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A low-cost, year-round seabird monitoring programme in the English channel and Bay of Biscay: preliminary results 1995-2001

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In 1995, the Biscay Dolphin Research Programme established a monthly, year-round seabird and cetacean monitoring programme in the western English Channel and eastern Bay of Biscay, using the P&O Portsmouth cruise-ferry the Pride of Bilbao and volunteer surveyors. On each four-day survey trip bird recording was made during all daylight hours, enabling the whole of the route to be sampled over much of the year. Over the 5.25 year recording period 44 seabird species were recorded, with more than 100 000 seabirds counted in approximately 50 000 km of search effort, spread over 85 ICES rectangles (measuring 15' latitude by 30' longitude). Shelf waters of the northern Bay of Biscay were found to have presumed important numbers of wintering Northern Gannet *Morus bassanus* and Great Skua *Catharacta skua* at relatively high densities. A number of other species including Divers *Gaviiformes*, gulls *Laridae* and auks *Alcidae* were present at lower abundance. During the summer, these shallow waters supported moulting populations of Mediterranean Shearwater *Puffinus yelkouan (mauretanicus)* at the northern edge of their range and European Storm-petrels *Hydrobates pelagicus*, which are scarce in north European waters at this time of year. A number of seabirds rare elsewhere in north European waters were regularly recorded during the late summer and autumn period in shelf-edge and deep water areas of the Bay of Biscay, including Little Shearwater *Puffinus assimilis*, Cory's Shearwater *Calonectris diomedea*, Great Shearwater *Puffinus gravis*, Grey Phalarope *Phalaropus fulicaria*, and Sabine's Gull *Larus sabini*. Spectacular numbers of Great and Cory's Shearwaters were found in most years of survey, with loafing flocks of hundreds of birds seen on numerous occasions. Recent methodology enhancements have been made to improve the quality of monitoring data, and further improvements are proposed. The BDRP surveys have demonstrated how volunteers and ferries can be used to generate low-cost, quantitative data in areas where large -scale systematic surveys are unlikely to be carried out. The results of such surveys may have considerable conservation and policy relevant implications, particularly in the designation and year-round management of marine Important Bird Areas.

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1. Introduction

This paper presents baseline monitoring data on the distribution and relative abundance of seabirds in offshore waters of the eastern Bay of Biscay and western English Channel. These data derive from a preliminary analysis of sightings data collected through Biscay Dolphin Research

Programme (BDRP) surveys, between 1995 and 2001. BDRP is a voluntary marine research, education and conservation organisation, sponsored by P&O Portsmouth and affiliated to Sea Watch Foundation.

There have been relatively few offshore seabird surveys in the eastern Bay of Biscay and the Western Approaches of the English Channel (White & Reid 1997) in comparison with surrounding UK waters and the eastern North Sea. The European Seabirds at Sea Team survey/database area extends as far south as the north coast of Brittany, but not into the Bay of Biscay (Webb pers comm). Seabirds at Sea (SAS) surveys in the western English Channel have located internationally important populations of Great Skua *Catharacta skua*, Northern Gannet *Morus bassanus* and Little Gull *Larus minutus* (Stone *et al*. 1995).

Seabird survey and distribution data from the Bay of Biscay are patchy, available published data mainly describing individual species. Hémery & Jouanin (1988) analysed survey and other data of Leach's Petrels *Oceanodroma leucorhoa*, estimating a Biscay winter population of 0.3-2 million birds. Le Mao & Yésou (1993) estimated the late summer coastal population of Yellow-legged Gulls *Larus cachinnans* along the French coast of the Bay of Biscay at approximately 20 000 birds. Yésou (1986) further estimated that 8-10 000 Mediterranean Shearwaters *Puffinus yelkouan (mauretanicus)* undertake a post-breeding moult in French coastal waters. A recent study by Guerin (1999) has identified a similar early summer coastal occupancy of Cory's Shearwater *Calonectris diomedea* off northwest France. Offshore seabird surveys in the eastern Bay of Biscay have been undertaken and compiled by Bourne (1986). More recently transect surveys off the northwest coast of France have been carried out by local French groups (Webb pers comm.). Casual records from bird watchers have been collated periodically from the Bay of Biscay. In 1990, Seawatching and Birding Alternatives produced a report of sightings from Plymouth (England) to Santander (Spain) crossings. Since 1997 England-Spain ferry sightings have been collated by Organisation Cetacea and summarised in annual reports.

Until recently, marine environments have received little attention in terms of identifying Important Bird Areas (IBAs) due to the difficulty in defining and delineating individual sites (Heath & Evans 2000). Skov *et al*. (1995) identified the coastal waters off Start Point (Devon, southern England) in the western English Channel as an IBA. Not enough data are available to assess accurately IBA status in other parts of the Channel (Skov *et al*. 1995) and no work has been done to identify candidate IBAs in offshore waters of the Bay of Biscay (Heath & Evans 2000).

In 1995, BDRP launched a year-round seabird-monitoring programme in the western English Channel and eastern Bay of Biscay, the primary aim being to generate baseline data on the seasonal distribution and abundance of seabirds in these under-sampled regions.

2. Study area and methods

The study area is situated in temperate waters of the northeast Atlantic, between

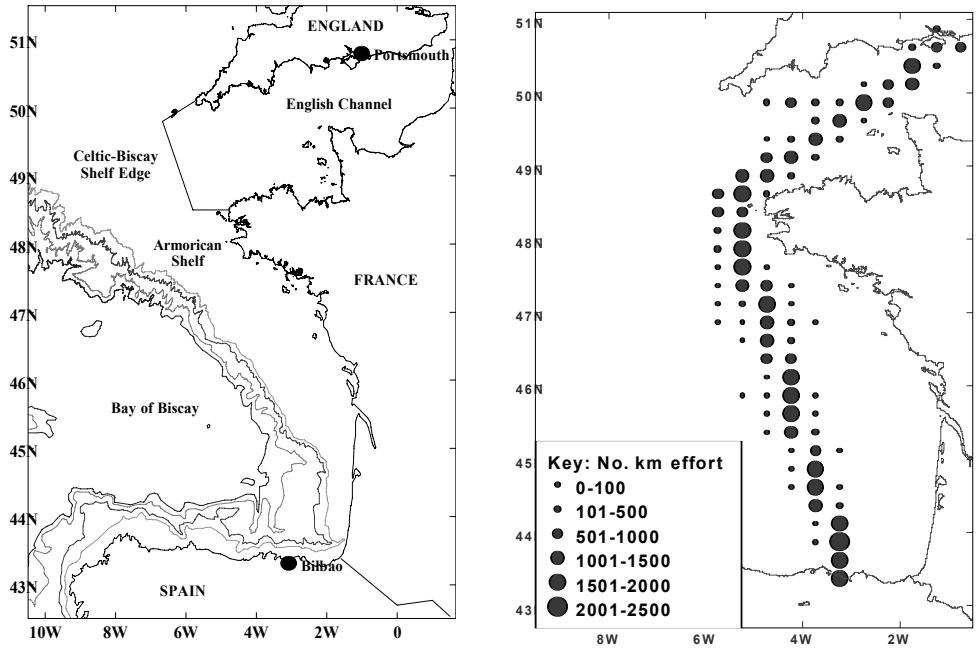

Fig. 1. (a) Study area and (b) survey coverage 1995-2001 (In Fig. 1a depth contours from right to left are 200 m, 1000 m, 2000 m, and 4000 m.).

latitudes 43° to 51°N and 0° to 8°W and comprises two major seas, the English Channel and Bay of Biscay (Fig. 1a). For the purposes of this paper, the two seas have been demarcated by latitude, with seabird sightings north 48°30'N classified as within the English Channel, whilst those to the south in the Bay of Biscay.

BDRP seabird survey work in the English Channel and Bay of Biscay was undertaken exclusively from the P&O Portsmouth cruise-ferry, the Pride of Bilbao. The ferry sails between Portsmouth in southern England and Bilbao in northern Spain, traversing British, French and Spanish waters. The ferry follows a set route, but the course alters at times and in total effort-related sightings data have been obtained from 85 ICES (International Council for the Exploration of the Sea) rectangles, measuring 15' latitude by 30' longitude (Fig. 1b). The English Channel consists of shallow continental shelf waters that rarely exceed 100 m in depth. Depth increases slightly to between 100 and 200 m over the Armorican Shelf off the southwest coast of Brittany. The main feature of the survey area is the region of steep continental slope, which marks the border between continental shelf waters and the abyssal plain of the Bay of Biscay. Along the slope, water depth drops from 200 m to over 4000 m over distances as little as 35 km. The Bay of Biscay predominantly is a deep-water area, approaching depths of 5000 m in some places. In the southern portion of the Bay, seabed topography is highly variable and two deep-water canyons extend to within 17 km of the Spanish coastline. The easternmost canyon known as the Cap De Breton Canyon, is traversed during the ferry crossing.

Tab. 1. Survey effort (km travelled) by season in the English Channel and Bay of Biscay on bird recording trips.

Season (Months)	No of trips	English Channel km travelled	Bay of Biscay km travelled
Spring (Mar-Jun)	17	8683	11912
Summer/Autumn (July-Oct)	18	5198	9830
Winter (Nov-Feb)	16	7338	5629
Total		21219	27370

Year-round, monthly seabird surveys were undertaken from the Pride of Bilbao ferry. Each return crossing extended over four days, allowing the whole route to be sampled at least once during daylight hours in summer and approximately 75% of the route in winter. The main gap in coverage was the northern Celtic-Biscay shelf-edge (45°N-46°30'N).

On each trip, effort-related seabird recording was carried out during all available daylight hours by a team of three experienced volunteer observers. Recording was carried out from a fixed position on the bridge of the ship, at a height of 32 m and speed of 15-22 kt. Each seabird observed ahead of the ship was counted once only, with sightings grouped into minute-long periods. Between 1995 and July 2000, all birds within an assumed 2 km-wide strip either side of ahead were counted. For each seabird sighting the following records were made: species name, number seen, and where possible age and sex. Notes on behaviour were also made, including associations with fishing vessels, cetaceans, and environment effects such as oiling and fishing net entanglement. From August 2000, refinements were made to the methodology, to enable estimation of bird density in ICES rectangles. All birds observed ahead of the ship were recorded once only as either (1) inside an imaginary 300 m recording box on the starboard side, or (2) outside the 300 m box (but presumed within 2 km).

Effort data was collected simultaneously with sightings data, to enable the number of sightings to be scaled to recording effort and (to detect change) the calculation of relative frequency, abundance and density. At 15 to 30-minute intervals, or whenever the ship's course changed, a range of variables was measured, including the ship's speed and course, and those of sea and weather such as sea state and visibility (Evans 1995).

Between August 1995 and February 2001, 63 (four-day) survey trips were made, resulting in more than 65 000 km of completed search effort. Bird data were collected on 51 trips, totalling just under 50 00 km of survey effort, even coverage being attained through the seasons (N=16-18 trips, Tab. 1).

The survey effort travelled, in km and by ICES rectangle (30' latitude by 15' longitude), and the latitude and longitude of all bird sightings (from timings) were calculated by formulas in MS Excel. Distribution maps have been generated by DMAP biological mapping software supplied by Dr Alan Morton.

3. Results

Over the 5.25-year recording period 44 seabird species were recorded (Tab. 2), more than 100 000 seabirds being counted in approximately 50 000 km of search effort. Northern Gannet was the most abundant species in both seas, but a full analysis of this species has yet to be completed, due to the volume of records, although a preliminary inspection of the

Tab. 2. Bird species recorded in the eastern Bay of Biscay and western English Channel on BDRP surveys 1995-2001. Ten most abundant species given in ascending rank order.

SEABIRD FAMILY	SPECIES	BISCAY COUNT (RANK)	CHANNEL COUNT (RANK)	GRAND TOTAL
Gaviidae	Red-throated Diver *Gavia stellata*	0	7	7
Gaviidae	Black-throated Diver *Gavia arctica*	0	2	2
Gaviidae	Great Northern Diver *Gavia immer*	0	7	7
Gaviidae	Diver sp	1	3	4
Podicipedidae	Black-necked Grebe *Podiceps nigricollis*	7	0	7
Procellariidae	Northern Fulmar *Fulmarus glacialis*	653 (7)	803 (4)	1456
Procellariidae	Cory's Shearwater *Calonectris diomedea*	3308 (5)	7	3315
Procellariidae	Great Shearwater *Puffinus gravis*	6175 (2)	4	6179
Procellariidae	Sooty Shearwater *Puffinus griseus*	97	21	118
Procellariidae	Little Shearwater *Puffinus assimilis*	10	0	10
Procellariidae	Manx Shearwater *Puffinus puffinus*	70	91 (10)	161
Procellariidae	Mediterranean Shearwater *P. yelkouan mauretanicus*	49	8	57
Procellariidae	Shearwater sp.	0	1	1
Procellariidae	Small Shearwater sp	1	2	3
Procellariidae	Cory's/Great Shearwater	391	12	403
Hydrobatidae	European Storm-petrel *Hydrobates pelagicus*	314 (9)	407 (9)	721
Hydrobatidae	Leach's Storm-petrel *Oceanodroma leucorhoa*	3	10	13
Hydrobatidae	Wilson's Storm-petrel *Oceanites oceanicus*	3	0	3
Hydrobatidae	Madeiran Storm-petrel *Oceanodroma castro*	1	0	1
Hydrobatidae	Petrel sp	35	12	47
Diomedeidae	Black-browed Albatross *Diomedea melanophris*	1	0	1
Sulidae	Northern Gannet *Morus bassanus*	4500**(1)	6376**(1)	10876
Phalacrocoracidae	Great Cormorant *Phalacrocorax carbo*	269	52	321
Phalacrocoracidae	European Shag *Phalacrocorax aristotelis*	7	3	10
Anatidae	Common Scoter *Melanitta nigra*	50	62	112
Phalaropodidae	Grey Phalarope *Phalaropus fulicaria*	21	4	25
Stercorariidae	Pomarine Skua *Stercorarius pomarinus*	70	14	84
Stercorariidae	Arctic Skua *Stercorarius parasiticus*	40	6	46
Stercorariidae	Long-tailed Skua *Stercorarius longicaudus*	5	2	7
Stercorariidae	Great Skua *Catharacta skua*	915 (6)	627 (6)	1542
Stercorariidae	Arctic/Long-tailed Skua	1	3	4
Stercorariidae	Pomarine/Arctic Skua	10	9	19
Laridae	Mediterranean Gull *Larus melanocephalus*	18	51	69
Laridae	Little Gull *Larus minutus*	307 (10)	41	348
Laridae	Sabine's Gull *Larus sabini*	172	10	182
Laridae	Black-headed Gull *Larus ridibundus*	505*	2588*	3093
Laridae	Common Gull *Larus canus*	3	940*	943
Laridae	Kittiwake *Rissa tridactyla*	4631 (4)	3174 (3)	7805
Laridae	Lesser Black-backed Gull *Larus fuscus*	5430 (3)	3910 (2)	9340
Laridae	Herring Gull *Larus argentatus*	166	1961*	2127
Laridae	Yellow-legged Gull *Larus cachinnans*	2500*	1	2501
Laridae	Great Black-backed Gull *Larus marinus*	409 (8)	753 (5)	1162
Laridae	Gull sp.	56	168	224
Laridae	Large Gull sp	2304	1314	3618
Laridae	Small Gull sp	26	2	28
Sternidae	Sandwich Tern *Sterna sandvicensis*	39	16	55
Sternidae	Common Tern *Sterna hirundo*	69	563 (7)	632
Sternidae	Arctic Tern *Sterna paradisaea*	22	7	29
Sternidae	Little Tern *Sterna albifrons*	2	1	3
Sternidae	Black Tern *Chlidonias niger*	5	3	8
Sternidae	Tern sp	71	2	73
Sternidae	Common/Arctic tern	142	30	172
Alcidae	Common Guillemot *Uria aalge*	290	418 (8)	708
Alcidae	Razorbill *Alca torda*	37	63	100
Alcidae	Little Auk *Alle alle*	1	0	1
Alcidae	Atlantic Puffin *Fratercula arctica*	54	30	84
Alcidae	Auk sp	93	146	239

* Coastal species with incomplete counts (not included in species rankings).
** Northern Gannet data incomplete in table, but top ranking species in both regions.
Categories unidentified to species level were not included in ranking.bles

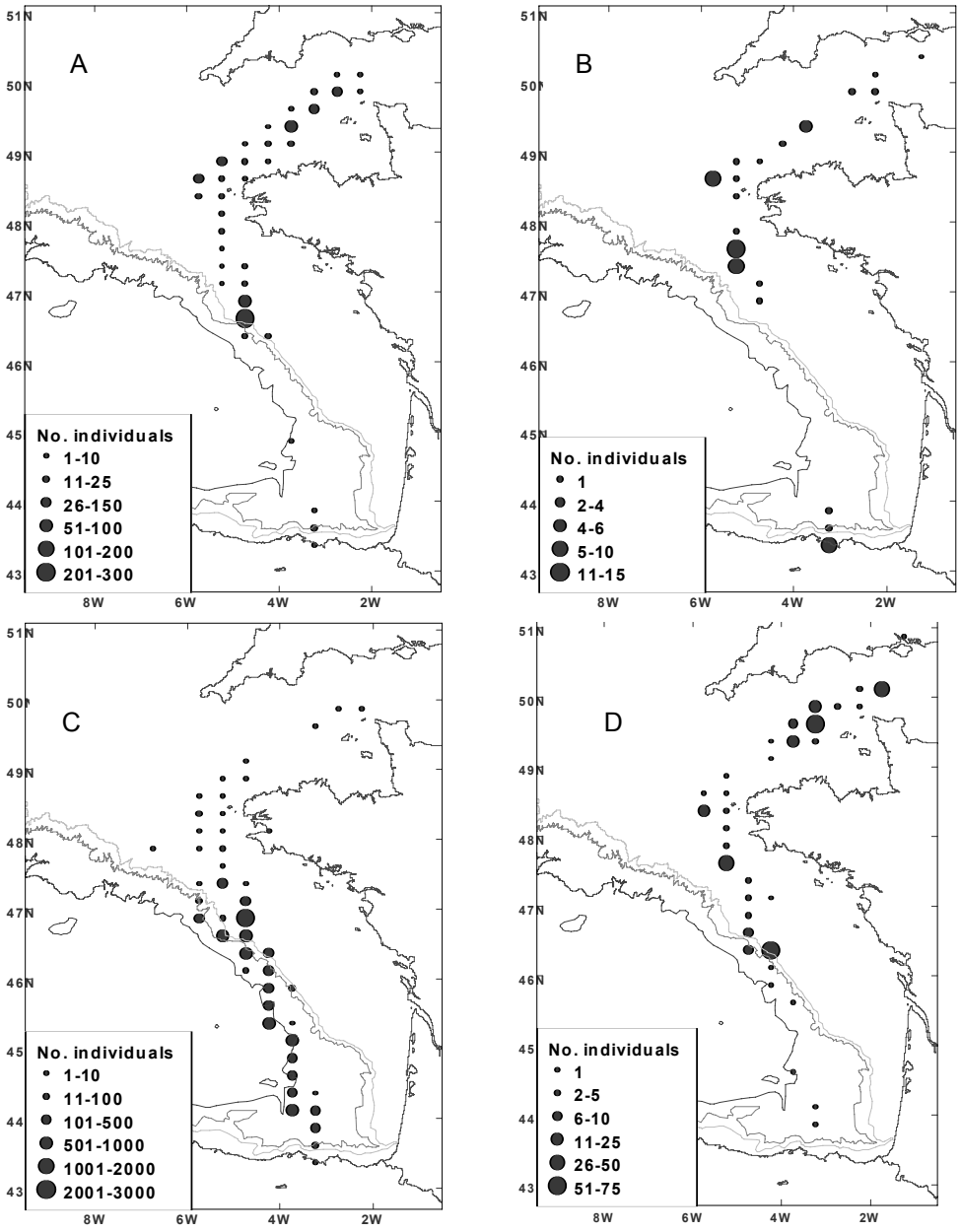

Fig. 2. Distribution and relative abundance of selected seabirds (Depth contours from right to left 200m, 1000m, 4000m). (a) Great Skua November to February, (b) Atlantic Puffin November to February, (c) Great & Cory's Shearwaters Jul-Nov, (d) European Storm-petrel Aug-Oct.

data indicates the largest numbers are found during the late winter period, in the western English Channel and the Armorican Shelf of northern Biscay. This region was also found to support a number of other wintering birds including high

Tab. 3. Bird species which may occur in offshore waters of the western English Channel and eastern Bay of Biscay at levels of regional and north European conservation importance.

Species	Area	Timing	Likely conservation significance
Cory's Shearwater	Biscay	July-Oct	International
Great Shearwater	Biscay	Aug-Nov	International
Mediterranean Shearwater	Biscay/W Channel	Jul-Nov	International
European Storm-petrel	N Biscay/W Channel	Aug-Oct	Regional
Northern Gannet	N Biscay/W Channel	Nov-Feb	International
Great Skua	N Biscay/W Channel	Nov-Feb	International
Kittiwake	Biscay/W Channel	Nov-Feb	Regional
Lesser Black-backed Gull	Biscay/W Channel	All year	Regional
Razorbill	Biscay/Channel	All year	Regional
Common Guillemot	Biscay/Channel	All year	Regional
Atlantic Puffin	Biscay/Channel	All year	Regional

densities (0.5 birds/km^2, Feb 2001) of Great Skua (Fig. 2a) and lower densities of Little Gull, Razorbill *Alca torda*, Common Guillemot *Uria aalge*, Atlantic Puffin *Fratercula arctica* (Fig. 2b) and several gull species. Great Skuas and auks were also recorded regularly in the shelf waters of the southern Bay of Biscay.

Relatively large numbers of Kittiwake Rissa tridactyla and Lesser Black-backed Gull *Larus fuscus* were found in both seas, especially in association with fishing boats. For Lesser Black-backed Gull, a substantial proportion (33%) of sightings were recorded in March and April, presumably indicating a passage of birds through their area from south European wintering grounds. During winter, a high proportion of those aged (e.g.more than 75%, November 2000) recorded off the Brittany Coast were considered to be one of the northern European races *L.f. intermedius* that breeds only in Netherlands, Denmark and southern Norway (Snow & Perrins 1998) and is scarcer than most European gulls at sea. Approximately three-quarters of Kittiwake sightings were recorded during the winter months, confirming the importance of these shelf waters for the species.

A number of seabirds rare in north European waters were regularly recorded during the late summer and autumn period in the Bay of Biscay including Mediterranean Shearwater, Cory's Shearwater, Great Shearwater *Puffinus gravis*, Grey Phalarope *Phalaropus fulicaria* and Sabine's Gull *Larus sabini*. Spectacular numbers of Great and Cory's Shearwaters (Fig. 2c) were found in most years of survey, with loafing flocks of hundreds of birds seen on numerous occasions. Both species were widely distributed from 43°30' to 47°30'N in water depths of 100 m to over 4000 m. Wilson's storm-petrel *Oceanites oceanicus* and Little Shearwater *Puffinus assimilis* were seen on a number of occasions, and are known from casual records to occur with regularity.

Petrels (Hydrobatidae) were undoubtedly under-recorded due to the height of observation and speed of travel. European Storm-petrel *Hydrobates pelagicus* was by far the most frequently recorded petrel, the majority (80%) of sightings occurring between August and October in shelf waters (Fig. 2d). Leach's Petrels *Oceanodroma leucorhoa* were exclusively seen during September and October, with no evidence of a large wintering population as described by Hémery & Jouanin (1988).

4. Discussion

There are a number of likely reasons why the outer reaches of the English Channel and Bay of Biscay have been less well surveyed for seabirds, than for example coastal UK waters and the North Sea. The Channel and Biscay have been presumed to hold lower densities of seabirds, especially auks, vulnerable to pollution incidents. Both seas are relatively inaccessible and are notorious for stormy weather, making surveys logistically more difficult. Perhaps the most important reason is that exploitation for oil and gas has been little developed. Dedicated seabird surveys are very costly. The majority of European offshore surveys so far completed have been achieved only in an economic context as part of environmental impact assessments for the oil and gas industries.

For these reasons, funding is unlikely to be available in the near future for large-scale dedicated surveys. Low-cost methods using ferries therefore are likely to be the only realistic option of getting data from these regions. BDRP surveys in the western English Channel and Bay of Biscay have provided a wealth of new data on the distribution and status of seabirds in these waters and will act as a baseline from which to monitor future changes. New information has been generated on the precise range of a number of species including Little Shearwater, Cory's Shearwater, Great Shearwater, Great Skua and Atlantic Puffin.

The ferry route samples all the major topographical features and underwater habitats found in the English Channel and Bay of Biscay, but cannot be considered fully representative of these seas and consequently population estimates cannot be derived from the survey results. However, from a preliminary analysis of the data, it is possible to speculate on the likely species occurring in both seas in numbers of conservation significance (Tab. 3).

Future analyses will concentrate on mapping the seasonal abundance of all species, and generating more density estimates. Throughout the survey period, the recording priority of BDRP has remained to generate reliable monitoring data on cetaceans. Because of a combination of manpower limitations, the ship's extraordinarily high viewing platform and the rapid speed of the ship, it has not been thought possible to record seabirds using standard seabird monitoring methods (Tasker *et al*. 1984). As a consequence, calculated seabird density estimates will not be directly comparable, as correction factors cannot be applied for birds such as auks and petrels, whose detectability decreases with distances from the survey vessel. These species will be particularly under-recorded on the current survey vessel, owing to the viewing height. Subject to resources, future BDRP surveys for auks and petrels will use standard methods. It is thought that the panoramic view provided by the survey vessel should enable accurate densities of visible species such as Northern Gannet, Great Skua, Great Shearwater, Cory's Shearwater and gulls, and hence no change of methodology is planned for these species.

The BDRP surveys have demonstrated how volunteers and ferries can be used to generate low-cost, quantitative data that may have considerable conservation and policy relevant implications, particularly in the designation and year-round management of marine IBAs.

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