Using Northern Fulmars as an ecological monitor of marine litter in line with indicators set for UK Marine Strategy Descriptor 10

DEFRA Project code ME5227

Illustrated results with the: **Annual/Interim Project Report for Period 2021**

Susanne Kühn & Jan A. van Franeker
Wageningen Marine Research, Ankerpark 27, 1781 AG Den Helder, The Netherlands
@ Susanne.kuehn@wur.nl jan.vanfraner@wur.nl

Cite as: *Kühn, S. & Van Franeker J.A. 2023. Using Northern Fulmars as an ecological monitor of marine litter in line with indicators set for UK Marine Strategy Descriptor 10. DEFRA Project code ME5227. Illustrated results with the: Annual/Interim Project Report for Period 2021. 14pp doi: https://doi.org/10.18174/585706*

©2023 Wageningen Marine Research. This work is licensed under the Creative Commons CC-BY-NC-SA license. For license conditions see: https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode

Wageningen Marine Research accepts no liability for consequential damage, nor for damage resulting from applications of the results of work or other data obtained from Wageningen Marine Research. Client indemnifies Wageningen Marine Research from claims of third parties in connection with this publication.

Current situation

Because annual data may show strong variation due to smaller sample size or other reasons, the fulmar monitoring program mostly considers data over 5 year periods. For the North Sea coast of the United Kingdom, over the 5 year period 2017-21, 84% of 108 investigated fulmars had some plastic in the stomach. Averaged over all individuals, stomachs contained 23.8 plastic particles, mostly small items, with a combined average mass of 0.17 gram per bird.

The major figure to consider in terms of national and international policy, is that of the Ecological Quality Performance (EcoQ%). This is, the percentage of birds exceeding the level of 0.1 grams of plastic in the stomach. OSPAR has formulated a long term policy target for ecological quality in relation to plastic marine litter, which states that the percentage of fulmars with more than 0.1 g of plastic in the stomach must be reduced to under 10% for at least five consecutive years. Details for fulmars from the UK North Sea coast over the 2017-21 period are given in Table 1, showing 45.3% of birds having more than 0.1 g of plastic in the stomach.

These values are very similar to the results of the previous report (in which 45.0% of the fulmars exceeded the threshold between 2016-20). Currently, in most North Sea areas, around 50% of investigated fulmar stomachs have more than 0.1 g of plastic. However, this is still distant from OSPAR's ecological target for marine litter.

In future reports, the wording ‘EcoQ%’ will change to FTV% (Fulmar-Threshold-Value %) to bring the UK reporting in line with terminology used by the EU Marine Strategy Framework Directive. There is virtually no difference between the EcoQO and the FTV. In contrast to the arbitrarily chosen EcoQO, the FTV is based on fulmar litter data from the cleanest known study area (Arctic Canada), where 10.06% of the fulmars exceeded the 0.1 gram threshold (Van Franeker et al. 2021).

Table 1 Current annual and five year average plastic ingestion level for fulmars from the United Kingdom North Sea coast, 2017 to 2021. The Frequency of Occurrence (%FO) is the percentage of birds with plastics in the stomach. The EcoQ% gives the percentage of fulmars having more than 0.1 g in the stomach. The long term policy target is that this percentage should be reduced to under 10%.

United Kingdom

North Sea regions		TOTAL PLASTICS			
			average number	average mass	EcoQ%
Year	*n*	%FO	n ± se	g ± se	*(% > 0.1g)*
2021	*21*	81%	19.8 ± 10.4	0.14 ± 0.06	29%
period					
2017_21	*108*	84%	23.8 ± 4.0	0.17 ± 0.02	45%

Considerable time has been dedicated to increase sampling effort at the different locations in the UK. This effort has resulted in new sampling locations on the Scottish mainland. Seven individuals were collected in 2020 and one in 2021. Of these, two 2020 birds remained in rehab for too long (>3 days) to be considered within this monitoring scheme. However, these birds are still useful to better understand the disappearance rate of plastics via excretion. It is expected that fulmars can excrete up to 75% of the plastics within a month (Van Franeker & Law 2015). In 2021, a total of 22 birds were collected, of which one fulmar could not be included, as no stomach was present.

Currently a few incidental birds found on the UK west coast are excluded, as data from that region is yet insufficient for detailed analyses. During a pilot study in 2002, it was calculated that about 40 per year are needed to reliably draw conclusions on changes in ingested litter quantities. Occasional lower annual samples are not a problem, but will lengthen the periods to reliable trend establishments (Van Franeker & Meijboom 2002). There are six birds available from the West coast of the UK, collected between 2011 and 2020. Table 2 summarizes these incidental finds. Detailed information of these birds (from 2019 onwards) is presented in the according ‘Finders Information Reports’ provided by WMR (see e.g. the most recent version here: https://doi.org/10.18174/585268). In the supplement, details are given for all UK data combined. In years to come, it remains an important task to extend the network of beach surveyors.

Table 2 Details of the fulmars incidentally collected on the UK west coast. Due to the small sample size, these birds cannot yet be included in the data analysis.

Bird Code	Location	N plastic items per bird	Plastic mass (g) per bird
SKI-2011-001	St. Kilda	13	0.2921
SOE-2014-001	Cornwall	4	0.0208
SOE-2015-001	Cornwall	3	0.0086
SOE-2019-001	Gloucestershire	0	0.0000
SCO-2020-003	Western Scotland	6	0.0266
SCO-2020-005	Western Scotland	3	0.0162

Trends

Rather than the actual value at a specific moment, it is important to assess trends indicating whether environmental quality is improving or not. For the entire North Sea (including the UK), a significantly decreasing plastic mass has been detected in fulmars between 2009 and 2018, which indicates slow but robust improvement in environmental quality (Van Franeker et al. 2021). Following the OSPAR Guidelines (OSPAR 2015) trends are evaluated over the most recent decade, by linear regression analysis of log transformed individual plastic mass data against the year of collection of each bird.

For the UK North Sea coast, over the 2012-21 decade, the available sample of fulmars is 161 birds. Over this period, all plastics combined and the sub-category user plastic have decreased significantly (both p=0.003). Industrial plastics (so-called pellets or nurdles) are cylindrical granules of 4-5 mm in length, they can be considered as raw plastic or a half-product in the form of which plastics are usually first produced. User plastics include all types of consumer plastics, including sheets, threads, foams, fragments and other types of plastics. Industrial plastics show a downward trend, but this trend is currently not significant (p=0.130). Statistical trends require probabilities of the p=0.05 or smaller to reflect significance. When considering the entire monitoring period from 2002-2021, all plastic in UK North Sea coast fulmars decreases but not significantly (p=0.065), this is also true for the subcategories user and industrial plastics.

Figure 1 compares trends of the EcoQ performance in the UK with those in the Netherlands for the period since the start of the international Save the North Sea project in 2002. Trends in plastic mass for the Netherlands used to be decreasing significantly, however in 2021 an unusual large amount of plastics was detected and interrupted the decrease in plastic mass. The reason for this sudden increase is unclear (Kühn et al. 2022).

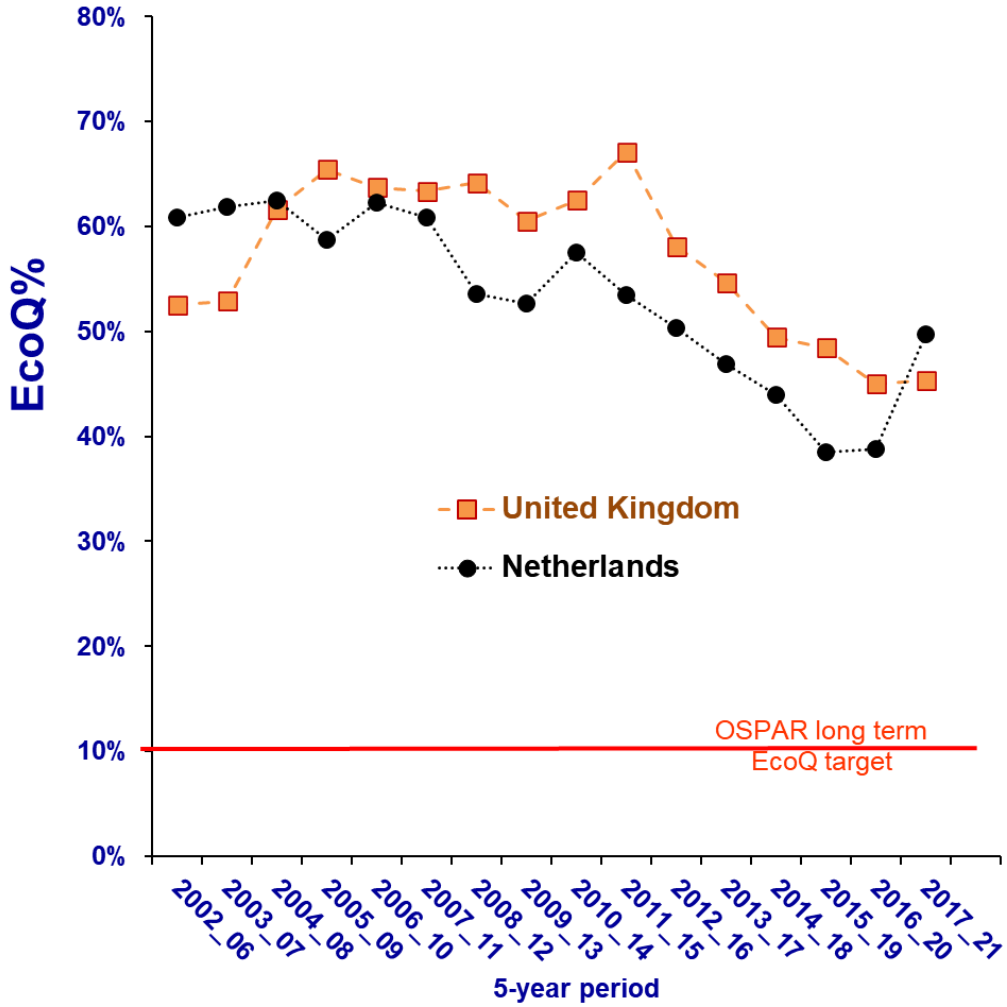

Figure 1. Comparative trends since 2002 for Netherlands and UK North Sea coast in EcoQ% (the proportion of fulmars having more than 0.1 g of plastic in the stomach). Data are illustrated by running 5-year average values, and by themselves do not represent statistical analyses. Data for the Netherlands from Kühn et al. (2022).

Substantial regional variations exist within the three UK main subareas of the monitoring program, which may explain the fact that a significant decrease in the UK has been reached years later than the Netherlands and the entire North Sea region combined (Van Franeker et al. 2021).

For the most recent period (2012-2021) overall plastic mass in fulmars is decreasing significantly, which is reflected in a significant decrease in the UK mainland region (p=0.05) and on the Shetland Islands (p=0.043), but not on the Orkneys where plastics are decreasing but not on a significant level.

While in former years, the Shetlands were the only sub-region showing an increase of plastic mass in all plastic categories (user, industrial and thus all plastics combined). This trend has now reversed, with the Shetlands showing a significant decrease in user and overall plastics and a slight (but non-significant) decrease of industrial pellets.
When referring to EcoQ performance however, the Orkneys are now the closest to the OSPAR long term target (42% of the birds exceed the 0.1 g threshold) within the UK, as shown in Figure 2.
Data for UK 5 year averages as used in Figures 1 and 2 and results of statistical tests are provided in the supplementary tables, together with details on numerical and mass abundance of plastics in fulmar stomachs specified per region.

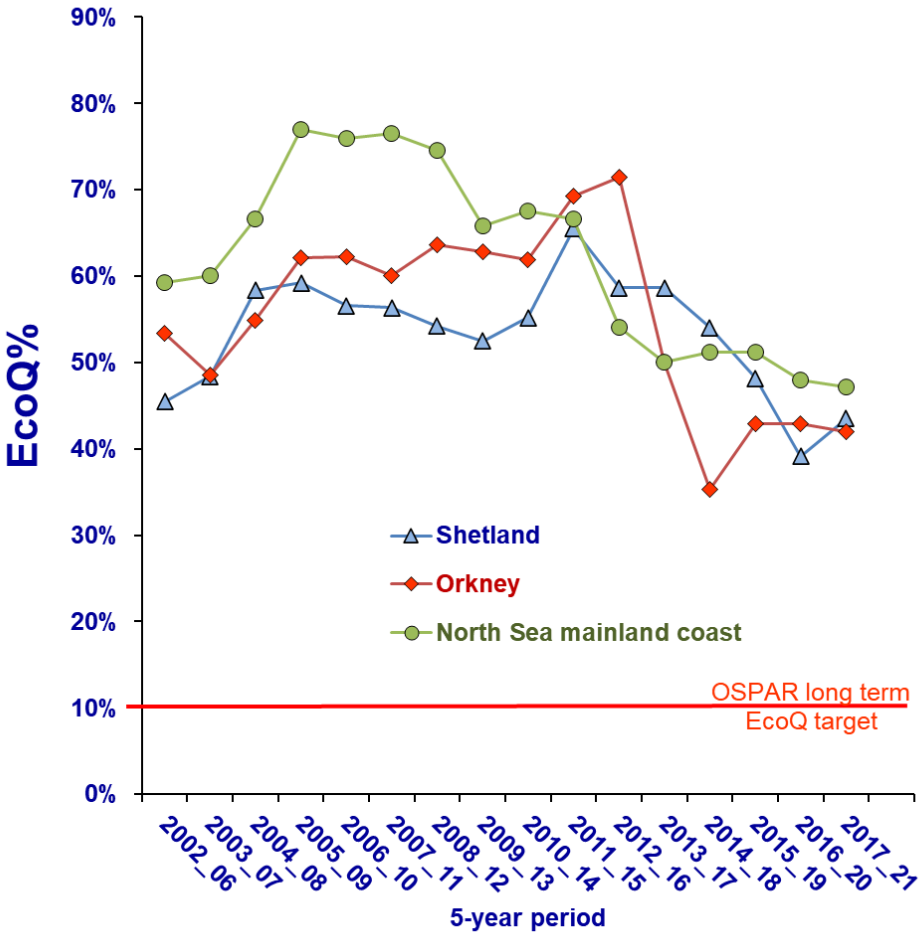

Figure 2. Trends in Fulmar EcoQ% in the three main study regions in the UK since 2002. Blue triangles show data from the Shetlands, red diamonds represent the Orkneys and green circles indicate data from the North Sea mainland. Data are illustrated by running 5-year average values, and by themselves do not represent statistical analyses.

Conclusion

Fulmars from the UK North Sea coast, show declines in plastic mass in their stomachs, but are still far off the OSPAR long term policy target which requires that at most 10% of birds may exceed the level of 0.1 g of plastic in the stomach.

Considerable time has been dedicated to increase sampling effort at the different locations in the UK. This effort has resulted in new sampling locations on the Scottish mainland. Over the current 2017-2021 period, 108 fulmars from the UK North Sea coast were investigated, among which 84% contained some plastic. Each fulmar on average had 23.8 plastic pieces in the stomach weighing 0.17 g. Overall, 45% of UK North Sea fulmars had more than 0.1 g of plastic in the stomach.

The pattern over time in UK appears similar to that in the Netherlands (Fig.1) in that the marine litter situation seems to be improving. It is not clear what has caused the recent increase in Dutch data and whether this is an exception or the reversal of a trend. No such effect has been observed in the UK data. Over the past 10 years, UK data suggest a significant decreasing trend in user and overall plastic mass, as well as a continuous, but non-significant decrease in ingested industrial plastic pellets.

Our data currently hold six birds found on the western coast of the UK plus two from Ireland, however, these birds are too few to be analysed separately and potentially confusing if included. In years to come, it remains an important task to maintain and where possible extend the network of beach surveyors. On an opportunity, trips may be organised in future, to give public lectures and to support or train people in the collection of fulmars from beaches.

In order to further stimulate support we made an illustrated report on dissection details and stomach contents of fulmars from UK in 2020 and 2021 (Van Franeker et al. 2023). Without the many volunteers surveying beaches, a project like this is impossible. We are truly grateful for all their support, and hope that they will continue the work until our seas are free, or at least almost free, of marine plastic litter.

The available Finders Reports can be found here:

- Van Franeker, J.A., Kühn, S., 2019. Finders Information United Kingdom 2018-19. Wageningen Marine Research, SNS Fulmar Study Report, Den Helder, The Netherlands, pp 30 (contact authors to retrieve copy)
- Van Franeker, J.A., Kühn, S., Turner, D.M., 2020. Finders Information United Kingdom 2019. Wageningen Marine Research, SNS Fulmar Study Report, Den Helder, The Netherlands, pp 24 doi https://doi.org/10.18174/530534
- Van Franeker, J.A., Kühn, S., 2022. Finders Information - United Kingdom - 2020. Wageningen Marine Research, SNS Fulmar Study Report, Den Helder, pp 15 doi https://doi.org/10.18174/571906
- Van Franeker, J.A., Kühn, S., Bittner, O., Fairclough, K., Huband, S., Kakkonen, J.E., McIntosh, K., Miles, W., Turner, D.M., 2023. Finders Information United Kingdom 2021. Wageningen Marine Research, SNS Fulmar Study Report - FindersInfo_UK2021_batch5report, Den Helder, The Netherlands, pp 52 doi https://doi.org/10.18174/585268

Results in datafiles

Raw data on individual birds and ingested plastics, which DEFRA must submit to the OSPAR secretariat, have been provided as separate file OSPARsourcedata_2021_GBR.xlsx (also added as comma separated text file csv). This current file replaces the previous one (December 2022), as additional birds from 2020 and 2021 were added.

References

Kühn, S., Meijboom, A., Bittner, O., Van Franeker, J.A., 2022. Fulmar Litter Monitoring in the Netherlands – Update 2021, Den Helder, The Netherlands, pp 59 doi https://doi.org/10.18174/575038

OSPAR 2015. Guidelines for Monitoring of plastic particles in stomachs of fulmars in the North Sea area.. OSPAR Commission Agreement 2015-03 (Source: EIHA 15/5/12 Add.1). 26pp. http://www.ospar.org/convention/agreements?q=fulmar&t=32281&a=&s=.

Van Franeker, J.A., Kühn, S., Anker-Nilssen, T., Edwards, E.W.J., Gallien, F., Guse, N., Kakkonen, J.E., Mallory, M.L., Miles, W., Olsen, K.O., Pedersen, J., Provencher, J., Roos, M., Stienen, E., Turner, D.M. & Van Loon, W.M.G.M. 2021. New tools to evaluate plastic ingestion by northern fulmars applied to North Sea monitoring data 2002-2018. Bulletin 166: 112246 doi https://doi.org/10.1016/j.marpolbul.2021.112246

Van Franeker, J.A., Kühn, S., Bittner, O., Fairclough, K., Huband, S., Kakkonen, J.E., McIntosh, K., Miles, W., Turner, D.M., 2023. Finders Information United Kingdom 2021. Wageningen Marine

Research, SNS Fulmar Study Report -FindersInfo_UK2021_batch5report, Den Helder, The Netherlands, pp 52 doi https://doi.org/10.18174/585268

Van Franeker, J.A., Law, K.L., 2015. Seabirds, gyres and global trends in plastic pollution. Environmental Pollution 203: 89-96 doi http://dx.doi.org/10.1016/j.envpol.2015.02.034

Van Franeker, J.A., Meijboom, A., 2002. Litter NSV - Marine litter monitoring by northern fulmars. A pilot study. Alterra, Alterra-Rapport 401, Wageningen, pp 72 doi http://edepot.wur.nl/45695

Susanne Kühn & Jan van Franeker
Wageningen Marine Research, Den Helder, The Netherlands,
March 2023

Supplementary data tables

Supplementary tables on the following pages show the details for overall UK fulmar monitoring, and for each of the three main subregions: Shetland Islands, Orkney Islands, and the mainland North Sea coast of England and Scotland (which is mainly represented by North East England).

The first table on each page shows running 5 year average data since the start of the Save the North Sea project in 2002. Data provide averages of plastic numbers and mass with standard error, and the EcoQ% (the proportion of fulmars having over 0.1 g of plastic in the stomach).

When distributing information on the 'current situation', it is the most recent 5-year average data-line that should be used. Annual data, certainly on subregional scales, often have too low sample size and may be subject to unexplained interannual variations. The running 5 year data are often used to provide a graphical impression of trends (see main report), but by themselves have no statistical meaning.

Statistical tests for trends within the UK North Sea area are shown in Supplement Table 2. Tests are performed according to the standard methodology in the fulmar monitoring program (OSPAR 2015 Guidelines), that is by linear regression using ln-transformed mass of plastic of each individual bird against its year of collection. Tests are done for industrial plastics and user plastics, and for their combination. Tests are repeated for the long term dataset (since 2002), and for the most recent decade. The decadal change is the major output considered in the monitoring program.

UK North Sea DATA COMBINED

Supplement Table 1 Plastic in Fulmars from the UK North Sea coast per 5-year period. Given are the sample size (n), the percentage of birds with plastics (Frequency of occurrence; %FO), the average number (n) and mass (gram) including the standard errors (± se) and the percentage of birds exceeding the policy target of 0.1 gram of plastic in their stomachs (EcoQ%).

UK (North Sea)		Total plastics			
PERIOD	*n*	%FO	average number n ± se	average mass g ± se	**EcoQ%** ***(over 0.1 g)***
2002_06	*139*	93%	23.8 ±3.2	0.22 ±0.03	**53%**
2003_07	*155*	93%	25.1 ±3.3	0.22 ±0.02	**53%**
2004_08	*193*	94%	30.4 ±3.1	0.30 ±0.04	**62%**
2005_09	*165*	93%	31.3 ±3.2	0.36 ±0.05	**65%**
2006_10	*171*	93%	30.0 ±3.1	0.35 ±0.05	**64%**
2007_11	*172*	92%	29.6 ±3.0	0.35 ±0.05	**63%**
2008_12	*162*	94%	30.1 ±2.9	0.38 ±0.05	**64%**
2009_13	*114*	93%	37.6 ±9.4	0.34 ±0.05	**61%**
2010_14	*88*	94%	39.1 ±12.0	0.32 ±0.05	**63%**
2011_15	*76*	95%	45.5 ±13.8	0.42 ±0.08	**67%**
2012_16	*74*	95%	41.8 ±14.2	0.38 ±0.08	**58%**
2013_17	*64*	92%	39.2 ±16.2	0.33 ±0.09	**55%**
2014_18	*95*	88%	23.0 ±3.8	0.25 ±0.06	**49%**
2015_19	*97*	86%	24.1 ±3.9	0.24 ±0.05	**48%**
2016_20	*100*	86%	22.5 ±3.8	0.16 ±0.02	**45%**
2017_21	*108*	84%	23.8 ±4.0	0.17 ±0.02	**45%**

Supplement Table 2. Tests are performed according to the standard methodology in the fulmar monitoring program (OSPAR 2015 Guidelines), that is by linear regression using ln-transformed mass of plastic of each individual bird against its year of collection. Tests are done for industrial plastics and user plastics, and for their combination. Tests are repeated for the long term dataset (since 2002; Table A), and for the most recent decade (Table B). The decadal change is the major output considered in the monitoring program.

*The regression line ('trend') is described by y = Constant + estimate*x in which y is the calculated value of the regression-line for year x. Given are the number of birds available for the tests (n), the constant and slope including the standard error. When the t-value of a regression is negative, it indicates a decrease in the tested litter-category; a positive t-value indicates increase. A trend is considered significant when the probability (p) of misjudgement of data is less than 5% (p<0.05). Significant trends in the table are labelled with positive signs in case of increase (+) in plastic mass or negative signs in case of decrease (-). Significance at the 5% level (p<0.05) is labelled as - or + ; at the 1% level (p<0.01) as -- or ++; and at the 0.1% level (p<0.001) as --- or +++. Where test results are not significant (n.s.) but close (p<0.1), upward or downward arrow indicates the potential direction of change.*

A. LONG TERM TREND 2002 to 2021

plastics in fulmar stomachs in the UK North Sea

	n	constant	slope	se	t	p	
Industrial Plastics (lnGIND)	*493*	46.9	-0.0258	0.0167	-1.55	0.122	*n.s.*
User Plastics (lnGUSE)	*493*	52.2	-0.0273	0.0157	-1.74	0.082	↓ *n.s.*
All plastics combined (lnGPLA)	*493*	55.9	-0.0290	0.0157	-1.85	0.065	↓ *n.s.*

B. RECENT TREND 2012 to 2021

plastics in fulmar stomachs in the UK North Sea

	n	constant	slope	se	t	p	
Industrial Plastics (lnGIND)	*182*	151.0	-0.0777	0.0511	-1.52	0.130	*n.s.*
User Plastics (lnGUSE)	*182*	308.0	-0.1540	0.0514	-2.99	0.003	↓ - -
All plastics combined (lnGPLA)	*182*	310.0	-0.1549	0.0512	-3.03	0.003	↓ - -

SHETLAND ISLANDS

Supplement Table 3 Plastic in Fulmars from the Shetland Islands per 5-year period. Given are the sample size (n), the percentage of birds with plastics (Frequency of occurrence; %FO), the average number (n) and mass (gram) including the standard errors (± se) and the percentage of birds exceeding the policy target of 0.1 gram of plastic in their stomachs (EcoQ%).

Shetland Islands		Total plastics			
PERIOD	*n*	%FO	average number n ± se	average mass g ± se	**EcoQ%** ***(over 0.1g)***
2002_06	*55*	91%	14.9 ±2.2	0.18 ±0.04	**45%**
2003_07	*62*	94%	15.0 ±2.0	0.17 ±0.03	**48%**
2004_08	*72*	96%	22.9 ±3.9	0.29 ±0.07	**58%**
2005_09	*76*	92%	23.1 ±3.9	0.30 ±0.07	**59%**
2006_10	*76*	92%	23.0 ±3.9	0.29 ±0.06	**57%**
2007_11	*71*	92%	23.4 ±4.1	0.31 ±0.07	**56%**
2008_12	*59*	93%	25.5 ±4.8	0.35 ±0.09	**54%**
2009_13	*40*	93%	42.1 ±23.8	0.29 ±0.07	**53%**
2010_14	*29*	100%	48.3 ±32.7	0.33 ±0.09	**55%**
2011_15	*29*	100%	53.2 ±32.5	0.52 ±0.18	**66%**
2012_16	*29*	100%	51.0 ±32.6	0.50 ±0.18	**59%**
2013_17	*29*	93%	48.2 ±32.7	0.43 ±0.17	**59%**
2014_18	*37*	92%	26.6 ±7.8	0.38 ±0.14	**54%**
2015_19	*27*	89%	31.4 ±10.6	0.42 ±0.18	**48%**
2016_20	*23*	87%	29.3 ±12.3	0.22 ±0.06	**39%**
2017_21	*23*	83%	29.1 ±12.4	0.22 ±0.06	**43%**

ORKNEY ISLANDS

Supplement Table 4 Plastic in Fulmars from the Orkney Islands per 5-year period. Given are the sample size (n), the percentage of birds with plastics (Frequency of occurrence; %FO), the average number (n) and mass (gram) including the standard errors (± se) and the percentage of birds exceeding the policy target of 0.1 gram of plastic in their stomachs (EcoQ%).

Orkney Islands		Total plastics			
PERIOD	*n*	%FO	average number n ± se	average mass g ± se	**EcoQ%** ***(over 0.1g)***
2002_06	*30*	93%	31.7 ±8.8	0.28 ±0.07	**53%**
2003_07	*33*	88%	26.2 ±7.8	0.27 ±0.06	**48%**
2004_08	*31*	87%	22.5 ±7.9	0.40 ±0.16	**55%**
2005_09	*37*	86%	26.7 ±7.2	0.48 ±0.16	**62%**
2006_10	*45*	89%	23.7 ±6.0	0.45 ±0.13	**62%**
2007_11	*50*	88%	21.3 ±4.4	0.42 ±0.12	**60%**
2008_12	*44*	91%	23.3 ±5.0	0.46 ±0.14	**64%**
2009_13	*35*	91%	26.4 ±6.1	0.39 ±0.11	**63%**
2010_14	*21*	90%	18.9 ±5.4	0.30 ±0.09	**62%**
2011_15	*13*	92%	26.2 ±8.3	0.38 ±0.12	**69%**
2012_16	*7*	86%	17.3 ±7.1	0.38 ±0.18	**71%**
2013_17	*8*	88%	10.4 ±4.1	0.26 ±0.12	**50%**
2014_18	*17*	76%	10.1 ±2.9	0.18 ±0.07	**35%**
2015_19	*28*	75%	14.6 ±4.7	0.19 ±0.05	**43%**
2016_20	*28*	75%	13.6 ±4.7	0.16 ±0.04	**43%**
2017_21	*31*	81%	13.5 ±4.2	0.18 ±0.05	**42%**

NORTH SEA COAST MAINLAND UK
Eastern Scotland, North-East England, South-East England

Supplement Table 5 Plastic in Fulmars from the UK North Sea mainland coast per 5-year period. Given are the sample size (n), the percentage of birds with plastics (Frequency of occurrence; %FO), the average number (n) and mass (gram) including the standard errors (± se) and the percentage of birds exceeding the policy target of 0.1 gram of plastic in their stomachs (EcoQ%).

UK Mainland North Sea **Total plastics**

PERIOD	*n*	%FO	average number n ± se	average mass g ± se	EcoQ% *(over 0.1g)*
2002_06	*54*	94%	28.5 ±6.0	0.22 ±0.03	**59%**
2003_07	*60*	95%	35.0 ±6.9	0.23 ±0.03	**60%**
2004_08	*90*	96%	39.1 ±5.2	0.27 ±0.03	**67%**
2005_09	*52*	98%	46.5 ±6.4	0.36 ±0.06	**77%**
2006_10	*50*	98%	46.2 ±6.7	0.34 ±0.07	**76%**
2007_11	*51*	98%	46.4 ±6.7	0.35 ±0.07	**76%**
2008_12	*59*	97%	39.7 ±5.1	0.35 ±0.06	**75%**
2009_13	*38*	95%	43.3 ±12.3	0.36 ±0.09	**66%**
2010_14	*37*	92%	43.4 ±12.6	0.34 ±0.08	**68%**
2011_15	*33*	91%	46.6 ±14.1	0.36 ±0.08	**67%**
2012_16	*37*	92%	39.3 ±12.7	0.29 ±0.07	**54%**
2013_17	*26*	92%	38.0 ±16.8	0.25 ±0.08	**50%**
2014_18	*41*	90%	25.1 ±5.1	0.17 ±0.05	**51%**
2015_19	*41*	90%	25.7 ±5.1	0.14 ±0.03	**51%**
2016_20	*48*	92%	24.2 ±4.5	0.13 ±0.02	**48%**
2017_21	*53*	87%	27.5 ±5.6	0.13 ±0.02	**47%**

UK All coasts
Includes incidental fulmars from Western UK coast

Supplement Table 6 Plastic in Fulmars from all UK coasts (including incidental fulmars from the western UK coast) per 5-year period. Given are the sample size (n), the percentage of birds with plastics (Frequency of occurrence; %FO), the average number (n) and mass (gram) including the standard errors (± se) and the percentage of birds exceeding the policy target of 0.1 gram of plastic in their stomachs (EcoQ%).

United Kingdom

All coasts

		TOTAL PLASTICS					
			average number		average mass		EcoQ%
Year	*n*	%FO	n	± se	g	± se	*(% > 0.1g)*
2021	*21*	81%	19.8	± 10.4	0.14	± 0.06	29%
period							
2017_21	*111*	84%	23.3	± 3.9	0.17	± 0.02	44%