics (MSFD Indicator 10.1.3 trends in microparticles)

Changes in stomach contents of fulmars in the North Sea have been monitored since the 1980s. Although overall abundance of plastics in stomach have shown non-explained changes over time, rapid reductions in abundance of industrial plastic within one to two decades have shown that fulmar stomach contents rapidly reflect changes in source specific plastic abundances in their environment (Van Franeker et al. 2011; Van Franeker & Law 2015), and are thus an effective way to assess the success of policy measures, reflecting the improved environmental quality for marine organisms and the pelagic marine environment.

2.2 Quantitative objectives

The **reference level** for presence of plastics in stomachs of Northern Fulmars (or any marine organism) is zero, as synthetic materials are solely manmade, and were only introduced into the marine environment since about the mid-1900s.

However, accepting that incidental losses are unavoidable OSPAR (2008, 2009), has defined an (undated) **target level** for the Fulmar EcoQO 3.3 in the North Sea as:

> *"There should be less than 10% of northern fulmars (*Fulmarus glacialis*) having more than 0.1 g plastic particles in the stomach in samples of 50 to 100 beach-washed fulmars from each of 4 to 5 areas of the North Sea over a period of at least five years".* Thus, from this definition, the basic monitoring information required is the total mass of plastic in individual stomachs, and the percentage of stomachs exceeding the 0.1g critical level (referred to as 'EcoQO performance').

This OSPAR target may actually be seen as a **baseline level**, because this level currently does exist in in relatively clean arctic marine environments such as the Canadian Arctic (Van Franeker et al. 2011; Kühn & Van Franeker 2012) and could be seen as a global background 'noise' that can only change on the long term by global changes.

For the Fulmar EcoQO, OSPAR has made a **spatial distinction** within the North Sea into 1) Scottish Islands, 2) east England, 3) Channel area, 4) southeastern North Sea (Belgium, Netherlands, Germany), 5) Skagerrak area (Denmark, Norway, Sweden). Significant differences between part of these areas exist, with highest level of pollution in the Channel area, gradually decreasing to more northern areas within the North Sea and beyond (Van Franeker & Law 2015). OSPAR has set the same target level for all these North Sea areas, and has not specified a target date.

For future spatial aggregations, please note that OSPAR is working towards a consistent system of different levels of 'geographical reporting units' (OSPAR-ICG-MAQ 2015a) to be applied for all its different future assessments (OSPAR-ICG-MAQ 2015b). Future aggregations may thus differ from the one used so far in Fulmar EcoQO monitoring (examples in Chpt 3.5 of these guidelines).

The temporal aspect, although not specified in the OSPAR target, is certainly relevant for policies under the European Marine Strategy Framework Directive (MSFD) in Descriptor 10 Indicator 2. Good Environmental Status (GES) has to be achieved by 2020. OSPARs Regional Action Plan for marine litter in the MSFD (OSPAR (2014b) has not yet identified regional or overall targets. It appears that current national ambitions vary widely from the original EcoQO target to unspecified rates of change (Van Acoleyen et al., 2014).

Power analyses in the pilot study by Van Franeker & Meijboom (2002) indicated that fulmar monitoring data may be expected to be able to detect statistically significant trends ($p<0.05$) over time periods of 4-8 years depending on the type of plastics considered: periods of significant change indeed have been observed in early monitoring years, for user plastics, but for industrial plastics in particular (Van Franeker et al. 2011; Van Franeker & Law 2015) . About 40 stomachs was found to be the recommended sample size for a location and time specific figure for plastic ingestion.

Globally, it has been estimated that 80% of marine plastic debris originates from land (Faris & Hart, 1994). Indeed, huge masses of plastics are estimated to enter the sea from land based sources (Jambeck et al., 2015) but similar estimates for sea based litter are lacking. In the North Sea, at least for macro-debris on beaches, sea based sources (shipping, fisheries, aquaculture, offshore industry) are thought to be the dominant source (van Franeker 2005; Fleet et al. 2009). Although sources for smaller debris in the North Sea are less clear, spatial details in types and quantities in debris ingested by fulmars (Van Franeker et al. 2005) similarly support a important role of sea based sources in the North Sea. It may thus be expected that Fulmar EcoQO monitoring will be most sensitive for measures and environmental targets focused on sea based activities including harbour policies.

2.3 Monitoring Strategy: design of specific monitoring strategy

The OSPAR EcoQO target has been defined in simple terms of a proportion of sampled birds exceeding a critical level of total plastics mass in the stomach (EcoQO Performance). In its most basic form, a monitoring strategy could thus be limited to measuring total plastic mass in stomachs of fulmars without any further detail (Level 1 in Figure 1).

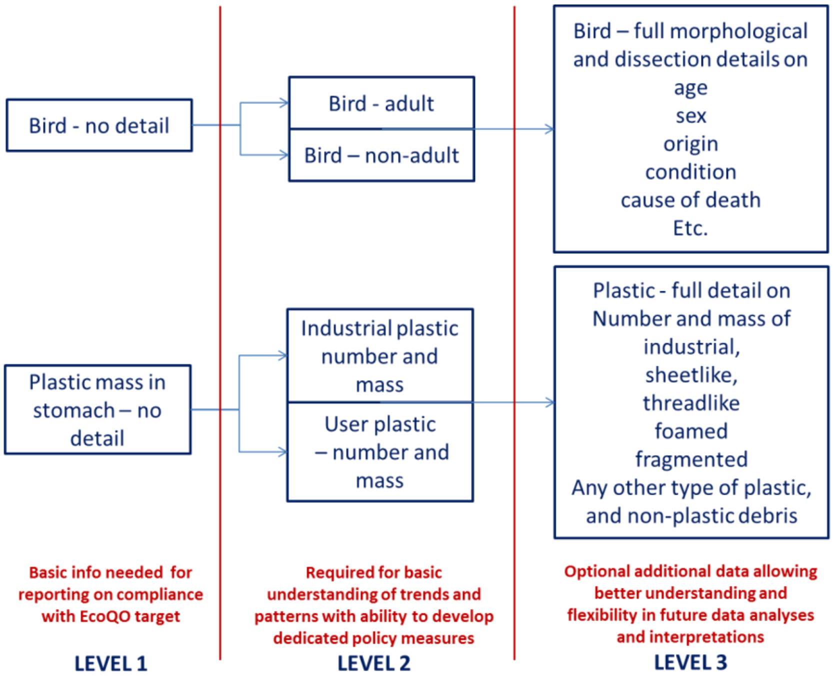


Figure 1 **Schematic representation of potential levels in design of the monitoring strategy**

However, it is strongly recommended that the monitoring strategy records additional parameters for age of birds and major plastic debris types in stomachs (Level 2 in Fig. 1). Since plastic ingestion is known to be age dependent (Van Franeker & Meijboom 2002), adult as opposed to non-adult age-groups should be identified during dissections. Concerning plastic stomach contents, as a minimum a distinction should be made between industrial preproduction plastic resin pellets and user plastic debris. This is because the former will usually relate to unintended losses during production or transport, and the latter to at least partly intentional discharge of plastic consumer debris, and thus require different policies towards reduction. These types of plastics also have shown different trends in the past. Differentiation between industrial and user plastic debris by both number and mass has been of major importance in understanding processes affecting oceanic accumulation of debris (Van Franeker & Law 2015). Additionally, in terms of impacts, user plastics contain many potentially dangerous additives that are mostly lacking in the industrial pellets.

A range of further details may be recorded in dissections and stomach analysis, broadening scientific and policy applications ('Level 3' in Fig. 1) but these are not directly required in current monitoring for OSPAR or MSFD and thus not specified in this protocol. For level 3 dissection details see Van Franeker (2004) and for stomach content analysis Van Franeker et al. 2011. Ideally, level 3 should also include assessments of polymer types and chemical properties of plastic and other debris, relevant for the impacts on organisms and ecosystems. Level 3 studies have usually been out of the scope of funds for EcoQO monitoring, and are conducted out of scientific interest.

2.4 Sampling Strategy - Field sampling and monitoring Equipment

Details provided here are restricted to monitoring implementation at level 2 of Fig.1. For details of additional level 3 assessments see Van Franeker (2004) and Van Franeker et al. (2011).

Fulmars used in long-term studies within the North Sea are birds found dead on beaches. The pilot study by Van Franeker & Meijboom (2002) showed that no statistically valid differences could be identified between stomach contents of birds that had slowly starved and died (most beach victims) and 'healthy' birds that had died instantly, e.g. by drowning in nets or collisions with ship structures, light-houses etc. So, results from the sample of birds collected from beaches can be considered representative for all fulmars in the area.

A range of organisations and volunteers is involved in collecting corpses from beaches. This may vary from volunteers of local bird clubs, bird rehabilitation centres, formal Beached Bird Surveys by bird societies or semi-governmental organisations; municipal beach cleaning groups and others. Payments for beach surveys and fulmar collections are out of range for almost any monitoring program. Therefore, to maintain cooperation of all involved, coordinators of the program must dedicate substantial time for contacts with field workers, to stimulate them and provide feedback. This for example involves writing of local project newsletters (see e.g. http://www.nhsn.ncl.ac.uk/news/cms/beached-bird-surveys , blogs e.g. https://plastictides.wordpress.com , facebook pages https://www.facebook.com/southwestfulmars and the maintenance of the dedicated IMARES project site www.wageningenur.nl/plastics-fulmars, frequent personal contacts, media contacts and presentations. In the Netherlands, fulmars have been collected from 1979 onwards; other North Sea countries started to participate since 2002 with initial support from EU Interreg funds. From elsewhere, fulmars accidentally killed in long-line fisheries and stomachs of birds hunted for human consumption have been used. Birds are kept in local freezers provided by the project, and transported to coordinators at an opportunity basis.

2.4.1 Collecting and handling of dead fulmars

2.4.1.1 Frequency of searches for fulmars

Searches for beached fulmars can be conducted as a part of regular Beached Bird Survey (BBS) programmes, or as a part of more local beach inspections for different reasons including clean-up activities by municipal or other organisations. In either system, it may be important to rely not only on a standard schedule of full surveys (e.g. monthly), but to attempt to have a less formal but more frequent partial survey that would detect increased numbers of corpses. Fulmars often wash ashore in irregular pulses or wrecks related to conditions of weather, food, disease or pollution incidents. Bird corpses that are left in the tideline for prolonged periods of time, suffer decay (but see notes on sample quality), and may be scavenged by other birds or mammals. Coordinators may ask their contacts to keep an eye open all the time, and to be informed on any apparent increase in beached birds. When such happens, temporarily increased search effort in surrounding areas can assist in obtaining adequate sample sizes of beached fulmars.

2.4.1.2 Sample size

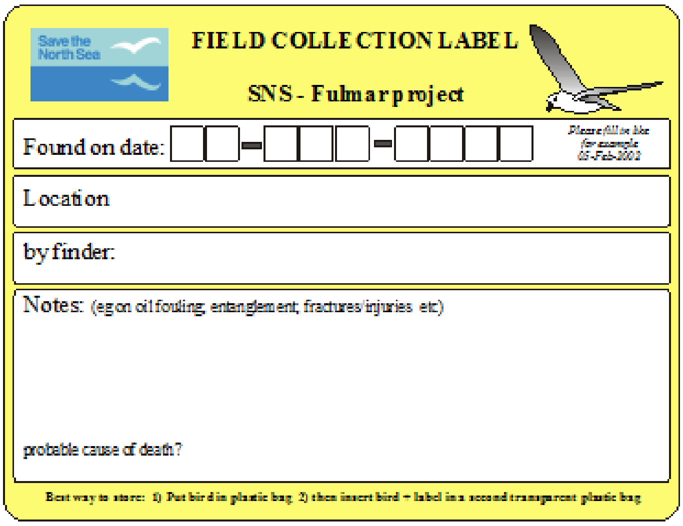
Results from the Dutch pilot study (Van Franeker & Meijboom 2002) indicated that about 40 fulmar stomachs are an adequate sample size to provide a reliable figure for the litter situation at a particular location and point in time. Ideally, the different areas or countries would thus aim to collect 40 or more beached or other dead fulmars per year. For some areas this will definitely be a difficult task due to the length or type of coastline, prevailing winds, removal of corpses by scavenging mammals, or scarcity of fulmars offshore. In the SNS study however, we can deal with suboptimal local sample sizes by combining locations into areas and by evaluating pooled data using multiple years (5-year averages used in OSPAR and MSFD analyses).

2.4.1.3 Sample quality

With regard to adequate sample sizes it is important to note that there is no need to restrict collection to ‘fresh’ specimens. Even fairly decayed or partly scavenged corpses can be used, as long as the stomach is intact. The stomach wall is much more resistant to decay than most other internal organs. Knowledge on sex and age is important background knowledge, but for analyses of data it is not necessary that ***all*** variables of e.g. age are known for ***all*** samples.

2.4.1.4 Labelling, packaging and storage of corpses

Already at the beach, especially if birds are fouled by oil or other contaminants, corpses should be individually packed to avoid transfer of fouling from one bird to the other. It is important that collected corpses are immediately individually labelled with information on location, date, finder and any possible relevant information (for example if the bird was entangled in a net or other indicators for cause of death). Pencil should be used, and not ink or texter. Preferably a lay-out as in the standard SNS collection label is used. Corpses should be stored deep-frozen (-16°C or below) in a properly sealed plastic bag, and then with the label in a second plastic transparent bag, again well sealed. The 'double bag' procedure prevents that the label becomes unreadable due to fouling or wetting of the label and at the same time prevents the corpse from drying out in the freezer.



Please note that on all labels and forms we strongly recommend to use date notation as for example 11-FEB-2015 (so: Day 2 digits - month 3 letters - year 4 digits'. Use lettering for month as Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov. Other types of date notations such as 11-2-2015 or 11/2/15 have led to many errors in data systems, because day and month and year positions are swapped in different national notations and computer software packages.

Figure 2 **Example of collection label**

2.4.1.5 Caution

Most beach surveyors will be aware of risks of searching beaches and picking up birds. Toxic substances may wash ashore and may have fouled birds. Also, birds may carry diseases (psittacosis/ornithosis; avian tuberculosis and; flu, histoplasmosis; cryptococcus; puffinosis). Transmission of bird-diseases to humans is rare, and is usually limited to people with already lowered immunity and to situations where large concentrations of live animals are kept in confined spaces (rehabilitation centres, aviaries, pigeon sheds etc). Disease may be transmitted in particular by aerial particles and by dry faeces. In 130 fulmars beached around the North Sea in period 2004-2009, no avian flu has been detected (Info V. Munster, Erasmus University). Specific information on risks from picking up or handling dead birds from beaches is not available. However, the potential contact with toxic chemicals and diseases urges a number of common sense procedures during beach surveys and laboratory investigations. Unnecessary contact may be avoided by packing birds in proper plastic bags and by wearing surgical gloves. Do not eat or smoke or wipe eyes or nose with unwashed dirty hands. In the lab one may wear a dust-mask and ensure proper air-removal and cleaning procedures. Although the effect of deep-freezing on the infection risk from various diseases seems unknown, it may be recommended to deep-freeze samples prior to the laboratory work. Risks from handling birds can never be totally excluded and it remains a personal decision whether or not to participate in BBSs' and to pick up or handle dead seabirds. Much information for an independent decision is available through the internet (search eg for bird disease, or ornithosis).

2.4.2 In the laboratory:

Of course any participant in this monitoring is free to record all sorts of data concerning finding details, dissections and stomach analysis. Here only the parameters required for standardized data submission to OSPAR are specified. A shortlist and details are provided in these guidelines, and they are summarized in a separate one page Annex 1 (revised from OSPAR 2015: EIHA15-5-E) ; Annex 2 example data sheet and Annex 3 (example AreaCode system)

1. SampleCode (Unique Sample Identifier, e.g. NET-2012-001)
2. SpeciesName (scientific name: *Fulmarus glacialis*)
3. SampleDate (in specified numerical format (YYYYMMDD; NB: no hyphens!)
4. Country (English name ISO, details below)
5. LocationDescription (description of location where found; max 75 characters)
6. AreaCode (in agreed format of 3 Letters plus 4 Digits, e.g. NLD4040; details below)
7. Latitude (in decimal degrees using WGS84)
8. Longitude (in decimal degrees using WGS84)

9. SEX (M=male, F=female, UNK=unknown)
10. AGEGR (Agegroup as ADULT, NONAD, NOAGE)
11. NIND: number of industrial pellets
12. GIND: mass of industrial plastic (in grams to 4th decimal)
13. NUSE: number of user plastic particles
14. GUSE: mass of user plastic (in grams to 4th decimal)
15. NPLA: total number of plastic particles
16. GPLA: total mass of plastic (in gram to 4th decimal) of plastic

These data fields provide all information that is needed to prepare assessments as specified below or in future other geographical units.

2.4.2.1 Sample code

Before dissection, bird corpses should be given a clear and unique collection number to identify all further steps in the research. Such collection numbers are best issued by the person responsible for dissections in a particular region or country at the moment of dissection. Within the SNS fulmar project, the following preferential approach for numbering has been adopted:

- prefix — 3 CAPITAL LETTERS
- year of finding — 4 digits (e.g. 2004)
- sequence number per year — 3 digits (e.g. 001)

These components are separated by hyphens, e.g. NET-2004-098. The prefix lettercode is usually indicative for a local group or geographical range, but not fixed: please coordinate letter-codes with lead to ensure unique sample codes. In the sequential number, please ensure to include leading zeros to avoid mistakes and sorting problems.

Prefixes so far used in the collection number system of the SNS fulmar study group :

BEL-	=	Belgium
ESC-	=	East Scotland
FAE-	=	Faroe Islands
FRA-	=	northern France (Pas de Calais)
GER-	=	Germany North Sea coast
ICE-	=	Iceland
IRL-	=	Ireland
LIS-	=	Norway Lista area
NEE-	=	Northeast England
NET-	=	Netherlands
NMD-	=	Normandy France
NNO	=	Northern Norway
ORK-	=	Orkney Islands
SEE-	=	Southeast England
SHE-	=	Shetland Islands
SKA-	=	Denmark Skagen area
SKI-	=	St. Kilda
SOE-	=	South England
SVA	=	Svalbard
SWE-	=	Sweden (Sotenas area)

2.4.2.2 SpeciesName

At this stage, only the Northern Fulmar is used in this monitoring format, but other species might be included in future. The species name to be specified is the scientific name according to http://www.marinespecies.org . The scientific name for Northern Fulmar is *Fulmarus glacialis*

2.4.2.3 SampleDate

Please give as YYYYMMDD, in a numerical format, without hypens. For example 20121225 for the 25th of December 2012. Do NOT use spreadsheet date formats with hyphens or back-slashes because these differ internationally and will lead to errors in a shared database.

2.4.2.4 Country

Please provide the country name in full in English following the listing in http://unstats.un.org/unsd/methods/m49/m49alpha.htm , only slightly adapted to reduce length and replace spaces by underscores (e.g. 'United Kingdom of Great Britain and Northern Ireland' is replaced by United_Kingdom). The list below gives slightly adapted **English country names** plus the **ISO ALPHA-3 CODE** for the country from above mentioned weblink:

Belgium	BEL
Denmark	DNK
Faroe_Islands	FRO
France	FRA
Germany	DEU
Iceland	ISL
Ireland	IRL
Netherlands	NLD
Norway	NOR
Portugal	PRT
Spain	ESP
Svalbard_JanMayen	SJM
Greenland	GRL
Sweden	SWE
United_Kingdom	GBR
Guernsey	GGY
Jersey	JEY
Isle_of_Man	IMN

2.4.2.5 LocationDescription

Details of place where the bird was found, e.g. "Texel paal 12 Hoornderslag-Westerslag" with a free text maximum of 75 characters.

2.4.2.6 AreaCode, Latitude and Longitude

Please provide an AreaCode for the location description above, in the format agreed between the North Sea groups: that is as a 3 CAPITAL LETTER country code plus a 4 DIGIT NUMBER .

The 3 letter Country Code follows ISO 3166: as listed in in section 2.4.2.4 and following the standards in http://unstats.un.org/unsd/methods/m49/m49alpha.htm

The 4 digits represent a hierarchical sequence of smaller geographical units. e.g. a Dutch example: in NLD404, NLD stands for the Netherlands and 4040 follows the number codes used by the Netherlands Beached Bird Survey (NZG-NSO): 4040 is the code for main area 4 (Western Wadden Sea Islands) and 040 is the NSO traject-number for the North Sea beach on the Island of Texel, between km marks 10 and 15. The exact hierarchical structure of numerical codes differs per country, and e.g. in United Kingdom will be largely county based.

Each AreaCode has (will be given) a fixed 'general' combination of Latitude and Longitude. These are given as decimal degrees using WGS84 CRS. In this system Western longitudes have negative sign, eastern ones positive. For example, **Fair Isle** is part of the Shetland Islands, and would have

AreaCode GBR1011, Latitude 59.5325 and Longitude -1.6328 (in traditional degrees and minutes: 59°31.95 North and 1°37.97' West). Where more detailed coordinates for the bird are available and/or desirable, a more specific latitude and longitude as measured by GPS in the field or derived from a detailed LocationDescription can overrule the general combination.

This method of AreaCodes, with added latitude and longitude allows functional use in any sort of aggregation in geographical reporting units including the ones considered in the OSPAR system of nested units (OSPAR-ICG-MAQ 2015)

2.4.2.7 Sex, age group and stomach content data

Details for the assessment of sex (M=male, F=female or UNK=not known), and age (AgeGroup as ADULT, NONAD or NOAGE) are given in section 2.4.3. The assessment of number of particles (integer) and their mass (gram accurate to 4th decimal) and typing as industrial or user plastics is detailed in section 2.4.4.

Figure 3 **Save the North Sea 2002-2004 fulmar study locations and aggregation** Fulmar-Litter study sites in the Save the North Sea Project (SNS) 2002-2004. Colour of symbols indicates geographical grouping used in earlier analyses, using 5 a split into 5 areas of: 1) Scottish Islands (red), 2) East England (blue), 3) Channel area (white), 4) Southeastern North Sea (yellow), and 5) Skagerrak area (white). Not all locations are equally active. The Faroe Islands are considered as an external reference monitoring site for the North Sea.

2.4.3 Dissection methods and anatomical records

2.4.3.1 Start of dissection

The dissection of the bird may start by making a long lengthwise ventral section just through the skin over the breastbone and belly to near the cloaca

At this stage, one should attempt to **keep the tissue-lining around the intestinal cavity intact**. The thin-walled and large glandular stomach (proventriculus) lies immediately below and can be easily damaged if you cut too deep. Things may not only get messy, but part of stomach contents may get lost, and we want to inspect 'complete stomach contents'.

Open the bird by 'peeling off' the skin to both sides. Keep the fat layer attached to the skin. You can now optionally (level 3) check breast-muscle condition, subcutaneous fat, and internal signs of moult of the coverts on the breast.

Carefully cut the lining around stomach/intestines to start inspecting sex and age characters from internal organs. **Do NOT remove the stomach until you have assessed sex and age characters.** Earlier removal of the stomach will certainly reduce the potential for sexing the bird correctly. The soft tiny organs in juvenile birds are easily damaged, especially so in more decayed specimens. Just move intestines gently to one side (usually the right side of the bird) while searching for the left-side sexual organs, which are positioned 'deep down' in close association with the kidneys, which are more or less attached to the back-bone.

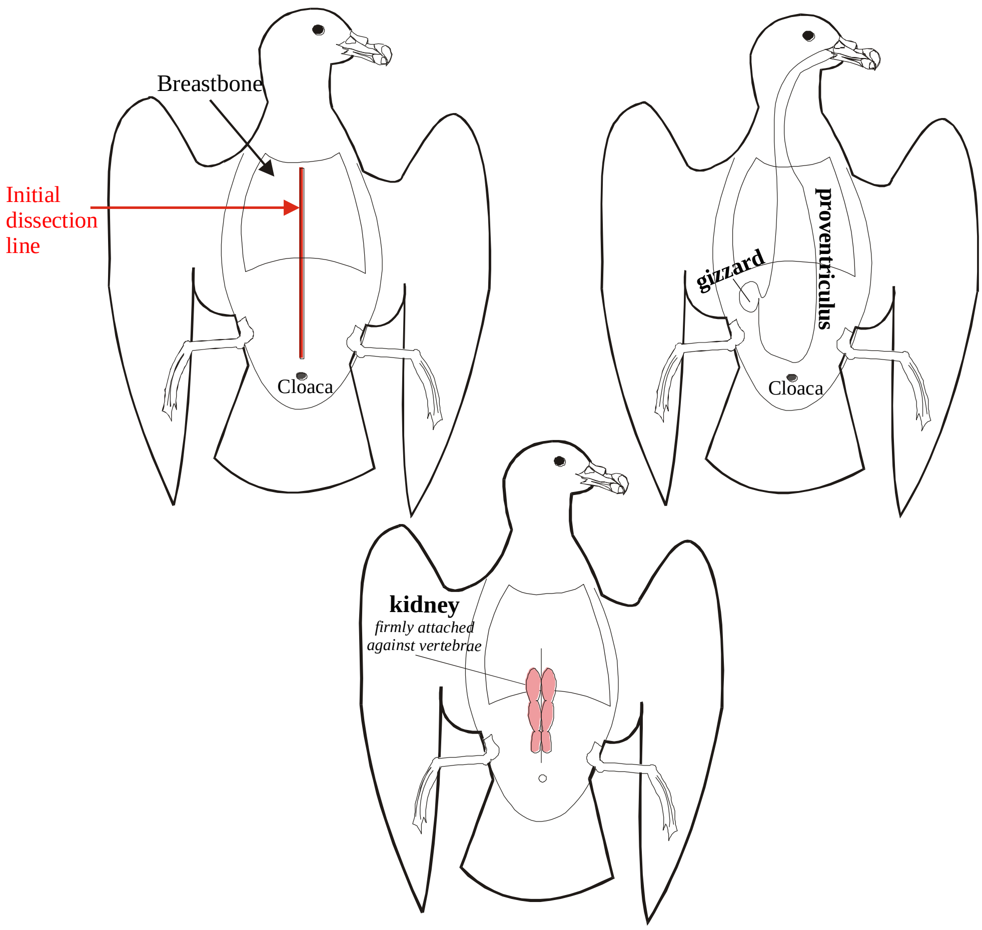
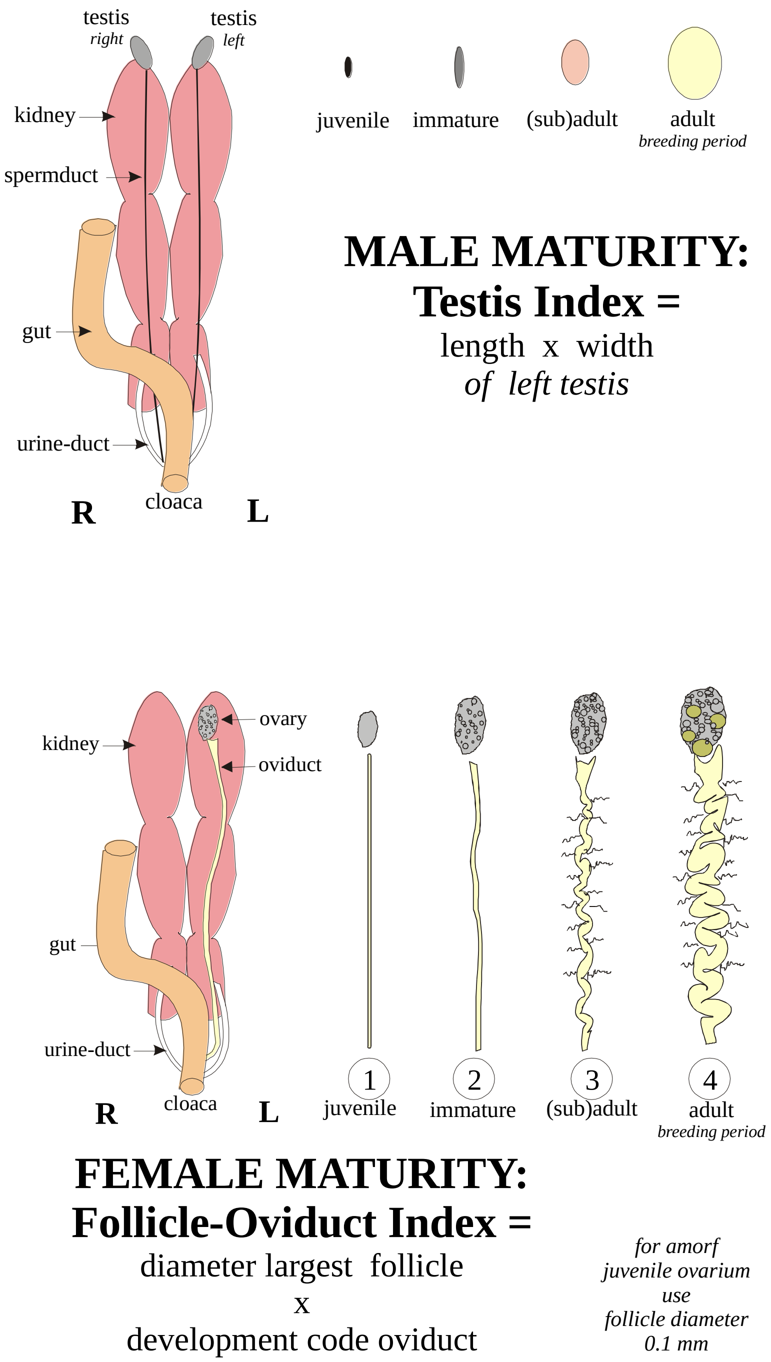


Figure 4 **Dissection: first skin-incision, position of stomach, and position of kidneys**

2.4.3.2 *Sex and Bursa Fabricius (sexual maturity & age)*

At level 2 monitoring, age groups distinguished are coded “ADULT” versus “NONAD” (non-adults) with NOAGE being the notation for birds of which age is not known. Sexes are labelled as M for male, F for female and XX for sex not known.

The NONAD category comprises juveniles, 2[nd] year birds, and immatures. The ADULT category concerns birds that have likely bred or have been hormonally very close to breeding and are likely to occupy their own sites in colonies. Such birds are almost certainly older than 5 years, and probably mostly older than 10 year. The distinction is made because non-adult birds have on average higher loads of plastics in their stomachs. Data records should allow checks for relative constant proportions of age groups in samples. If age composition of samples would show consistent change over time to a particular age group, time trends would become biased. So far, age groups have been combined in presentations of EcoQO performance.



The age group of a bird is assessed on the basis of sexual organs and presence of Bursa of Fabricius. The sexual organs are situated close to the kidneys and can thus only be found by pushing the overlying organs (mainly stomach and intestines) gently to the side. Initially look for the sexual organs at the LEFT side, because female birds develop sexual organs (ovarium and oviduct) only at the left side of their body. Males have testes on both sides. Especially juvenile birds may pose problems for less experienced observers.

Figure 5

Sex and sexual maturity assessment

In ***juvenile females*** the ovary has not yet developed follicles. The organ is not much more than a light brownish, sometimes almost transparent flat organ pressed against the upper kidney. The oviduct in such birds is still very thin and straight, embedded in the transparent thin tissue-layers that separate sub-compartments in the intestinal cavity (so the oviduct is not 'attached' to the kidney, as might be the suggestion from drawings but 'hangs' from the back). In **older 'mature' females** periodic development oviduct-tissue during the breeding season and egg formation/passage have created a wider and curved oviduct with evident 'stretch-markings' in the surrounding tissue. *(Female sexual maturity index, used in more detailed studies, is based on the developmental stage of the oviduct and the diameter of the largest follicle in the ovary in mm. For juvenile females with undeveloped ovary, use follicle-size 0.1 mm. Oviduct code 4 is restricted to adult breeding females, when the oviduct strongly enlarges and the tissue becomes fleshy).*

In ***juvenile males*** the testes are very small blackish and elongated (looking like a small 'mouse-dropping'). They are sometimes hard to find, situated in tissue-strings going from the upper side of the kidney into the linings that separate the intestinal and breast-cavity (lung/heart). In difficult birds, definitely check also the right side of the body (males having testes on both sides) to see if you find a similar structure. In **older males** the testes gradually become larger and are more 'bean'shaped and sized, usually with a variable fleshy or creamy colour. Only during the mating season do they swell up to a really large size with a creamy colour. In that condition, also the otherwise inconspicuous sperm ducts are easily seen because they are filled with whitish sperm. *(Male maturity index, used in more detailed studies, is calculated as length x width of the left testis (mm)).*

A useful additional age-character is the **Bursa of Fabricius**, a gland-like organ involved in development of 'immunities'. This bursa is large in fulmar chicks, disappears mostly within the first year but persists into the second year of life in some individuals.
To find the bursa, the intestines have to be pulled backwards. Since this destroys the various tissue layers in which oviducts and sperm-ducts are situated, only do this after you have completed the 'sex-section'. Search for the bursa on the dorsal side of the gut close to the cloaca. It is situated in the area where also the urine-ducts and oviduct or sperm ducts enter the cloacal area. Especially in fat birds or decaying specimens, the bursa may not be easy to find. It may be not much more that a rather flat organ pressed against the gut. Use tweezers to 'loosen' it along the edges to confirm it is indeed a gland-like organ that you are looking at (sometimes, the cloacal area may be visible as somewhat transparent circular area in the wall of the gut, which can be confusing).

The AGEGROUP for females is thus relatively simple to assess, that is ADULT when oviduct condition is stage 3 (winter) or 4 (early summer breeding), and NONAD for all females with less developed oviducts. In males the difference is not always that clear: presence of bursa, and small, dark (blackish, dark grey) testes indicate NONAD agegroup, flesh coloured or swollen creamy coloured testes indicate ADULT agegroup. Testis size is not decisive as this changes considerably between early summer breeding and the remainder of the year.

When age details are not known, the agegroup is listed as 'NOAGE'

MALE & FEMALE AGE-INDICATOR

BURSA FABRICIUS

The Bursa Fabricius may be found on the dorsal side of the gut, near the cloaca, where also urine-ducts and sperm-ducts or oviduct open into the cloacal area. The bursa is large in chicks but gradually disappears during juvenile/young life-stages and is lacking in subadults and adults

BURSA - INDEX

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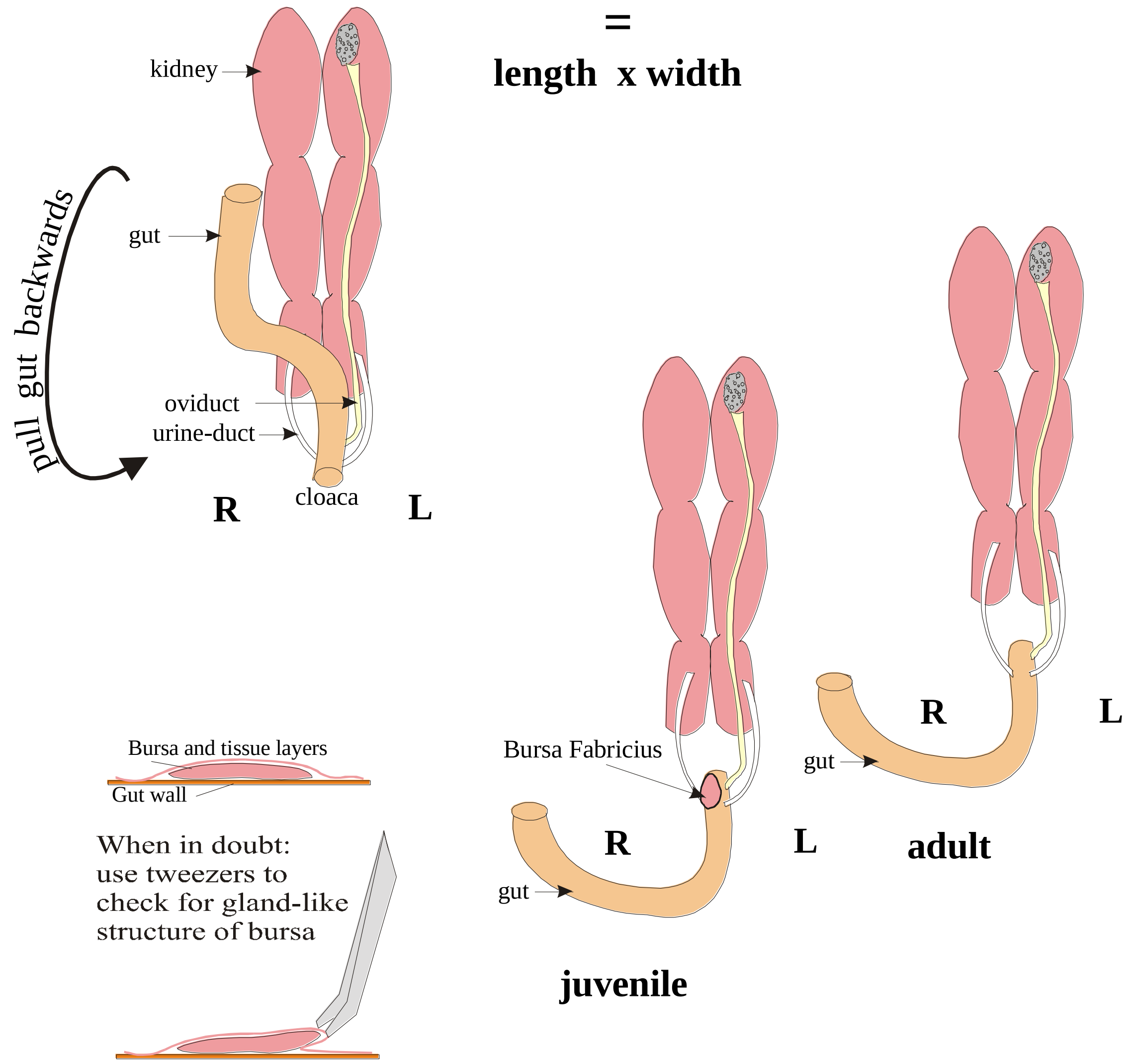


Figure 6 **Assessment of presence of Bursa Fabricius**

2.4.4 Stomach procedure

After dissection, depending on work-schedules, stomachs of birds can be refrozen for storage before being opened for analysis of the contents. Stomachs of fulmars have two 'units': ingested food is initially is stored and starts to be digested in a large glandular stomach (the proventriculus) after which it passes into a small muscular stomach (the gizzard) where harder prey remains can be processed through mechanical grinding. In early phases of the project, data for the two individual stomachs were recorded separately, but for the purpose of reduction in monitoring costs, the contents of proventriculus and gizzard are now usually combined.

Stomach contents are carefully rinsed in a sieve with a 1 mm mesh and then transferred to a petri dish for sorting under a binocular microscope. The 1 mm mesh is used because smaller meshes become clogged with mucus from the stomach wall and with food-remains. Analyses using smaller meshes were found to be extremely time consuming and particles smaller than 1 mm seemed rare in the stomachs, and when present contribute little to plastic mass.

If oil or chemical types of pollutants are present, in level 3 studies these may be sub-sampled and weighed before rinsing the remainder of stomach content. If sticky substances hamper further processing of the litter objects, hot water and detergents are used to rinse the material clean as needed for further sorting and counting under a binocular microscope. However, if plastic particles are intended to be subject of further chemical analysis, they should only be rinsed softly with cold water, and then stored in freezer in pre-washed glass jars or aluminium foil.

2.4.4.1 Categorization of debris in stomach contents

The following categorization is used for plastics with acronyms between parentheses. These types of plastics can be identified visually directly or aided by binocular microscope. Analysts need to have a proper level of knowledge of food remains in seabird stomachs to avoid confusion between plastics and different types of natural materials (such as eye lenses, squid-beaks, fish bones otoliths, stones etc.). In level 2 studies only the two major categories of plastics are quantified. For further subcategories and other types of debris and food remains in stomachs see e.g. Van Franeker et al. 2011.

PLASTICS (PLA)

Industrial plastic pellets (IND). These are small, often cylindrical-shaped granules of ± 4 mm diameter, but also oval, disk-like and rectangular shapes occur. Various names are used, such as pellets, beads or granules. They can be considered as “raw” plastic or a half-product in the form of which plastics are usually first produced (mostly from mineral oil). The raw industrial plastics are then usually transported to manufacturers that melt the granules and mix them with a variety of additives (fillers, stabilizers, colorants, anti-oxidants, softeners, biocides, etc.) that depend on the user product to be made. For the time being, included in data output for this category are a relatively small number of very small, usually transparent spherical granules also considered to be a raw industrial product.

User plastics (USE) (all non-industrial remains of plastic objects), thus including sheets, threadlike materials, foamed synthetics, hard fragments from larger objects, and any other type of user plastics including e.g. cigarette filters, pieces of balloon rubber, elastics, etc..

For each of these two main categories, for each bird individually, record is made of

- The number of particles (N=count of number of items in each (sub)category)
- mass (W=weight in grams) using Sartorius electronic weighing scale after at least a two day period of air drying at laboratory temperatures. This is done separately for the subcategories. Weights are recorded in grams accurate to the 4th decimal (= tenth of milligram).

Acronyms used for categories as above, may be extended to describe datasets. Logarithmic transformed data are initiated by 'ln' (natural logarithm); mass data are characterized by capital G (gram) and numerical data by N (number). For example lnGIND refers to the dataset of ln-transformed data for the mass of industrial plastics in the stomachs; acronym NUSE refers to a dataset based on the number of items of user plastics. Total Plastics (PLA) is simply calculated as the sum of numbers or mass of INDustrial plastics plus USErs plastics.

2.5 Quality assurance/ Quality Control

Methods for the OSPAR Fulmar-EcoQO approach have been developed under guidance of working groups of ICES and OSPAR. Methods and results have been published in peer-reviewed scientific literature (e.g. Van Franeker et al. 2011; Van Franeker & Law 2015). Participating research organisations will have their own Quality Control Systems. When collating data from different national sources the OSPAR secretariat will run final quality controls.

2.6 Data reporting, handling and management

The data set from the fulmar monitoring is managed by the OSPAR Secretariat and should be submitted by Contracting Parties on an annual basis. The reporting format, as outlined in Annex 1, has been agreed by OSPAR (Agreement 2015-09), including the area codes outlined in Annex 2. The dataset will be made available through the OSPAR Data and Information System (www.ospar.org), including inspire compliant metadata. As the data has been collected for scientific purposes there will be a delay of 3 years before the data is made available to the public to allow for the publication of peer reviewed research.

3 Assessment

3.1 Data acquisition

On the basis of the raw data tables, these data can be presented in different assessment formats:

Incidence The simplest form of data presentation is by presence or absence. Incidence (Frequency of occurrence) gives the percentage of investigated stomachs that contained the category of debris discussed. The quantity of debris in a stomach is irrelevant in this respect.

Arithmetic Average Data for numbers or mass are frequently shown as averages with standard errors (se) calculated for a specific type of debris by location and specified time period. Averages are calculated over all available stomachs in a sample, so including those that contained no plastic (‘population averages’). Especially when sample sizes are smaller, arithmetic averages may be influenced by short term or local variations or extreme outliers. An option then is to pool data over a larger area or longer time period. An additional alternative to reduce the influence of outliers is by logarithmic transformation of data.

Geometric Mean Sample sizes may not be large enough to average out the impact of occasional extreme outliers. Therefore, data are sometimes additionally presented as geometric means, calculated from logarithmic data values. Logarithmic transformation reduces the role of the higher values, but as a consequence the geometric mean is usually considerably lower than the arithmetic average for the same data. In mass data for plastics in the fulmar stomachs, geometric means are only about one third to half of the arithmetic averages. Geometric means thus do not properly reflect absolute values, but are useful for comparative purposes between smaller sample sizes, for example when looking at annual data rather than at 5-year-periods. Logarithmic transformation cannot deal with the value zero, and thus the common approach chosen is to add a small value (1 in numerical data and 0.001g in mass data) to all data points, and then subtracting this again when the mean of log values is back-calculated to a normal value (the geometric mean). However, this implies that geometric means are less reliable with an increasing number of zero values in a dataset. The natural logarithm (ln) is used to compute geometric means.

EcoQO performance is the main assessment figure derived from the raw data. OSPAR (2010b) words its Ecological Quality Objective (EcoQO) for levels of litter (plastic) in stomachs of fulmars (the ‘Fulmar-Litter-EcoQO’) as: *“There should be less than 10% of northern fulmars (Fulmarus glacialis) having more than 0.1 gram plastic particles in the stomach in samples of 50 to 100 beach-washed fulmars from each of 4 to 5 different areas of the North Sea over a period of at least 5 years”.* Thus, the information requested for OSPAR and the EcoQO focuses on the category of ‘total plastic’ and pooled data for 5-year periods over larger areas, and a simple decision rule for each stomach if the plastics in it weigh more than 0.1 gram or less, including zero. EcoQO compliance or performance is thus defined as the percentage of birds in a sample that has 0.1 g or more plastic mass in the stomach. The OSPAR target is to reduce that percentage to under 10%. The EcoQO format is a highly simplified form of data-presentation but through that simplicity escapes the problems faced by more sophisticated procedures that try to deal with excessive outliers or a large proportion of zero values in a data set. In the background however, details of subcategories of plastic continue to play an important role for correct interpretation of the EcoQO metric.

Data pooling 5 year periods. To avoid erratic information on the level of ingested plastics from short term variations, data are frequently pooled into 5-year periods. Such pooled data for 5-year periods are not derived from the annual averages, but are calculated from all individual birds over the full 5-year period. For data presentation, the **Current Situation** of plastic ingestion is defined as the figures for incidence and number or mass abundance or EcoQO performance for the most recent 5-year period, not the figures for the recent single year. Time related changes are illustrated in graphs by running 5-year averages, each time shifting one year and thus overlapping for four years. These graphs have no statistical meaning.

Spatial data pooling. For pooling study locations in the North Sea, the OSPAR EcoQO target definition has triggered a grouping into five areas: the Scottish Islands (Shetland and Orkney), East England (northeast and southeast England), the Channel (Normandy and Pas de Calais), South-Eastern North Sea (Belgium, Netherlands and Germany), and the Skagerrak (Skagen, Denmark, Lista, Norway and Swedish west coast). As mentioned above, a structured system of different levels of geographical reporting units for future assessments is in development (OSPAR-ICG-MAQ 2015a and b) The number of monitored units in the Greater North Sea and Celtic Sea and Arctic will hopefully increase in future. The raw data format allows later reorganisation of spatial pooling of data.

3.2 Preparation of data

Data acquisition has been fully standardized according to methods specified in above chapter 2.4 and thus need no normalisation to adapt to different monitoring methods. Temporal (5-year periods) and spatial aggregation of data has been discussed in above chapter 3.1. These are the aggregation levels for current assessments, but are flexible for future changes because of raw data availability.

3.3 Assessment criteria

As discussed above, the current spatial scale compares 5 areas and temporal scale the recent 5 year period. These are linked to the target level as defined by OSPAR (*"There should be less than 10% of northern fulmars (Fulmarus glacialis) having more than 0.1 gram plastic particles in the stomach in samples of 50 to 100 beach-washed fulmars from each of 4 to 5 different areas of the North Sea over a period of at least 5 years").* Baseline and reference levels have been discussed in Chapter 2.2.

3.4 Spatial Analysis and / or trend analysis

Statistical tests

Data from dissections and stomach content analysis are recorded in Excel spreadsheets and next stored in Oracle relational database. GENSTAT 17 was used for statistical tests (http://www.vsni.co.uk/software/genstat/). As concluded in the pilot study (Van Franeker & Meijboom 2002) and later reports, statistical trend analyses for EcoQO purposes are conducted using mass data.

Tests for trends over time are based on linear regressions fitting ln-transformed plastic mass values for individual birds on the year of collection. Logarithmic transformation is needed because the original data are strongly skewed and need to be normalized for the statistical procedures. The natural logarithm (ln) is used. Tests for **'long term' trends** use the full data set; **'recent' trends** only use the past ten years of data. This 10-year period was derived from the pilot study (Van Franeker & Meijboom 2002), which found that in the Dutch situation a series of about eight years was needed to potentially detect significant change. To be on the safe side in our approach, this period was arbitrarily increased to a standard period of 10 years for tests of current time related trends. The test statistic is a t-score (t) defined by t = b1 / SE where b1 is the slope of the sample regression line, and SE is the standard error of the slope.

Statistical tests of geographical differences are conducted in GENSTAT 17th edition, using mass data from individual birds over the most recent 5-year period. Spatial differences in ingested plastic mass are evaluated by fitting a negative binominal generalized linear model with areaas a factor with a log ratio link function and estimated dispersion parameter. The test statistic is a t-score for residual variance for the geographical unit.

3.5 Presentation of assessment results

Results for long term monitoring in the Netherlands, and from 2002 to 2011 in the whole of the North Sea, have been presented in a series of reports and scientific publications. See references of Van Franeker et al. Data are presented in various ways derived from information described in chapters 3.1 to 3.4, and in summary refer to pooled 5 –year data in graphs and tables for:

- **Incidence** = the frequency of occurrence of plastics in stomachs
- **Average ± se** = arithmetic population average, usually given with standard errors
- **Geometric mean** =mean based on log transformed data reducing influence of outliers
- **EcoQO performance** = the % of birds having more than 0.1 gram of plastic in the stomach

Graphs often use the pooled data for 5 years, but shifting one year by data point. Data points and connecting lines only intend to visually illustrate trends over time or geographic patterns and have no statistical relevance.

Statistics - Statistical analyses are solely based on the mass of plastic using ln-transformed data from individual birds. Tests for significance of trends over time are based on linear regressions of ln-transformed data against year of collection. The **long-term trend** is derived from the full dataset, the **Recent trend** from only the most recent 10 years of data and most relevant to current policy decisions. Area differences are evaluated in a negative binomial generalized linear model with area included as a factor and test statistic a t-score based on residual variance for the area (Genstat 17th Edition). In addition to research reports and scientific publications, a view of presentation of assessment results may be found in OSPAR 2014a.

EXAMPLES OF TABULAR AND GRAPHICAL DATA PRESENTATIONS

derived from Van Franeker et al. 2013, and Van Franeker et al. 2014 (IMARES Reports)

Table i ***Data summary for study years added to the existing monitoring series for the Netherlands*** *(the table presents year or period of sampling with sample size (n), and for each of main plastic categories and total plastic the incidence (%), the average number of particles (n) and the associated average mass per bird in gram (g). The final column gives EcoQO performance, that is the percentage of birds that exceeds 0.1 g of plastic mass in the stomach.*

		INDUSTRIAL PLASTICS			USER PLASTICS			ALL PLASTICS (ind+user)			
Year	*n*	%	n	g	%	n	g	%	n	g	EcoQO
2012	*80*	59%	1.8	**0.04**	89%	17.9	**0.255**	90%	19.6	**0.297**	49%
2013	*24*	63%	2.2	**0.04**	92%	24.6	**0.137**	92%	26.8	**0.176**	46%
period **2009-13**	*227*	**56%**	**3.6**	**0.08**	**93%**	**24.5**	**0.217**	**94%**	**28.1**	**0.297**	**52%**

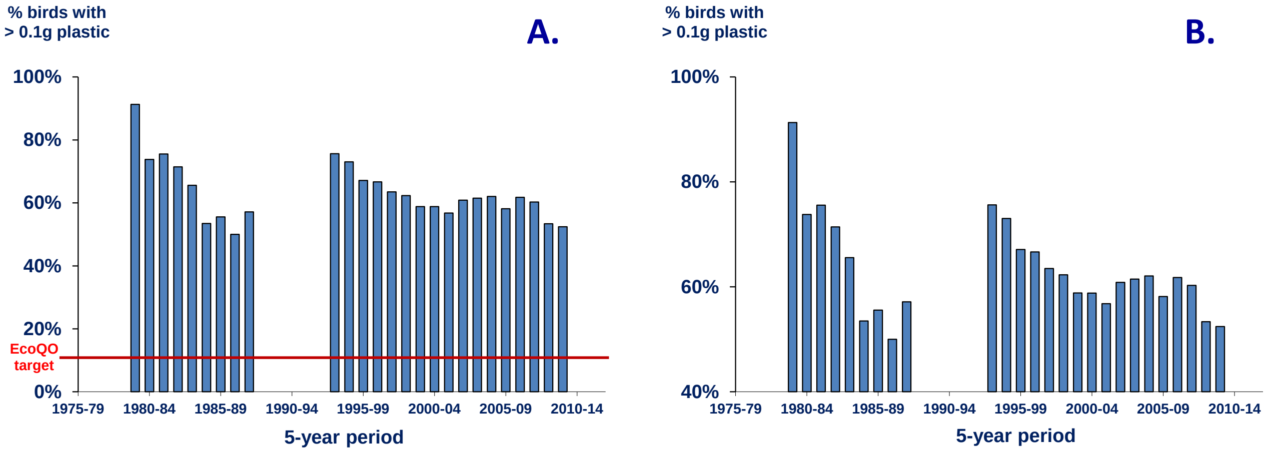


Figure 7 **EcoQO performance among fulmars from the Netherlands 1979-2013. A:** data for the proportion of birds having more than 0.1 gram of plastic on a full 100% scale, illustrating the distance to the 10% target as defined by OSPAR; **B:** same data but y-axis restricted to the observed range,. Data are shown by annually updated 5 year performances (i.e. data points shift one year ahead at a time). Data for early 1990s not shown because of small sample size (<=10)

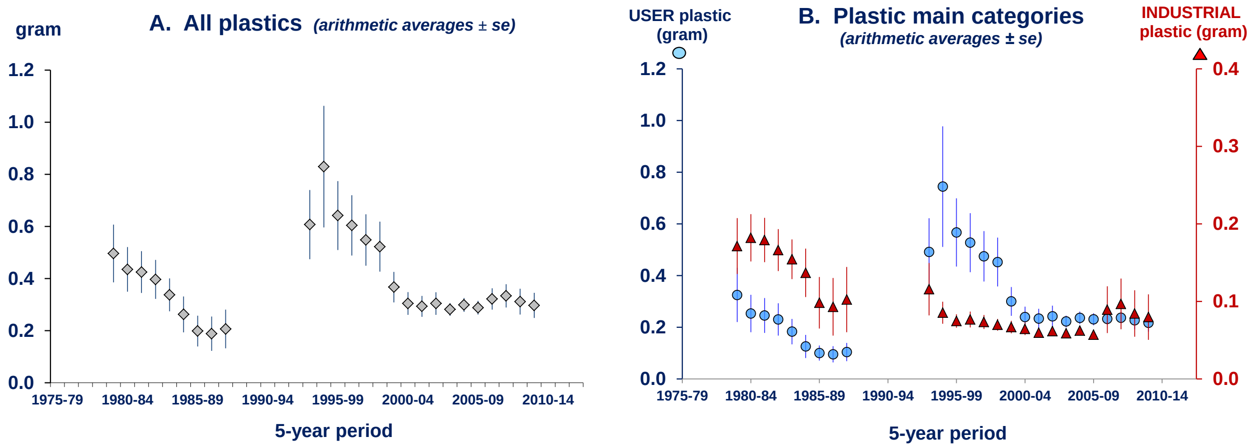


Figure 8 **Plastic mass in stomachs of fulmars from the Netherlands 1979-2013. A**: all plastics combined (grey diamonds) and **B:** user plastic (blue circles, left y-axis) and industrial plastic (red triangles, right y-axis). Data are shown by arithmetic average ± standard error for mass for running 5 year averages (i.e. data points shift one year ahead at a time) where sample size was over 10 birds.

Table ii ***Linear regression analysis of trends in plastic ingestion in Dutch fulmars for (A) long-term and (B) recent 10-year data series.*** *Trends in plastic mass evaluated by ln-transformed individual mass values against year. EcoQO performance by simple numerical score for above or below the critical 0.1 gram level (0 below; 1 above).*

A. **LONG TERM TRENDS 1979-2013**
for plastics in Fulmar stomachs, the Netherlands

	n	Constant	estimate	s.e.	t	p	
Industrial plastics (lnGIND)	*997*	89.5	-0.0469	0.0102	-4.60	<**0.001**	**- - -**
User plastics (lnGUSE)	*997*	-9.7	0.0035	0.0088	0.40	0.689	*n.s.*
All plastics combined (lnGPLA)	*997*	37.2	-0.0197	0.0085	-2.31	**0.021**	**-**
EcoQO performance (all ages)	*997*	13.4	-0.0064	0.0023	-2.82	**0.005**	**- -**

B. **RECENT 10-YEAR TRENDS 2004-2013**
for plastics in Fulmar stomachs, the Netherlands

	n	Constant	estimate	s.e.	t	p	
Industrial plastics (lnGIND)	*517*	5.3	-0.0049	0.0309	-0.16	0.875	*n.s.*
User plastics (lnGUSE)	*517*	2.1	-0.0024	0.0268	-0.09	0.929	*n.s.*
All plastics combined (lnGPLA)	*517*	10.2	-0.0063	0.0268	-0.23	0.815	*n.s.*
EcoQO performance (all ages)	*517*	22.7	-0.0110	0.0070	-1.57	0.118	*n.s.*

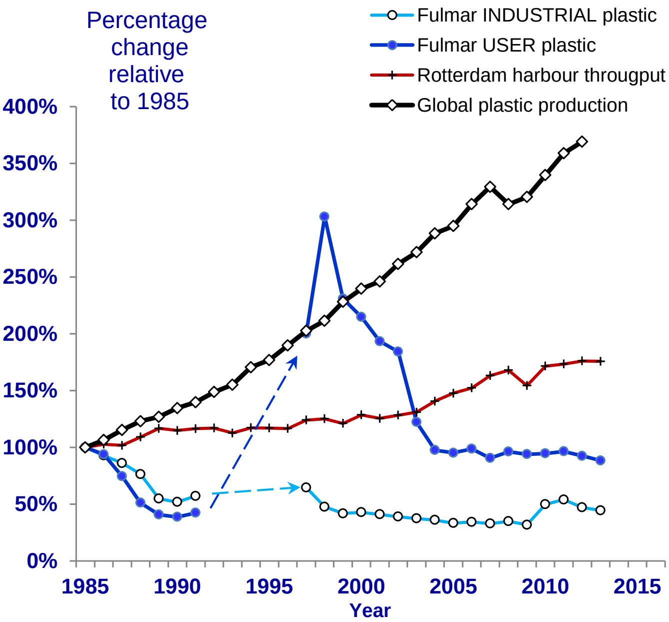
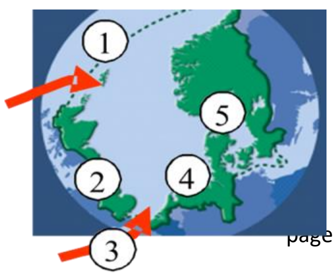


Figure 9 Comparative trends in global plastic production, freight quantities handled by Port of Rotterdam, and mass quantities of industrial and user plastics in stomachs of fulmars (5-year arithmetic averages). Shown are cumulative percentage changes from reference year 1985.



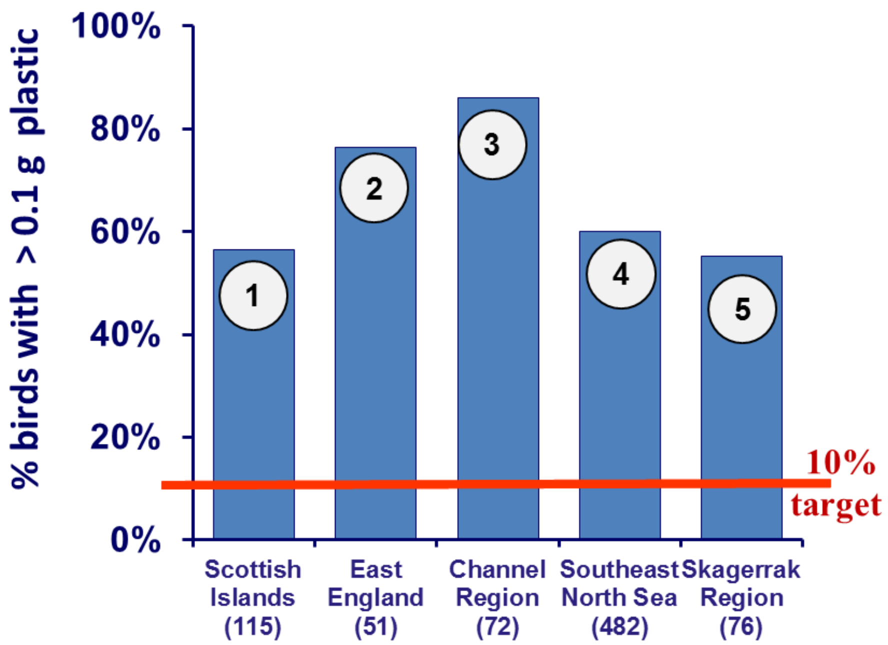


Figure 10 **EcoQO performance in North Sea areas 2007-2011**

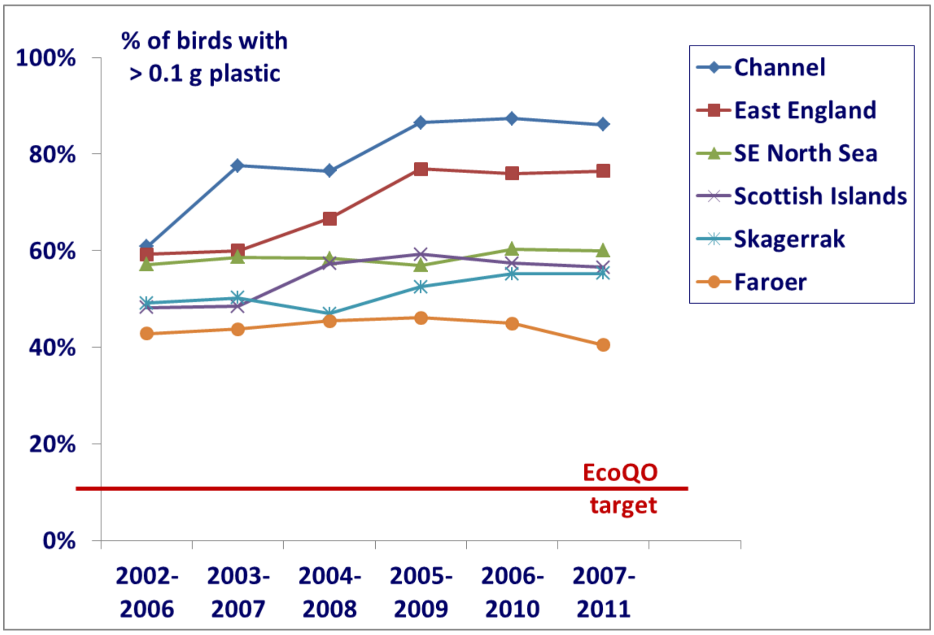


Figure 11 **Trends in EcoQO performance in different areas of the North Sea since 2002** (by running 5-year average data).

4 Change Management

The fulmar monitoring and assessment is well established and has a high level of maturity. However, request for changes of the Fulmar monitoring method still may arise from the TG ML, OSPAR ICGML or OSPAR EIHA. These requests will be discussed by the Netherlands with Jan Andries van Franeker, who coordinates the scientific part of the monitoring of this indicator. The results of this discussion will be reported back to the working group who posed the question.

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ANNEX I

(also provided as digital file FulmarGuidelines-annex1_20150820.docx)

OSPAR DATA FORMAT FOR THE FULMAR INDICATOR

Data format *(revised from EIHA15-5-E; details in JAMP-CEMP Guideline)*

Field	Example	Remarks
SampleCode	NET-2012-001	Unique number for sampled bird: formed of **three CAPITAL LETTERS**, hyphen, **YEAR**, hyphen, **sequential 3-DIGIT-NUMBER** within that year. *(Lettercode usually indicative for a local group or geographical range, but not fixed: please coordinate letter-codes with lead; in sequential number please ensure to include leading zeros).*
SpeciesName	Fulmarus glacialis	Scientific species name (following the World Register of Marine Species: http://www.marinespecies.org/)
SampleDate	20130918	**YYYYMMDD** (date numerically as yearmonthday Without hyphens e.g. 20130918 representing 18-Sep-2013)
Country	Netherlands	English Country Name following the listing in: http://unstats.un.org/unsd/methods/m49/m49alpha.htm (sometimes shortened; see list in JAMP Guideline)
LocationDescription	Texel paal 12 Hoornderslag-Westerslag	Description of sample location (text max 75 characters)
AreaCode	NLD4040	AreaCode as agreed between the North Sea groups: that is as a **3 CAPITAL LETTER** country code plus a **4 DIGIT NUMBER** *(The Country Code follows ISO 3166: as listed in http://unstats.un.org/unsd/methods/m49/m49alpha.htm. The 4 digits represent a hierarchical sequence of smaller geographical units. e.g. in NLD404, NLD stands for the Netherlands and 4040 represents the number coding used by the Netherlands Beached Bird Survey (NZG-NSO): 4040 is the code for main area 4 (Western Wadden Sea Islands) and 040 is the NSO traject-number for the North Sea beach on the Island of Texel, between km marks 12 and 15. The exact hierarchical structure of numerical codes differs per country.*
Latitude	53.0415	Latitude in decimal degrees using WGS84 CRS; latitudes listed can either be a general one linked to the AreaCode or a more specific for LocationDescription
Longitude	4.7136	Details as for Latitude; negative values for western longitudes; positive for eastern longitudes)
Sex	F	SEX of the bird: choose from list: ➢ M = Male ➢ F = Female ➢ UNK = Unknown
AgeGr	NONAD	AGEGROUP code choose from list: ➢ ADULT = Adult (breeding age) ➢ NONAD = Non Adult (juveniles + immatures) ➢ NOAGE = Not Aged
NIND	10	Count of the number of industrial plastic particles in the sample
GIND	0.1664	Mass of industrial plastic particles in grams, to 4 decimal places
NUSE	65	Count of the number of user plastic particles in the sample
GUSE	0.3938	Mass of user plastic particles in grams, to 4 decimal places
NPLA	75	Count of the total number of plastic particles in the sample
GPLA	0.5602	Total mass of all plastic particles in grams, to 4 decimal p

ANNEX 2 (Also provided as digital file FulmarGuidelines-annexes2and3_20150820.xlsx)

ANNEX 2

EXAMPLE OSPAR DATA submission format *(Netherlands 2013)*

SampleCode	SpeciesName	SampleDate	Country	LocationDescription	AreaCode	Latitude	Longitude	Sex	AgeGr	NIND	GIND	NUSE	GUSE	NPLA	GPLA
NET-2013-010	Fulmarus glacialis	20130211	Netherlands	Vlissingen strand NSO 1002	NLD1002	51.4571	3.5094	F	NONAD	2	0.0341	28	0.3486	**30**	**0.3827**
NET-2013-023	Fulmarus glacialis	20131210	Netherlands	Zeeland; Strand West Kapelle-Zoutelande NSO 1003	NLD1003	51.5067	3.4115	F	ADULT	6	0.1302	39	0.1953	**45**	**0.3255**
NET-2013-024	Fulmarus glacialis	20131212	Netherlands	Zeeland; West Kapelle Zeedijk NSO 1003	NLD1003	51.5067	3.4115	M	ADULT	1	0.0246	3	0.0435	**4**	**0.0681**
NET-2013-005	Fulmarus glacialis	20130918	Netherlands	Bloemendaal aan Zee paal 61 - NSO 2026	NLD2026	52.4221	4.5284	M	NONAD	0	0	5	0.037	**5**	**0.037**
NET-2013-012	Fulmarus glacialis	20130524	Netherlands	NHpl 22 Hondsbossche Zeewering NSO 3034	NLD3034	52.8094	4.6539	F	ADULT	3	0.0467	50	0.265	**53**	**0.3117**
NET-2013-019	Fulmarus glacialis	20131018	Netherlands	NHpl 23 Hondsbossche Zeewering NSO 3034	NLD3034	52.8094	4.6539	F	NONAD	1	0.0134	7	0.0421	**8**	**0.0555**
NET-2013-021	Fulmarus glacialis	20131215	Netherlands	Texel Paal 9 Mokbaai-HoornderslagHors NSO 4039	NLD4039	52.9867	4.6978	M	ADULT	0	0	2	0.098	**2**	**0.098**
NET-2013-001	Fulmarus glacialis	20130918	Netherlands	Texel paal 12 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	F	NONAD	10	0.1664	65	0.3938	**75**	**0.5602**
NET-2013-002	Fulmarus glacialis	20130918	Netherlands	Texel paal 12 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	M	NONAD	7	0.0165	178	0.4511	**185**	**0.4676**
NET-2013-003	Fulmarus glacialis	20130918	Netherlands	Texel paal 12 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	F	NONAD	3	0.0679	23	0.0994	**26**	**0.1673**
NET-2013-007	Fulmarus glacialis	20130918	Netherlands	Texel Paal 15 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	F	NONAD	2	0.0589	15	0.1557	**17**	**0.2146**
NET-2013-009	Fulmarus glacialis	20130201	Netherlands	Texel Paal 15 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	F	ADULT	0	0	1	0.0001	**1**	**0.0001**
NET-2013-015	Fulmarus glacialis	20130915	Netherlands	Texel Paal 11 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	M	NONAD	0	0	6	0.038	**6**	**0.038**
NET-2013-020	Fulmarus glacialis	20131209	Netherlands	Texel Paal 14 Hoornderslag-Westerslag NSO 4040	NLD4040	53.0434	4.6850	M	NONAD	1	0.0173	8	0.0918	**9**	**0.1091**
NET-2013-004	Fulmarus glacialis	20130917	Netherlands	Texel paal 26 Slufter-Vuurtoren NSO 4043	NLD4043	53.1781	4.8131	F	NONAD	1	0.0287	21	0.1375	**22**	**0.1662**
NET-2013-022	Fulmarus glacialis	20130912	Netherlands	Texel; Oudschild Haven; south of tar factory NSO 4047	NLD4047	53.0498	4.8911	M	NONAD	0	0	4	0.0137	**4**	**0.0137**
NET-2013-008	Fulmarus glacialis	20130706	Netherlands	Vlieland Jachthaven - Strandhotel NSO 4049	NLD4049	53.3198	5.0979	F	ADULT	2	0.0437	10	0.0111	**12**	**0.0548**
NET-2013-011	Fulmarus glacialis	20130524	Netherlands	Ameland Wad Nes NSO 5073	NLD5073	53.4262	5.7303	F	ADULT	2	0.0446	4	0.0211	**6**	**0.0657**
NET-2013-017	Fulmarus glacialis	20130609	Netherlands	Rottumerplaat Weststrand NSO 5080	NLD5080	53.5605	6.4564	F	ADULT	0	0	0	0	**0**	**0**
NET-2013-018	Fulmarus glacialis	20130611	Netherlands	Rottumerplaat Weststrand NSO 5080	NLD5080	53.5605	6.4564	F	ADULT	0	0	9	0.0382	**9**	**0.0382**
NET-2013-013	Fulmarus glacialis	20130527	Netherlands	Rottumeroog NZ strand NSO 5081	NLD5081	53.5587	6.5753	M	NONAD	6	0.1065	76	0.5612	**82**	**0.6677**
NET-2013-014	Fulmarus glacialis	20130603	Netherlands	Rottumeroog NZ strand NSO 5081	NLD5081	53.5587	6.5753	M	NONAD	5	0.1446	32	0.1982	**37**	**0.3428**
NET-2013-016	Fulmarus glacialis	20130607	Netherlands	Rottumeroog NZ strand NSO 5081	NLD5081	53.5587	6.5753	F	ADULT	0	0	5	0.0396	**5**	**0.0396**
NET-2013-025	Fulmarus glacialis	20131208	Netherlands	Friesland; Wierum NSO 6094	NLD6094	53.4064	5.9257	M	NONAD	0	0	0	0	**0**	**0**

EXAMPLE OSPAR DATA submission format *(Netherlands 2013)*

ANNEX 3 (Also provided as digital file FulmarGuidelines-annex2and3_20150820.xlsx)

AreaCode Example

AreaCodeExample (Netherlands) = This Dutch system is more detailed than needed in OSPAR, but functionally links to 4 digit system used in the the Dutch Beached Bird Survey (NZG-NSO) traject codes *(used with permission of Kees Camphuysen, coordinator of NZG-NSO)*

area description	AreaCode	LATD	LOND
NETHERLANDS COAST OR INLAND not specified	NLD0000	52.6000	4.6000
NETHERLANDS SEA not specified	NLD0009	53.0000	4.0000
Netherlands Delta coast or inland - not specified	**NLD1000**	**51.7000**	**3.7000**
DELTA; ZEEUWS-VLAANDEREN Belgische grens - Breskens; paal 0-14	NLD1001	51.4067	3.4360
DELTA; WALCHEREN; Vlissingen - Zoutelande; paal 26-36	NLD1002	51.4571	3.5094
DELTA; WALCHEREN; Zoutelande - Westkapelle; paal 22-26	NLD1003	51.5067	3.4115
DELTA; WALCHEREN; Westkapelle - Domburg paal; 16-22	NLD1004	51.5578	3.4197
DELTA; WALCHEREN; Domburg - Veerse Dam; paal 5-16	NLD1005	51.5979	3.5094
DELTA; Veerse Dam; paal 3-5	NLD1006	51.6081	3.6093
DELTA; WALCHEREN; Veerse Dam - Wissekerke haven; paal 0-3	NLD1007	51.6164	3.6715
DELTA; SCHOUWEN; Neeltje Jans; Schelphoek	NLD1008	51.6521	3.6715
DELTA; SCHOUWEN; De Punt - Westerschouwen; paal 12-18	NLD1009	51.6801	3.6491
DELTA; SCHOUWEN; Westerschouwen - Brouwersdam; paal 1-12	NLD1010	51.7489	3.7225
DELTA; SCHOUWEN; Middenplaat	NLD1011	51.7744	3.8143
DELTA; GOEREE; Brouwersdam - Ouddorp; paal >10	NLD1012	51.8267	3.8438
DELTA; GOEREE; Ouddorp - Kwade Hoek; paal 7-10	NLD1013	51.8516	3.9254
DELTA; GOEREE; Kwade Hoek - Haringvlietdam; paal <7	NLD1014	51.8567	4.0029
DELTA; Haringvlietdam	NLD1015	51.8503	4.0304
DELTA; VOORNE; Voorne strand; paal 6-16	NLD1016	51.8923	4.0009
DELTA; VOORNE; Westplaat	NLD1017	51.9255	4.0009
DELTA; Maasvlakte	NLD1018	51.9887	4.0055
DELTA; Nieuwe Waterweg	NLD1019	52.0000	4.0536
Netherlands South Mainland ;coast or inland	**NLD2000**	**52.2000**	**4.4000**
Netherlands DELTA & S.Mainland offshore	**NLD2009**	**52.2000**	**4.0000**
Z.-H. Hoek van Holland - Monster; paal 112-118	NLD2019	52.0113	4.1017
Z.-H. Monster - Kijkduin; paal 106-112	NLD2020	52.0518	4.1566
Z.-H. Kijkduin - Scheveningen; paal 102-106	NLD2021	52.0794	4.1988
Z.-H. Scheveningen - Katwijk; paal 86-102	NLD2022	52.1505	4.2969
Z.-H. Katwijk - Noordwijk; paal 82-86	NLD2023	52.2175	4.4038
N.-H. Noordwijk - Langevelderslag; paal 75-82	NLD2024	52.3216	4.4578
N.-H. Langevelderslag - Zandvoort; paal 66-75	NLD2025	52.3768	4.4921
N.-H. Zandvoort - Bloemendaal; paal 60-66	NLD2026	52.4221	4.5284
N.-H. Bloemendaal - Ijmuiden; paal 56-60	NLD2027	52.4559	4.5392
Netherlands North Mainland ;coast or inland	**NLD3000**	**52.7000**	**4.6300**
Netherlands N.Mainland offshore	**NLD3009**	**52.7000**	**4.0000**
N.-H. IJmuiden - Wijk aan Zee; paal 52-55	NLD3028	52.4860	4.5604
N.-H. Wijk aan Zee - Castricum; paal 45-52	NLD3029	52.5429	4.5830
N.-H. Castricum - Egmond aan Zee; paal 38-45	NLD3030	52.6128	4.5988
N.-H. Egmond aan Zee - Bergen aan Zee; paal 33-38	NLD3031	52.6582	4.6030
N.-H. Bergen aan Zee - doorbraak; paal 30-33	NLD3032	52.7009	4.6138
N.-H. doorbraak - Camperduin; paal 26-30	NLD3033	52.7421	4.6247
N.-H. Hondsbossche Zeewering; paal 20-26	NLD3034	52.8094	4.6539
N.-H. Petten - Callantsoog; paal 13-20	NLD3035	52.8590	4.6806
N.-H. Callantsoog - Groote Keeten; paal 10-13	NLD3036	52.9044	4.6915
N.-H. Groote Keeten - Huisduinen; paal 0-10	NLD3037	52.9482	4.6998
N.-H. zeewering Den Helder	NLD3038	52.9748	4.7624
Netherlands Texel-Vlieland-Griend-Richel islands	**NLD4000**	**53.2000**	**4.9000**
Netherlands Texel-Vlieland-Griend-RIchel offshore	**NLD4009**	**53.2000**	**4.5000**
TEXEL; Razende Bol (Noorderhaaks)	NLD4038	52.9800	4.6917
TEXEL; Mokbaai - Hoornderslag; De Hors; paal 0-10	NLD4039	52.9867	4.6978
TEXEL; Hoornderslag - Westerslag; paal 10-15	NLD4040	53.0434	4.6850
TEXEL; Westerslag - De Koog; paal 15-20	NLD4041	53.0796	4.7081
TEXEL; De Koog - De Slufter; paal 20-25	NLD4042	53.1309	4.7543
TEXEL; De Slufter - vuurtoren; paal 25-32	NLD4043	53.1781	4.8131
TEXEL; vuurtoren - De Cocksdorp; paal 32-36	NLD4044	53.1811	4.8895
TEXEL; De Cocksdorp - De Schorren	NLD4045	53.1493	4.9229
TEXEL; De Schorren - Oostkaap	NLD4046	53.1035	4.9269
TEXEL; Oostkaap - Oudeschild	NLD4047	53.0498	4.8911
TEXEL; Oudeschild - 't Horntje	NLD4048	53.0155	4.8410
VLIELAND; Jachthaven - Strandhotel; paal 50-55	NLD4049	53.3198	5.0979
VLIELAND; Strandhotel - paal 46; paal 46-50	NLD4050	53.3143	5.0350
VLIELAND; paal 46 - Pad van zes; paal 43-46	NLD4051	53.2934	4.9738
VLIELAND; Pad van zes - Vliehors; paal 41-43	NLD4052	53.2725	4.9332
VLIELAND; Vliehors	NLD4053	53.2412	4.8577
VLIELAND; Posthuiswad - Dodemansbol	NLD4054	53.2422	4.9969
VLIELAND; Dodemansbol - Lange Paal	NLD4055	53.2636	5.0160
VLIELAND; Lange Paal - veerhaven	NLD4056	53.2750	5.0557
VLIELAND; veerhaven - jachthaven	NLD4057	53.2855	5.0979
Griend	NLD4058	53.2780	5.2371
Richel	NLD4059	53.2933	5.1367
Netherlands Terschelling to Rottumeroog islands	**NLD5000**	**53.4600**	**5.8000**
Netherlands Terschelling to Rottumeroog offshore	**NLD5009**	**53.8000**	**5.8000**
TERSCHELLING; Amelander Duin - Schellingerland; paal 18-30	NLD5059	53.4625	5.5004
TERSCHELLING; Schellingerland - Hoorn; paal 15-18	NLD5060	53.4376	5.3739
TERSCHELLING; Hoorn - Midsland aan Zee; paal 11-15	NLD5061	53.4247	5.3127

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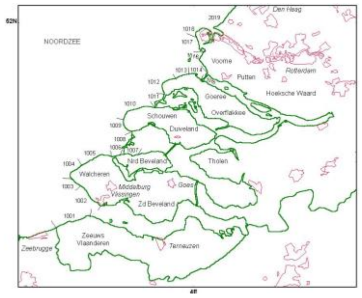

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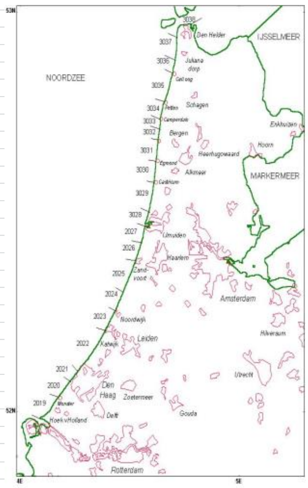

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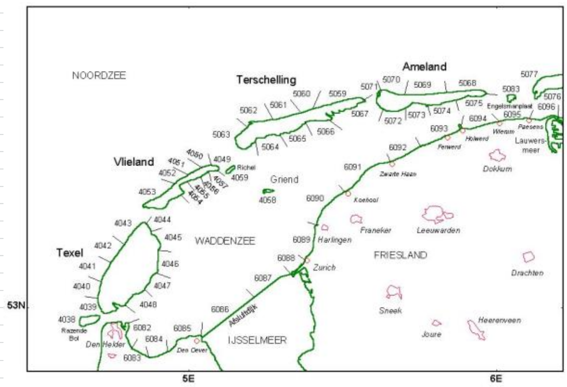

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