

Marine Birds: Environmental quality indicators

Laëtitia Petit



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Marine birds: Environmental quality indicators

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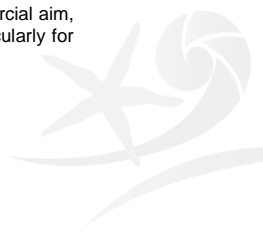


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Marine birds: Environmental quality indicators

Oiseaux marins : indicateurs de la qualité du milieu

ABSTRACT

Within the framework of OSPAR and the Marine Strategy Framework Directive, indicators are developed and used to assess the ecological status of the marine environment.

The Ecological Quality Objectives developed by OSPAR set targets for determined indicators particularly within the framework of the EcoQO Fulmar-Litter and EcoQO Oiled-Guillemots monitoring studies.

This report presents the results of the "beached birds" survey for the Nord – Pas-de-Calais, Picardy and Normandy regions and the EcoQO surveys done for the Picardy and Normandy regions. These surveys provide indications about mortality in winter, shed light on the impacts of natural or human-induced events and help to assess the state of the marine environment.

A comparative analysis of results over time demonstrates the need to continue these surveys with increasing discipline (every year), through significant involvement of volunteers, surveys of the entire coast and coordination across the whole marine sub-region.

KEYWORDS: indicator, bird, marine environment, beaching, oiled-guillemots, fulmar-litter.

RÉSUMÉ

Dans le cadre d'OSPAR et de la Directive Cadre Stratégique pour le Milieu Marin, des indicateurs sont développés et mis en place. Ces indicateurs permettent d'évaluer le bon état écologique du milieu marin.

Les « Ecological Quality Objectives » développé par OSPAR fixe des objectifs pour des indicateurs déterminés notamment dans le cadre des suivis « EcoQO Fulmar-Litter » et « EcoQO Oiled-Guillemots ».

Ce rapport présente les résultats de l'enquête « oiseaux échoués » pour les régions du Nord – Pas-de-Calais, la Picardie et la Normandie ainsi que les suivis « EcoQO » réalisés pour les régions Picardie et Normandie. Cette enquête et ces suivis permettent de dégager des indications sur la mortalité hivernale, de mettre en avant des impacts d'événements d'origine naturelle ou anthropique et de participer à l'évaluation du bon état écologique du milieu marin.

L'analyse des résultats comparée à l'évolution temporelle permet de démontrer la nécessité de poursuivre ces recensements avec une rigueur accrue (reconduction annuelle), une mobilisation des bénévoles, la prospection de l'ensemble du littoral et une concertation sur l'ensemble de la sous-région marine.

MOTS-CLÉS : indicateur, oiseau, milieu marin, échouage, oiled-guillemots, fulmar-litter



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I. Introduction

1.1 The indicator concept

The marine environment is subject to many types of pressure and to the environmental impact of human activities, requiring its environmental status to be monitored and assessed. The Marine Strategy Framework Directive (MSFD) defines "good environmental status" of the marine environment as follows: *"The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations."* (MSFD, 2012). In this context of "good environmental status" (GES) and management, there is a real need for indicators to monitor the environment, and more specifically for marine protected areas (MPA). These areas are managed in specific ways to achieve short- and long-term objectives. To be able to adapt these objectives to changes at the site, assessment must be possible.

According to Pelletier et al (2005): *"An indicator may be seen as a qualitative or quantitative variable that can be obtained from field surveys or from models, and that can be directly linked to a management objective or a research question (Pelletier et al., 2005)."*

It is associated with an interpretation framework (threshold, trend) in order to establish a diagnosis.

Furthermore, an indicator used for diagnosis purposes must be presented in an appropriate form for users. As indicators should serve as an aid for management decisions by assessing good environmental status, the French MPA Agency (*Agence des aires marines protégées*) develops a catalogue of indicators for the marine environment.

1.2 Beached marine birds and EcoQO

The OSPAR Convention (Oslo Paris) is a system whereby fifteen governments cooperate to protect the marine environment of the North-East Atlantic. Programmes and measures have been organised to ensure that the national actions taken to fight threats to the marine environment are effective. The "Ecological Quality Objectives" system (EcoQO) developed by OSPAR together with the International Council for the Exploration of the Sea (ICES) *"defines the desired qualities of selected components of marine ecosystems in relation to human pressures"* (OSPAR Commission, 2010a). To measure progress made, this system sets objectives for determined indicators thus providing complete coverage of ecosystems and the pressure they sustain.

In this report, two EcoQO monitoring studies are presented: Fulmar-Litter and Oiled-Guillemots. The EcoQO Fulmar-Litter study concerns plastic particles in the stomachs of seabirds, here the Northern Fulmar (*Fulmarus glacialis*). It is stated as follows: *"There should be less than 10% of northern fulmars having more than 0.1g plastic particles in the stomach in samples of 50 to 100 beach-washed fulmars found from each of 4 to 5 areas of the North Sea over a period of at least five years."* (OSPAR Commission, 2010b)



The EcoQO Oiled-Guillemot study concerns the rate of oiled Guillemots (*Uria aalge*). It is stated: "The average proportion of oiled common guillemots in all winter months (November to April) should be 20% or less by 2020 and 10% or less by 2030 of the total found dead or dying in each of 15 areas of the North Sea over a period of at least 5 years." (OSPAR Commission, 2010c)

Within the framework of the MSFD, indicators can be used to assess and monitor progress made with a view to achieving the GES prescribed by the Directive. The beached birds and Ecological Quality Objectives surveys are included in the monitoring programme of the Action Plan for the Marine Environment for descriptor D1 and can also be a source of information for two of the eleven MSFD descriptors:

- D8 – Concentrations of contaminants are at levels not giving rise to pollution effects: assessment of the impact of oil pollution on birds, indicator of the oil pollution of marine and coastal environments
- D10 – Properties and quantities of marine litter do not cause harm to the coastal and marine environment: assessment of the impact of litter pollution on birds, indicators of marine and coastal environment pollution by plastic particles

Birds in the Channel are exposed to many natural threats (predation, weather hazards) but also to human-induced threats. Pressure caused by humans is strong and continuous and results from urban development, shipping, fishing, recreational activities and pollution, etc. Many marine birds are washed up on the beaches of the Channel coastline and the number of beach-washed birds and the causes of their death provide information about the species' conservation status and the quality of the marine environment, on various scales. The principle of surveying beached birds has been implemented since the 1970s.

Several species can be identified. In Normandy, where beached bird surveys have been carried out for over forty years, 106 taxa have been identified. Six of them account for 70% of all beached birds (Le Guillou, 2006). Alcidae, i.e. the Common Guillemot (*Uria aalge*) and the Razorbill (*Alca torda*), alone account for 45% of beached birds, followed by the Common black-headed gull (*Larus ridibundus*), the Herring gull (*Larus argentatus*), the Black-legged kittiwake (*Rissa tridactyla*) and the Great Crested Grebe (*Podiceps cristatus*).



II. Surveys

2.1. Methodology

The "Beached Birds" survey and the Fulmar-Litter EcoQO and Oiled-Guillemots EcoQO monitoring studies were carried out in France during winter 2013-2014 on the shores of Nord – Pas-de-Calais, Picardy and Normandy respectively by the Groupe Ornithologique et Naturaliste du Nord-Pas-de-Calais (GON), Picardie Nature (PN) and the Groupe Ornithologique Normand (GONm). Each region was divided up into different areas sufficient for detailed analysis, the areas being chosen based on knowledge of the potential for beaching at these sites. The areas covered in Picardy and Normandy were then plotted in relation to the boundaries of existing MPA and wetland areas.

2.1.1. Beached Birds survey

The Beached Birds survey is used within the framework of the Marine and Coastal Birds Observatory (Observatoire des oiseaux marins et côtiers) of the Channel-North Sea marine sub-region (<http://www.oiseaux-manche.org>) and is based on an annual survey of dead beach-washed birds. The survey consists of searching along the coast for all dead birds, regardless of species. As far as possible, the individuals are identified, as is the cause of death.

The causes of death detected can be oil pollution (traces of oil on the feathers, death more often being caused by its ingestion), hunting (traces of lead on fresh bodies) or unknown (which includes all the other causes not identified in this protocol).

To correspond to European surveys, the survey is traditionally done around the last two weeks of February and particularly the last weekend in February. The Nord – Pas-de-Calais coastline was covered between 17 and 23 February 2014 but mainly on the weekend of 22/23 February 2014. The coastline of Picardy was mostly surveyed on 26 February 2014. The coast of Normandy was mainly covered on the last weekend in February. Kilometric objectives were defined per area on the Picardy and Normandy coasts but without focussing on any specific portion of the coast.

To avoid double counts, each association has its own method: the GON uses a survey map; PN takes similar data into account over several sessions to remove likely and/or definite double counts; and the GONm marks the birds.

For the Beached Birds survey, areas were initially defined (see Appendix 1: list of projected areas) totalling 147 km of coastline for Nord – Pas-de-Calais, 31.9 km for Picardy and 275 km for Normandy.



Beaching rate

The beaching rate or mortality index corresponds to the number of beached individuals per km.

$$\text{Beaching rate} = \frac{\text{Number of birds}}{\text{Kilometres covered}} \quad (1)$$

The Beached Birds survey can also be used as an indicator under the OSPAR Convention.

Expected indicators for the Beached Birds survey:

- Number of beached birds per kilometre covered, per species and per cause of death (where this information can be determined);
- Recording of the state of the wave mark (absent, weak, thick, covered with sand);
- Presence of oil;
- Presence of human litter.

2.1.2. EcoQO Fulmar-Litter and EcoQO Oiled-Guillemots studies

The Ecological Quality Objectives (EcoQO) Fulmar-Litter and Oiled-Guillemots studies (OSPAR Commission, 2009) are based on the collection of dead Northern Fulmars (*Fulmarus glacialis*) and Common Guillemots (*Uria aalge*) along the coast. The quality of these monitoring studies depends on the number of dead bodies found as the information necessary for the indicators is measured on the individuals and not on the number of kilometres of coastline covered. The dead bodies generally remain between 14 and 21 days in winter (Houwen 1968, Bargain *et al.* 1986, Sheridan and Pamart 1988, Tanis and Mörzer Bruijns 1962). It was therefore decided to do one outing every two weeks to optimise the work, increase the potential number of bodies to collect, and gather as much information as possible from the bodies.

Searches are done on sample areas between November and April for the Guillemots and without any seasonal restriction for the Fulmars: they take place from 15 January to 15 March in Picardy and from 15 December to 15 March in Normandy. The sample areas may be completed by other searches (with other dates, location and regularity) for areas described as additional, as was the case for the coasts of Normandy.

The collected bodies of Northern Fulmars and Common Guillemots are identified: their age, origin and the cause of death are defined to the extent possible; the bodies are also examined to check for the presence of oil and to assess the state of the body. Morphometric operations (study and analysis of the shape of organs) and necropsies (or dissections) are also done.

For the EcoQO Fulmar-Litter study, the stomachs of the Fulmars are removed and their contents are examined to see whether there are any particles from human activities (plastics, polystyrene, paraffins, aluminium, etc.). The causes of death are also investigated and can be due to the ingestion of these particles, drowning, strangulation by fishing gear, etc.

The stomach contents may be kept for subsequent, more in-depth analyses.



For the EcoQO Oiled-Guillemots study, the bodies are examined for traces of oil on the feathers and traces of lesions due to ingestion during the necropsy. The causes of death are also investigated and may be due to ingestion of oil, drowning or strangulation by fishing gear.

When possible, oil samples are taken and kept for further, more thorough analyses to identify the products and their origin.

For the EcoQO Fulmar-Litter and EcoQO Oiled-Guillemots studies, areas were initially defined (see Appendix 2: list of projected areas) totalling 31.9 km of coastline for Picardy and 27 km for Normandy, completed by additional areas not pre-defined.

The EcoQO Oiled-Guillemots and EcoQO Fulmar-Litter studies can also be used as indicators under the OSPAR Convention.

Expected indicators for the EcoQO Oiled-Guillemots monitoring study:

- Number of beached birds per kilometre covered;
- Number of Guillemots bodies contaminated with oil;
- Number of bodies with lesions caused by ingestion of oil.

Expected indicators for the EcoQO Fulmar-Litter monitoring study:

- Number of beached birds per kilometre covered;
- Number of Fulmar stomachs containing particles from human activities.

2.2. Results

2.2.1. Beached Birds Survey

Nord – Pas-de-Calais

For the Nord – Pas-de-Calais region, a total 147 km of coastline were covered by GON for the Beached Birds survey with 39 km for the Nord and 108 km for Pas-de-Calais (Table 1).



	Areas	No. km covered
Nord	From the Belgian border to the mouth of the Aa	39
	TOTAL	39 km
Pas-de-Calais	From the mouth of the Aa to Cap Blanc Nez	37
	From Cap Blanc Nez to Cap Gris Nez	12
	From Cap Gris Nez to Audresselles	5
	From Audresselles to Le Portel	17
	From Le Portel to Hardelot	8
	From Hardelot to the mouth of the Canche	9
	From the mouth of the Canche to Merlimont	10
	From Merlimont to the mouth of the Authie	10
TOTAL	108 km	

Table 1. Coastline covered for the Nord – Pas-de-Calais region

During the Beached Birds survey, 131 birds were counted and 20 different species were identified. For numerous species or groups of species only a few birds were found. The three most represented species are the Razorbill (38.9%), the Herring Gull (12.2%) and the Common Guillemot (10.7%) which thus account for a substantial portion (61.8%) of the beach-washed birds (cf. Figure 1).

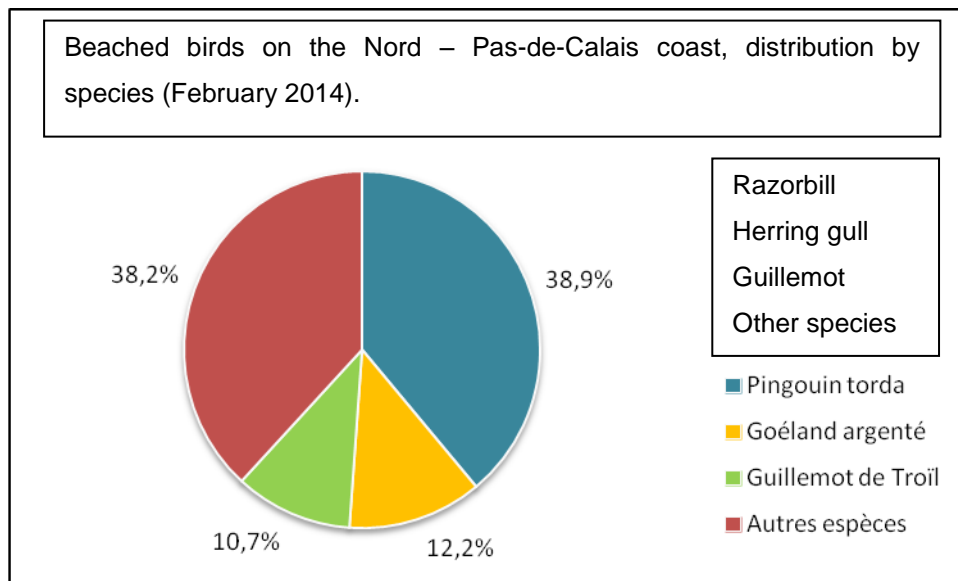


Figure 1. Distribution of beached birds on the Nord – Pas-de-Calais coast by species

It shall be noted that bands were recovered from two bodies: one Razorbill and a Northern Gannet; one Balearic Shearwater, one Common Puffin and one Great Skua were also found.

The beached birds were distributed geographically over the two French departments as follows (Table 2):

	Areas	No. beached birds
Nord	From the Belgian border to the mouth of the Aa	23
	TOTAL	23 birds
Pas de Calais	From the mouth of the Aa to Cap Blanc Nez	18
	From Cap Blanc Nez to Cap Gris Nez	5
	From Cap Gris Nez to Audresselles	0
	From Audresselles to Le Portel	59
	From Le Portel to Hardelot	10
	From Hardelot to the mouth of the Canche	4
	From the mouth of the Canche to Merlimont	7
	From Merlimont to the mouth of the Authie	5
TOTAL	108 birds	

Table 2. Distribution of the beached birds according to the areas and departments in the Nord – Pas-de-Calais region.

The beaching rate was calculated using the formula (1) for the Nord and Pas-de-Calais departments and for the whole region (Table. 3). Example of calculation for the Nord: 23 birds / 39 km = 0.59 birds/km. The calculation of this index confirms the trend seen during the beached birds survey and makes comparisons possible (per year, per area, per region, etc.).

	Beaching rate (birds/km)
Nord	0.59
Pas-de-Calais	1.00
Nord - Pas-de-Calais	0.89

Table. 3. Beaching rate in the Nord – Pas-de-Calais region

The Pas-de-Calais department was more affected by beaching than the Nord with one bird per km vs. 0.59 birds per km.

The geographic distribution of beach-washed birds depending on the direction of the coast is as follows:



Description of the area	No. of beached birds	Beaching rate (birds/km)	Comment
Coast facing north-west towards the North Sea (76km – from the Belgian border to Cap Blanc-Nez)	41 birds	0.54	Moderate
Coast facing south-west towards the Channel (17km – from Cap Blanc-Nez to Audresselles)	5 birds	0.29	Almost zero
Coast facing north-west towards the Channel (25km – from Audresselles to Hardelot)	69 birds	2.76	Very high
Coast facing west towards the Channel (29km – from Hardelot to the mouth of the Authie)	16 birds	0.55	Moderate

Different causes of death were identified:

- Only one case potentially due to oil (Kittiwake),
- One or two bodies can be considered to be caused by shooting (Eurasian curlew and Razorbill),
- One body could suggest that it was caught in a fishing net (Razorbill),
- No evidence of undernutrition was found for the bodies of Alcidae. The conditions at sea had not been particularly bad locally but there is a possibility of a very rough sea probably located in the southern part of the strait of Pas-de-Calais, or even in the Atlantic.

Picardy

For the Picardy region and thus the Somme department, a total 21.6 km of coast were covered by PN as part of the beached birds survey. The correspondence between the areas covered and the MPA sectors is shown in the table below (Table.4).

Code	MPA sector	Relevant area	No. of km covered
Pic02	From Routhiauville headland to the new headland	From Authie bay to Quend-Plage marina	6.5
Pic04	Bottom of the Bay of Somme	From La Maye car park to Crotoy marina	2.9
Pic05	From Le Hourdel headland to the Cayeux lighthouse	From Le Hourdel blockhouse to Cayeux-sur-Mer lighthouse	5.9
Pic06	From the Cayeux-sur-Mer lighthouse to the entrance to Mers-les-Bains	From Hâble d'Ault to Ault marina	6.3
TOTAL			21.6km

Table.4. Coastline covered for the Picardy region



The beached birds survey conducted in the Picardy region counted a total of 29 birds and identified eight species (4 Laridae could not be identified due to the decomposition of the bodies). Most bodies belonged to three families: Laridae (9 individuals: 2 Herring gulls, 2 Common gulls, 1 Great black-backed gull, 4 Gulls sp.), Alcidae (14 individuals with 8 Common Guillemots, 5 Razorbills and 1 Atlantic Puffin) and the Sulidae (5 Northern Gannets). The three most represented species are the Common Guillemot (27.6%), the Northern Gannet (17.2%) and the Razorbill (17.2%) accounting for a significant proportion (61.1%) of the beached birds (Figure 2).

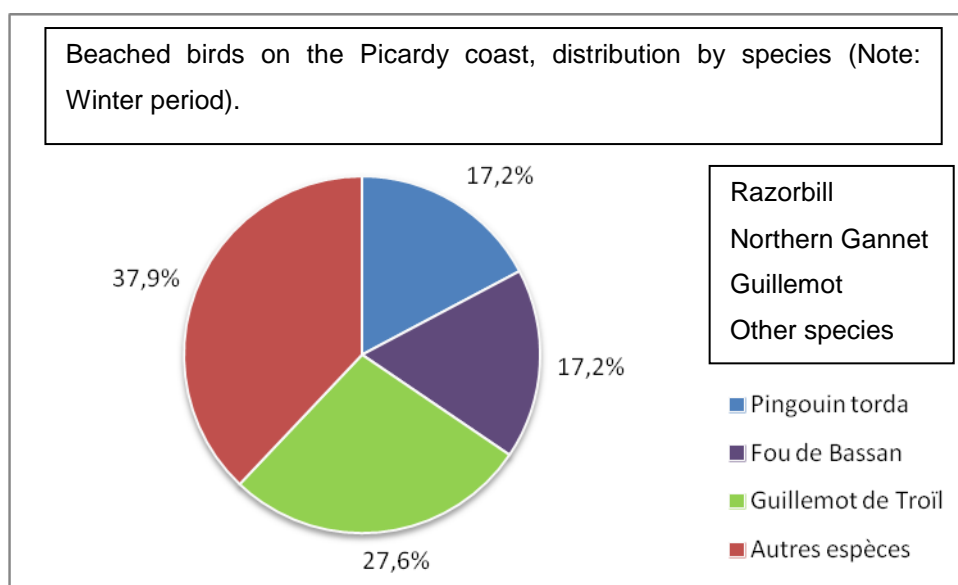


Figure 2. Distribution of beached birds on the Picardy coast by species

The beached birds were distributed geographically over the department as shown below (Table 5):

Code	Areas	No. of beached birds
Pic02	From Routhiauville headland to the new headland	0
Pic04	Bottom of the Bay of Somme	3
Pic05	From Le Hourdel headland to Cayeux lighthouse	9
Pic06	From Cayeux-sur-Mer lighthouse to the entrance to Mers-les-Bains	17
TOTAL		29 beached birds

Table 5. Distribution of beached birds in Picardy by area

The beaching rate was calculated according to the formula (1) for the Picardy region and thus the Somme department (Table. 6). Example of calculation: 29 birds / 21.6 km = 1.34 birds/km.

Beaching rate calculation (bird/km)	
Picardy	1.34



Table 6. Beaching rate in the Picardy region

The causes of death were identified in the field except for the Common Guillemot for which special analyses were done and presented as part of the EcoQO study. The causes of death are mostly unknown (58.6%) but the violent storms in February could be responsible for 38% of cases. Oil only represents 3.4% of the identified causes.

Information about the state of the water marks and their composition was also noted. The state of water marks provides information about areas that are propitious or not to deposits, like dead birds for example. Small water marks or those covered with a lot of dry plant matter or sand are not ideal for finding bodies unlike those that are thicker and comprise waste from the marine environment. This information is provided in the table below:

Areas covered	State of the water mark	Composition of the water mark
Pic 05: From Le Hourdel blockhouse to the casino in Cayeux-sur-Mer	Thick but spread out	Plastic, rope, netting, animal and plant fragments from the sea Plant fragments from the Molière dunes
Pic 06: From Hâble d'Ault to the Ault marina	Thick	Plastic, rope, netting, animal and plant fragments from the sea
Pic 02: From the bay of Authie to Quend-Plage marina	Small, covered with sand	All sorts of waste but predominantly dry plant matter
Pic 04: From La Maye car park to Crotoy marina	Thick	A lot of dry plant matter from the bay that covers the other waste.

Table 7. State and composition of the water mark by area covered in Picardy

It shall be noted that no trace of oil or any other highly toxic substance (except plastic litter) was found during the studies. The highest beaching rates were effectively recorded in areas Pic 05 (1.5 beached birds) and Pic 06 (2.7 beached birds) where the water mark is thick and abundant with marine waste of human origin, suggesting that these areas are more significantly exposed to the tides.

Normandy

For the Normandy region, a total 367.1km of coastline were covered by GONm for the beached birds survey with 78.5 km for Seine-Maritime, 71.5 km for Calvados and 217.1 km for La Manche (Table. 8).

Department	No. of km covered
Seine-Maritime	78.5 km
Calvados	71.5 km
Manche	217.1 km



Table 8. Coastline covered for the Normandy region

During the Beached Birds survey, 724 birds were counted and 22 different species belonging to 10 families were identified. The three most represented species are the Razorbill (39.8%), the Common Guillemot (33%) and the European shag (6.4%), which thus account for a significant proportion (79.2%) of the beach-washed birds (see Figure 3).

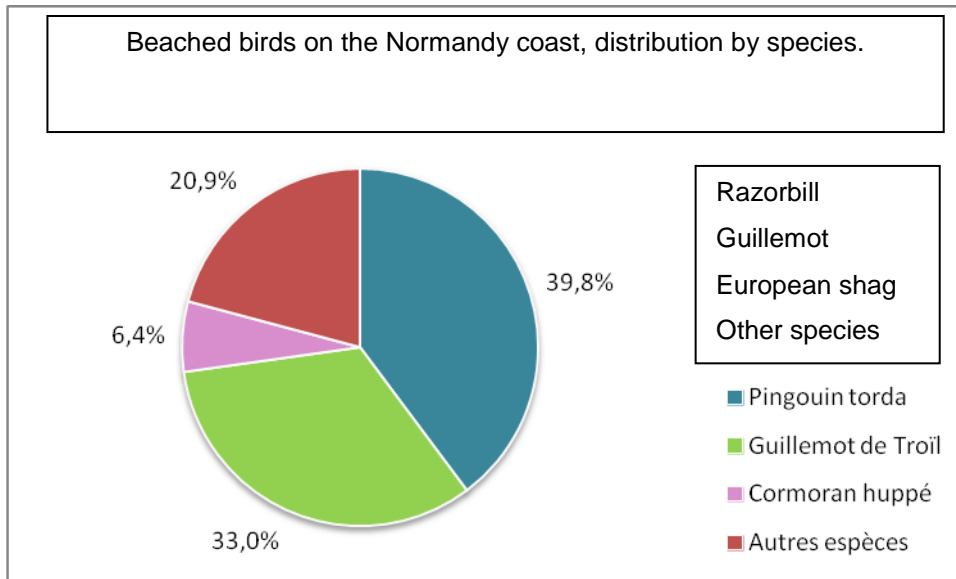


Figure 3. Distribution of beached birds on the Normandy coast, by species

The beached birds were geographically distributed over the three departments as follows (Table 9):

Department	No. of beached birds
Seine-Maritime	56 beached birds
Calvados	5 beached birds
Manche	663 beached birds

Table 9. Distribution of beached birds across the departments of Normandy

The beaching rate was calculated using the formula (1) for the Seine-Maritime, Calvados and Manche departments and for the entire region (Table 10). Example of calculation for Seine-Maritime: 56 birds / 78.5 km = 0.71 birds/km.

	Beaching rate calculation (bird/km)
Seine-Maritime	0.71
Calvados	0.07
Manche	3.05
Normandy	1.97

Table 10. Beaching rate in the Normandy region

Significant variability can be noted across the Normandy region, with the highest beaching rate (3.05 birds per km) in the Manche department. We can also note the high proportion of beached birds (663 birds, i.e. 91.56%) probably linked to the very high number of birds washed up this winter on the Atlantic coasts due to the violent storms at the beginning of 2014.

Winter 2013-2014 was the worst of the decade. It has been difficult to identify the causes of mortality due to the state of the bodies or because the cause is invisible to the naked eye, such as ingestion of toxic products. The cause of death is unknown in 97.8% cases. Different causes were nonetheless identified for 16 bodies:

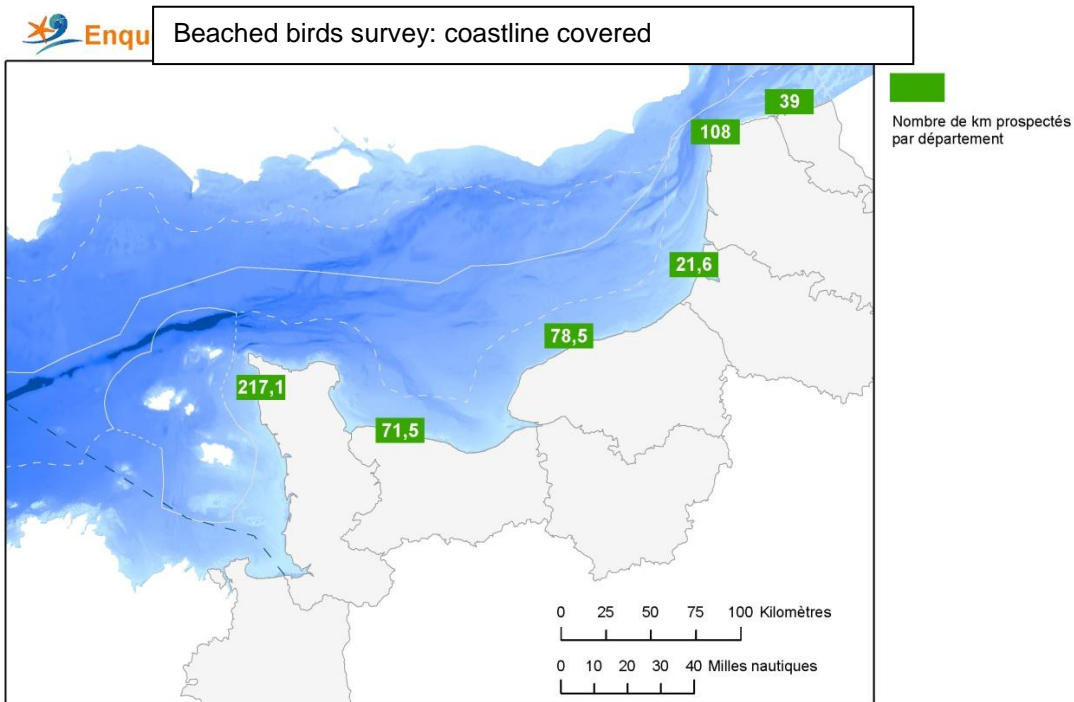
- 15 cases can be linked to oil, of which 12 in a definite manner,
- There were apparently no cases of shooting.



SUMMARY of the Beached Birds surveys

		No. of kilometres covered	No. of beached birds	No. of species	Majority species	Beaching rates	Causes of death
Nord - Pas-de-Calais	Nord	39	23		Razorbill (39%) Herring gull (12%)	0.59	Oil: 1 Fishing: 1
	Pas-de-Calais	108	108	20	Common Guillemot (11%)	1.00	Shooting: 1 to 2 Undetermined: 127
Picardy	Somme	21.6	29	7	Common Guillemot (27.6%) Northern Gannet (17.2%) Razorbill (17.2%)	1.34	Oil: 1 Storms: 11 Undetermined: 17
Normandy	Seine-Maritime	78.5	56		Razorbill (40%) Common	0.71	Oil: 15 Shooting: 1
	Calvados	71.5	5	22	Guillemot (33%)	0.07	Undetermined: 708
	Manche	217.1	663		European shag (6.4%)	3.05	

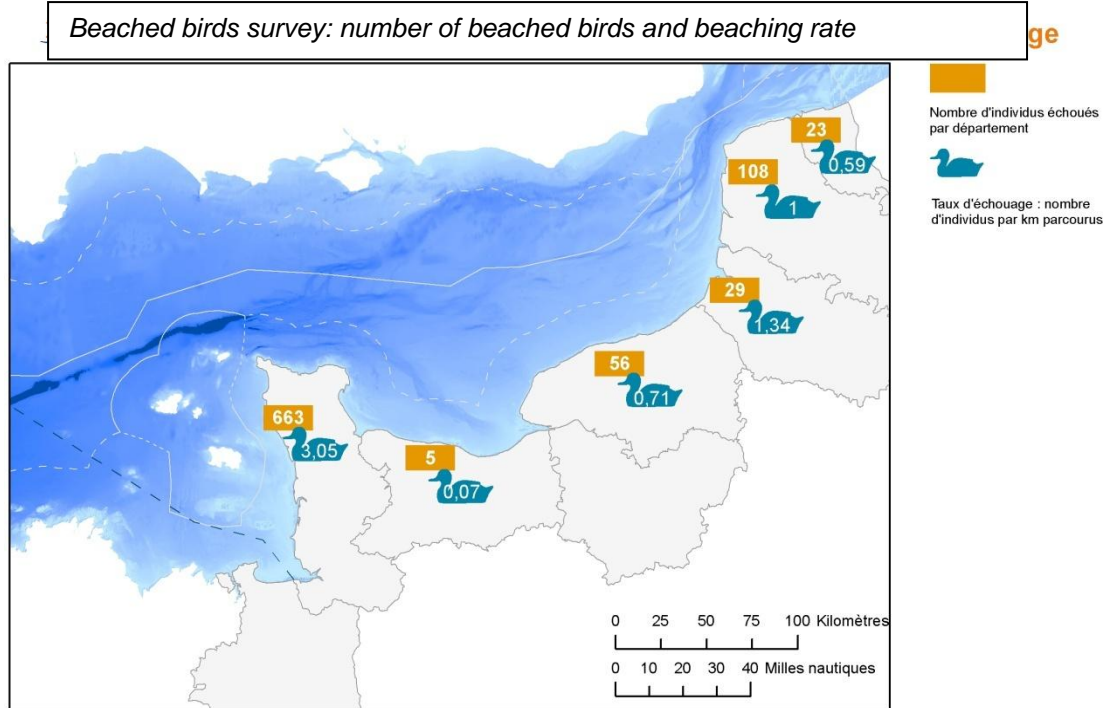
Table 11. Summary of results of the Beached Birds survey in the Nord – Pas-de-Calais, Picardy and Normandy regions.



Sources des données :
 - Groupe ornithologique normand et nord 2014
 - Délimitations maritimes : Délimitations indicatives et provisoires de l'espace maritime français métropolitain (d'après données du SHOM et de l'IGN pour les limites officielles et des raccords réalisés par l'Agence des aires marines protégées), juillet 2008
 - Trait de côte français : Trait de côte Histolitt © IGN-SHOM 2007
 - Bathymétrie : SHOM, Ifremer
 - Villes principales : IGN BD Carto

Système de coordonnées : Lambert 93 / RGF 93 / IAG GRS 1980

Figure 4. Map of the coast covered in the Nord – Pas-de-Calais, Picardy and Normandy regions



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 - Groupe ornithologique normand et nord 2014
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 - Villes principales : IGN BD Carto

Système de coordonnées : Lambert 93 / RGF 93 / IAG GRS 1980

Figure 5. Map of results of the Beached Birds survey for the Nord – Pas-de-Calais, Picardy and Normandy regions

2.2.2. EcoQO Fulmar-Litter and EcoQO Oiled-Guillemots monitoring studies

Picardy

A total 74.1 km of coastline were covered by PN for the EcoQO Fulmar-Litter and Oiled-Guillemots studies presented by area in the table below (Table 12):

Code	MPA sector	Area	No. of km covered
Pic02	From Routhiauville headland to the new headland	From Authie bay to Quend-Plage marina	6.5
Pic04	Bottom of the Bay of Somme	From La Maye car park to Crotoy marina	2.9
Pic05	From Le Hourdel headland to Cayeux lighthouse	From Le Hourdel headland to Le Hourdel blockhouse	11.8
		From Le Hourdel blockhouse to Cayeux-sur-Mer lighthouse	
Pic06	From Cayeux-sur-Mer lighthouse to the entrance to	From Cayeux lighthouse to the casino in Cayeux-sur-Mer	52.9

Mers-les-Bains	From the Casino in Cayeux-sur-Mer to the Hâble d'Ault reserve	
	From Hâble d'Ault to the Ault marina	
	Cliffs between Mers-les-Bains and Ault	
	TOTAL	74.1km

Table 12. Coastline covered for the Picardy region

- EcoQO Fulmar Litter

No dead Fulmar was found on the Picardy coast.

- EcoQO Oiled Guillemots

During the EcoQO Oiled-Guillemots study, 13 dead bodies were collected on the coasts of Picardy and autopsied. The bodies were generally found incomplete: the head was missing from 3 individuals, and at least one foot was missing from 4 individuals; only 5 individuals were in a recent state. Most of the Guillemots were found on 26 February with signs of undernutrition no doubt due to difficulties feeding in bad weather conditions.

Following the autopsy, several potential causes of death were identified:

- Oil: 2 individuals (maybe not directly victims as the bodies were in a state of decomposition or showed signs of weakness due to the storms),
- Absorption of toxic products or another non-identified substance: 6 bodies (but also suffering undernutrition that can be caused by storms),
- Storms: 9 bodies (but atrophied pectorals and empty stomachs).

The beaching rate was then calculated using the formula (1). Example of calculation: 13 birds / 74.1 km = 0.18 birds/km:

Beaching rate calculation (bird/km)	
Total	0.18

Table 13. Beaching rate of the Guillemot in the Picardy region

Number of Oiled Guillemots	% of oiled birds
2	15.4

Table 14. Percentage of oiled Guillemots in the Picardy region.

Out of the 13 Guillemot bodies, two were therefore found oiled, i.e. 15% of oiled Guillemots for winter 2013-2014 on the coasts of Picardy. The maximum threshold of 10% of oiled Guillemots tolerated to suggest the good status of marine waters is therefore exceeded for winter 2013-2014 on the coasts of Picardy.



Normandy

A total 805 km of coastline were covered by the GONm as part of the EcoQO Fulmar-Litter and Oiled-Guillemots studies, with 342.75 km for Seine-Maritime, 115.5 km for Calvados and 346.8 km for the Manche department. These distances can also be divided up between the sample areas covered seven times (371 km) and the additional areas (434 km) subsequently added.

Code	Sample areas	No. of km covered
Seine-Maritime		
HNO04	From Saint-Aubin-sur-Mer to Quiberville From Saint-Valéry-en-Caux to Veules-les-Roses	
HNO08	From Yport to Fécamp	
HNO09	From Octeville-sur-Mer to Saint-Jouin-Bruneval	
	TOTAL	252km
Calvados		
BNO04	From Villers-sur-Mer to Bénerville	
	TOTAL	49km
Manche		
BNO17	From Quinéville to Saint Marcouf	
BNO22	Anse de Vauville (cove)	
	TOTAL	70Km
Normandy	TOTAL	371Km

Table 15. Coastline covered, details of the sample areas for the Normandy region

Department	Sample areas (No. of km covered)	Additional areas (No. of km covered)	TOTAL
Seine-Maritime	252	90.75	342.75km
Calvados	49	66.5	115.5km
Manche	70	276.8	346.8km
Normandy	371km	434km	805km

Table 16. Summary of the coast covered per department in Normandy, per sample area and per additional area

- EcoQO Fulmar Litter

Only one individual was picked up on 25 November 2013 on the Normandy coast, on the East coast of Cotentin in the Manche department and more precisely in the AAMP area no. BNO17.

Description of the bird

The bird found was a male in its second year (identified by an analysis of gonad development). The body was recent and the head was missing; the muscle mass was reduced; coverts and down were missing on the left side and the internal organs were in good condition.

Stomach content

Various substances were found in the Fulmar's stomach weighing approximately 1g: coverts and down, industrial grease, industrial plastic, household plastic, polyurethane foam, polypropylene, glass, gravel and wood. The elements of definite human origin were the most represented on the whole. The Fulmar's stomach contained 17 items of plastic waste and other petroleum derivatives, plus the industrial grease.

Probable cause of death

The ingestion of down and coverts after cleaning its feathers soiled by industrial grease (oil) led to the formation of a large, dense knot due the mechanical effect of the gizzard; the bird can neither digest nor regurgitate this knot. This obstruction of the gizzard renders the assimilation of solid foods difficult. The bird therefore probably died of starvation. Another probable cause can however be identified: the missing head might suggest an incidental catch by fishing gear.

- EcoQO Oiled Guillemots

During the EcoQO Oiled-Guillemots study, 288 dead bodies were found on the coasts of Normandy distributed geographically across the three departments as shown below (Table 17):

Total per department	
Seine-Maritime	24
Calvados	0
Manche	259
Normandy	283 beached Guillemots

Table 17. Distribution of beached Guillemots for the Normandy region

The beaching rate was calculated using the formula (1). Example of calculation: 24 birds / 342.75 km = 0.07 birds/km:

Beaching rate calculation (birds/km)	
Seine-Maritime	0.07



Calvados	0.00
Manche	0.75
Normandy	0.35

Table 18. Beaching rate for the Guillemot in the Normandy region

Through the study, 176 bodies were picked up to be analysed: 21 in Seine-Maritime and 155 in the Manche department.

Following the autopsy, several potential causes of death were identified:

- No body was found completely covered in oil.
- 11 bodies had external and/or internal traces of oil (Table 19).
- General exhaustion of the organism appears to be the main cause in the Western Manche with, in particular, 37 bodies linked to drowning, including one individual showing signs of being caught by fishing gear.
- A state of undernutrition in the Eastern Manche.
- Furthermore, the stomachs collected did not contain any food.

Oil-related mortality (analyses on 176 bodies)

Area	No. of beached birds	No. with external traces of oil	% with external traces of oil	No. with internal traces of oil	Total no. with traces of oil	% oiled guillemots
West Cotentin	155	7	4.52	6	11	7.10
East Cotentin	0	0	0	0	0	0
Calvados	0	0	0	0	0	0
Seine-Maritime coast	21	7	33.33	1	8	38.10
TOTAL	176	14	7.95	7	19	10.80

Table 19. Percentage of oiled Guillemots in the Normandy region.

Only the Seine-Maritime coast has a rate of mortality caused by oil which can be considered very poor (>10%)

Summary of the EcoQO Oiled-Guillemot studies

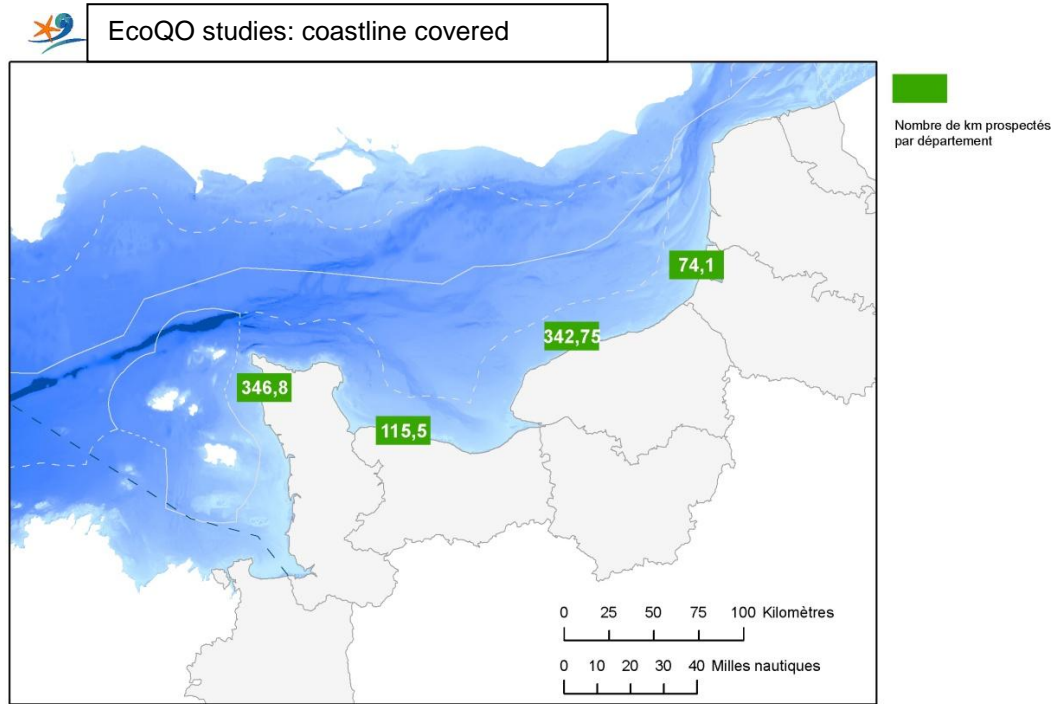
		No. of kilometres covered	No. Guillemots	Beaching rate
Picardy	Somme	74	13	0.18
Normandy	Seine-Maritime	342.75	24	0.07
	Calvados	115.5	0	0.00
	Manche	346.8	259	0.75

Table 20. Summary of the beaching rates of the EcoQO Oiled-Guillemots studies in the Picardy and Normandy regions.



		No. of Guillemots analysed	No. of oiled Guillemots	% of oiled birds
Picardy	Somme	13	2	15.4
	Seine-Maritime	21	8	38.10
Normandy	Calvados	0	0	0.00
	Manche	155	11	7.10

Table 21. Summary of percentages of oiled Guillemots in the EcoQO Oiled-Guillemots studies in the Picardy and Normandy regions.



Sources des données :
 - Groupe ornithologique normand et nord 2014
 - Délimitations maritimes : Délimitations indicatives et provisoires de l'espace maritime français métropolitain (d'après données du SHOM et de l'IGN pour les limites officielles et des raccords réalisés par l'Agence des aires marines protégées), juillet 2008
 - Trait de côte français : Trait de côte Histolitt © IGN-SHOM 2007
 - Bathymétrie : SHOM, Ifremer
 - Villes principales : IGN BD Carto

Système de coordonnées : Lambert 93 / RGF 93 / IAG GRS 1980

Figure 6. Map of the coast covered in the Picardy and Normandy regions

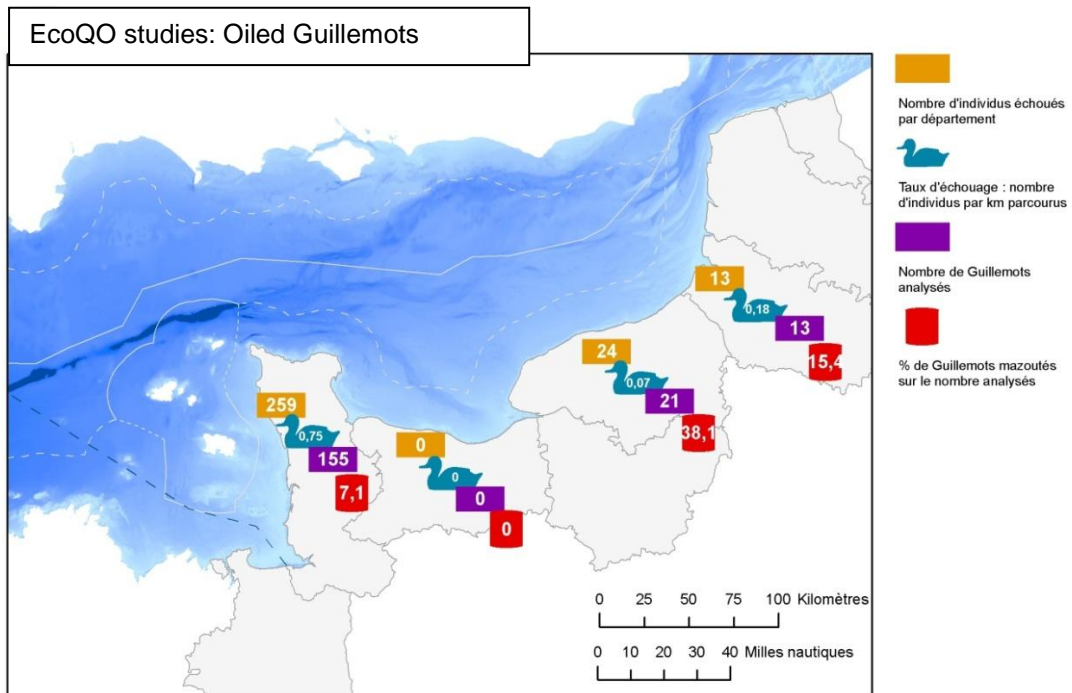


Figure 7. Map of results of the EcoQO Oiled Guillemots study for the Picardy and Normandy regions

III. From survey to indicator

3.1. Temporal evolution

Nord – Pas-de-Calais

In the Nord – Pas-de-Calais region, 43 years of surveys mean that the disparity of results over these coasts can be analysed. The period from 1983 to 1985 was marked by a high mortality (beaching rate of 12 to 13) and exceptional numbers were recorded in 1991 and 2003: respectively 3,942 and 3,130 beached birds (beaching rate of 52 and 41 birds per km). 2014 can thus be regarded as a year with an extremely low mortality rate, with 131 beached birds listed, i.e. 0.89 birds per km (0.59 birds per km for the Nord department, 1 bird per km for the Pas-de-Calais department).

Over the 1969-2011 period, two thirds of deaths (69%) have no identified connection with any human activities whatsoever; one third can be explained by oil pollution (26%) and hunting (5%). The OSPAR Convention sets the critical threshold at 10%, so a poor status is thus confirmed for this period.

In 2003, the high mortality was due to the oil spill off the coast of Dunkirk following the sinking of the *Tricolor* (oiled birds). Oil pollution is the main cause identified, but there is reason to believe that, following the harsher sanctions on oil dumping (Law of 3 May 2001), it has significantly dropped since the early 2000s (excluding the disaster in 2003).

Causes having no identified connection with human activities can be due to climate conditions (cold spells, windy periods) leading to malnutrition or the development of diseases that weaken the birds' organism and eventually cause death. These events can be the cause of a significant portion of the high mortality recorded in some years. Most of the spells of very cold weather (1969 to 1971, 1973, 1979, 1981, 1983-1987, 1991) have an average mortality of 11.3 birds per km, which is approximately two times the average recorded over the four decades of monitoring (Gon & Ward A, 2011). The results for 1991 are unusual with a great diversity of species and approximately 60% of beached birds belonging to land species (mainly passerines). These two characteristics can be linked to the cold weather in January and February 1991 (Raevel, 1992). In 2014, probable causes of death could be identified for a few cases and are related to oil, shooting and one catch in a fishing net. For the Alcidae, no evidence of undernutrition was found. Conditions at sea were not, furthermore, very bad, but a significantly rough sea was recorded on 23 February.

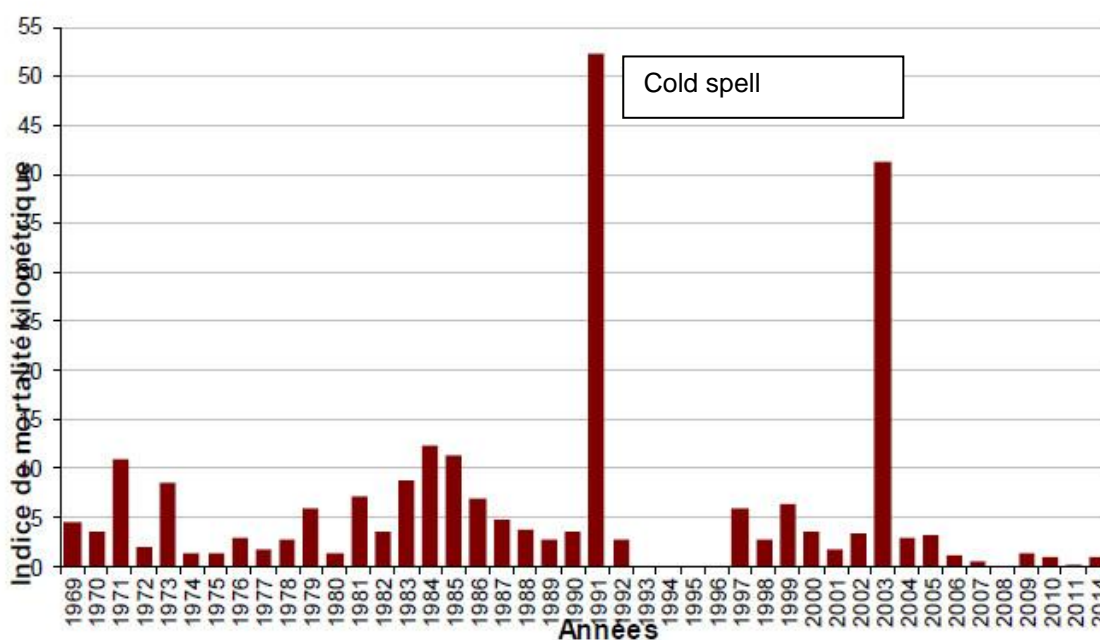


Figure 8. Variation in the average number of beached birds found per kilometre on the coast of Nord – Pas-de-Calais from 1969 to 2014 (according to Le Guillou et al., 2014)

Picardy

The information available about the surveys and studies conducted in the Picardy region comes from articles published in the *Avocette* (nature review by Picardie Nature) and data for certain years.

An exceptionally high mortality was noted in 1991 following a cold spell in January and February (Raevel, 1992). Around Authie Bay, the beaching rate was 273.5 birds per km and around the Bay of Somme, 78.7 birds per km. Approximately 75 to 93% of birds belonged to families of land birds (particularly passerines). That year, 502 Common Guillemots were found.

Mortality was also high in 1999, with 665 beached birds (i.e. approximately 4.8 beached birds per km) including 309 Common Guillemots and 31 Northern Fulmars.

In 2000, 428 birds were found on the coasts (i.e. approximately 2.9 beached birds per km) including 326 in January and February which is no doubt due to the storms that occurred at the end of 1999. The number of Guillemots was 109 (mainly in January and February) and 5 Fulmars were found. The causes of death are unknown for the most part (approx. 60%). Oil (27%) nonetheless accounts for a substantial portion particularly in the areas south of the Bay of Somme and is believed to be linked to the sinking of *Erika* in December 1999; the threshold of 10% is therefore exceeded, and the poor status is thus confirmed for the year 2000. Death by shooting represents 4% and concerns several protected species (fishing activity is not mentioned).

In 2004, 377 birds were found beach-washed (i.e. approximately 3 beached birds per km) of which 63% in January and February. Common Guillemots accounted for 13% of those found (49 birds, i.e.

0.4 birds per km) and the Northern Fulmar represented 2% (7 bodies, i.e. 0.1 birds per km). Causes of death are mainly unknown (85%). Oil represents a percentage by no means insignificant (13%) and mainly affects Guillemots. The poor status is once again confirmed for 2004. Deaths caused by shooting and fishing are more difficult to assess.

Over the period from 1970 to 1985, information is available about the Common Guillemot and the Northern Fulmar. 94 Fulmars were found with a record number of 12 Fulmars in February 1984 whose deaths are thought to be due to a long period of storms. Over the 1967 to 1989 period, 2,672 Common Guillemots were found and among the identified causes of death of human origin, 98% were oil-related, particularly in 1981. The birds were mostly found outside the major "oil spills" of which the public is aware, and are thought to have died as a result of oil dumping, or problems on rigs. The proximity of the Antifer oil port built at the start of the '70s and of coastal rivers could also be a significant source of oil.

In 2014, a small number of bodies was found, with 1.16 birds per km compared to 3 birds per km in 2000 and 2004. The portion of beached Common Guillemots was also very low, with 0.18 birds per km in 2014 vs. 2.7 and 0.4 birds per km in 2000 and 2004 (13 beached birds in 2014 compared to 678 in 1981, 502 in 1991 and 309 in 1999). The Guillemot does not therefore appear to suffer from exceptionally high mortality on the coasts of Picardy in 2014.

The Northern Fulmar also sustained fewer deaths in 2014, as no body was picked up. In 1999, 31 Fulmars had been found, 5 in 2000 and 7 in 2004.

In 2014, several causes of death were identified/suspected: storms, fishing and oil pollution. As part of the EcoQO Oiled-Guillemot study carried out in 2014, 15% of the 13 guillemots had traces of oil, so the poor status is once again confirmed.

Normandy

In Normandy, the results on the coasts can be analysed thanks to 40 years of surveys (Figure 9). We can see that the 1983-1984 period and 1991 have high beaching rates (4.4 birds per km). The year 2014 has a lower beaching rate (1.97 birds per km), but winter 2013-2014 is still however the worst winter over the last decade, in terms of number of deaths. Furthermore, this beaching rate places winter 2013-2014 in twelfth position in 42 years.

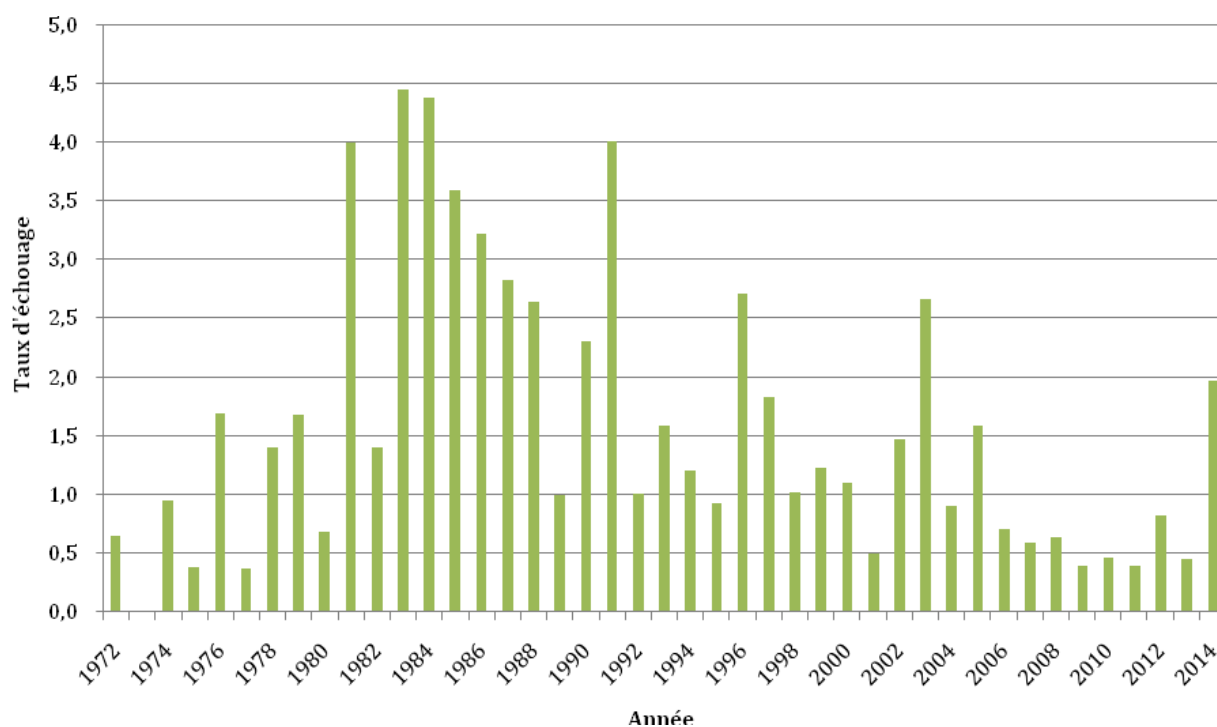


Figure 9. Beaching rate by year (according to Le Guillou et al., 2014)

In 2014, in Normandy, a higher beaching rate can be noted in the Manche department (3.05 birds/km) than in Calvados (0.07 birds/km) and Seine-Maritime (0.71 birds/km).

The rate of oiled birds remained relatively high during the survey period, with however, a significant drop in recent years. This comparison again suggests that measures taken in respect of oil shipping and sanctions on oil dumping are increasingly effective.

In 2014, 7.95% of analysed bodies of Common Guillemots had external traces of oil and 10.80% had external and/or internal traces. The Oiled-Guillemots indicator objective of less than 10% therefore appears to be achieved for Normandy on the whole, despite a very poor indicator for Seine-maritime (38%).

The calculation of the Fulmar-Litter indicator shows 100% of birds with plastic particles in their stomach but this indicator must be put into perspective as only one body was found and analysed.

These results show that the indicators are meaningful over the long term.

3.2. Discussion

Beached Birds Survey

The surveys conducted provide insights into actual mortality. The surveys are indeed conducted over short, or very short periods (2 days for the beached birds survey), and many dead bodies disappear before they are counted (eaten by predators, sunk, covered with sand, water marks). The results are therefore most certainly underestimated. They do however, reveal some trends concerning the winter mortality of seabirds on the Channel North Sea seaboard, and demonstrate the

significant impacts of natural or human-induced events in the sub-region. The localised nature of the beachings also underlines the significant role that currents play in the visibility of the phenomenon.

The beached birds survey conducted in February 2014 shows that the beaching rates are relatively low on the Channel North Sea coast, ranging from 0.07 birds per km covered along the very sheltered coasts of Calvados to 3.05 on the west coast of Cotentin. Beaching rates are much lower than in the past even though, this year, Normandy posted a sad record for the last decade.

The high beaching rates reached on the Atlantic coast between February and March 2014 further to the numerous winter storms (average rate of 15.77 with thresholds ranging from 5.63 to 29.85 - Farque *et al.*, 2014) are therefore not found in the Channel North Sea marine sub-region. The impact of these Atlantic storms does however affect the Channel North Sea marine sub-region with Normandy reaching the highest beaching rate since 2003 and the coasts the most exposed to the westerly winds recording the highest rates which decrease with distance from the Atlantic seaboard (3.05 in West Cotentin, 1.16 in Picardy, and 1 in Pas de Calais).

It is therefore important to consider weather conditions when analysing results, as they are one of the main natural causes of death of beached birds found in 2014 (very difficult sea conditions inducing great energy-consuming efforts and difficulty reaching feeding areas that provide energy).

Now, winter 2014 was marked by a series of storms and atmospheric disturbances coming from the Atlantic. Strong winds (mainly westerly and south-westerly) and storms hit almost the entire country and particularly the Atlantic and Channel coasts; in particular, on 14 and 15 February 2014, storm "Ulla" off the coast of Brittany was the most violent all winter with wind speeds exceeding 150 km/hr on the coasts (Météo-France, 2014).

The analysis of the beached species collected during the annual survey at the end of February shows that Alcidae are very much in the majority across the entire seaboard: they are one of the three predominant species in the three regions with percentages close to 40% for the Razorbill in Normandy and Nord – Pas-de-Calais (19% in Picardy) and 30% for the Common Guillemot in Normandy and Picardy (10% in Nord – Pas-de-Calais). Furthermore, the Atlantic Puffin was also exceptionally impacted this year on the west coast of Cotentin. These species that are small in size are exclusively pelagic and quickly suffer from poor conditions at sea. Thus, the stomachs of the guillemots beached on the coasts of Normandy were empty, which corroborates the assumption that they died of exhaustion and the fact they could not reach feeding areas during the storms. The species most frequently found beached in the three regions also include the Herring gull (Nord – Pas-de-Calais), the Northern Gannet (Picardy) and the European shag (Normandy). Laridae are the second most impacted family in general on the Channel North Sea seaboard.

EcoQO Fulmar-Litter study

Only one Northern Fulmar body was found this year across the Normandy and Picardy regions. The cause of death could not be determined for definite, although the presence of a substantial knot containing a high proportion of down and mineral grease suggests that death was

caused by oiled feathers. No conclusion can therefore be drawn from this isolated case, except that the mortality recorded for this species in 2014 is very low (an average of 13 cases a year were counted over the 1972/2007 period in Normandy, of which 27% due to oil (Le Guillou, 2006).

EcoQO Oiled-Guillemot study

The highest oil-related mortality rate is that of the coasts of Pays de Caux (38.1%) followed by the coast of Picardy (15.4%) and the west coast of Cotentin (7.1%). However, the coasts of Calvados, which are relatively sheltered from the dominant westerly winds were not affected. The most impacted coasts (Pays de Caux and Picardy) are located North East of the mouth of the Seine and Antifer oil port. This corresponds to the location of the Seine coastal river which laps the coasts of Seine Maritime, Picardy and then Nord – Pas-de-Calais. Furthermore, we note a decrease in the oil-related mortality rate moving from the coasts of Pays de Caux towards Picardy. It would be interesting to find out whether this rate continued to drop along the coasts of Pas-de-Calais located further North East. We can however wonder whether there is any connection between the presence of the Seine coastal river and Antifer oil port, located upstream from this oil contamination. Several years of monitoring will be needed to confirm or rule out this hypothesis.

3.3. Conclusion and outlook

Despite some implementation difficulties, in terms of regularity and length of the survey period, the beached birds survey and the EcoQO studies provide indications about mortality in winter and bring to light some impacts of both natural and human-induced events. These surveys must be continued with more discipline: they must be repeated every year, with significant engagement of volunteers and exploration of the entire coastline; they must also be done in a coordinated manner across the whole marine sub-region. Switching to a two-week interval and finding better solutions for marking the bodies would ensure better monitoring of variations in mortality. These leads will improve knowledge in this area and give us a better understanding of bird wintering patterns at sea.

Some adjustments to the surveyed areas should be considered. Some are dangerous and far from ideal for finding bodies, such as the foot of the cliffs located between Mers-les-Bains and Ault in Picardy for example. Others, however, should be covered systematically as many observations are possible (substantial deposits of marine debris), such as the Hâble d'Ault area in Picardy. Priority areas should not be changed from one year to the next.

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Appendices

Appendix 1

Predicted areas for each region for the Beached Birds survey

Region	Area	Km of coast
Nord-Pas-de-Calais	From the Belgian border to the mouth of the Aa	39
	From the mouth of the Aa to Cap Blanc Nez	37
	From Cap Blanc Nez to Cap Gris Nez	12
	From Cap Gris Nez to Audresselles	5
	From Audresselles to Le Portel	17
	From Le Portel to Hardelot	8
	From Hardelot to the mouth of the Canche	9
	From the mouth of the Canche to Merlimont	10
	From Merlimont to the mouth of the Authie	10
Picardy	From Le Hourdel headland to Le Hourdel blockhouse	1,4
	From Le Hourdel blockhouse to Cayeux-sur-Mer casino	5.9
	From Cayeux-sur-Mer casino to the Hâble d'Ault reserve	2.3
	From Hâble d'Ault to Ault marina	6.3
	Cliffs between Mers-les-Bains and Ault	6.6
	From Authie bay to Quend-Plage marina	6.5
	From La Maye car park to Crotoy marina	2.9
Normandy	From Beauvoir to Granville	20
	From Granville to Barneville-Carteret	37
	From Barneville-Carteret to Auderville	21
	From Auderville to Gatteville-le-Phare	26
	From Gatteville-le-Phare to Les Veyes	30
	From Osmanville to Courseulles-sur-Mer	29
	From Courseulles-sur-Mer to La Rivière-Saint-Sauveur	32
	From Le Havre to Fécamp	27
	From Fécamp to Veules-les-Roses	25
	From Veules-les-Roses to Le Treport	28



Appendix 2

Predicted areas for each region for the EcoQO monitoring study

Region	Area	Km of coast
Picardy	From Le Hourdel headland to Le Hourdel blockhouse	1.4
	From Le Hourdel blockhouse to Cayeux-sur-Mer casino	5.9
	From Cayeux-sur-Mer casino to the Hâble d'Ault reserve	2.3
	From the Hâble d'Ault to the Ault marina	6.3
	Cliffs between Mers-les-Bains and Ault	6.6
	From Authie bay to Quend-Plage marina	6.5
	From La Maye car park to Crotoy marina	2.9
Normandy	Vauville	2
	From Quinéville to Saint Marcouf	5
	From Villers-sur-Mer to Bénerville	4
	From Yport to Fécamp	5
	From Saint-Valéry-en-Caux to Veules-les-Roses	6
	From Saint-Aubin-sur-Mer to Quiberville	5





PANACHE

Protected Area Network Across
the Channel Ecosystem

PANACHE is a project in collaboration between France and Britain. It aims at a **better protection** of the Channel marine environment through the **networking** of existing marine protected areas.

The project's five objectives:

- **Assess** the existing marine protected areas network for its ecological coherence.
- **Mutualise** knowledge on monitoring techniques, share positive experiences.
- **Build** greater coherence and foster dialogue for a better management of marine protected areas.
- **Increase** general awareness of marine protected areas: build common ownership and stewardship, through engagement in joint citizen science programmes.
- **Develop** a public GIS database.

France and Great Britain are facing similar challenges to protect the marine biodiversity in their shared marine territory: PANACHE aims at providing a **common, coherent and efficient reaction**.

PANACHE est un projet franco-britannique, visant à une **meilleure protection** de l'environnement marin de la Manche par la **mise en réseau** des aires marines protégées existantes.

Les cinq objectifs du projet :

- **Étudier** la cohérence écologique du réseau des aires marines protégées.
- **Mutualiser** les acquis en matière de suivi de ces espaces, partager les expériences positives.
- **Consolider** la cohérence et encourager la concertation pour une meilleure gestion des aires marines protégées.
- **Accroître** la sensibilisation générale aux aires marines protégées : instaurer un sentiment d'appartenance et des attentes communes en développant des programmes de sciences participatives.
- **Instaurer** une base de données SIG publique.

France et Royaume-Uni sont confrontés à des défis analogues pour protéger la biodiversité marine de l'espace marin qu'ils partagent : PANACHE vise à apporter une **réponse commune, cohérente et efficace**.

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