Marine birds survey and marine protected areas monitoring in the Channel

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PANACHE

Monitoring

Protected Area Network Across the Channel Ecosystem

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Prepared on behalf of / Etabli par

by / par

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Within the framework of / dans le cadre de

PANACHE
Protected Area Network Across the Channel Ecosystem

Work Package 2

Work quotation: Mannaerts, G., Booker, H., Aulert, C. 2014. Marine birds and MPA monitoring. Report established by the RSPB and the 'Agence des aires marines protégées for the Protected Area Network Across the Channel Ecosystem (PANACHE) project. Project founded by the INTERREG France (Channel) – England (2007 – 2013) program, 53 pp.
Cover photo : C. Lefeuvre / Agence des aires marines protégées

This publication is supported by the European Union (ERDF European Regional Development Fund), within the INTERREG IVA France (Channel) – England European cross-border co-operation programme under Objective 4.2. "Ensure sustainable environmental development of the common space" - Specific Objective 10 "Ensure balanced management of the environment and raise awareness about environmental issues".
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Suivi des oiseaux marins et des aires marines protégées dans la Manche

ABSTRACT

Seabirds are at the top of the marine food chain and are therefore an essential part of the functioning of marine ecosystems and can be used to assess the environmental status of the marine environment. They are an integral part of the protective measures taken by the European Union, through the OSPAR Convention, the Marine Strategy Framework Directive (MSFD) and Natura 2000.

This study wished to develop to develop a harmonised approach to assessing bird numbers and their state of conservation, and to to gain a greater understanding of the numbers and distribution of seabirds within and around MPAs and to help determine issues affecting birds that will guide management requirements for MPAs.

KEYWORDS: .....

RÉSUMÉ

Les oiseaux marins se trouvant au sommet de la chaîne alimentaire marine, ils jouent un rôle essentiel dans le fonctionnement des écosystèmes marins et peuvent être utilisés pour évaluer le statut environnemental du milieu marin. Ils font partie intégrante des mesures de protection prises par l'Union européenne par le biais de la Convention OSPAR, de la Directive-cadre « stratégie pour le milieu marin » (DCSMM) et de Natura 2000.

Cette étude a souhaité développer une approche harmonisée de l'évaluation des effectifs et obtenir une meilleure compréhension des effectifs et de la distribution des oiseaux marins au sein et autour des AMP et déterminer les problèmes affectant les oiseaux qui orienteront les exigences de gestion des AMP.

MOTS-CLÉS : ….

Acknowledgements

The RSPB would like to thanks, for wintering surveys: Chris Townend, Nigel Hewitt, John White, Rob Macklin, Mike Langman, Doug Cullen, Tony Richardson and Kevin Rylands; for Kittiwake surveys: Chris Townend, Liz Harris, Steve Henry, Nigel Hewitt, John White; and for guillemot survey: Noel Hughes and the Torbay Coast and Countryside Trust volunteers.

The French Marine protected areas would like to thanks all the partners of the Channel marine birds observatory: the Groupe Ornithologique et Naturaliste du Nord-Pas-de-Calais, Picardie Nature, Bretagne Vivante, the Groupe Ornithologique Normand, GEOCA, the LPO-7iles and the windfarm consortium WPD.

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2.1 Marine birds protection in the Channel

Seabirds are at the top of the marine food chain and are therefore an essential part of the functioning of marine ecosystems and can be used to assess the environmental status of the marine environment. They are an integral part of the protective measures taken by the European Union, through the OSPAR Convention, the Marine Strategy Framework Directive (MSFD) and Natura 2000.

The OSPAR Convention requires each State to take all the necessary measures to prevent and remove pollution and to protect the marine area. Under OSPAR, a list of threatened or declining habitats and species was established, including certain seabirds (OSPAR, 2007). States are committed to taking measures to protect these habitats and species in the regions in which they are under threat.

The MSFD adopted in 2008, requires each Member State to develop a strategy for the marine environment applicable to its marine waters in order to achieve or maintain good environmental status, including protected areas. It divides the marine area into four regions; for consistency, the scope of the MSFD encompasses the OSPAR convention.

The Natura 2000 network is a set of European sites on land and at sea identified for the rarity or fragility of wildlife species (animal or plant) and their habitats. The network aims to preserve or restore good status of natural habitats and populations of wild species and to avoid disturbances that can impact them. The title "Natura 2000" refers to two kinds of area:

- Special Areas of Conservation (SAC): introduced by the 1992 "Habitats, Fauna and Flora" Directive on the conservation of environmental sites featuring habitats or species of wild fauna and flora of Community interest.
- Special Protection Areas (SPA): introduced by the 1979 "Birds" Directive on the conservation of wild birds.

In the Channel, some SPAs have been identified for seabirds, though these are largely on the French side. Further SPAs are currently being considered in English waters within the Channel, including St Austell bay to Fal Bay psSPA for wintering waterbirds and the Solent and Dorset Coast possible SPA for foraging terns. Considered as marine protected areas (MPA), these Natura 2000 sites are sometimes overlapped with an OSPAR designation, considering some marine birds

In England, Marine Conservation Zones (MCZs), designated under the Marine and Coastal Access Act (2009) cannot currently be designated for seabirds. However, there are MCZs with seabird interest where the PANACHE project can help identify issues and management opportunities to guide the protection of seabirds in these areas and to inform further designations.

In France, there are 28 existing MPAs for seabirds, including some offshore sites for foraging birds (e.g. Banc de Flandres). There are eight Nature Reserves focusing partially on marine birds (St Brieuc, Iroise, Sept Iles, Sillon de Talbert, Bay of Somme, Seine Estuary, Platier d'Oye, Beauguillot, Baie de Canche) and two *Arrêtés Préfectoraux de Protection du Biotope*. Marine birds are also part of the protection afforded through the *Parc Naturels Marins*.

2.1 Rationale

The purpose of the seabird case study led into the PANACHE project is to increase the level of survey of seabirds in and around Channel MPAs, to gain an up to date picture of numbers and productivity on both sides of the Channel in the same time frame. There are advantages in this approach which allows a co-ordinated health check of Channel seabirds. Not all seabirds can be assessed within the PANACHE project so a selection of sites and species were chosen that represent the range of MPAs and help inform the management of those sites. The case study has two key aims:

- To develop a harmonised approach to assessing breeding and wintering bird numbers (and their state of conservation) across a sample of Channel MPAs and surrounding areas.

- To gain a greater understanding of the numbers and distribution of seabirds within and around MPAs and to help determine issues affecting birds that will guide management requirements for MPAs.

To meet these aims, the following objectives have been developed:

Objective 1 (a): Survey of breeding success and functionality at colonies of kittiwake (OSPAR priority species) (England and France)

Objective 1(b): Survey of breeding success of terns, shags and great cormorants (France)

Objective 2: Survey of guillemot colonies and interactions with sea users (England)

Objective 3: Survey of wintering divers and grebes inside and around MPAs (England and France)

In addition to this case study, the creation of the Marine Bird Observatory was initiated in 2014 for the Channel-North Sea marine sub-region. This initiative is led by the French MPA Agency (*Agence des Aires Marines Protégées*) in partnership with NGOs, managers and scientists, to coordinate and centralise the data from the various surveys.

There are several aims:

- Set up long-term monitoring of marine bird populations to gain a better understanding of the biological and demographic functioning of these populations with a view to preserving the natural heritage and maintaining biodiversity.
- Have complementary methods from national markets that respond to issues in the sub-region.
- Think in terms of MPA network with nesting of scales (sites, regions, sub-region, national, international).
- Introduce relevant indicators and metrics in order to complete the MPAs' dashboards.
- Set up monitoring initiatives that meet requirements under the OSPAR convention, the Birds Directive and the MSFD: Descriptor 1 (Biodiversity is maintained), Descriptor 4 (Elements of food webs ensure long-term abundance and reproduction), Descriptor 8 (Concentrations of contaminants give no effects), Descriptor 10 (Marine litter does not cause harm)
- Pool resources by creating a network of observers (managers, scientists, NGOs).

But above and beyond the monitoring and surveys conducted, the aim is to have a shared database that everyone can use.

To fully complete the approach, it would be necessary to extend this observatory to all Channel and North Sea waters on either side of the French-English border. The PANACHE project aims to lay the foundations by implementing monitoring and surveys of marine and coastal birds on both sides of the Channel.

II. Methodology

This case study investigates a number of different species, some in the breeding season and others in winter. There are published methods for monitoring seabird populations, and these have been applied on both sides of the Channel.

For the survey of wintering birds, there are some minor differences in methods between France and England based on the scale of the survey, for example in France, a greater area of coast was surveyed, amounting to 1400 km, compared to 26 km in England. This is partially due to the fact that while in England RSPB was responsible for the whole survey, in France the survey was spread between several local NGOs.
For the survey of nesting birds, methodologies published by JNCC (GISOM in France) provide detailed guidance and monitoring forms for assessing populations and breeding success of seabird species (Walsh et al 1995). Additionally, with the advancement of new technologies, the ability to track where breeding seabirds forage is enabling assessments of how birds use the sea, favoured areas, distances travelled, and therefore building understanding of the pressures faced. This greater knowledge should help the further designation of MPAs and the management of classified sites.

Methodology is outlined for each of the objectives in turn.

2.1. Objective 1 (a). Kittiwake (Rissa tridactyla) monitoring.

2.1.1. Kittiwake breeding study

The JNCC Seabird Monitoring Handbook (Walsh et al 1995) in England and the documents published by the GISOM in France were used for colony counts and assessments of breeding success at all colonies. Both are based on the same techniques.

Kittiwakes breed between May and July. An initial visit to the breeding colony was undertaken in late May or early June with a count of Apparently Occupied Nests (AON). Nests taken into account are the ones totally finished, even if no eggs are laid later on. This allows an estimate of the breeding population.

A second visit was undertaken mid-July (or a little earlier depending on the surveys conducted in June) across the entire colony (or a representative sample) to count the chicks. This allows juvenile production to be studied (average number of juveniles per breeding couple). It includes all observable juveniles, including those only a few days to a few weeks old on the date of the last visit. The breeding success rate is calculated based on the same observations, like the percentage of couples raising at least one fledgling.

2.1.2. Kittiwake tracking study.

In addition to monitoring the colonies, three sites in France were studied by telemetric tracking. This study aims to determine the preferred habitats of kittiwakes in these colonies by studying the routes travelled and the phases of activity.

The individuals were caught using nets installed vertically along the cliffs using stretched ropes or poles. 15 adult birds per site were equipped with Ecotone Uria-type GPS loggers (remotely downloadable).

2.2 Objective 1 (b) Survey of shags, great cormorants and terns

2.2.1. Shags (Phalacrocorax aristotelis) breeding study

The survey of shags was conducted on 19 colonies on the French shoreline of the Channel-North Sea marine sub-region in 2014. The best time of year to survey colonies is the end of April (with an inter-annual variability of a few weeks).

The survey of breeding birds is based on a count of Apparently Occupied Nests (AON) either directly at the colony (island colonies), or remotely (colonies on cliffs), depending on sighting conditions.

Certain sites were monitored more thoroughly to analyse juvenile production (average number of fledglings per breeding couple): these colonies were monitored from the end of April to mid-July (two colonies were visited as of the end of February/March) with a number of visits ranging from three to six.

Nests monitored for production are numbered and mapped and the content of accessible nests is recorded at each visit, with an estimation of the age of the brood, or the adult's activity is noted if the content of the nest is not visible (brooding parent or not). In cases in which a nest-by-nest survey was not possible, an overall assessment of the number of fledglings was made on the entire colony. (Cadiou et al. 2009, Geoca 2014).

In addition to the counts, fresh pellets were retrieved, when available, in order to gather information about diet through subsequent analyses.

2.2.2. Great Cormorants (*Phalacrocorax carbo*) breeding study

Seventeen colonies of great cormorants were monitored between Brittany and Normandy during the 2014 breeding season, from January to July.

The size of the population is measured by counting Apparently Occupied Nests (AON), and can be updated by a second visit to the same site at least one month later.

Several visits were made to nine sectors to count the number of juveniles and measure productivity. These counts were made difficult by disturbance caused by visits to the islands. On the cliffs, however, observation can be done more regularly, but the juveniles are only visible once they are big enough.

2.2.3. Litter in the nests of Shags and Great Cormorants.

The frequency and abundance of litter is assessed both for the nests of shags and great cormorants. When observing nests to count the eggs and chicks, the amount of litter is assessed according to five classes:

Code	Number of items of litter
LØ	No item visible in the nest
L1-5	1 to 5 identified items visible
L6-10	6 to 10 visible items
L11-20	11 to 20 visible items
L20+	More than 20 visible items

Other information can be noted at the same time (fishing line, rope, etc.).

2.2.4. Terns breeding study

The four species of tern found on the Channel-North Sea shoreline of France were monitored in 2014. These are the Sandwich Tern (*Thalasseus sandvicensis)*, the Roseate Tern (*Sterna dougallii)*, the Common Tern (*Sterna hirundo)*, and the Little Tern (*Sternula albifrons*).

As the GISOM protocol recommends, owing to their particular sensitivity, the terns were counted using different methods depending on the context, in order to keep all disturbance to a minimum. Whatever the method (at the colony or remotely), the number of Apparently Occupied Nests (AON) was counted, with the particularity, for these species, that the nests are generally difficult to see and consist solely of slight dips. The counts were done at the end of the incubation period and thus mainly took into account the number of adults in incubation position and the eggs.
Depending on the case, production was studied for the entire colony or a sub-colony, with no nest-by-nest detail, with two counts performed two weeks apart. All the chicks considered to be "potentially produced", and therefore which should normally leave the nest, are counted. These are juveniles that are two to three weeks old, except for the Little Tern for which young birds that are ten to fifteen days old can already be considered.

2.3 Objective 2. Guillemot monitoring.

This part of the case study was delivered with Torbay Coast and Countryside Trust, managers of the Berry Head National Nature Reserve in Devon. A team of volunteers conducted two hour watches over three daytime periods, to cover early morning, mid day and evening. Watches were undertaken three times a week, beginning in May through to fledging time in July. The location of rafting birds was recorded along with the passage of every form of craft passing through the area, whether motorised or manually propelled.

The study took place between 3 May and 17 July 2013. Observations covered the pre-laying and egg-laying periods, incubation, chick-rearing and fledging.

Monitoring of the guillemot colony took place from a safe vantage point approximately 350m from the colony. Observations were conducted using binoculars, telescope and the naked eye.

Observation periods were selected to encompass busy marine periods coupled with observer availability. Each two hour shift was undertaken twice on a Monday, Wednesday and Friday, and three times on Saturday and Sunday, totalling 24 hours per week. Recordings were also taken of weather conditions and sea state using standard JNCC methodology (Walsh et al 1995). No observations were made in heavy rain, fog, or in conditions above Sea State 2.

Observations of vessel entry into a defined study area around the colony were recorded onto pre-prepared sheets. To ensure within-observer and between-observer reliability was consistent, training sessions were conducted and support given.

Craft size (small: <10 ft, medium: 10 - 20 ft, large: >20 ft) and type (Motor boat, fishing boat, sail boat, canoe, windsurfer or specified other) were recorded for each craft track through the study area. Craft speed was calculated by presence of a bow wave indicating a speed greater than 5 knots.

When a craft entered the area, rafts of guillemots were noted, including position and number of individuals. The track of the vessel was noted through the study area and its position noted when a change in the guillemots' behaviour was noted.

A disturbance was defined as causing either "head-bobbing" behaviour (i.e. up and down jerking motions of the head, often done as a group response and often associated with warning and stress) of a bird on the cliff; swimming away, or "flushing" (i.e. partial or complete exodus of guillemots from the cliff or water), or a combination of these (Birkhead 1977, Rojek 2007).

Responses were described as Level 1: head bobbing, swimming away, or Level 2: flushing.

Results were collated and analysed at the end of the season.

2.4 Objective 3. Wintering divers and grebes.

The three species of divers: the Black-throated diver (*Gavia arctica)*, the Great Northern diver (*Gavia immer)* and the Red-throated diver (*Gavia stellata)*, and four species of grebe: the Great Crested Grebe (*Podiceps cristatus)*, the Red-necked Grebe (*Podiceps grisegena)*, the Slavonian grebe (*Podiceps auritus)*, and the Black-necked grebe (*Podiceps nigricollis)*, potentially present in the Channel-North Sea, were monitored in Normandy during winter 2011-2012 (between 20 December

and 20 January) and along the entire French Channel-North Sea shoreline during winter 2012-2013 (between 18 December and 24 January). For the former survey, vantage points were positioned at least every 5 to 6km, whereas in 2012-2013, they were taken every 10 kilometres on average (with a very high variation of up to one point every 40km in Brittany).

In England, between November 2012 and March 2013, a survey of wintering birds was undertaken along part of the South Devon coast, the area that was identified as potentially important during surveys in the mid 1990s (Slade 1996). This survey was a direct repeat of that earlier survey and the area included the Torbay proposed Marine Conservation Zone (pMCZ) and adjacent area. Counts were undertaken approximately every two weeks, but a minimum of once a month between December and March. Eight surveyors were involved in the survey, with each surveyor (or pair) being responsible for a series of survey points and planning their survey in response to the water conditions. Vantage points were spaced to minimise the chance of double counting individual birds.

The same method was used on both sides of the Channel. Observers counted all birds present in an arc around their location, over 1km on either side (in England the behaviour of the bird was recorded as well, whether sitting on the water, feeding, or standing on a rock). Counts were for an initial period of 10 minutes, but with an additional 10 minutes to account for any birds that may have been missed in the initial 10, and even a further 10 minutes if necessary. All sightings were recorded on a recording form, along with details of the weather, time and any human activities operating the area.

By doing these counts inside and outside marine protected areas, the aim is to assess each site's responsibility in relation to the entire population, and the effect of these sites' management over the medium and long term thanks to counts at a regular time interval.

III. Study Sites

3.1. Objective 1 (a). Kittiwake (Rissa tridactyla) monitoring.

There were two sample sites on the English coast, both in SW England; one in Devon (Straight Point) and one in Cornwall (Rinsey Head). Neither site is associated with an existing MPA, however both are important in a SW England context. The rings shown on the map indicate the mean and mean-maximum and maximum foraging ranges for kittiwake (Thaxter et al, 2012).

The Straight Point site could only be viewed effectively from a boat, while the Rinsey Head colony could be surveyed from land.

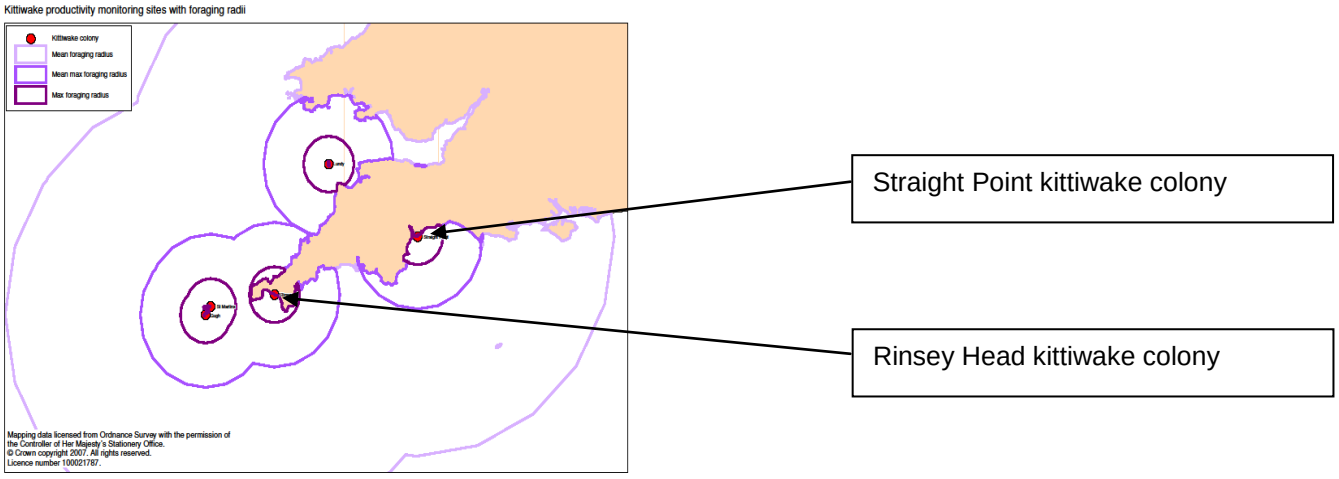

Figure 1: location of kittiwake colonies and monitored sites in SW England

In France, kittiwake breeding was monitored in 2013 and 2014 on six colonies (see map here below) :

- Four cliff colonies in Normandy, monitored by the Groupe Ornithologique normand: Saint-Pierre-du-Mont, Englesqueville-la-Percée, Cap d'Antifer and Cap Fagnet, sites designated SPA)
- Two colonies in the North, monitored by the Groupe Ornithologique et Naturaliste du Nord-Pas-de-Calais: Cap Blanc Nez and Boulogne-sur-mer, spread over several buildings in the urban environment).

Three of them were also monitored by telemetry to study their feeding areas: St-Pierre-du-Mont, Fécamp, and Boulogne-sur-mer.

While the latter colony was studied mainly to find out how the urban colonies use the Estuaires Picards and Mer d'Opale marine nature park with a view to drafting the management plan, the sites in Normandy were studied to meet the need for knowledge about the sufficiency of the MPA network and possible interaction with the Courseulles-sur-Mer and Fécamp offshore wind-farm projects.

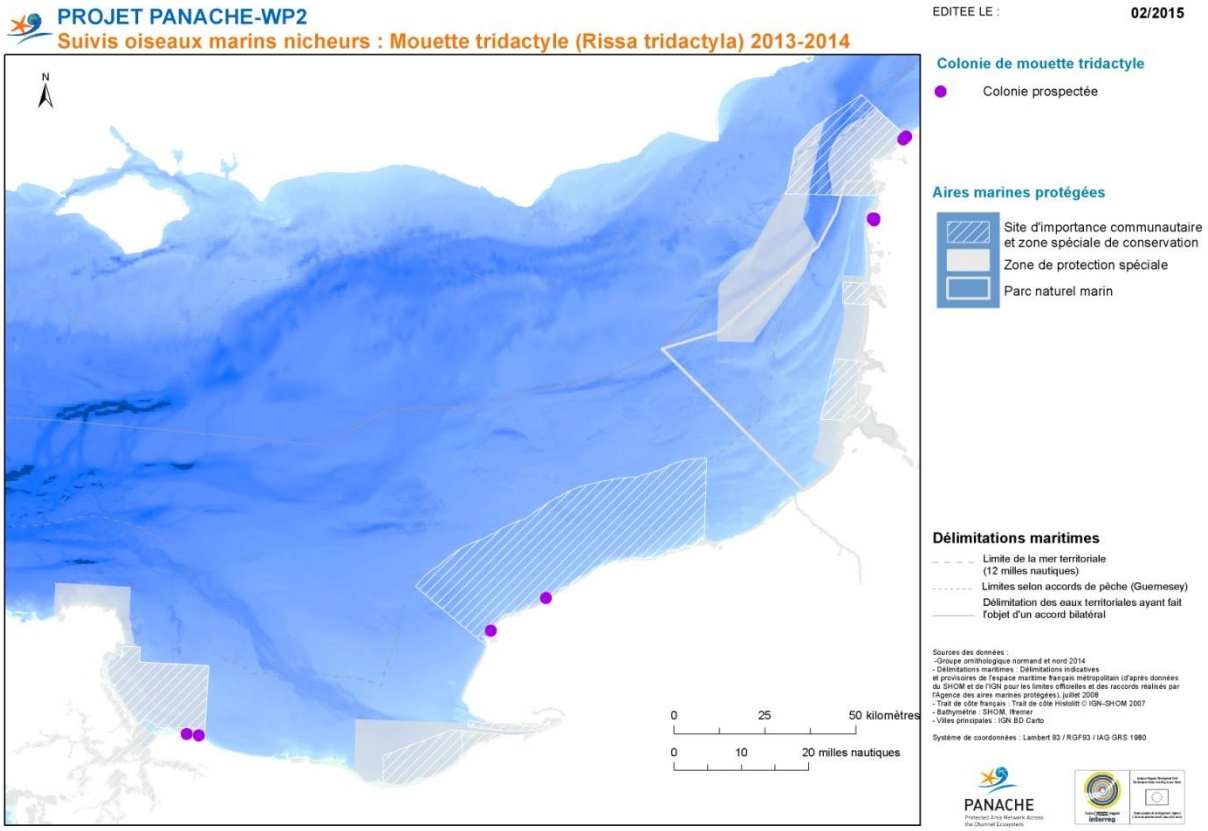

Figure 2. Localisation of kittiwake colonies in Frnace

3.2. Objective 1 (b) Survey of shags, great cormorants and terns

3.2.1. Shags

The survey of the number of shags was carried out on 24 colonies (including 22 in MPAs) on the French shoreline of the Channel-North Sea marine sub-region in 2014 (Figure 3). At the very least, the breeding population is counted (exhaustively or otherwise). In addition, surveys of juvenile production and litter and the collection of pellets were conducted on some colonies (Table 1).

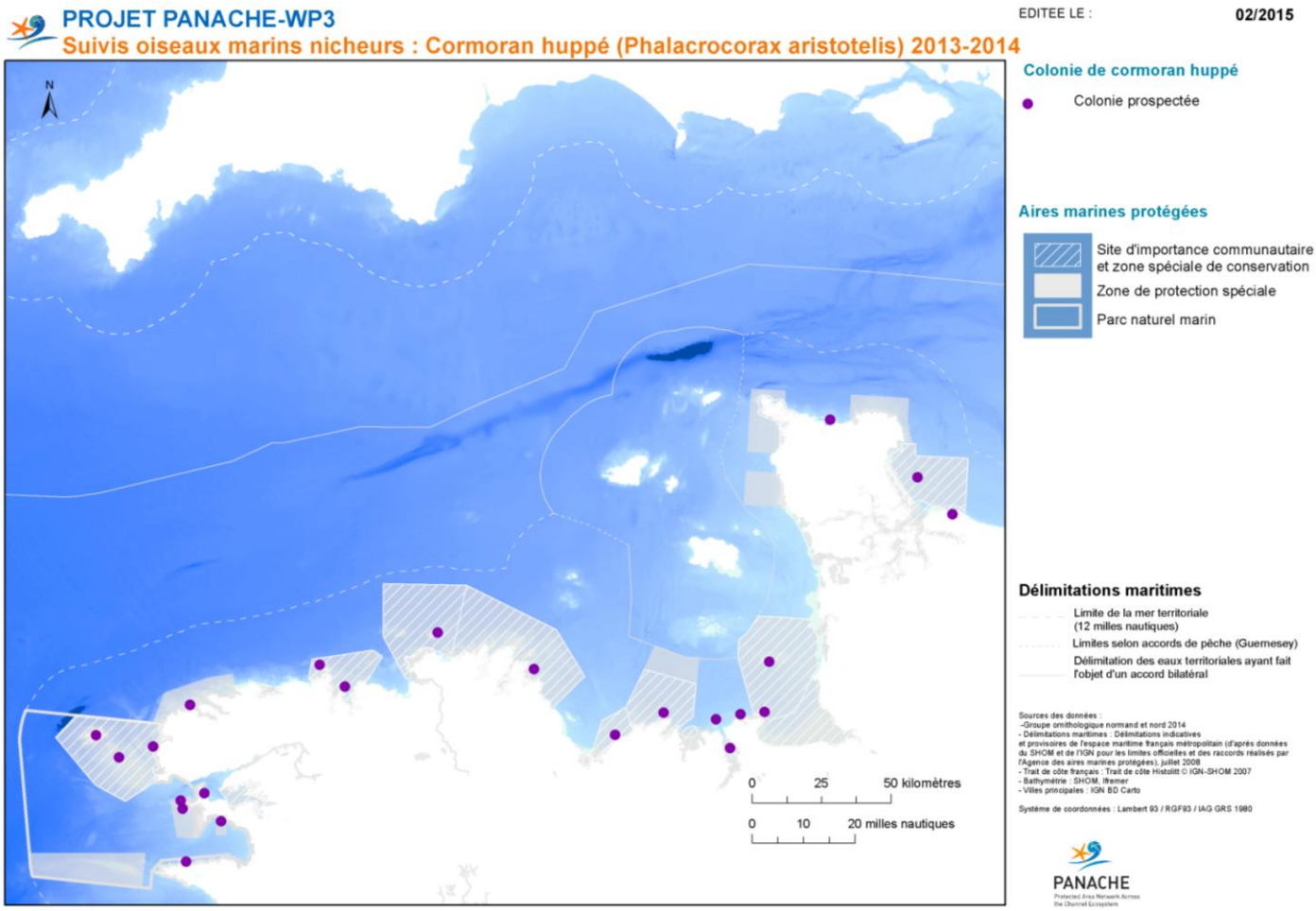

Figure 3: Location of the colonies of Shags (Bretagne Vivante)

Département-Colony	Breeding population	Litter quantification	Pellet collection	Production assessment
14-Saint-Pierre-du-Mont	Y	N	N	Y
50-Saint-Marcouf	Y	Y	Y	Y
50-Cherbourg	Y	Y	Y	N
50-Chausey islands	Y	Y	Y	Y
35- Sites of Cancale, Saint Malo Rance estuary	Y	Y	Y	Y
22-Cap Fréhel	Y*	Y?	N	Y
22-Verdelet	Y	Y	N	N
22-Trégor-Goëlo	Y*	Y	Y	Y
22-Sept-Îles archipelago	Y	Y	Y	Y
29-Morlaix bay	Y*	Y	Y	N
29-Batz island	Y*	Y	Y	Y
29-Trevoc'h	Y*	Y	N	N
29-Fourches	Y	Y	N	N
29-Ouessant	Y*	Y	N	Y
29-Molène islands	Y	Y	N	N
29-Brest harbour	Y*	Y	N	N
29-Camaret	Y*	Y	N	N
29-Sites of Crozon	Y*	Y	N	N
29-Cap Sizun	Y*	N	N	Y

Table 1. Parameters studied per site (non-exhaustive).*

3.2.2. Great Cormorants

Seventeen colonies of Great Cormorants were studied in 2014 as part of the PANACHE project, in Brittany and Normandy, out of some thirty colonies identified. Some colonies nesting inland were not included in this survey even though they mainly feed at sea. Juvenile production was only studied on some of the 17 colonies observed (Figure 4).

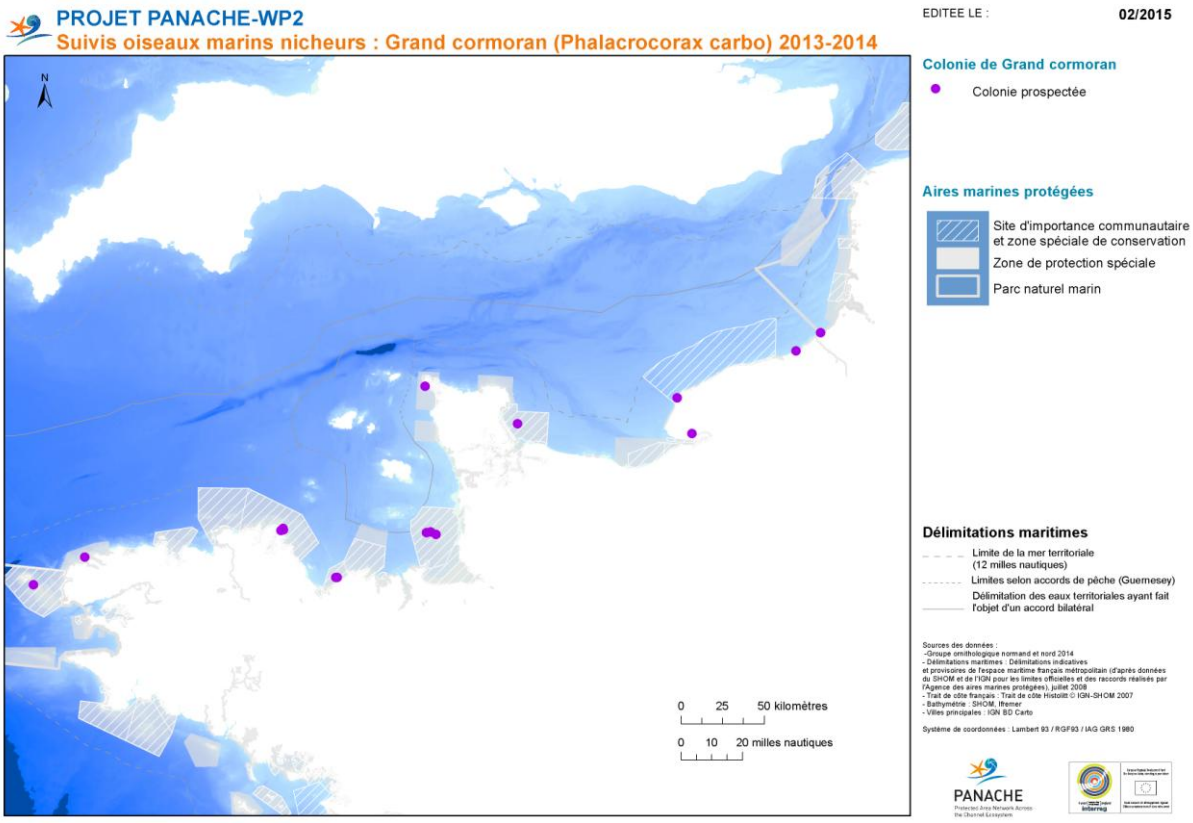

Figure 4. Map of the colonies studied

3.3.3. Terns

45 sites accommodate one of the four species of tern, mainly between northern Brittany and the Opal coast.

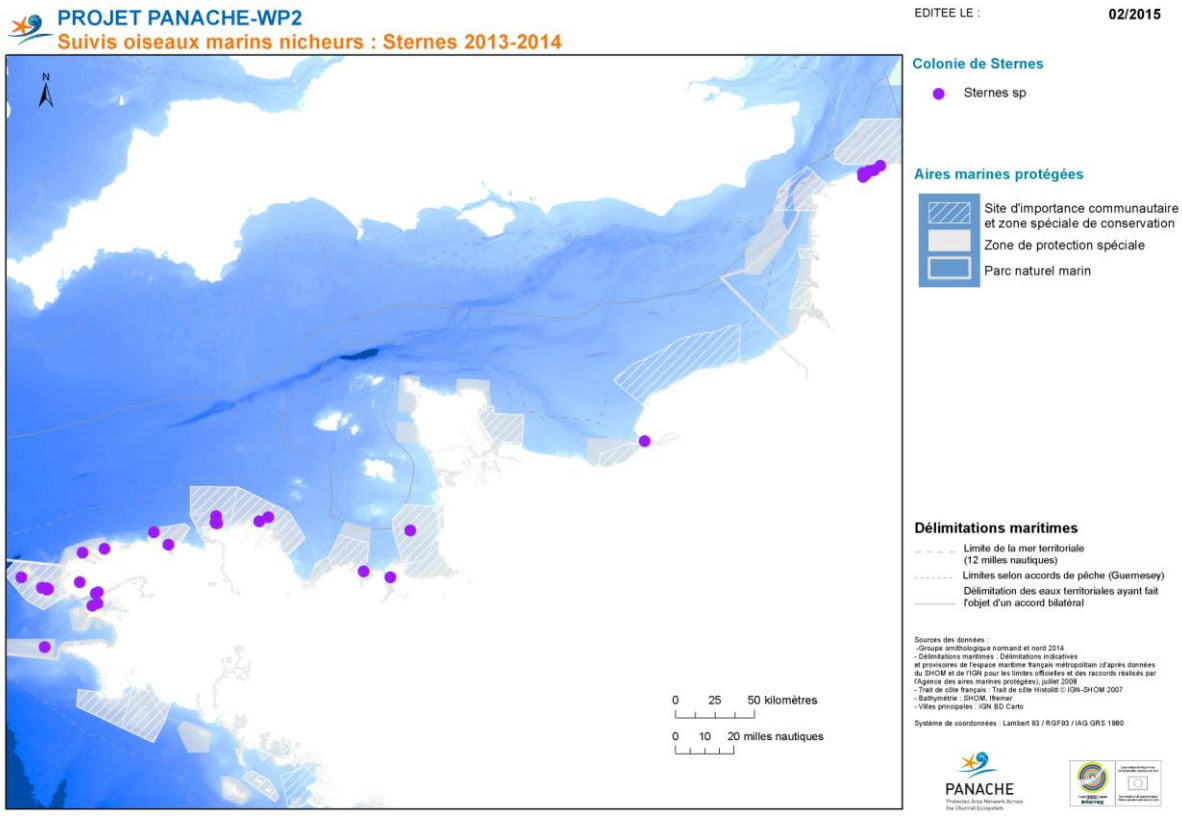

Figure 5. Map of the colonies of terns monitored

3.4. Objective 2. Survey of guillemot colonies and interactions with sea users.

The site studied was the guillemot colony at Berry Head, in Devon, which lies within the Torbay Marine Conservation Zone and is the largest guillemot colony on the south coast of SW England (Seabird 2000).

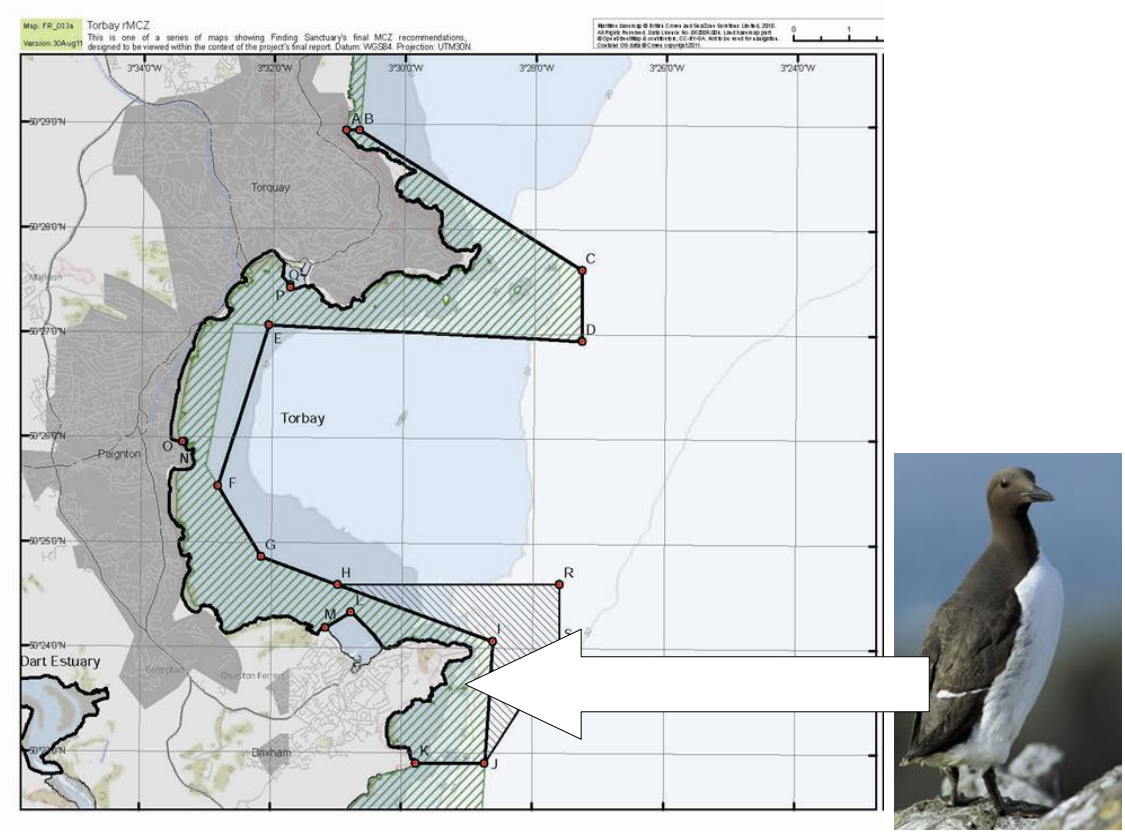

Figure 6: location of the guillemot colony within the Torbay MCZ (hatched area)

3.5. Objective 3. Wintering divers and grebes

On the English side, the diver and grebe study sites were also in Devon, encompassing the Torbay MCZ as shown in Figure 6 above, and extending north outside the MCZ to the edge of the Exe Estuary. Figure 7 below shows the survey points. Supplementary data were also supplied from a site at Otterton, just to the NE of the mapped area. The site locations were those used in the previous survey and were selected as suitable vantage points, adequately spaced to minimise the risk of double counting.

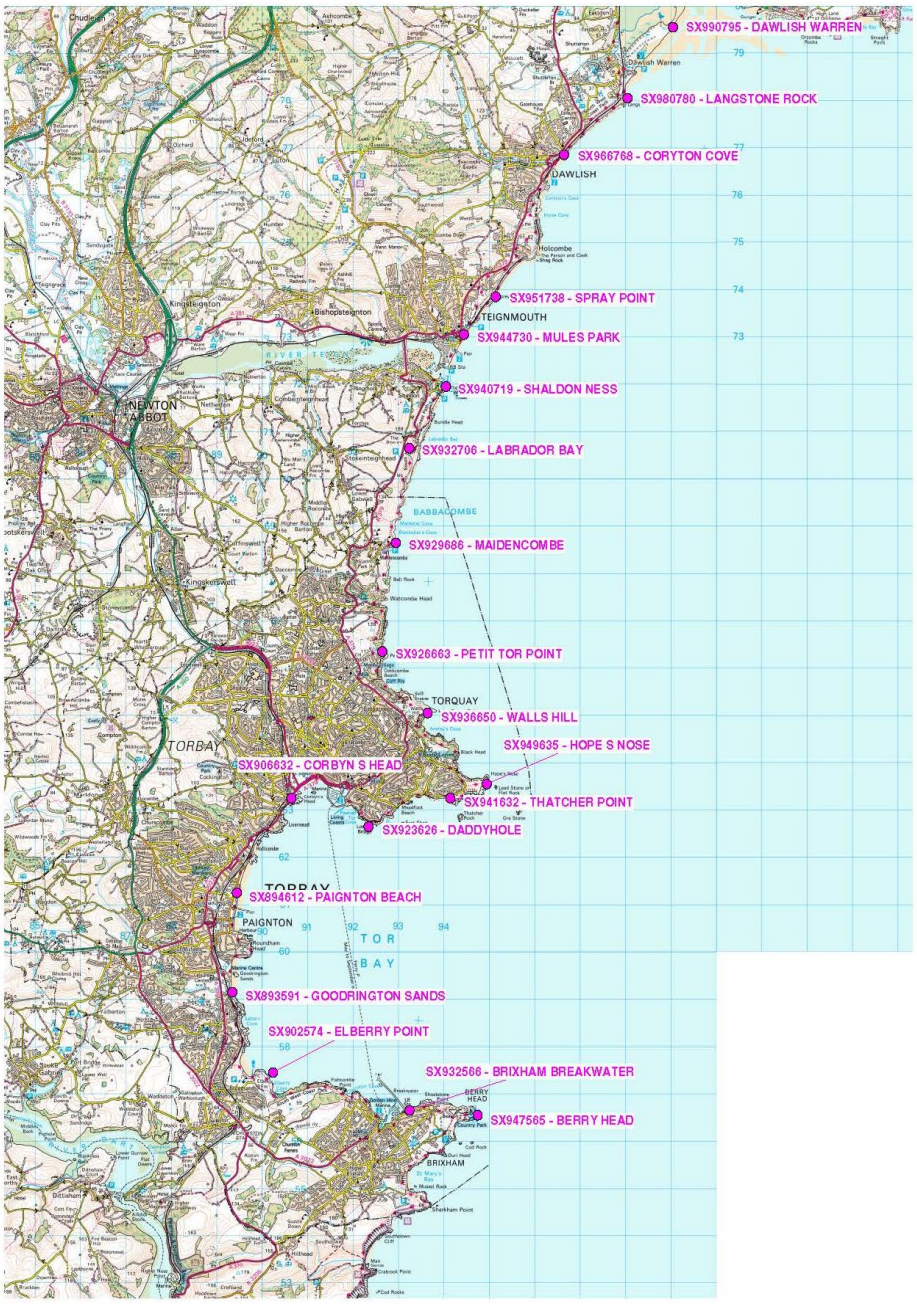

Figure 7. Survey locations in S Devon

In France, the survey of grebes and divers was done along the entire coast of the Channel-North Sea marine sub-region, spanning the regions of Brittany, Lower-Normandy, Upper Normandy, Picardy and Nord-Pas-de-Calais.

The whole coast was divided into 137 sectors taking into account the boundaries of existing marine protected areas for birds and wetland areas (if the sector were still too big, it was further divided).

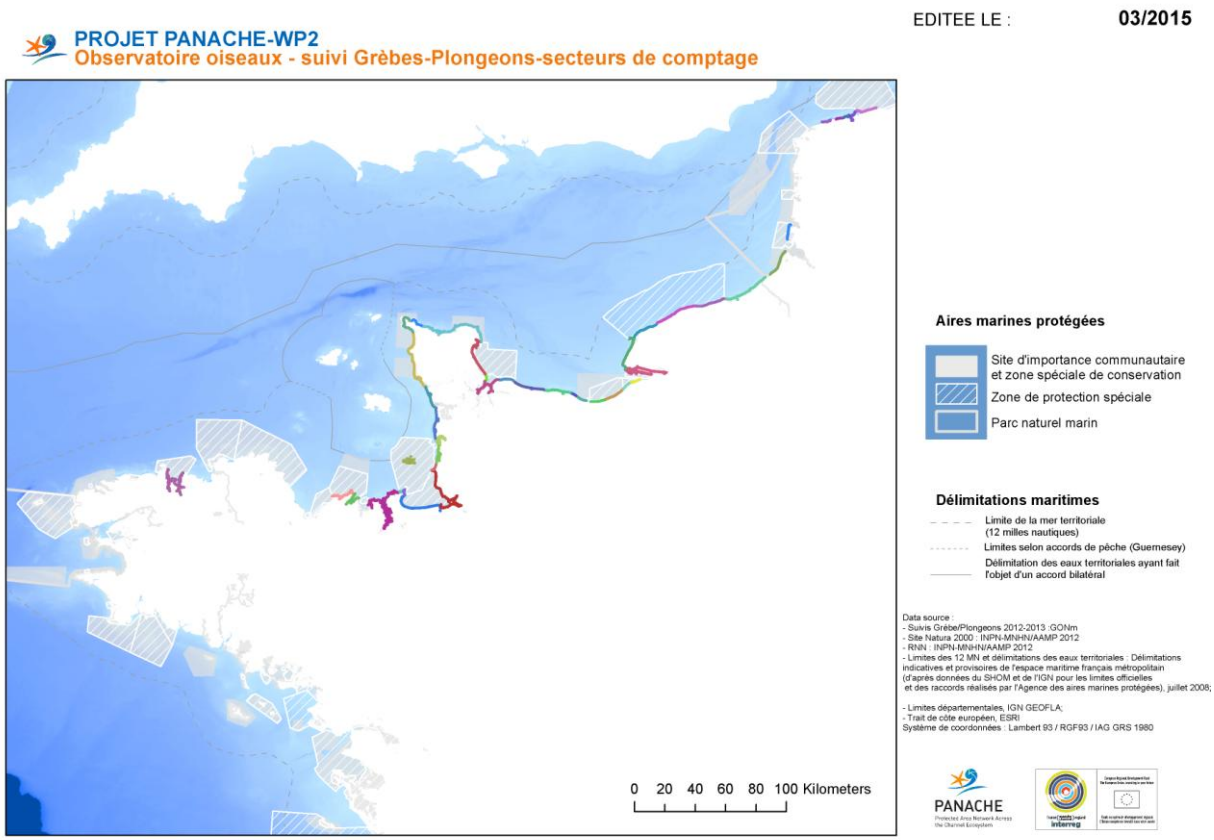

Figure 8. Map of sectors used to count grebes and divers in France

The survey points were thus allocated to each of these sectors based on their location. However, the number of points varied greatly depending on the region. Over the 1,400km of coastline, 138 survey points were listed (i.e. 1 point every 10km on average):

- 15 points in Brittany for approximately 600km (1 every 40km)
- 105 points in Normandy for approximately 600km (1 every 5.5km)
- 9 points in Picardy for 60km (1 every 6.5km)
- 9 points in Nord-Pas-de-Calais for 125km (1 every 14km)

IV. Results

4.1. Objective 1 (a): Survey of Kittiwake colonies

4.1.1. Productivity analysis

Three visits were undertaken to the Straight Point colony in both 2013 and 2014 by RSPB staff and volunteers. Results were also submitted to the JNCC Seabird Monitoring Database. The results between the two years were very similar, as presented below in Table 2. The Straight Point colony was visited three times by boat in each of the two survey years. The colony held 130 and 162 AONs respectively over the two years of monitoring, with breeding success taken from a sample of the nests and estimating productivity at 0.59 and 0.67ch/pr.

Figure 9. Part of the kittiwake colony at Straight Point, nr Exmouth, Devon, England (Photo: Chris Townend)

The Rinsey Head colony showed a drop in numbers over the two years of monitoring and complete breeding failure. For 2013, colony count data are missing for this site, but the observer reported some birds appearing to have re-located to a different site further along the coast. In 2014, 99 birds were present at the site early in the season, but by early June there were just 17 nests occupied but no evidence of any eggs laid.

	2013		2014	
	Colony Size	Productivity	Colony Size	Productivity
Straight Point	130 AON	0.59ch/pr (n=70)	162 AON	0.67ch/pr (n=69)
Rinsey Head	unknown	unknown	17 AON	0

Table 2. Kittiwake colony numbers and productivity at English sites

Of added interest, at the Straight Point colony in 2014, at least four colour ringed birds were seen, one on the final visit on 30 July (not associated with a nest) and the others a week or so later. The birds originated from a French colony in Finistère, Brittany (Jean-Yves Monnat, pers. comm.), demonstrating there is some level of interchange between the Channel colonies.

Figure 10. One of four colour ringed kittiwakes to appear at the Straight Point colony in 2014, having originated from a colony in Brittany. This bird and one other were ringed as juveniles this year. (Photo: Chris Townend)

		2013		2014	
		Colony size (AON)	**Productivity**	**Colony size** (AON)	**Productivity**
Normandy	**Saint-Pierre-du-Mont**	911-919	0,63-0,74	926-936	0,74-1,07
	Englesqueville-la-Percée	182	0	58- 64	0
	La Poterie-Cap d'Antifer	0	-	0	-
	Fécamp Cap Fagnet	440	0,61	287 - 359	0,69
	Total Normandy	1533 - 1541	0,52-0,57	1271-1359	0,66-0,86
Nord-Pas-de-Calais	**Cap Blanc Nez**	1648 - 1948	1,16	2613-2631	1,06-1,76
	Boulogne-sur-Mer				
	• Nemours/Napoléon	78 - 82	1,16 - 1,19	157	1,23-1,52
	• Loubet 1 Lock	137 - 141	1,28	57	1,04
	• Loubet 2 Lock	911-919	0,63-0,74	926-936	0,74-1,07
	• Harbour station	182	0	58- 64	0
	Total Nord-Pas-de-Calais	0	-	0	-

Table 3. Breeding numbers and productivity of French kittiwake colonies 2013 - 2014.

In Normandy (Upper Normandy and Lower Normandy), the colonies had approximately 1,540 couples in 2013, compared to 1,360 in 2014, i.e. approximately a quarter of the French population. The colony at Cap d'Antifer has totally disappeared and that of Englesqueville dropped by approximately 65% between the two years (with total breeding failure).

The breeding numbers and the productivity of the colonies in Nord-Pas-de-Calais are higher than those of the colonies in Normandy and mostly increased between 2013 and 2014. With over 2,000 couples in 2014, the Cap Blanc Nez colony is now the largest in France. The kittiwake is a species at the southern limit of the distribution area and we are seeing these populations gradually move upward to the North.

Figure 11. Fécamp/Cap Fagnet colony, Upper Normandy, France (Gérald Mannaerts)

Figure 12 shows changes in the Normandy populations since 1976. We can see here a gradual increase in breeding populations until the start of the years 2000. In parallel to this growth in the Normandy population, the colonies in Brittany located more south-west than the Normandy colonies record a decline or even disappearance from certain sites. In parallel to the decrease in the Normandy colonies seen in the years 2000, the size of colonies in the North of France is increasing. The distribution area of this species in France is indeed moving.

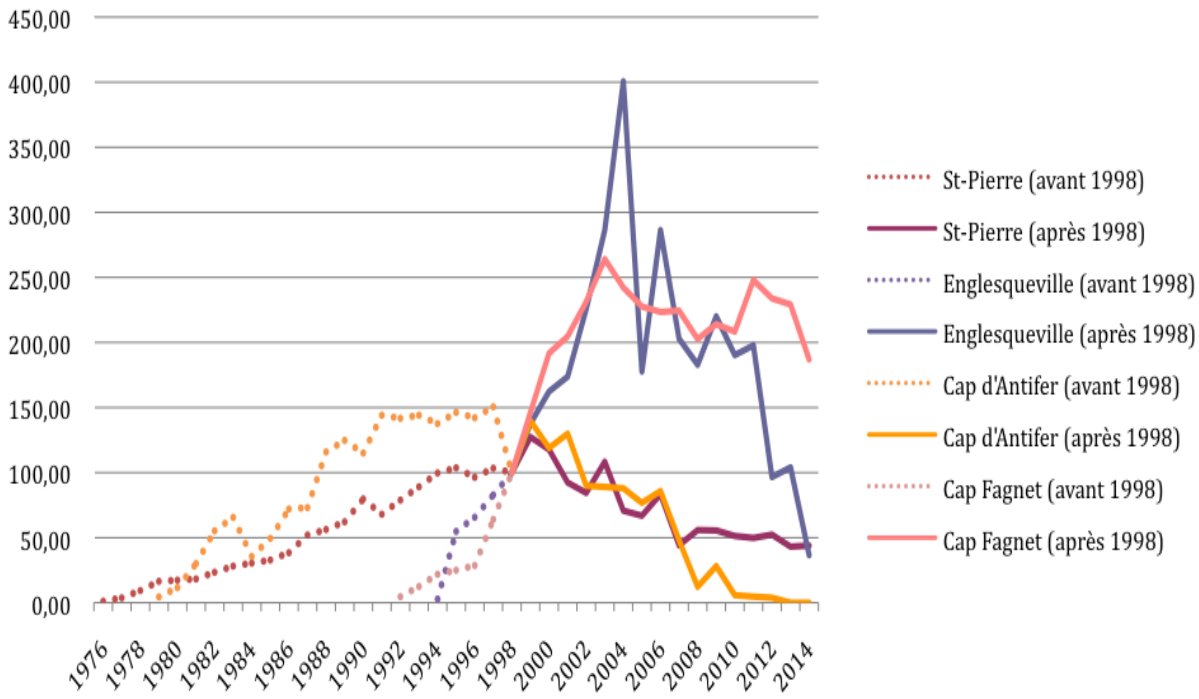

Figure 12. Change in kittiwake populations by colony in Normandy (Base 100 in 1998)

The general productivity of the English colonies is comparable of those of Normandy, while the studied colonies are much smaller in England than in France.

4.1.2. Kittiwake tracking study

45 individuals from Fécamp, Saint-Pierre-du-Mont and Boulogne-sur-Mer were fitted with GLS tags (15 per colony) during the breeding period. The Saint Pierre du Mont and Fécamp colonies are colonies based on natural sites (cliffs) whereas the Boulogne sur Mer colony corresponds to an urban site (nesting on buildings). The monitoring objectives differ depending on the site:

- Fécamp: coherence/sufficiency of the MPA network, particularly for the "Littoral Seino marin" SPA and potential interactions with the future wind farm located off Fécamp inside the SPA.
- Saint Pierre du Mont: coherence/sufficiency of the MPA network, particularly for the "Baie de Seine occidentale" and "Falaises du Bessin" SPAs and potential interactions with the future wind farm located off Courseulles sur Mer (outside SPA).
- Boulogne sur Mer: coherence/sufficiency of the MPA network, particularly for the Estuaires picards and Mer d'Opale marine nature park and for the network of SPAs located within it or nearby, and study of the functional zone of an urban colony.

Of the 45 individuals equipped, 43 delivered data: 15 for Saint Pierre du Mont and Fécamp and 13 for Boulogne sur Mer. The raw data illustrated on figure 11 already make a number of assumptions possible.

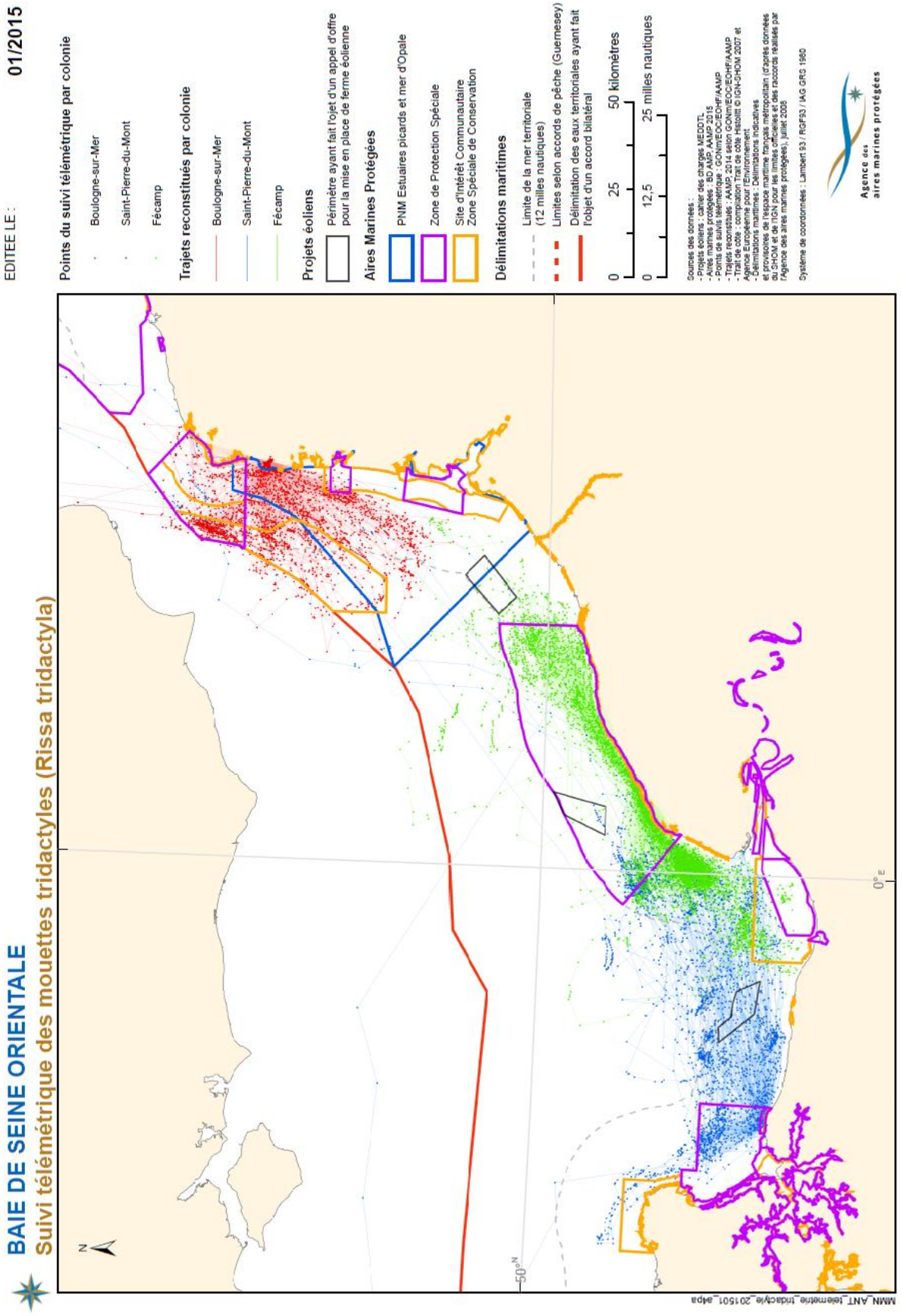

Figure 13. Raw data from the kittiwake GLS tracking study during the 2014 breeding period in France.

Birds from the Saint Pierre du Mont colony (in blue on the map) use the entire Bay of Seine; one individual travelled up to the North Sea just off the East coast of England, thus travelling several hundred kilometres in a few days, while another travelled along the south coast of Britain (south of Isle of Wight). Most groups prefer the centre of the Bay of Seine: therefore, the "Baie de Seine occidentale" and "Falaises du Bessin" SPAs are used greatly by these birds along with the "Récifs et marais arrière-littoraux du cap Lévi à la pointe de Saire"SCI located off the NE tip of Cotentin. To preserve the entire functional zone used by these birds, we can note a lack of designation in the centre of the Bay of Seine. Finally, if we focus on the potential risk of interaction with the Courseulles sur Mer wind farm project, the birds significantly visit the project's site.

The functional zone of birds from the Fécamp colony (in green on the map) is preferably an area near the colony, along the coasts of Pays de Caux. Some individuals venture outside the territory to use the eastern part of the Bay of Seine, off the Cap de la Hève. We can therefore say that the "Littoral Seino Marin" SPA provides a good response to the needs of birds present in this colony. Only the western area (off the Cap de la Hève) is lacking designation. As we said above, the birds mainly use the very coastal area and therefore, there will be very little interaction with the Fécamp wind farm project located further offshore. This confirms the observations already made by boat trips and aerial surveys as part of the impact studies carried out for the wind farm project.

Lastly, the Boulogne urban colony uses the marine environment for feeding purposes. The area used by the tagged kittiwakes corresponds to a sector stretching from the Bay of Somme in the South to the Cap Gris Nez in the North and mostly extending from the coast within the 12 NM limit. Some individuals travelled further to reach the mouth of the Thames and the waters off the East coast of England. Thus, these birds indeed use the Estuaires Picards and Mer d'Opale marine nature park, but also the "Cap Gris Nez" SPA and the " Ridens et dunes hydrauliques du détroit du Pas-de-Calais" SCI. The MPA network present in this sector appears to be satisfactory and would be even better if the "ridens et dunes hydrauliques du détroit du Pas-de-Calais" SCI were designated as SPA.

This first analysis done using raw data is only a first approach. In a second stage, a Kernel Density Estimation (KDE) will be done along with an analysis of preferred habitats (under way by the CEFE at the time of drafting the report). These more extensive analyses will provide a more thorough measurement of: the coherence of the MPA network, relations with the marine ecosystem and interactions with human activities and particularly the wind farm projects.

4.2. Objective 1 (b): Survey of breeding success of terns and shags – litter and pellet gathering for shags

4.2.1. Shags

Département-Colony	Size	Change (year)	Production (sample size)
14-Saint-Pierre-du-Mont	9	0% (2011)	2.38 (8)
50-Saint-Marcouf	299-313	-11% (2011)	1.59 (71)
50-Cherbourg	50-70	-40% (2011)	–
50-Chausey islands	932	+16% (2010)	0.63 (188)
35-other islands Cancale	109	-37% (2013)	–
35-Landes island	198	-8% (2013)	0.81 (58)
35-Grand Chevreuil	91	+32% (2011)	–
35-Cézembre	142	-11% (2013)	–
35-Ile aux Moines	25	+32% (2013)	0.60 (25)
22-Cap Fréhel	153	-9% (2013)	1.38 (151)
22-Verdelet	91	+30% (2011)	–
22-Trégor-Goëlo	230	-1% (2011)	0.32 (230)
22-Sept-Îles archipelago	240	-35% (2013)	0.00 (36)
29-Morlaix bay	155	-14% (2013)	0.04 (24)
29-Island of Batz	102	+8% (2009)	0.48 (102)
29-Trevoc'h	18	-18% (2013)	–
29-Fourches	86	-8% (2013)	–
29-Ouessant	114	-3% (2013)	1.44 (27)
29-Molène islands	665	+5% (2013)	–
29-Brest harbour	47	-2% (2012)	–
29-Camaret Toulinguet	163	-17% (2013)	–
29-Camaret Tas de Pois	317	-9% (2013)	–
29-Crozon îlot Aber	18	+38% (2013)	–
29-Cap Sizun	49	+4% (2013)	1.55 (31)

Table 4. Breeding numbers and productivity of the shag colonies in 2014

The year 2014 was marked by a late breeding season with production varying greatly across the sites. There was no production in the Sept-Iles colony and it was close to zero in Morlaix Bay.

The various colonies added together give a total size of approximately 4,300 couples, without any general trend emerging at "site" level since the last survey. The Sept-Iles population has decreased by 35% since 2013 in addition to its low production this year.

4.2.2. Great Cormorants (*Phalacrocorax carbo*) breeding study

Colony	Size/sector (total colony)	Production (sample size)
Roc'Hir	130	
Staon Vraz	4	
Trevoc'h	72	
Enez Rikard	43	
	(112)	
Enez Wragez	69	
Roc'h Losquet	2	0 (2)
Cote 12m	2	1.5 (2)
Les Trois Iles	83	1.15-1.42 (57)
Verdelet	51	
Huguenans	123	
Houlée	22 (163)	1.14 (22)
Petit Romont	18	1.17 (18)
Nez-de-Jobourg	46	2 (46)
Ile de Terre (Saint Marcouf)	451	
Seine Estuary	119	
Antifer	51	1.7 (40)
Val-le-Prêtre	96	1.32 (50)
Mesnil-Val	37	1.1 (38)

Table 5. Breeding numbers and productivity for Great Cormorant colonies.

The populations in the 18 sectors surveyed are quite variable with only two couples at the Roc'h Losquet and Cote 12 m colonies, compared to 451 at Saint-Marcouf.

Productivity is particularly high at the Nez-de-Jobourg site. Apart from two small colonies of two couples, the productivity of the three sites studied in the Western Channel (Trois iles, Petit Romont, Houlée) is quite similar but it varies much more in Pays de Caux (Antifer, Val-le-Prêtre, Mesnil-Val). There is no relationship between colony size and production.

4.2.3. Litter in the nests of Shags and Great Cormorants.

Département-Shag Colony	No. of nests studied	L0	L1-5	L6-10	L11-20	L20+	**% of nests containing litter**
14-Saint-Pierre-du-Mont	–	–	–	–	–	–	**–**
50-Saint-Marcouf	263	183	60	11	7	2	**30.4%**
50-Cherbourg	18	0	11	5	1	1	**100.0%**
50-Chausey	932	800	119	8	3	2	**14.2%**
35-Landes island	182	127	51	4	0	0	**30.2%**
35-Grand Chevreuil	90	45	36	7	2	0	**50.0%**
35-Cézembre	75	45	29	1	0	0	**40.0%**
35-Ile aux Moines	25	13	11	1	0	0	**48.0%**
22-Cap Fréhel	–	–	–	–	–	–	**–**
22-Verdelet	–	–	–	–	–	–	**–**
22-Trégor-Goëlo	218	205	13	0	0	0	**6.0%**
22-Sept-Îles archipelago	108	97	11	0	0	0	**10.2%**
29-Morlaix bay	135	100	32	3	0	0	**25.9%**
29-Island of Batz	98	79	19	0	0	0	**19.4%**
29-Trevoc'h	18	15	3	0	0	0	**16.7%**
29-Fourches	–	–	–	–	–	–	**–**
29-Ouessant	83	80	3	0	0	0	**3.6%**
29-Molène	411	397	14	0	0	0	**3.4%**
29-Brest harbour	–	–	–	–	–	–	**–**
29-Camaret – Toulinguet	159	15	87	35	18	4	**90.6%**
29-Camaret – Tas de Pois	280	196	79	3	2	0	**30.0%**
29-Crozon – Aber	18	4	9	5	0	0	**77.8%**
29-Cap Sizun	–	–	–	–	–	–	**–**

Great Cormorant colony	**No. of nests studied**	**L0**	**L1 - 5**	**L6 - 10**	**L11 - 20**	**L20+**	**%L+**
Chausey	163	162	1	0	0	0	0.6%
Saint Marcouf (Île de Terre)	263	246	17	0	0	0	6.5%

Table 6. Quantities of litter in shag and great cormorant nests

The amount of litter varies greatly from one colony to another. 100% of shag nests contained litter in Cherbourg compared to only 3.4% of nests of the same species in the Molène islands. For the Great Cormorant, the amount of litter is small with only small pieces at the only two sites studied: Chausey and Saint Marcouf.

On the islands of Chausey and Saint-Marcouf, the two species can be compared. At these sites, the amount of litter is higher in the nests of shags.

4.2.4. Terns

Out of some 45 sites studied, 3,049 to 3,076 couples of one of the four species of breeding tern were counted. The study of juvenile production was done exhaustively for the Sandwich tern, the Roseate tern and the Little tern, and on most sites occupied by the Common tern.

Area name	Site name	Sandwich tern			Roseate tern			Common tern			Little tern		
		J	C	J/C	J	C	J/C	J	C	J/C	J	C	J/C
Opal Coast (59)	Gravelines							1,906 - 2,482	1,423	1.34 - 1.74			
	Clipon										0	9	0.02
	Grand-Fort-Philippe										0	2	2
	Platier d'Oye – banc Casino	9	450	0.02							2		
Bay of Seine (76)	Seine Estuary											1	
Chausey (50)	Chausey islands							ns	17-22				
Rance Fluviale (35)	Various sites							8-10	7	1.14 - 1.43			
Bay of Lancieux et Fresnaye (22)	La Colombière	90-100	387	0,23 - 0.26	10 - 12	17 - 18	0.56 - 0.71	70	164-165	0.42 - 0.43			
Côte du Goëlo (22)	Various sites							45-67	86	0.52 - 0.78			
Jaudy Estuary	Sillon de Talbert												
Tregor north (22)	Various sites												

Sept-Iles (22)	Le cerf	0	0-4	0			
Côte de Granit Rose (22)	Le Gouffre	0	5	0			
	Ile de Costaeres	0	1	0			
	Ile Renote	0	3	0			
Morlaix Bay (29)	Ile aux Dames	10-15	17	0.59 - 0.88			
Island of Batz (29)	Enez Kernog	0	1-2	0			
Pays Pagan (29)	Etang du Curnic	17	18-19	0.89 - 0.94			
Region of the Abers (29)	Aber Benoit	11-13	20	0.55 - 0.65			
Pays d’Iroise (29)	Saint-Renan gymnasium	1-2	2	0.5-2			
Molène archipelago (29)	Banneg	34	35-40	0.85 - 0.97			
	Enez ar C’hrizien				0	1	0
	Kemenez slipway	57	30-35*	/	16	7	/
	South Kemenez Ledenez	0	6	0	0	6	0
	Vraz Kemenez Litiri	14	20	0.7	32	31	1.03
Brest Harbour (29)	Roscanvel Bay	ns	15	/			
	Ducs d’Albe pointe	5	34	0.15			

	d'Armorique													
	Brest com. harbour							0-1	2	0-0.5				
	Gabion of the comm. harbour							73	154	0,47				
Sein & Chaussée (29)	Ile de Sein										2	2	1	
Size Channel-North Sea			837		10-12	17-18			2,059 - 2,082			143		
Production of juveniles/couple		99-109	837	0.12-0.13	10-12	17-18	0.56 - 0.71	2,194 - 2,803	1,991 - 2,000	1.10-1.41	36	130	0.28	

* the numbers followed by an asterisk are those estimated from a distance and are not taken into account to calculate production owing to the under-evaluation of the number of breeding couples that this quite imprecise counting method causes

Table 7. Breeding numbers and juvenile production for the four species of tern in the Channel-North Sea marine sub-region, 2014.

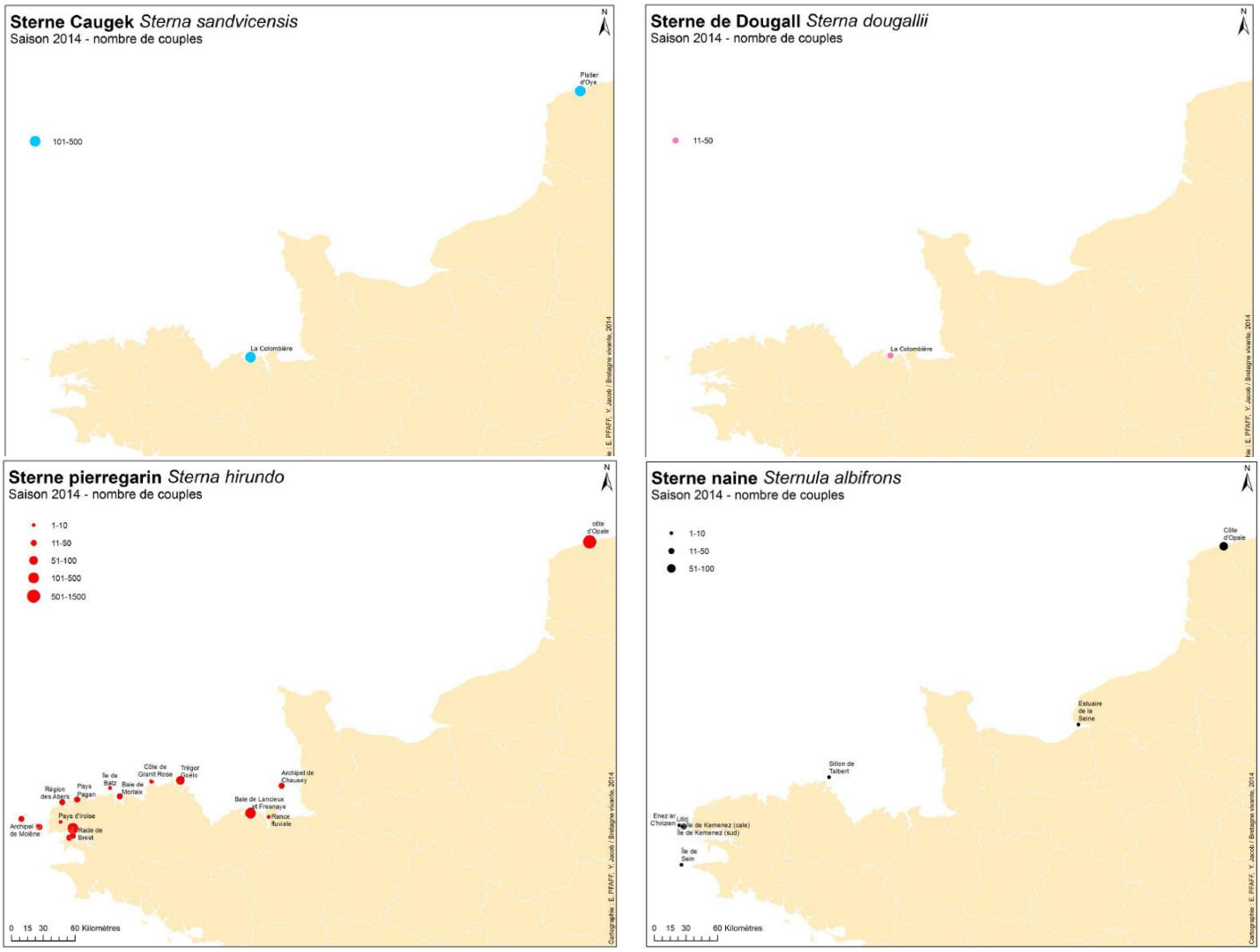

Figure 14. Breeding numbers per species at the different sites

The Common tern is the most abundant species and the one with the biggest distribution, with 2,059 to 2,082 breeding couples spread over 40 sites. Almost 70% of this population nests on the roofs of industrial buildings in Gravelines. The production analysed on a sample of some 2,000 couples gives an average of 1.25 juveniles/couple for all the French coasts in the Channel-North Sea marine sub-region.

The Sandwich tern only has two dense colonies totalling 837 couples: Le Platier d'Oye (450 couples) and La Colombière (387 couples). While the latter colony had a production of 0.23 juveniles/couple, it was only 0.02 for the Platier d'Oye.

The 143 couples of Little terns are spread mainly between the sediment banks of the Opal coast and the islands and islets in the Iroise Sea, with a few couples in the Bay of Seine and Trégor-Goëlo. Average minimum production is 0.26 juveniles/couple with a maximum on the island of Litira in the Molène archipelago of 1.03 juveniles/couple.

Only one colony of Roseate tern is found in the Channel-North Sea (out of two in France), on La Colombière island. It has between 17 and 18 couples which produced 10 to 12 fledglings.

4.3. Objective 2: Survey of guillemot colonies and interactions with sea users

Data from the guillemot survey were analysed by Torbay Coast and Countryside Trust (Hughes 2013). From May to July 2013, a total of 105 hours of observation were carried out. During 72 of these sessions there were 153 occasions where vessels entered the study area. Canoes appeared to cause the most disturbance, although this was not statistically significant. A total of 121 vessels were present while birds were rafting, of which 84 led to a response by the birds. Responses were noted particularly when vessels approached within 50m of rafting birds.

The type of vessel was not overall statistically significant in the severity of a behavioural response. Figure 15 shows the relative percentages of a moderate behavioural response (level 1, head bobbing/swimming away) and a severe response (level 2, flushing).

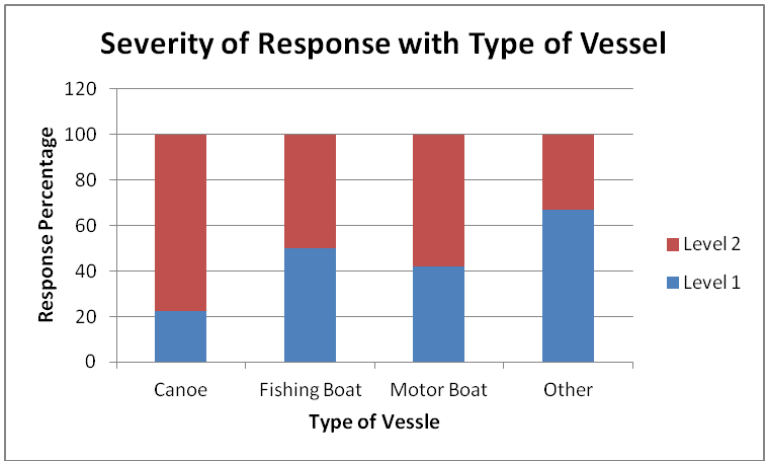

Figure 15. Severity of response with vessel type

The distance of a marine vessel from the guillemots was found to have a significant effect on whether a behavioural response was generated. In Figure 16 the effects of distance of vessel is broken down in to the response of rafting guillemots.

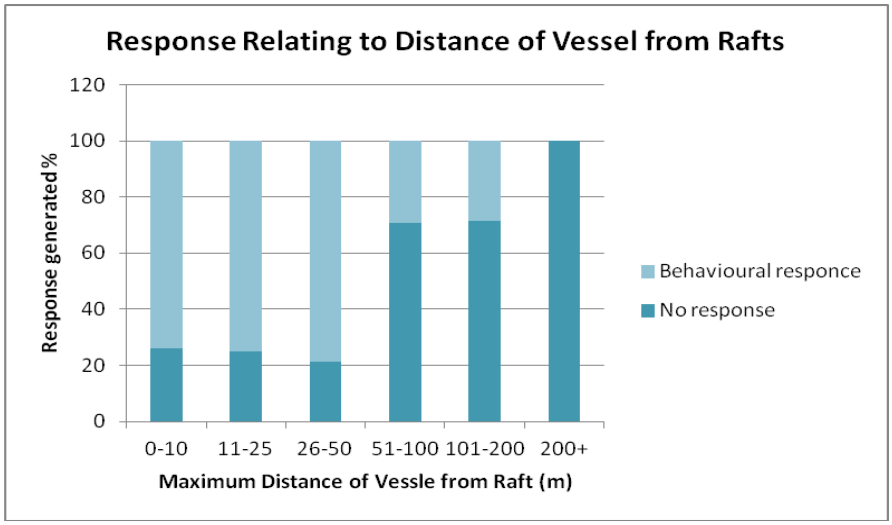

Figure 16. Response relating to distance of vessel from rafts

4.4. Objective 3: Survey of wintering divers and grebes inside and around MPAs: France

On the English side, eight volunteers took part in the surveys from 20 watch points. Surveys were undertaken approximately fortnightly between November 2012 to March 2013.

All species of wintering birds were recorded and their activities noted in line with the method. The results have been compiled and compared to the previous survey back in the mid 1990s. Any records of flying birds have been excluded from the data. The peak count from each site and the average count from each site have been presented in Appendix, alongside results from the previous survey in 1994/5.

Maps detailing the results from each watch point for each species group are presented below. All counts refer to birds on the water in sight of land and only sites with 10 or more birds recorded have been mapped. The maps include supplementary data from Otterton, the most north-easterly point on the map.

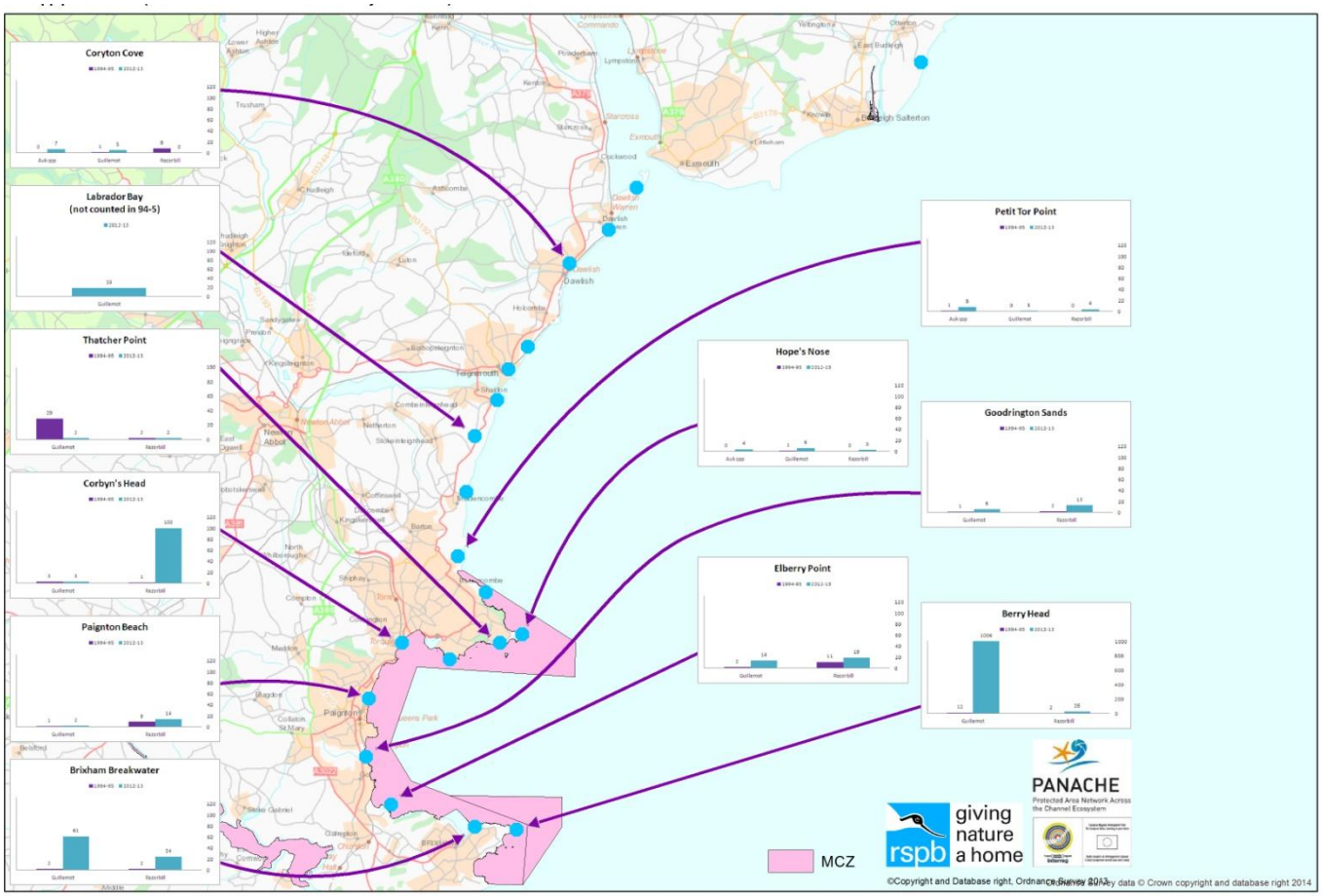

Figure 17. Survey locations with the numbers of auks at each site in both the 2012/13 survey and the previous survey in 1994/5, within and outside the Torbay MCZ

The map shows that the MCZ holds a greater number of wintering auks than the area outside the MCZ. A peak count of over 1,000 guillemots was recorded from Berry Head (included birds standing on the cliff), the most southerly survey point, plus a count of 61 from Brixham Breakwater, also within the MCZ. These figures are considerably greater than those in the previous survey when the peak count from any of the watch points was 29 guillemots. Razorbill numbers were similarly higher than in the previous survey with a peak count of 100 birds from Corbyn's Head. The peak counts from outside the MCZ were just 19 guillemots and eight razorbills.

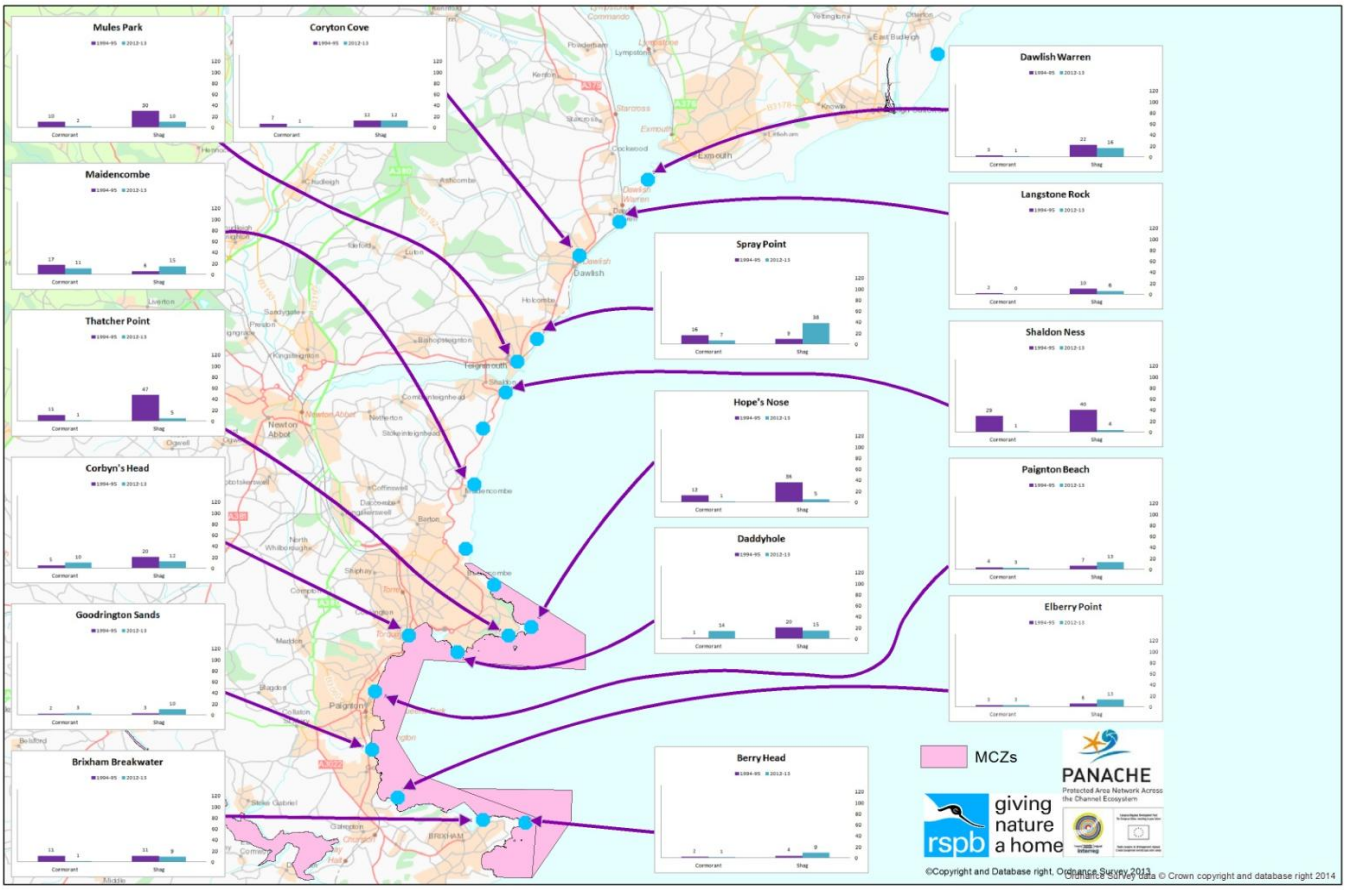

Figure 18. Survey locations with the numbers of cormorants and shags at each site in both the 2012/13 survey and the previous survey in 1994/5, within and outside the Torbay MCZ.

This survey recorded fewer shags and cormorants compared to 1994/5, reflected by a drop in both the peak and mean counts. Across the survey area, the peak count of shags was 72 and cormorants, 29. Within the MCZ, the peak count of shags was 53, compared to 102 in 1994/5; for cormorants, the peak count was 24 compared to 26 in the previous survey.

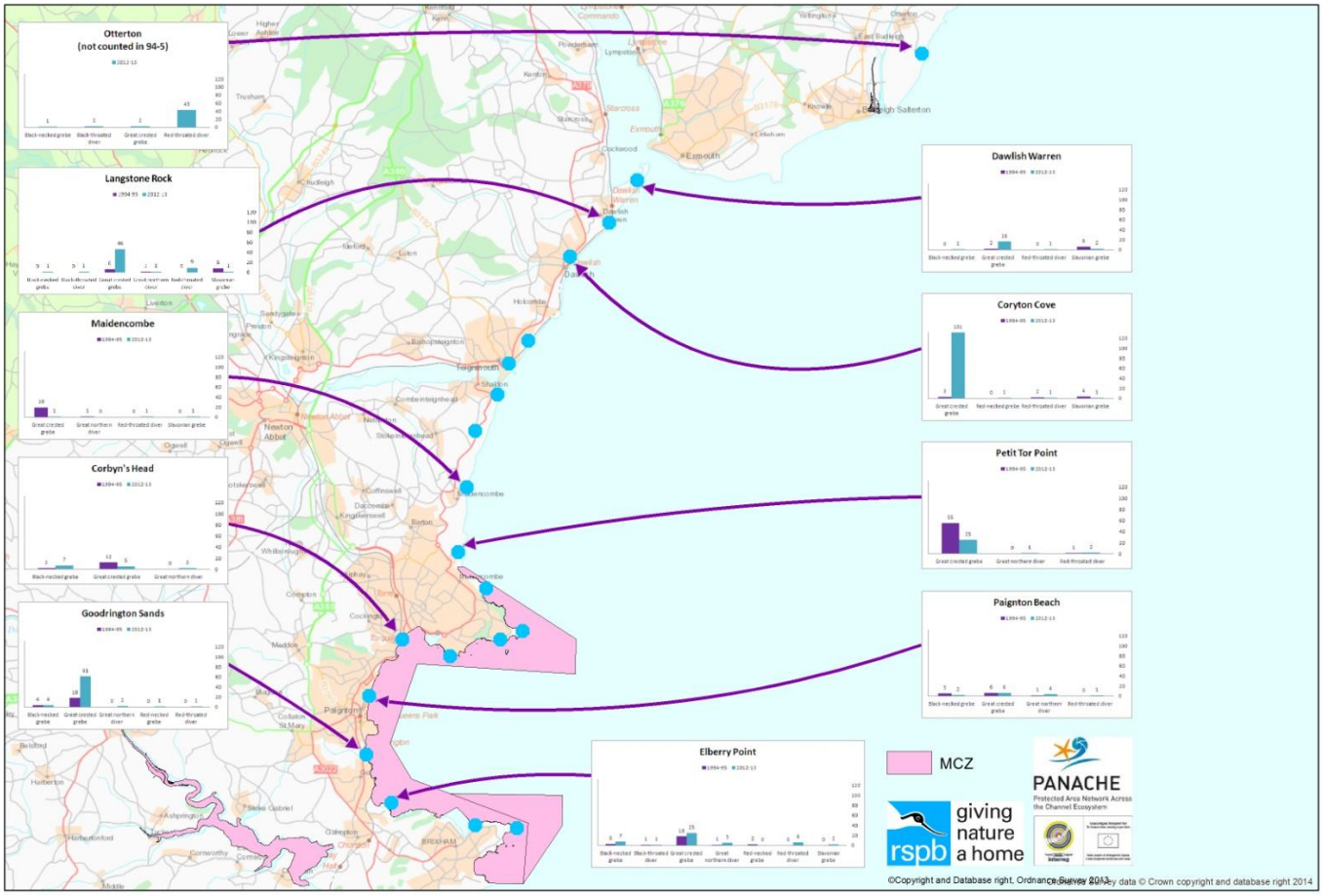

Figure 19. Survey locations with the numbers of divers and grebes at each site in both the 2012/13 survey and the previous survey in 1994/5, within and outside the Torbay MCZ.

Diver and grebe species present in the survey area were black-necked grebe (peak count 10), black-throated diver (peak count 2), great crested grebe (peak count 131), great northern diver (peak count 7), red-necked grebe (peak count 2), red-throated diver (peak count 43) and Slavonian grebe (peak count 2). All were present within the MCZ, with great crested grebe the most numerous, with a peak count of 64. There was just one red-necked grebe and one black-throated diver recorded within the MCZ.

Ducks are not shown on any of the maps, but common scoter and a single eider were present. The one adult male eider duck was reported on 2 Feb 2013 from Coryton Cove. Common scoter were found throughout, with a peak count of 26 within the MCZ.

In France, the survey carried out in winter 2012-2013 concerned all the regions.

	Brittany	Normandy	Picardy	Nord – Pas-de-Calais	Total
Black-throated diver	0	124	0	0	124
Great northern diver	11	7	0	1	19
Red-throated diver	5	261	71	65	402
Great crested grebe	55	4756	103	1,063	5,977
Red-necked grebe	0	1	0	0	1
Slavonian grebe	7	96	0	11	114
Black-necked grebe	94	87	0	45	226

The black-throated diver was only found in Normandy and the wintering population has increased compared to previous surveys (83 individuals for 2001-2002 and 2011-2012, i.e. 50% more). This increase is, however, irregular: it can be seen in the west coast of Cotentin and the Pays de Caux but numbers decrease on the east coast of Cotentin and Bessin.

The great northern diver shows a gradient decreasing from west to east, with a drop in numbers in Normandy.

The red-throated diver is the most abundant diver with a reverse gradient increasing from west to east. Numbers are down in Cotentin and increase in Calvados and along the coast of Caux.

The numbers of red-necked grebe had already declined greatly in previous surveys (from 14 to 3 individuals), and only one individual was spotted. The species is no doubt about to cease wintering regularly in the Channel.

Wintering numbers of Slavonian grebe have been regularly decreasing since 2001 in Normandy in all sectors west and north of Cotentin. The changes seem to suggest an eastward movement of the wintering zone of this Nordic species.

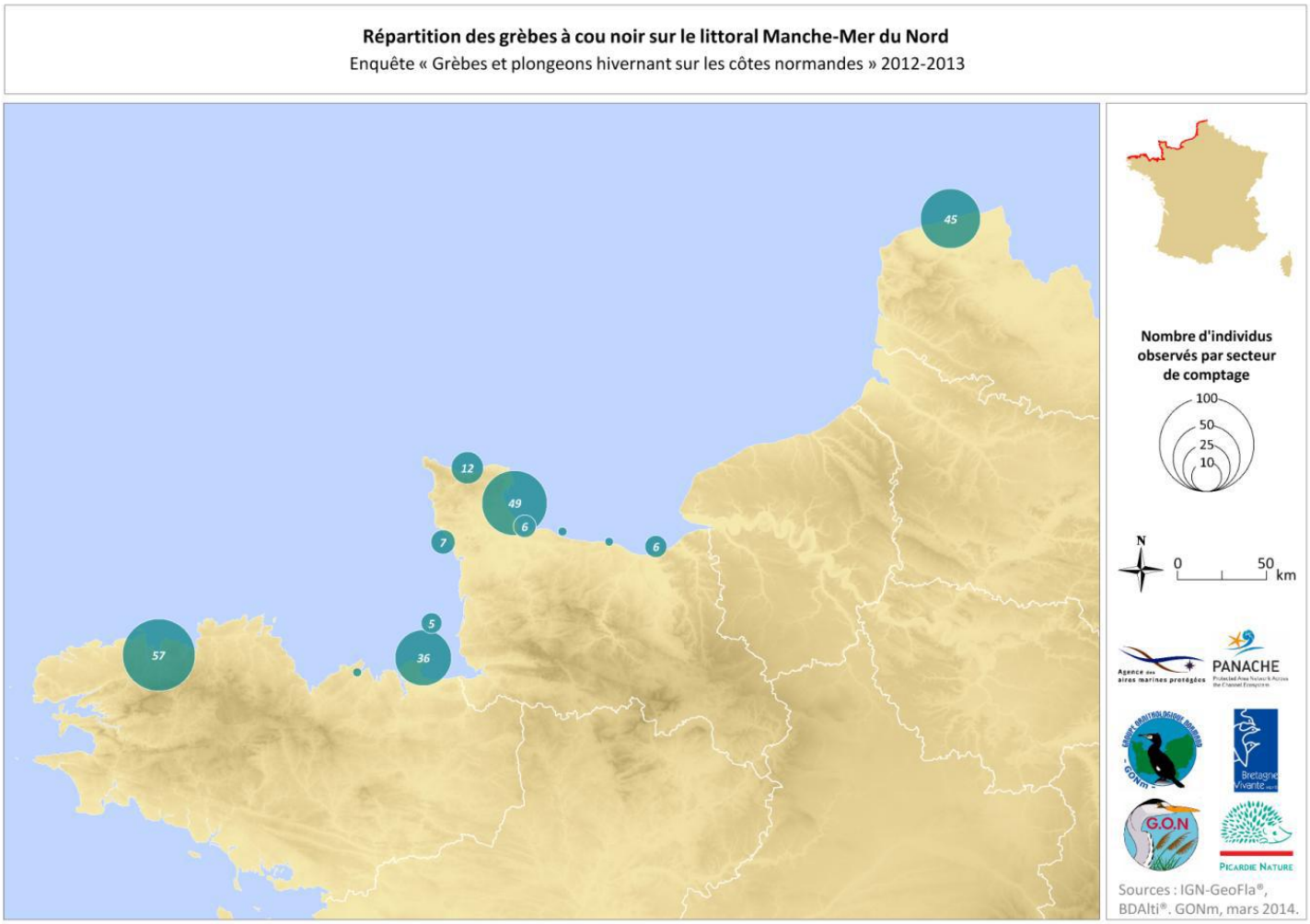

Figure 20. Distribution of black-necked grebes on the Channel-North Sea coast (2012-2013 survey - GONm)

The distribution of the black-necked grebe in the Channel does not present any gradient but is very disparate, occupying certain sectors (estuaries and bays) and leaving portions of coast practically unoccupied between these preferred zones.

There are very few crested grebes in the Western Channel: starting from bay of Veys, 45% of the coastline accounts for only 5% of individuals. This distribution is independent of habitats with three preferred areas: Pays d'Auge coast, Pays de Caux coast and the strait of Nord-Pas-de-Calais.

V. Discussion

Marine birds are good, visible indicators of the condition of the sea. They are long lived and therefore monitoring should be long term to understand how they use and are impacted by changes and use of the marine environment. For example, kittiwakes have shown movement through the north in recent years.

After 10 years of data on grebes and divers we begin to see a coherent pattern, showing potential new places for MPA. But need more “big” surveys for high sea. This can also help direct management.

5.1. Kittiwakes

The two kittiwake colonies studied on the English side of the Channel are important in a SW England context. Neither are designated SSSI nor have an MPA associated with them, but kittiwakes are in decline across England and France so are a monitoring priority and a species for which MPAs are sought.

The Straight Point colony remains an important regional site and numbers and productivity were similar in both years. Little is known of the foraging areas of the birds from this colony but further monitoring, and if possible, research into the foraging area would be beneficial in understanding site protection and management opportunities. Further monitoring will also be beneficial in understanding more about the interchange between birds from colonies on different sides of the Channel.

At Rinsey Head this colony appears to be in steep decline. The colony was monitored between 2006 and 2009 when there were 103, 113, 111 and 128 AONs respectively with productivity ranging between 0.29 and 0.61ch/pr (JNCC Seabird Colony Database). More recently, the colony held 76 pairs in 2011 with a productivity of 0.29ch/pr (JNCC Seabird Colony Database). Until the last couple of years, this was one of the most important sites in Cornwall. The reason for the sudden abandonment of this site is not clear, and it is possible that birds have relocated to sites further along the coast. Further monitoring of surrounding areas will be beneficial in future years.

In France, the situation contrasts between the Normandy colonies in decline and the colonies in the Nord Pas de Calais on the increase. Production indicators range from zero to very good depending on the sites (cf. below), but we have also noted that they are better in Nord Pas de Calais than Normandy. Several factors can explain these trends and this North/South contrast:

- global changes (the kittiwake population in France on the southern distribution boundary tending to move northwards).
- change of nesting sites
- predation

- disturbance
- reduction in food resources
- ectoparasites (mainly the tick *Ixodes urae*) (Monnat, Cadiou, 2004)

5.2. Guillemots

The guillemot colony at Berry Head is the largest mainland colony on the Channel coast of SW England with around 900 breeding individuals nesting on a small cliff face and forming part of the Berry Head to Sharkham Point SSSI. Interestingly, the waters immediately adjacent to the colony have unique statutory protection as an 'Area of Special Protection (ASP)' a very small marine protected area especially for guillemots, which gives powers to the Harbour Authority to protect the guillemots from disturbance by people. The sea area around the colony also forms part of the Torbay MCZ.
The Torbay Coast and Countryside Trust, which manages the land at Berry Head National Nature Reserve, has been working in partnership with RSPB, to monitor the colony and seek management solutions to minimize disturbance to the guillemots. The study results have shown that the presence of marine craft near to the guillemot colony during the breeding season does lead to some disturbance observable through behavioural characteristics. It has shown that a variety of craft enter the Area of Special Protection (and MCZ) throughout the breeding season. Different types of craft cause different degrees of response from the guillemots both on the cliff and on the water. It was notable that the response was more marked when vessels approached within 50m of rafting birds. There are plans to continue the monitoring to provide further evidence to support management decisions, but already the results should help guide stakeholder discussions on appropriate management of human activities in the waters around the colony.

5.3. Wintering birds

The Torbay MCZs appears to hold a greater number of wintering guillemots, razorbills, shags, cormorants and great northern divers than the surrounding area. Additionally, auk and great northern diver peak and mean counts were much higher than in the previous survey in 1994/5. The high guillemot numbers were associated with the breeding colony at Berry Head (discussed above), providing further evidence that the Torbay MCZ is important for this species.

Outside the MCZ area, there was a large presence of great crested grebes off Dawlish with a peak count of 131 compared to just 8 in 1994/5. However, these observations are snapshots so it is possible that higher counts were missed in previous years and that this count is not exceptional. Further survey is needed to confirm the relative importance of this area.

Red-throated divers off Otterton further east, had a peak count of 43, indicating this part of Lyme Bay could be another important wintering area for waterbirds and is worth further survey.

To determine the importance of the Torbay MCZ and the surrounding waters, we look at the criteria for national and international importance. Thresholds for national importance for birds are set at 1% of the Great Britain (GB) population, and at 1% of the biogeographic population for international importance. These qualifying thresholds are listed in appendix 1.

Two of the species present (black-necked grebe and red-necked grebe) in the survey area occur at very low levels in GB such that 1% of GB population is just a single bird, for black-throated diver it is just 6 birds; and for Slavonian grebe, 11 birds (Musgrove et al 2013). In these cases minimum thresholds of 50 birds are used to signify national importance (Musgrove et al 2013). In the survey area these species were present at low numbers. Given their scarcity in GB their presence in this area is significant, in particular the peak count of 10 black-necked grebes within the MCZ. The GB wintering total for this species is just 130 birds (Musgrove et al 2013).

Additional to the 2012/2013 survey, counts by a local experienced observer over the winter of 2013/14 revealed particularly high numbers of some species in Torbay, including a peak count of 51 great northern divers on 31 December 2013 (M. Langman pers. comm.), which exceeds the criteria for international importance. A peak count of 11 black-necked grebes was also noted on 11 December 2013 (M. Langman pers. comm.), which further demonstrates that Torbay is of regular importance for this species. It is possible that severe weather during December 2013 could have accounted for the increased numbers of divers using the bay, perhaps adding to the importance of the MCZ.

The numbers of cormorants, shags, guillemots and razorbills are not significant in a national context but the concentration of guillemots present in the winter within the MCZ, associated with the breeding site at Berry Head, warrants further investigation as to how the birds are using the MCZ area. This ties in with the monitoring under objective 2, which has studied disturbance of the guillemots during the breeding season and is discussed above.

Thanks to these studies, the coherence of the MPA network can also be assessed. The wintering grebes and divers survey conducted during winter 2013 – 2014 enabled the coherence of the MPA network on the French coast to be assessed for these species.
Table 8 clearly shows that the coastal SPA network is coherent for several species since the great majority of them was counted within the network, particularly for the most coastal species such as the great crested grebe (84.5% in Normandy and 82.7% for the Channel-North Sea MSR) or the black-necked grebe (77.8% in Normandy and 71.4% for the MSR). Here, we have drawn a distinction between Normandy where the entire coast was covered and the Channel-North Sea Marine Sub-Region (MSR) where only sample sectors of the coast (including Normandy) were covered for the counts. Other species are seen less in the SPAs but are still in a majority such as black-throated divers (54.4%), great northern divers (55.6% and 76.2%) and red-throated divers (61.7% and 61.2%) (species also found further offshore and/or in small numbers). Finally, some species are present in a minority in the SPA or not present at all such as the red-necked grebe (0%) and the Slavonian grebe (35.4% and 36%). In fact, only one red-necked grebe is present in the entire MSR (rare species),

whereas 114 Slavonian grebes are present, which leads to the conclusion that the coastal SPA network does not correspond well to this species' winter distribution.

The same exercise was done taking into consideration the network of National Nature Reserves (NNR). Unlike the SPA network (focused on birds), the NNR network does not correspond at all to the distribution of this species either in Normandy or across the whole MSR (sample sectors). Some species (black-throated and great northern divers, red-necked grebe) have never been counted inside the reserves, regardless of the geographic entity studied. These are therefore species in low numbers and/or with a more offshore distribution (divers). The other species (red-throated diver, great crested, Slavonian and black-necked grebe) have very low rates of presence below 23% and even lower in Normandy. As a result, the network of NNRs, which is a strong conservation status, is not adapted to these species in the Channel-North Sea MSR and even less so in Normandy (exhaustive count).

Geographic entity	Types of French MPAs	Black-throated diver	Great northern diver	Red-throated diver	Great crested grebe	Red-necked grebe	Slavonian grebe	Black-necked grebe
Complete count - Normandy	Outside SPA	45.6%	44.4%	38.3%	15.5%	100.0%	64.6%	22.2%
	Within an SPA	54.4%	55.6%	61.7%	84.5%	0.0%	35.4%	77.8%
	Outside NNR	100.0%	100.0%	96.9%	87.0%	100.0%	96.9%	92.6%
	Within an NNR	0.0%	0.0%	3.1%	13.0%	0.0%	3.1%	7.4%
Sample count – Channel-North Sea MSR	Outside SPA	45.6%	23.8%	38.8%	17.3%	100.0%	64.0%	28.6%
	Within an SPA	54.4%	76.2%	61.2%	82.7%	0.0%	36.0%	71.4%
	Outside NR	100.0%	100.0%	84.6%	77.4%	100.0%	97.4%	97.3%
	Within a NR	0.0%	0.0%	15.4%	22.6%	0.0%	2.6%	2.7%

Table 8. Representativeness of the SPA network and the NNR network across Normandy (complete count) and the Channel-North Sea MSR (Samples) for wintering grebes and divers in 2013-2014.

The maps below (**Erreur ! Source du renvoi introuvable.** et **Erreur ! Source du renvoi introuvable.**) illustrate this situation by taking the example of the great crested grebe and the red-throated diver. These maps clearly show the importance of the SPA network for these two species, the largest numbers mostly being found inside SPAs (particularly for the great crested grebe). The "Littoral Seino marin" SPA (off the Pays de Caux) and the "Littoral augeron" SPA (eastern coast of Calvados) are of particular importance for the two species.

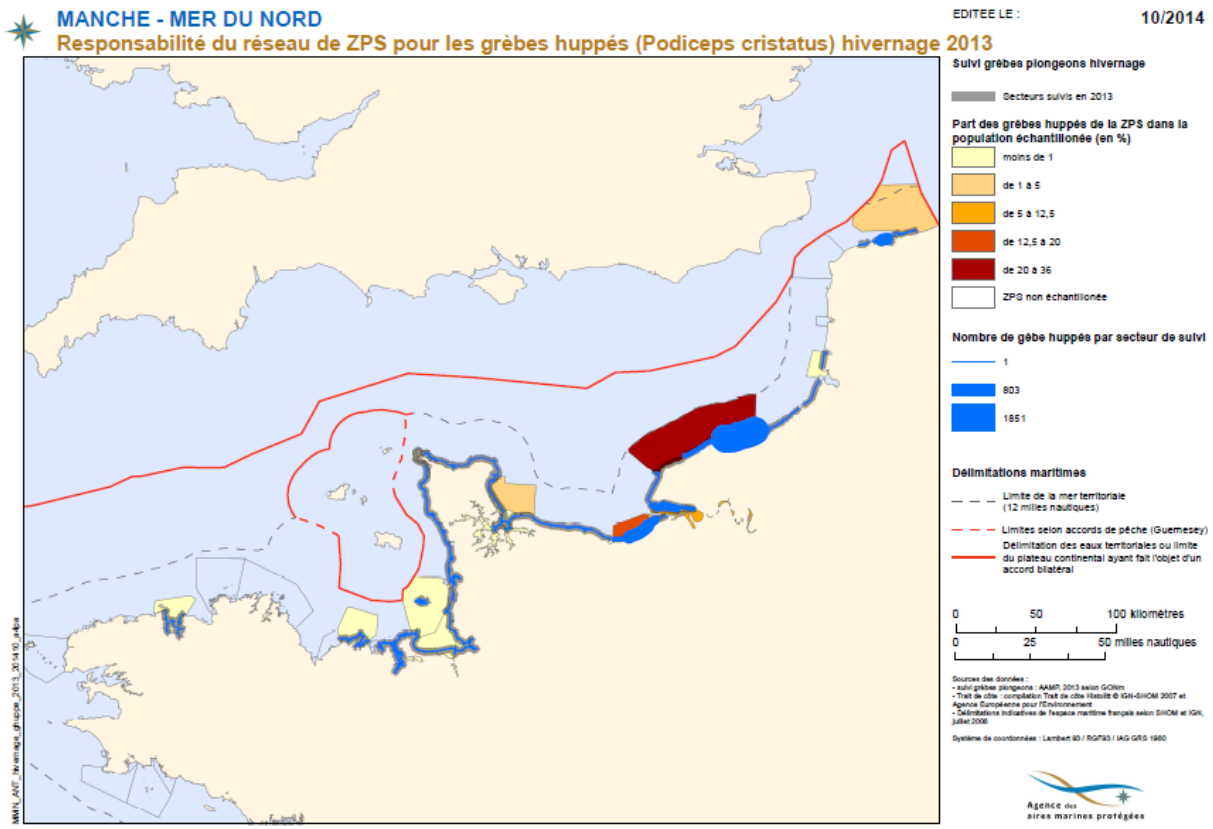

Figure 21. Responsibility of the SPA network for crested grebes during wintering 2013-2014

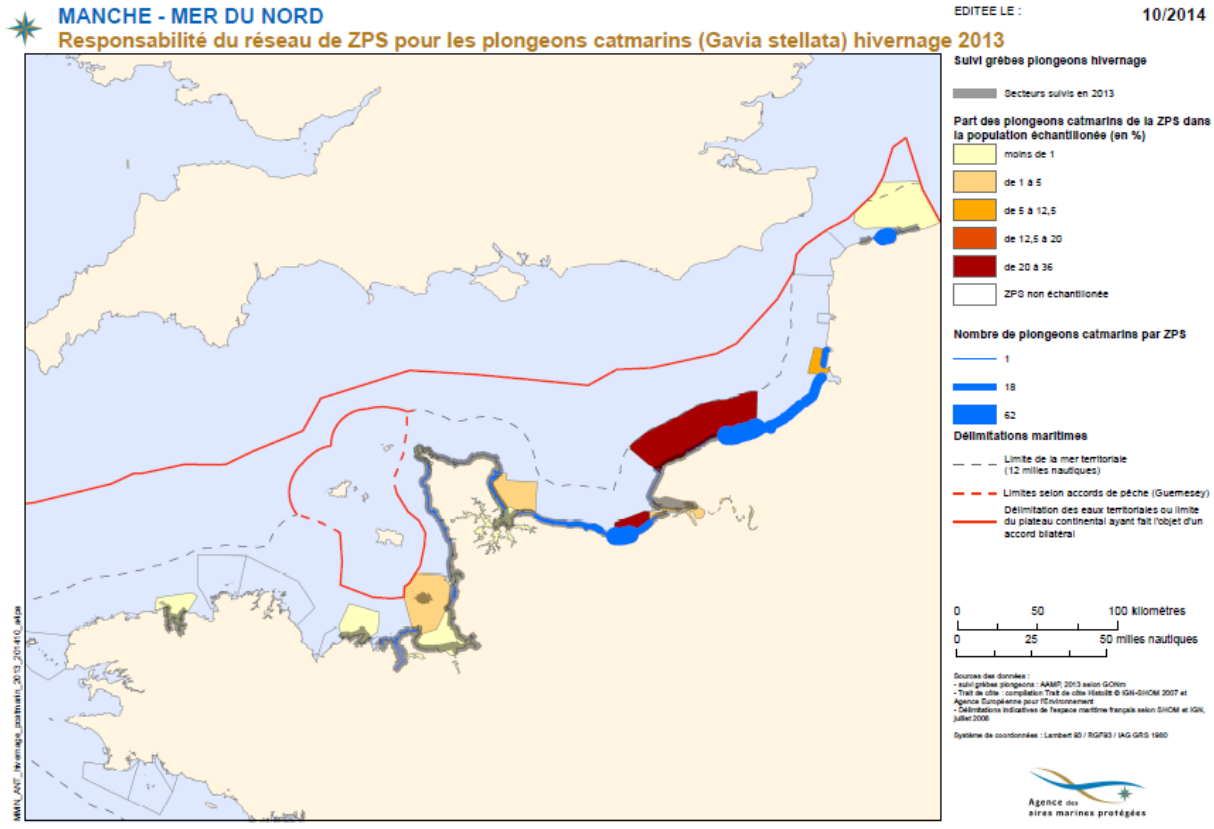

Figure 22. Responsibility of the SPA network for red-throated divers during wintering 2013-2014

Outside the Devon survey area, on the French sites, the numbers of wintering birds found were much higher, e.g. huge numbers of great crested grebe.

5.4 From birds survey to MPA dashboard

As marine birds can be regarded as indicators of the marine ecosystem's conservation status due to their position in the food chain, it is interesting to measure the conservation status of these species. The conservation status of a species also allows priority conservation objectives to be defined for birds in the marine sub-region. Indicators can be developed to measure the conservation status of a species. Within the framework of the OROM's work (Observatoire Régional des Oiseaux Marins de Bretagne – Regional marine bird observatory of Brittany), Cadiou & Coll (2010) proposed an indicator of the health status of breeding marine birds based on changes in numbers and the production of offspring.

Production	[0_	[0,1	[0,2	[0,3	[0,4	[0,5	[0,6	[0,7	[0,8	[0,9	[1,0	[1,1	[1,2	[1,3	[1,4	[1,5	[1,6	[1,7	[1,8	[1,9	[2,0	[2,1	[2,2	[2,3	[2,4	[2,5
Espèce																										
Fulmar boréal	TM	M	M	Y	B	TB	TB	TB	TB	TB																
Océanite tempête	TM	M	M	Y	B	TB	TB	TB	TB	TB																
Cormoran huppé	TM	M	M	M	M	Y	Y	Y	Y	Y	B	B	B	B	B	TB	TB	TB	TB	TB	...					
Goélands	TM	M	M	M	M	Y	Y	Y	Y	Y	B	B	B	B	B	TB	TB	TB	TB	TB	...					
Mouette tridactyle	TM	M	M	M	Y	Y	Y	B	B	B	TB	TB	TB	TB	TB	...										
Sternes	TM	M	M	M	M	Y	Y	Y	Y	Y	B	B	B	B	B	TB	TB	TB	TB	TB	...					
Guillemot de Troïl	TM	M	M	M	Y	Y	B	B	TB	TB																
		Niveau de le production en jeunes																								
	TM	Très mauvais ou nul			M	Mauvais (ou Médiocre)										Y	Moyen			B	Bon		TB	Très bon		

Table 9. Thresholds currently considered for the five classes of juvenile production for the various species of marine bird studied (according to Cadiou et Coll., 2013)*

** Juvenile production (average number of fledglings per breeding couple) is presented in bands of 0.1 juvenile per couple (0 to 0.09, 0.1 to 0.19, etc.)*

Thus, if we take the table above (Table 9),

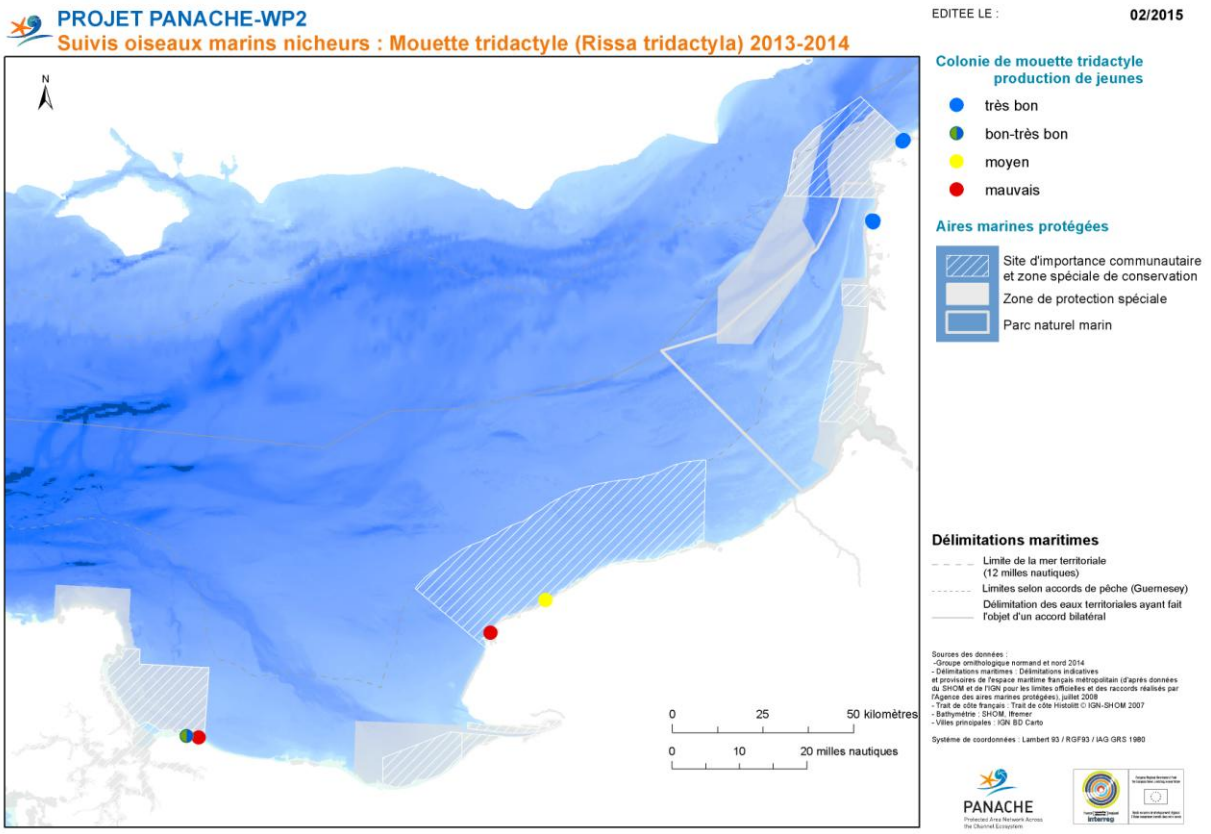

Table 10 shows that the kittiwake populations in Normandy are not in as good health as the populations in Nord Pas de Calais. This can be explained by several factors:

- change of nesting sites
- predation
- disturbance
- reduction in food resources
- ectoparasites (mainly the tick *Ixodes urae*) (Monnat, Cadiou, 2004)
- global changes (the kittiwake population in France on the southern distribution boundary tending to move northwards).

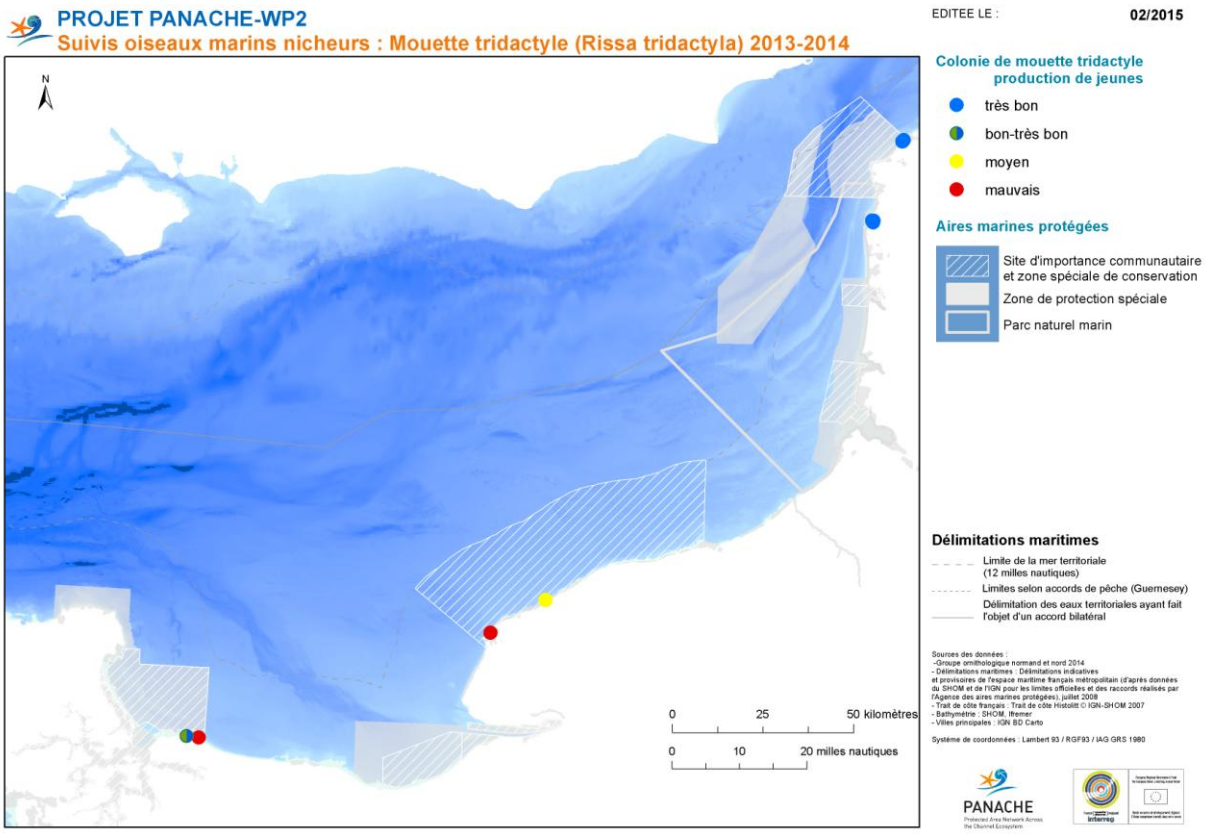

Table 10. Dashboard of French kittiwake colonies monitored, obtained from the production of juveniles.

Along the same lines, production indicators for colonies of shags vary greatly from one site to the next (

Figure 11).

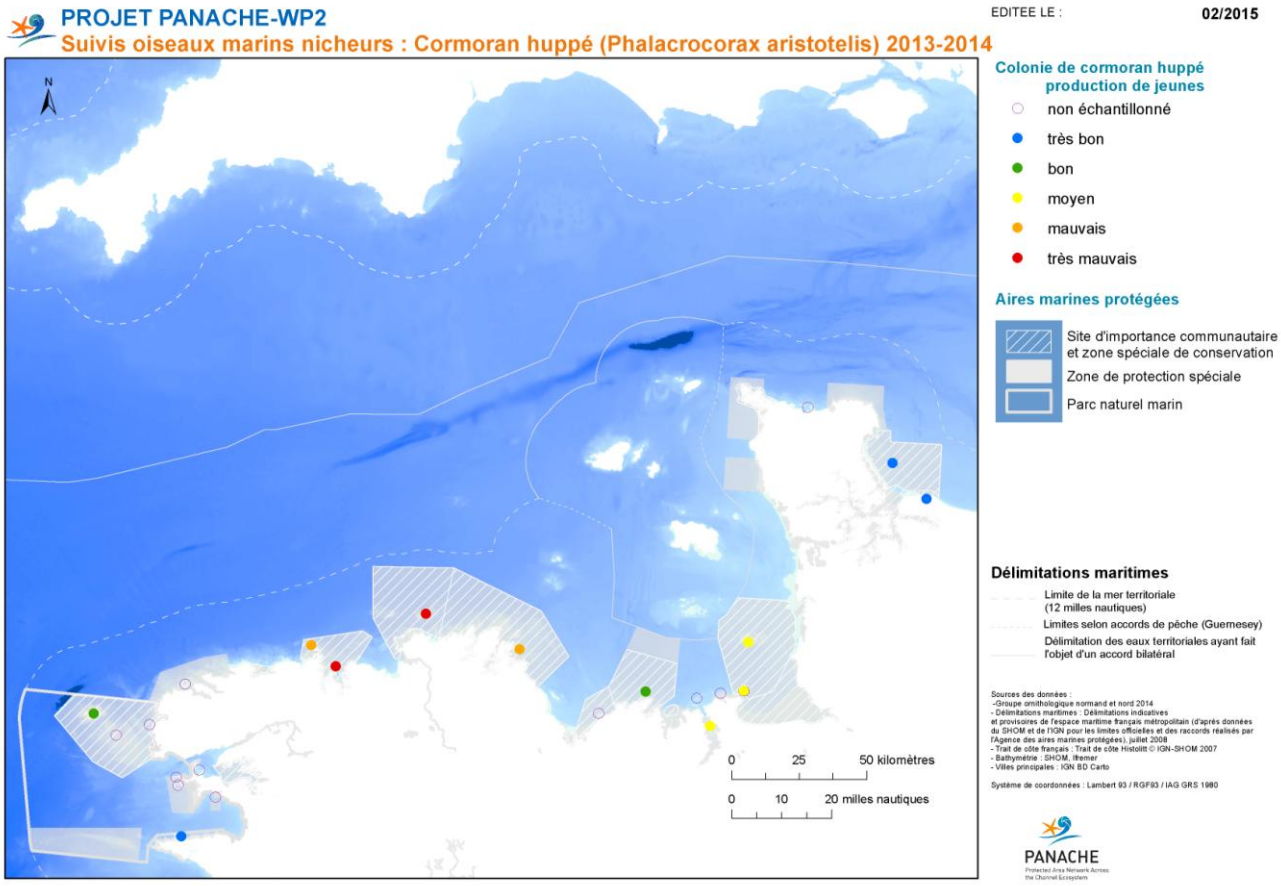

Figure 11. Dashboard of French sample colonies of shags obtained from the production of juveniles.

If we now consider the great cormorant (Table 12), juvenile production ranges from good to very good for all the sites monitored, except for the Roc'h Losquet colony (2 couples).

Colonies	Production
Roc'h Losquet	Very poor
Cote 12 m	Very good
Les Trois iles	Good
Houlée	Good
Petit Romon	Good
Nez de Jobourg	Very good
Antifer	Very good
Val-le-Pretre	Good
Mesnil-Val	Good

Table 12. Dashboard of French sample colonies of great cormorants obtained from the production of juveniles. (Ce tableau pourrait être transformé en carte ce qui faciliterait l'interprétation.)

If we consider all the colonies of terns monitored as part of this programme carried out in France, Table 13 shows that juvenile production results vary across the species. The common tern, which is the most common species, is in good health with a good productivity (1.1 to 1.41), whereas the Sandwich and Little tern have poor productivity rates (0.12 to 0.28). The Roseate tern, by far the rarest (1 colony of 17 to 18 couples) and thus the biggest conservation concern, shows an average productivity (0.56 to 0.71)

Species	Colonies	Production
Common tern	Sample Colonies MSR	Good
Sandwich tern	Sample Colonies MSR	Poor
Little tern	Sample Colonies MSR	Poor
Roseate tern	Sample Colonies MSR	Average

Table 13. Dashboard of French sample colonies of terns obtained from the production of juveniles.

Other indicators can be used, such as, for example, the litter found in the nests of shags and great cormorants. Table 14 shows that the abundance of litter in the nests of shags varies across the sites. However, a certain pattern can be seen: the colonies the farthest from the coast are less affected (Chausey, Tégor-Goelo, Sept Iles, Island of Batz, Ouessant, Molène, etc.) and those closest to the continent are the dirtiest (the most contaminated being a colony located in a Port: Cherbourg). This indicator appears to tally with the status of the colony's immediate ecosystem: the birds use local materials to build their nests. This indicator also provides information about the risks that can directly affect the species: litter that could be ingested by the birds or could be a trap (trapped feet or body preventing all movement and eventually causing death).

Département-Colony of shags	Number of nests studied	**% of nests with litter**	**Indicator***
50-Saint-Marcouf	263	**30.4%**	**Average**
50-Cherbourg	18	**100.0%**	**Very poor**
50-Islands of Chausey	932	**14.2%**	**Good**
35-Landes island	182	**30.2%**	**Average**
35-Grand Chevreuil	90	**50.0%**	**Average**
35-Cézembre	75	**40.0%**	**Average**
35-Ile aux Moines	25	**48.0%**	**Average**
22-Trégor-Goëlo	218	**6.0%**	**Good**
22-Sept-Îles archipelago	108	**10.2%**	**Good**
29-Morlaix bay	135	**25.9%**	**Average**
29-Island of Batz	98	**19.4%**	**Average**
29-Trevoc'h	18	**16.7%**	**Average**
29-Ouessant	83	**3.6%**	**Good**
29-Molène	411	**3.4%**	**Good**
29-Camaret – Toulinguet	159	**90.6%**	**Very poor**
29-Camaret – Tas de Pois	280	**30.0%**	**Average**
29-Crozon – Aber	18	**77.8%**	**Very poor**

Table 14. Abundance of litter in shag nests

**Very good = 0%, Good = [0-25%] Average=[25-50%], Poor=[50-75%], Very poor=above 75%*

The same exercise was done on two sites for the great cormorant (Table 15). The indicators of these two sites are considered to be good but the two sites taken into consideration are islands, and are therefore quite removed from the continent. As a result, if we work on the theory set forth for shags (the dirtiest sites are those the furthest from the continent), a good status indicator is logical. Continental sites should be included in the sample to check whether the same pattern emerges as for the shag.

Colony	No. of nests with litter	% of nests with litter	Indicator*
Chausey	163	0.60%	Good
Ile de Terre	263	6.50%	Good

Table 15. Abundance of litter in the nests of great cormorants

**Very good = 0%, Good = [0-25%] Average=[25-50%], Poor=[50-75%], Very poor=above 75%*

A comparison of the results for the shag and the great cormorant on the same sites (Table 16) shows that the results for the shag nests are not as good as for the great cormorant. This shows that it is

appropriate to measure this parameter for the two species' nests and that it is interesting, in parallel, to determine where the materials are collected for each one, to find out whether the great cormorant avoids litter more than the shag or whether the collection sites are not the same.

Species	Nests without litter			
	Saint Marcouf		Chausey	
	Rate	Indicator*	Rate	Indicator*
Great cormorant	94%	Good	99%	Good
Shag	70%	Average	86%	Good

Table 16. Percentage of litter-free nests and indicator based on % of nests with litter for the two species on Chausey and Saint-Marcouf.

**Very good = 0%, Good = [0-25%] Average=[25-50%], Poor=[50-75%], Very poor=above 75%*

VI. Conclusions and recommendations

Marine birds are good, visible indicators of the condition of the sea. They are long lived and require long term monitoring to understand how they use the seas and how they are impacted by changes in, and use of, the marine environment. Our work through this case study has given us new information on how birds are using MPAs and surrounding areas that should ultimately help guide management to safeguard these species into the future. It has also helped identify potential new sites, for example, in France, after 10 years of data on grebes and divers a coherent pattern is emerging, showing potential new places for MPAs.

Generally, data are still lacking off shore, where further surveys will help direct management of designated sites and potentially identify new important foraging or wintering areas.

The Channel is a relatively confined sea area, and further cross-Channel collaboration would be valuable to help us understand and protect the important seabird populations dependent on the Channel area.

The surveys carried out here are a first necessary step in assessing the conservation status of the bird populations and indirectly the marine ecosystem in the Channel / North Sea. As part of this Interreg programme, priorities have been defined, but other bird species must be monitored in other seasons on a regular and long-term basis.

This programme has demonstrated that it is worthwhile conducting these surveys on both sides of the Channel and that cooperation between France and Britain, or even Belgium too, is necessary for this shared heritage that the Channel and North Sea marine ecosystem represents. Of course, these surveys were carried out over a short period (1 to 2 years), but long-term monitoring is essential in order to:

- measure the efficiency of the MPA network and its management
- remove the artefacts linked to inter-annual variability.

These surveys also meet needs of the various national and international policies in place:

- France's national MPA creation and management strategy
- MSFD
- Natura 2000
- OSPAR, etc.

As these surveys were conducted over a short period (1 or 2 years), long-term monitoring is essential in order to:

- Measure changes in the conservation status of the bird populations and their habitats
- Measure the efficiency of the MPA network and its management
- Limit the artefacts linked to inter-annual variations.

To implement policies (National MPA strategy, MSFD, OSPAR, etc.), monitoring is required that allows us to measure the conservation status of the species, as they are indicative of the conservation status of the marine ecosystem and its good management. This cross-Channel work allows common protocols to be developed, for common species, based on the issues at stake. It has also led to the development of indicators that must now be taken into account by the two countries. These shared indicators provide identical measuring instruments that facilitate dashboard data entry on different scales: MPA, MPA network, Marine Sub-Region, National, European, etc.

Other surveys and monitoring initiatives need to be organised to meet MPA management needs and particularly needs of Natura 2000. While, in some cases, we are able to measure the conservation status of a species (or a group of species) and the changes to that status, there are gaps in our knowledge of the impact of human activities on those species. Thus, studies must be developed to improve knowledge of those interactions and then to measure how those impacts change. For a more detailed analysis, we must also study "natural" factors that can influence the conservation status of the bird populations such as climate, food resources, quality of the environment, etc.

As we said above, this programme is only the first step that must be turned into other long-term cross-border work focussing particularly on:

- Long-term monitoring of important bird populations, in all seasons
- The development and use of relevant indicators to measure the conservation status of the species and provide long-term dashboard data on several scales (site, network of sites, MSR, National, European, etc.)
- Improving knowledge of the impacts of human activities on bird populations and monitoring those activities over the long term
- Improving knowledge of natural factors that can impact bird populations (climate, food resources, quality of the environment, etc.) and monitoring those factors over the long term.

This collaboration must be expanded by integrating other countries that share heritage with France and England, namely Belgium or even the Netherlands.

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Appendix

Appendix 1. Whole survey area results for 2012/13

species	survey year	mean	peak (highest count on any one date)				
Black-necked grebe	2012-13	3.2	10				
Black-throated diver	2012-13	1.1	2				
Common Scoter	2012-13	15.6	46				
Cormorant	2012-13	6.6	29				
Great crested grebe	2012-13	22	131				
Great northern diver	2012-13	2.8	7				
Guillemot	2012-13	184	1067				
Razorbill	2012-13	18.6	107				
Red-necked grebe	2012-13		2				
Red-throated diver	2012-13	5.5	43*				
Shag	2012-13	20	72				
Slavonian grebe	2012-13	1.4	2				

*supplementary data from Otterton

Direct comparison for 2012/13 against 1994/5 (excluding Otterton and by site groups)

Torbay (includes the MCZ area) (Berry Head to Thatcher Point)

species	survey year	mean	peak		year	mean	peak
Black-necked grebe	2012-13	4.1	10		1994-5	4.4	9
Black-throated diver	2012-13	1	1		1994-5	1	1
Common Scoter	2012-13	23.6	26		1994-5	3	6
Cormorant	2012-13	8.1	24		1994-5	12.8	26
Great crested grebe	2012-13	19.8	64		1994-5	14.7	38
Great northern diver	2012-13	3.3	7		1994-5	1	1
Guillemot	2012-13	278	1067		1994-5	14.4	41
Razorbill	2012-13	27	103		1994-5	6.8	18
Red-necked grebe	2012-13		1		1994-5	1.5	2
Red-throated diver	2012-13	3.7	6		1994-5	0	0
Shag	2012-13	20.9	53		1994-5	35.6	102
Slavonian grebe	2012-13	1.5	2		1994-5	0	0

Teign-Torbay (Hope's Nose to Shaldon Ness)

species	survey year	mean	peak			mean	peak
Black-necked grebe	2012-13	0	0		1994-5	0	0
Black-throated diver	2012-13	1	1		1994-5	0	0
Common Scoter	2012-13	11.3	28		1994-5	5.5	7
Cormorant	2012-13	3.4	12		1994-5	26.3	51
Great crested grebe	2012-13	6.7	25		1994-5	24.5	56
Great northern diver	2012-13	1	1		1994-5	2.5	4
Guillemot	2012-13	9.5	19		1994-5	2.8	6
Razorbill	2012-13	3.3	5		1994-5	3	6
Red-necked grebe	2012-13	0	0		1994-5		1
Red-throated diver	2012-13	1.2	2		1994-5		1
Shag	2012-13	6.6	18		1994-5	43	67
Slavonian grebe	2012-13		2		1994-5	0	0

Dawlish (Mules Park to Dawlish Warren)

species	survey year	mean	peak			mean	peak
Black-necked grebe	2012-13	1	1		1994-5	0	0
Black-throated diver	2012-13	1	1		1994-5	0	0
Common Scoter	2012-13	7.7	54		1994-5	26.3	79
Cormorant	2012-13	2.7	9		1994-5	11.5	27
Great crested grebe	2012-13	21	131		1994-5	3.4	8
Great northern diver	2012-13	1	1		1994-5	2	2
Guillemot	2012-13	2.3	5		1994-5	2.3	5
Razorbill	2012-13	1.4	2		1994-5	6.5	15
Red-necked grebe	2012-13	1	1		1994-5	0	0
Red-throated diver	2012-13	3.1	9		1994-5	1.5	2
Shag	2012-13	13.4	42		1994-5	31	55
Slavonian grebe	2012-13	1.2	2		1994-5	5.2	10

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**.

- www.panache.eu.com –

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Kent Wildlife Trust

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Nausicaá – La mer est sur Terre

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