# The changing status of Balearic Shearwater in northwest European waters

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# The changing status of Balearic Shearwater in northwest European waters

*Russell B. Wynn and Pierre Yésou*

*ABSTRACT* Sightings data collated from the European Atlantic coastline reveal a recent change in the post-breeding distribution of the Balearic Shearwater *Puffinus mauretanicus*, and provide evidence for a progressive northwards shift in dispersal patterns. Numbers recorded in the traditional post-breeding quarters, centred on the French Biscay coast, have declined since the mid 1990s and now show marked inter-annual variability. In contrast, numbers recorded from northwest European coastlines have increased since the mid 1990s, the majority being seen along the coasts of northern France and southwest Britain, with smaller numbers north to southern Scandinavia. Although variability in observer effort may have contributed to the observed increase in northwest Europe, the spatial and temporal consistency of the data suggests that the trend is real. Large numbers of this Critically Endangered seabird are now spending part of the year in British and Irish waters; this paper highlights the need for future effort-based surveys across the species' non-breeding range, and will provide a baseline for conservation measures in northwest European coastal regions where large concentrations now occur regularly.

The Balearic Shearwater *Puffinus mauretanicus* is one of the world's most endangered seabirds (Oro *et al.* 2004; IUCN 2006). It is a regular visitor in varying numbers to west European (Atlantic) inshore waters during the summer and autumn, most commonly seen off Iberia, France and the southwestern coasts of Britain & Ireland during its post-breeding dispersal. The species is gregarious and found predominantly in inshore waters, the main food source being small shoaling fish, such as Sardines *Sardina pilchardus* and Anchovies *Engraulis encrasicholus*, obtained largely through plunge-diving (Le Mao & Yésou 1993; Arcos *et al.* 2000; Mayol-Serra *et al.* 2000). Trawler discards are also an important food source (Arcos & Oro 2002; Yésou 2003).

Although the species has attracted the interest of taxonomists and conservationists in recent years, there are, as yet, no comprehensive studies documenting the numbers reaching northwest European waters (note that, for the purposes of this study, 'northwest Europe' is defined as the area north of 48ºN, roughly coinciding with the northern margin of the Bay of Biscay; fig. 1). An assessment of temporal and spatial trends away from the breeding grounds is crucial when considering whether 'at sea' factors, e.g. increasing sea-surface temperatures and changing fishing practices, are contributing to the species' apparent population decline (see below). Consequently, in this study we have attempted to assimilate the available data on the

species' status in northwest European waters, to assess whether there has been any change in dispersal pattern and the number of birds involved. These data are compared with those from elsewhere in the species' non-breeding range and are intended to provide a baseline for future conservation-based surveys and studies.

### *Taxonomic status*

The taxonomic history of the species is complex. In Britain, the first major step was a split from Manx Shearwater *P. puffinus* in 1991 when, following a proposal by Bourne *et al.* (1988), it became known as the western race of Mediterranean Shearwater *P. yelkouan*. Then, a decade later, a further split led to recognition of Balearic Shearwater *P. mauretanicus* and Yelkouan Shearwater *P. yelkouan* as separate species (Sangster *et al.* 2002). Although Balearic Shearwater is presently listed at species level in most national and international avifaunas, uncertainties over its true taxonomic status remain. For example, recent studies have shown that some birds breeding in Menorca resemble *yelkouan* in plumage pattern but are intermediate between *mauretanicus* and *yelkouan* in terms of both biometrics (Ruiz & Martí 2004) and genetics (Genovart *et al.* 2005, 2007). The field identification of Manx, Balearic and Yelkouan Shearwaters has been covered previously in detail and will not be discussed here (see, for example, Yésou *et al.* 1990, Hobbs 2003, Gutiérrez 2004, Holmström 2005).

### *Breeding and population trends*

Balearic Shearwaters breed exclusively on the Balearic Islands, in the western Mediterranean, the breeding season being between February and June. Post-breeding dispersal into Atlantic waters occurs from late May onwards (fig. 1), with a return to the Mediterranean (to wintering grounds off the coast of northeast Spain) between September and November (Mayol-Serra *et al.* 2000; Ruiz & Martí 2004). This post-breeding dispersal involves mostly non-breeding immatures and newly fledged juveniles; birds do not breed until at least their third year (Aguilar 1999; Oro *et al.* 2004). Most Balearic Shearwaters undergo a full post-breeding moult between April and October, occasionally November (Yésou 1986; Mouriño *et al.* 2003; Sandoval 2005), approximately coinciding with their presence in Atlantic waters.

Recent estimates of the breeding population have varied: 1,300–2,800 pairs in 1984 (J. Mayol per J. Muntaner *in litt.*); c. 2,100–4,500 pairs between 1991 and 1999 (Ruiz & Martí 2004); 1,750–2,125 pairs in 2001 (Ruiz & Martí 2004) and 2,000–2,400 pairs in 2005 (Rodriguez-Molina & McMinn-Grivé 2005). Although the estimates show no obvious trend over the last two decades, the breeding range has contracted and numbers at long-term monitoring sites have clearly declined (Rodriguez-Molina & McMinn-Grivé 2005). A sharp drop in the numbers wintering off northeast Spain has also been noted in recent years, with 10,000–11,000

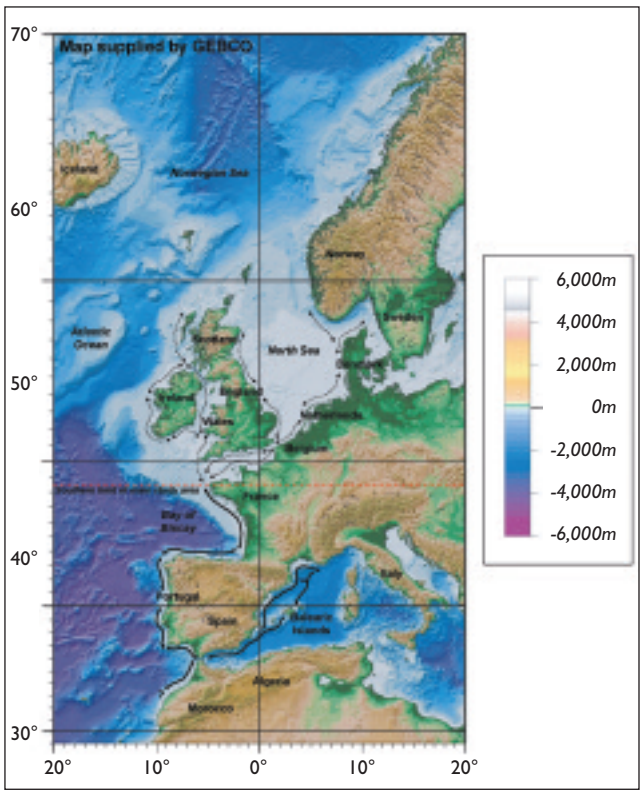


**Fig. 1.** Map showing post-breeding dispersal range of Balearic Shearwaters *Puffinus mauretanicus*. Bold lines delimit the core range (Mayol-Serra *et al.* 2000); dashed lines show extended range in northwest European waters (Yésou 2003; this study).

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**161.** Balearic Shearwater *Puffinus mauretanicus*, Lyme Bay, Dorset, July 2006.

birds recorded each winter in the early 1990s (Gutiérrez & Figuerola 1995) halving to a peak count of c. 5,000 during the winter of 2002/03 (Gutiérrez 2003). A similar decline has been observed in traditional post-breeding concentrations in the coastal waters of the Bay of Biscay, with 8,000–10,000 recorded annually off southwest France in the 1980s (Yésou 1986, 2003), but no more than half this number during census work in 1999/2000 (Yésou 2003). The total world population is currently believed to be in the region of just 10,000 individuals (Rodriguez-Molina & McMinn-Grivé 2005) and it has even been suggested that the species could become virtually extinct by 2040 (Oro *et al.* 2004). However, there are clearly still many uncertainties surrounding existing population estimates. As with all nocturnal, cave-nesting species, breeding numbers are difficult to assess accurately. In addition, the species is apparently prone to changing its favoured non-breeding quarters over relatively short periods of time, probably in response to fluctuating prey densities (Mayol-Serra *et al.* 2000).

The species' apparent decline is thought to be due to the low adult survival rate, which is in turn related to disturbance by humans and predation by introduced mammals on the breeding grounds, together with a lack of food resources and accidental bycatch in long-lines at sea (Aguilar 1999; Oro *et al.* 2004). Unsurprisingly, given the above statistics, the Balearic Shearwater has recently been categorised as 'Critically Endangered' on the IUCN Red List (IUCN 2006).

### *Data collection*

Land-based sightings of Balearic Shearwater, covering the period 1980–2003, were obtained from nine countries along the northwest European coastline (north of 48ºN). Records were obtained mostly via the relevant national or local ornithological records committee and in many cases these records have been peer-reviewed before acceptance. Records which had not been through an assessment procedure were screened and any for which the identification was in doubt were removed. In addition, an attempt was made to reduce the effects of obvious duplication between sites, particularly where records were received from closely spaced locations on the same date.

There has never been any effort-based survey of Balearic Shearwaters in northeast Atlantic waters. As a consequence, the data utilised in this study are likely to be affected by some degree of observer bias. Factors which may introduce such bias include: variation in observer effort and identification skills; a greater awareness of or interest in the species following its elevation to species status; and the improvement of optical equipment. Such factors are obviously difficult to quantify. However, after initial screening and analysis of

the data, it became clear that the spatial and temporal consistency of the results was high. Data from sites where experienced seawatchers have been recording seabirds for many years are especially valuable, and records from three such sites, the bird observatories at Dungeness (Kent), Portland (Dorset) and Cape Clear (Co. Cork), are presented in fig. 2. Data from Portland and Dungeness are broadly comparable with the overall British and Irish trend, although Cape Clear shows a peak in the early 1990s and subsequent decline.

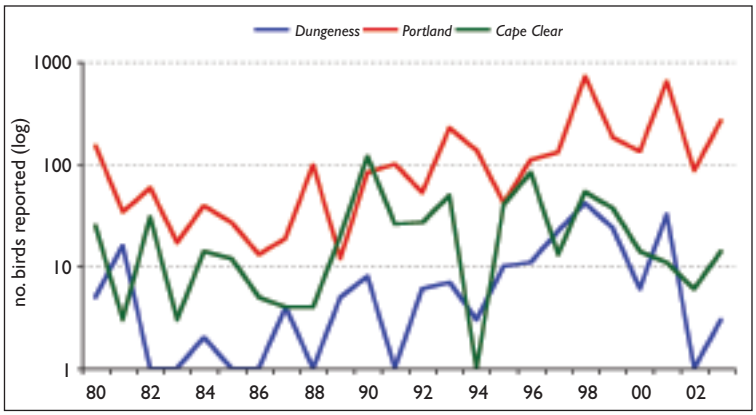


**Fig. 2.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* recorded at Dungeness (Kent), Portland (Dorset) and Cape Clear (Co. Cork) Bird Observatories during 1980–2003. Note that a logarithmic scale has been used on this plot to enable the time-series data for the three observatories to be plotted together and the trends at each site to be compared.

### *Status in Britain & Ireland: pre-1980*

Although records prior to 1980 are generally patchy and incomplete, useful insights may be gained from sites such as Portland Bill and Cape Clear, where Balearic Shearwaters have been identified and recorded for several decades. At both locations, numbers generally remained at a low level prior to 1980 (average annual totals of <150 at Portland and <30 at Cape Clear) with no overall trend, although there have been periodic influxes. For example, between 1958 and 1961 several hundred birds per year were recorded at Portland (exact numbers are hard to quantify as most birds were apparently undertaking local feeding movements and were counted repeatedly on successive days). The largest numbers were seen between August and October in 1960, with a peak day-count of 229 on 3rd October. This influx was not noted elsewhere, although records for this period are sparse. A further influx, between 1977 and 1980, was also noted at Portland, and to a lesser extent in west Cornwall and at Cape Clear. At Portland, numbers peaked in 1978, between June and October, with peak day-counts of 450 on 5th August and 618 on 9th August Again, it is not possible to calculate an accurate annual total because of birds lingering offshore for several days. These short-lived influxes may have been related to unusual climatic events. For example, the 1978 influx coincided with unusually low sea-surface temperatures throughout western Europe that year, temperatures in the western Mediterranean Sea during summer 1978 being more than 1°C below the 1949–2001 summer average.

### *Status in Britain & Ireland: 1980–2003*

Data for the Balearic Shearwater are available from across Britain & Ireland for much of this period, allowing a detailed analysis of trends in abundance and distribution. Although Irish and Welsh data for 1980–89 are incomplete, it is unlikely that, even when combined, they would contribute more than a further 20% (c. 60 birds) per year on average to the annual total during this period. This assumption is based upon data from 1990 onwards and is supported by long-term data from Cape Clear Bird Observatory.

Between 1980 and 1989, numbers of Balearic Shearwaters recorded in British and Irish waters remained consistently low (fig. 3), with an average of 318 birds reported per year. Since 1990, however, the species has shown a clear and dramatic increase, especially since the mid 1990s (fig. 3). During 1990–94 an average of 820 per year was recorded; numbers then doubled again to an average of 1,827 per year between 1995 and 1999 and 1,961 per year between 2000 and 2003. The peak year was 2001, with no fewer than 3,474 recorded. The overall upward trend is characterised by marked inter-annual variability. For example, the peak year of 2001 is set against relatively poor years

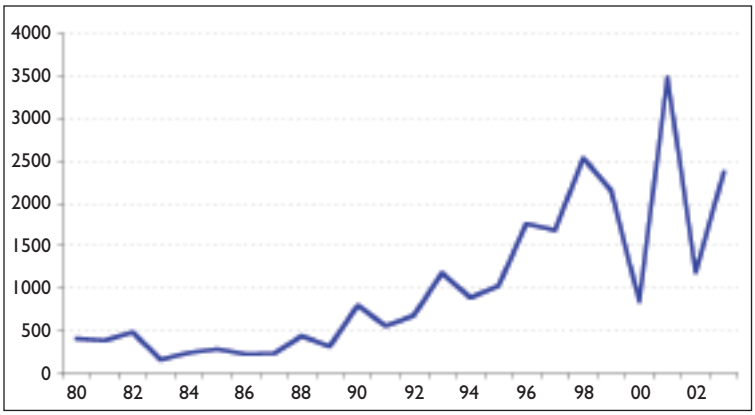


**Fig. 3.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in Britain & Ireland, 1980–2003.

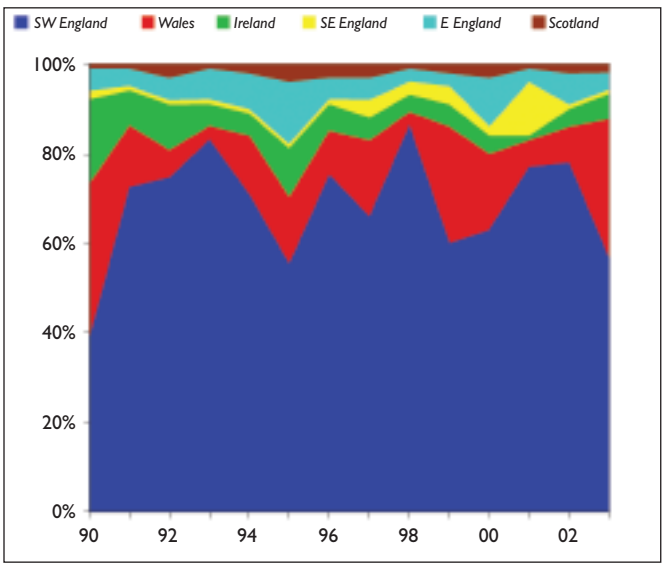


**Fig. 4.** Distribution of Balearic Shearwaters *Puffinus mauretanicus* by region in Britain & Ireland, 1990–2003.

in both 2000 and 2002, with annual totals of 846 and 1,187 respectively (fig. 3).

The distribution of Balearic Shearwater records in Britain & Ireland is heavily biased towards the southwest (fig. 4), as might be expected for a southern European species. The following accounts outline the species' temporal and spatial distribution in more detail.

*Southwest England*

Between 1990 and 2003, an average of 70% of the Balearic Shearwaters recorded annually in Britain & Ireland came from this region (fig. 4). The majority were seen off Cornwall (about 35% of the total), followed by Dorset (18%) and Devon (16%). Between 1980 and 1989, the numbers reported from southwest England averaged about 250 per year, but no clear trend (fig. 5). Between 1990 and 2003, however, numbers increased dramatically, particularly from 1996 onwards, peaking at 2,661 in 2001. This overall pattern of increasing numbers is consistently reflected at a county level, as is the marked inter-annual variability (fig. 5), and also by the data from Portland Bill (see above).

The key sites in the region are all well-known headlands favoured by seawatchers. These include Porthgwarra, Pendeen and St Ives (Cornwall), Hope's Nose, Berry Head and Prawle Point (Devon), as well as Portland. Birds have been recorded in all months, but the vast majority occur between July and October. For example, records from Cornwall for 1971 to 2003 reveal that 92% were noted in these four months, most in August (32%) and September (29%). Only 3% of records fell between December and May, coinciding with the birds' gradual return to the breeding grounds. Peak counts include 150+ lingering off Berry Head on 31st July 2001, and 78 there on 7th September 1998; 123 at Porthgwarra on 10th August 1996 and 85 there on 21st July 2001; and 85 off Portland Bill on 29th July 1998 and up to 90 lingering offshore there in late July 2001.

Relatively few are seen from the Isles of Scilly, where the peak annual total of 66 was recorded in 1999. However, it is notable that small numbers are recorded sporadically in July and August associating with the Manx Shearwater colony on Annet. Very few seem to penetrate far up the Bristol Channel, just 11 being recorded from Somerset up to 2003.

### *Wales*

The Welsh coast is the second most important region for Balearic Shearwaters in Britain & Ireland, accounting for an average of 13% (but up to 35%, in 1990) of the annual total between 1990 and 2003 (fig. 4). The numbers recorded between 1988 and 2002 show a slight increase (fig. 6), with successive five-year means of 107 (1988–92), 150 (1993–97) and 224 (1998–2002) and a record influx (of 773) in 2003.

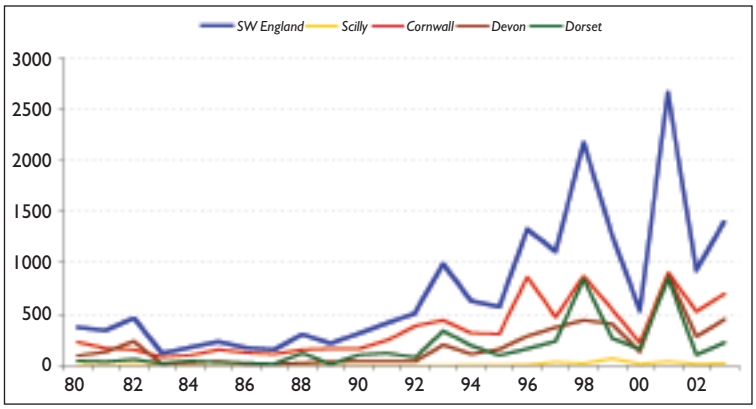


**Fig. 5.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in southwest England, 1980–2003.

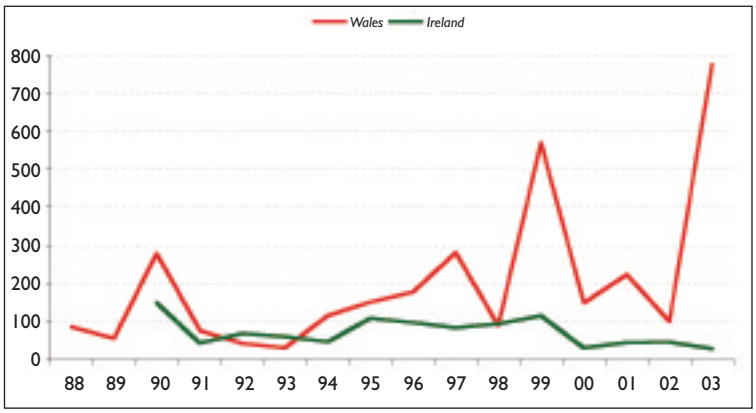


**Fig. 6.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in Wales and Ireland, 1988–2003.

The key site has traditionally been Strumble Head, in Pembrokeshire (and Pembrokeshire tends to account for around 80% of the Welsh annual total), but significant counts have also been made farther north, from Bardsey (Caernarfonshire) and Point Lynas (Anglesey). Most Balearic Shearwaters at Strumble Head occur between mid July and early November and usually involve birds associating with feeding movements of Manx Shearwaters. There is a scattering of winter records, apparently related to displacement during strong southwest gales.

Prior to the major influx in 2003, the peak day-count was 36 off Strumble Head, on 2nd October 1999. During 2003, unprecedented numbers lingered off the Glamorgan coast between Port Eynon Point and Rhossili, mainly between 18th August and 20th September, peaking at 250 on 3rd September. Significant counts were also reported from Anglesey later in the autumn, where there was a peak of 32 off Point Lynas on 3rd October.

### *Ireland*

On average, 7% of Balearic Shearwaters recorded from 1990 to 2003 were in Irish waters (fig. 4), though Ireland's share of the total peaked at 19% in 1990 (cf. Wales). Although the overall Irish totals do not extend back beyond 1990, there is no obvious trend in numbers through the period 1990–2003 (fig. 6), in contrast to the situation in Wales and England.

The majority are seen between July and October, and small numbers occur between November and February. The pattern observed during the peak year of 1990 was typical, there being a total of 149 recorded between 16th June and 28th September, of which 118 were seen from Cape Clear. Away from Cape Clear, Balearic Shearwaters are recorded regularly from other headlands in southern Ireland, including Carnsore Point (Co. Wexford), Galley Head (Co. Cork), Brandon Point (Co. Kerry) and Bridges of Ross (Co. Clare). Small numbers are also seen off Northern Ireland, particularly in the North Channel.

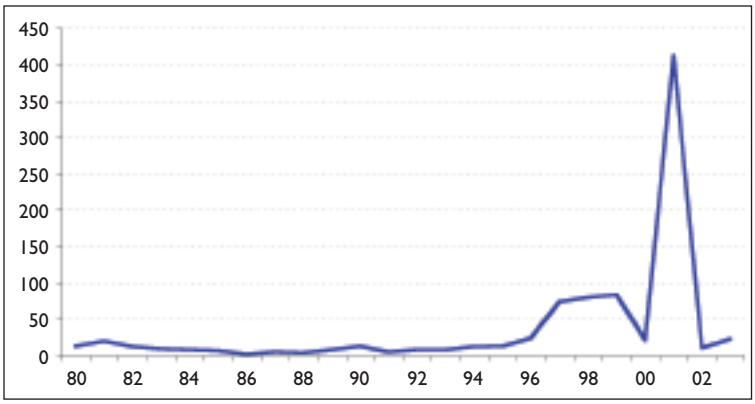


**Fig. 7.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in southeast England, 1980–2003.

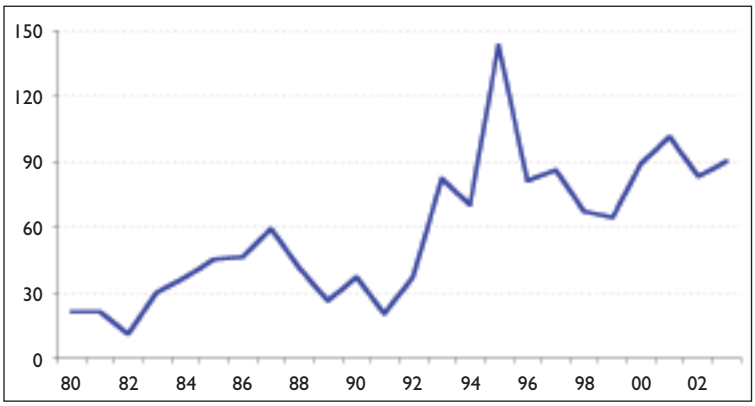


**Fig. 8.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in east England, 1980–2003.

### *Southeast England*

On average, around 3% of the annual total was seen from the well-watched coastline of southeast England between 1990 and 2003 (fig. 4), the figures varying between a peak of 12% in 2001 and <1% in several other years. Although the numbers recorded are small, they have clearly increased since the mid 1990s, both in the region as a whole, and at Dungeness, which is an important site in terms of consistency of effort (figs. 2 and 7). An average of nine per year in 1980–89 increased to 32 per year in 1990–99. In 2001, up to 418 were recorded; these are unprecedented numbers, illustrated by the fact that, in Hampshire, Sussex and the Isle of Wight, more were recorded in 2001 than in all previous years combined. Records are spread fairly evenly across the region, and show no obvious geographical pattern.

### *East England*

The long stretch of coast between Essex and Northumberland was responsible for 6% on average of the annual British and Irish total between 1990 and 2003 (fig. 4), but made up 14% of that total in 1995. An average of 34 per year in 1980–89 doubled to 69 per year in 1990–99 (fig. 8). From 2000 to 2003, this increased again to 91 per year, and there was a moderate influx of 101 in 2001 (cf. southeast England). In Suffolk, Norfolk, Cleveland and Northumberland (four of the six counties from which data were received), the peak years were either 2002 or 2003.

The majority have been seen from Norfolk and Yorkshire, and surprisingly few off Essex (nine up to 2003) and Suffolk (27 up to 2003). Nearly all records fall between June and October, peaking in August and September, together with a small number of winter records. The main site is Flamborough Head (East Yorkshire); a total of 722 Balearic Shearwaters was recorded there between 1976 and 2000, numbers peaking annually in August (44%) and September (33%), but falling to <5% in the period from November to June.

### *Northwest England*

Only eleven were recorded in Cumbria and Lancashire up to 2003, the majority between July and September.

### *Scotland*

Balearic Shearwater is still a rare bird in Scotland, which accounted for just 2% on average of the British & Irish annual total between 1990 and 2002 (fig. 4). Although the numbers involved are small, they have increased since the

mid 1990s (fig. 9). An average of about seven per year in 1980–89 increased to 25 per year in 1990–99, and reached a peak of 58 in 2003. Most are seen between August and October, with a few summer and winter records.

The majority are seen off southwest Scotland, particularly Ayrshire and Argyll, but small numbers are reported regularly from the Outer Hebrides and also Fife Ness, on the east coast. The species seems reluctant to wander far beyond the northern tip of mainland Scotland and there are currently no accepted records from Shetland.

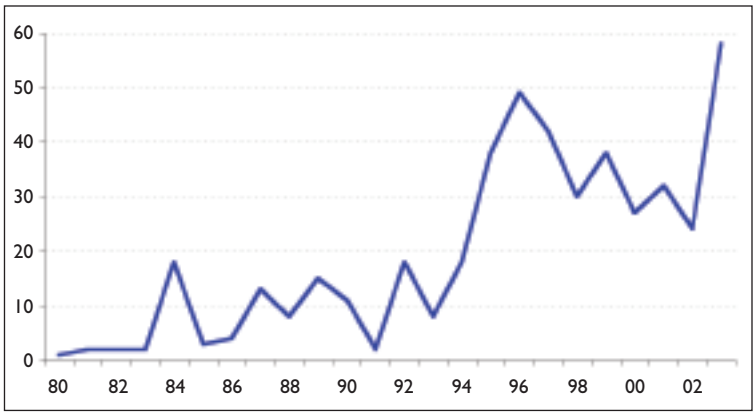


**Fig. 9.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in Scotland, 1980–2003.

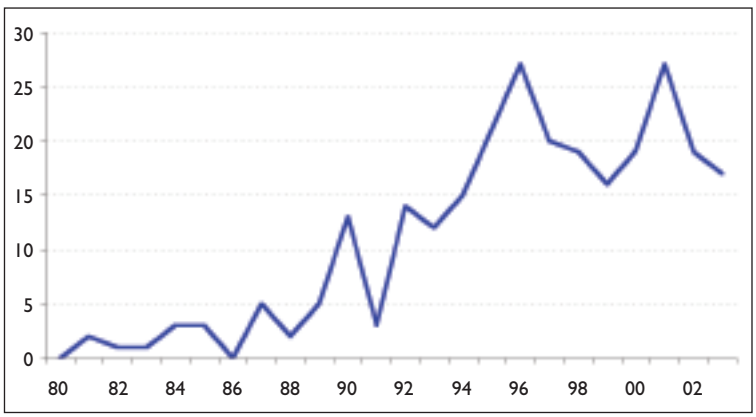


**Fig. 10.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in The Netherlands, 1980–2003.

## *Status elsewhere in northwest Europe (north of 48°N)*

### *Northwest France*

Balearic Shearwaters have been recorded regularly along the coast of northwest France since the beginning of seawatch surveys in the 1960s. Along the northern coast of Brittany, in the western part of the English Channel, birds are recorded frequently between the end of June and early October, followed by a few sightings of single birds or small parties through to January. Large groups can be encountered feeding on shoaling fish in the Golfe de Saint Malo, between Baie de Saint-Brieuc and Baie du Mont-Saint-Michel and the Chausey Islands. Fewer than 100 were seen at any one time during the 1970s, and numbers rarely exceeded 300 in the 1980s. However, counts then increased rapidly to a peak of 2,150 in 1996 and 2,250 in 1997, before declining to a few hundred in the late 1990s and early 2000s (e.g. only 130 counted in 2001). Variation in numbers is partly explained by the fact that birds are moving over a large area and sometimes remain offshore beyond sight of land; however, local observers are confident that the increase in the mid 1990s was genuine, as was the post-1997 decrease (Yésou 2003).

The species is much scarcer in the eastern half of the English Channel, where it is a scarce summer and autumn migrant, there being, at best, a few tens of individuals seen each year at any single locality. At Le Clipon, near Dunkerque, increased autumn seawatching effort has revealed no significant trend over the period 1987–2003, but has recorded an average 0.14 to 0.25 birds per hour for the period July to October. The exception was in 2001, when the frequency of sightings doubled to 0.42 birds per hour, after a total of 81 was recorded between 19th July and 13th September (cf. southern England).

### *The Netherlands*

In The Netherlands, Balearic Shearwater has traditionally been regarded as a scarce summer and autumn migrant. Prior to 1980 there were just nine records and during 1980–89 an average of just over two per year. This rose to 16 per year in 1990–99 and to 20 per year in 2000–03. The peak annual total of 27 was reported in both 1996 and 2001 (fig. 10). The vast majority of records occur in July (33%), August (35%) and September (20%), smaller numbers in June and October and just one outside these months, in December.

### *Denmark*

Balearic Shearwater is a scarce summer and autumn migrant in Denmark; all but two records fall between July and October (and c. 70% in August and September) and the vast majority along the North Sea coast. There were just three records before 1988, nine between 1988 and 1991, and then a more obvious increase in sightings from the mid 1990s (fig. 11).

### *Sweden*

All records are from the southwest coast, and most were seen during strong west or southwest winds. Up to 2004, a total of 25 were recorded (fig. 11), the first as recently as 1977, but since 1997, there has been a marked increase: a total of 18 between 1997 and 2004, and peaks of five in 1997 and six in 2003 (cf. Scotland, Denmark and Norway). All birds were recorded between 20th June and 7th October.

### *Norway*

The 17 Norwegian records fall between late June and early October, with the exception of one on 9th May 1991; most are of single birds from the southwest of the country. Seven were reported before 1991, and ten between 1997 and 2004, including four in 2003 (fig. 11).

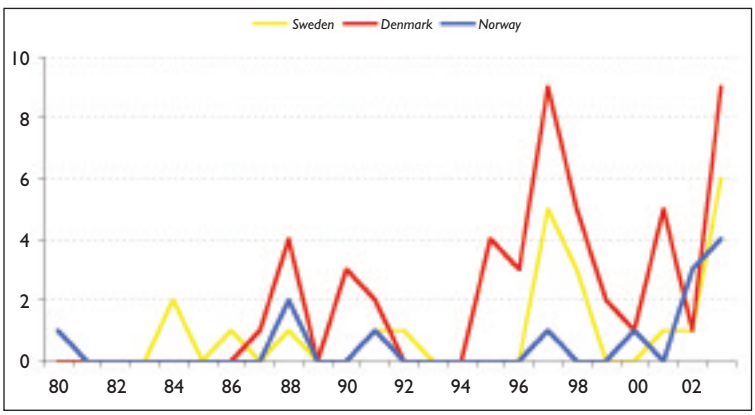


**Fig. 11.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported in Scandinavia, 1980–2003.

## *The southwest European perspective (south of 48°N)*

### *Southwest France and the Bay of Biscay*

According to Mayaud (1936), Balearic Shearwater has long been known as a regular and common migrant along the French coast between Arcachon in southern Biscay and southern Brittany. It was apparently regular and fairly abundant in the late nineteenth century, most birds being recorded between June and September–October, then becoming rare in winter. The first organised census, which included birds recorded at sea and from the coast, took place in the early 1980s, and this found an estimated 8,000–10,000 individuals in 1982–84 spending the summer months close to the French coast of Biscay. The main concentrations occurred in two areas: Mor-Braz in southern Brittany, and along the coast of Vendée (Hémery *et al.* 1986; Le Mao & Yésou 1993).

At Mor-Braz, Balearic Shearwaters usually occur well offshore and are difficult to survey. Nevertheless, between 1,600 and 4,000 were recorded on several occasions between the 1960s and 1980s. Subsequently, numbers appear to have declined and only a few hundreds have been counted since then (Yésou 2003), although there were up to 1,500 in late September 2002 and 1,100 in early September 2006. Surveys are more easily carried out in Vendée, where the shearwaters often congregate in rafts close to the coast at the end of the day. Between 1982 and 1984, over 1,000 were counted regularly here from June onwards, numbers peaking at 6,000–7,500 in July–August (fig. 12). Subsequent surveys at sea up to the mid 1990s showed little change in relative abundance. Since 1999, regular counts of rafting birds have resumed from the coast (Yésou 2003),

and these reveal a markedly different situation. Balearic Shearwater now tends to occur much later in the summer, peaking in late August and September, and its abundance shows marked inter-annual variability (fig. 12). In 2003, numbers returned to the level of the early 1980s; at least 5,000 were counted on ten different evenings between 20th August and 15th September, and estimates of 6,000–7,000 were made on 31st August and 1st September. Numbers peaked at approximately 4,000 in both 1999 and 2005, but only 1,500 in 2000 and just 450 in 2004.

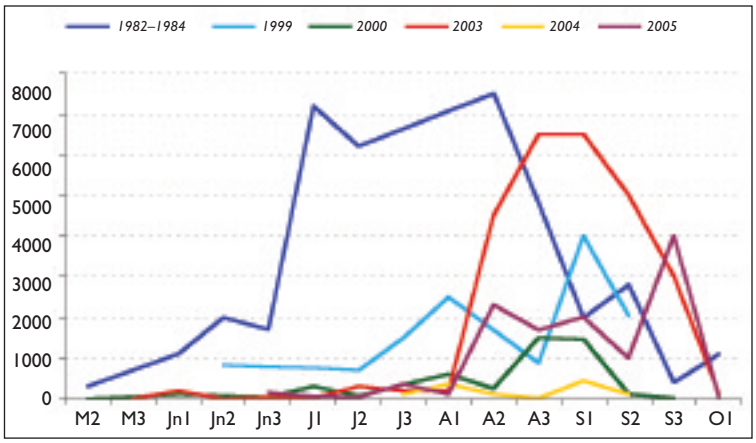


**Fig. 12.** Numbers of Balearic Shearwaters *Puffinus mauretanicus* reported off the coast of Vendée, western France, during 1982–84 and 1999–2005, showing the maximum count within each ten-day period.

Ship-based observations covering the western English Channel and eastern Bay of Biscay have been made by the Biscay Dolphin Research Programme during year-round monthly ferry crossings from 1995 to 2001 (Brereton *et al.* 2003; Hobbs *et al.* 2003). During the survey period, only 57 Balearic Shearwaters were reported along this route, about 95% of these being seen between June and November and a peak occurring in October. Records were well scattered, but there were slight concentrations off the Brest Peninsula and over the upper Cap Breton Canyon off northern Spain (Hobbs *et al.* 2003). However, few were seen in deep water over 100 km from land. In contrast, the vast majority of the 3,000 Cory's *Calonectris diomedea* and 6,000 Great Shearwaters *P. gravis* recorded during the survey period were in the deep waters of the Bay of Biscay, beyond the shelf edge (Brereton *et al.* 2003; Hobbs *et al.* 2003). It appears that Balearic Shearwater is scarce in deep water.

### *Spain*

Observations of birds moving to and from their moulting grounds in the Bay of Biscay have been made from the Galician coast of northwest Spain since 1976 (Mouriño *et al.* 2003). These observations reveal a pronounced passage to the northeast between June and August and a return movement to the southwest in September and October. The largest recorded movement was of 2,085 birds heading north off Finisterre on 28th July 1985. The abundance of suitable prey in this region, linked to seasonal upwelling, also encourages large flocks (>150 birds) to linger, particularly at the mouths of the Pontevedra and Vigo rias (Mouriño *et al.* 2003). Few large flocks are seen between November and May, 84% of records occurring between June and September. The highest counts of 'non-migrating' birds at most Galician sites were made prior to the mid 1990s, possibly indicating a recent decline. The peak count was of 1,395 birds at Pontevedra ria on 27th August 1991.

### *Portugal*

Large numbers of Balearic Shearwaters are regularly seen moving along the Portuguese coast, migrating to and from the Bay of Biscay. The highest counts are typically in September, the peak being 11,000 moving south off the Lisbon coast in just two hours on 29th September 1990 (Paterson 1997). There is some evidence for a decline in numbers over the last decade; for example, the peak count in the Lisbon area in recent years was just 1,591 on 23rd September 2000, whereas in the early 1990s counts of several thousand were regular (Paterson 1997; Ruiz & Martí 2004; Poot 2005).

Recent studies have also shown that large numbers of birds may linger off the Portuguese coast for several days or longer. In August and September 2002, a boat-based survey was carried out over the inshore waters along the coast between Figueira da Foz and Aveiro

(Petronilho *et al.* 2004). Two coast-parallel transects, about 1 km and 11 km offshore, were surveyed. Balearic Shearwaters were the commonest species encountered, the average being about 715 per trip during the five surveys. The peak count was 1,258 on 28th September (of which 93% were on the inshore transect). Birds were seen rafting in large flocks (100–200 birds) as well as flying in different directions and feeding, indicating that this may be a significant staging area. Large numbers were also seen along the Lisbon coast, between Guincho and Cascais, in June 2004 (Poot 2005). Successive counts on 2nd–4th June produced totals of 1,294, 953 and 1,177 birds respectively. In general, about 60% of the shearwaters were rafting, the largest single flock comprising 900 birds. Feeding flocks of up to 700 birds were also seen, in association with large numbers of Northern Gannets *Morus bassanus* and other seabirds.

## Discussion

The Balearic Shearwater has never been the subject of a systematic survey in northwest European waters, meaning that any analysis of numbers is reliant upon predominantly casual observations. Taking that into account, and also bearing in mind the potential biases outlined earlier, we still believe that the dataset obtained during this study is remarkably robust. For example, in Britain & Ireland, there has been no significant temporal change in the proportion of Balearic Shearwaters reported from different regions (fig. 4), suggesting that any observed changes in numbers are not simply due to variations in observer effort at a local or regional level. In addition, by normalising values for different countries for which comprehensive data were received, a remarkably consistent trend emerges across northwest Europe, a majority of countries showing a marked increase in Balearic Shearwater numbers in the mid 1990s (see fig. 13). We contend that the spatial and temporal consistency of the observed increase since the mid 1990s supports the hypothesis that the trend is real and not simply an artefact of observer effort.

### *Distribution change in northwest European waters*

Data analysed during this study confirm that a significant proportion of the Balearic Shearwater population disperses northwards beyond the Bay of Biscay into northwest European coastal waters in late summer and autumn, and that the largest numbers are recorded between June and October. The majority are seen along the coasts of northern France and southwest Britain, with decreasing numbers north to southern Scandinavia. Relatively few are recorded throughout Atlantic waters during the winter and spring, which indicates that both breeding and non-breeding birds return to the Mediterranean at this time.

Although short-lived influxes of Balearic Shearwaters into northwest Europe waters have been seen before during the past 50 years (see page 000), the data presented here suggest that the species is now undergoing a more sustained northward shift in its post-breeding distribution. Data from almost all the northwest European countries investigated show a marked increase in numbers from the mid 1990s onwards (fig. 13). Furthermore, this increase may be ongoing, as 2003 (the last year for which comprehensive data were available) was the first year when all of the northwest European countries

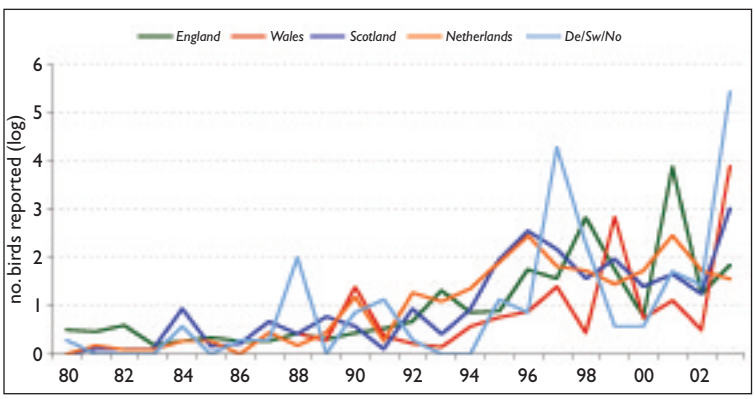


**Fig. 13.** This figure shows the increasing numbers of Balearic Shearwaters *Puffinus mauretanicus* being reported in northwest Europe between 1980 and 2003. The numbers of birds have been normalised by dividing individual annual totals for each country by the average annual total of that country for this period. Totals >1 are higher than the long-term average. Data for Denmark (De), Norway (No) and Sweden (Sw) have been summed to provide a figure for Scandinavia.

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**162.** Balearic Shearwater *Puffinus mauretanicus*, off Scilly, date unknown.

represented on fig. 13 had annual totals of more than 1.5 times the long-term average.

This overall upward trend is overlain by marked inter-annual variability (e.g. fig. 3), while there is also distinct spatial variability during influx years. For example, in 2001 record numbers were seen all along the south coast of England eastwards to northern France and The Netherlands, whereas in 2003 countries farther north (e.g. Wales, Scotland, Denmark, Sweden and Norway) experienced record numbers. This pattern may represent progressive northwards range expansion.

### *Controls on distribution changes*

The increase of Balearic Shearwaters in northwest European waters since the mid 1990s has coincided with a simultaneous decline in numbers recorded further south. For example, the main post-breeding concentrations off the French Biscay coast have declined dramatically over this period, and there is some evidence that birds are occurring later in the autumn and with greater inter-annual variability (fig. 12). Numbers recorded from Atlantic Spain and Portugal also appear to have declined since the mid 1990s, while population estimates in the breeding and wintering ranges in the Mediterranean suggest that the species is in overall long-term decline. The larger numbers observed in northwest Europe may thus represent greater dispersal within a declining population, and this raises the question of whether 'at sea' survival is a factor in the species' apparent population decline. This contrasts with previous studies, which have tended to concentrate on factors affecting the species at, or adjacent to, the breeding colonies (e.g. Aguilar 1999, Oro *et al.* 2004, Ruiz & Martí 2004). A detailed analysis of controls on the recent distribution change in Atlantic waters is currently in preparation, and will focus on the importance of increased sea-surface temperatures and changing distribution of prey fish, and the resulting impact on Balearic Shearwater distribution.

### *Summary and conservation implications*

The most recent estimates of population size for the Balearic Shearwater are in the region of 2,000–2,400 pairs, or 10,000 individuals when non-breeding birds are taken into account (Rodriguez-Molina & McMinn-Grivé 2005). Although the data presented in this study are not derived from systematic surveys, they nevertheless reveal that an increasingly significant proportion of the world population now regularly inhabits northwest European waters during the late summer and autumn. In 2001, 3,500 birds were reported from Britain &

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**163.** Balearic Shearwater *Puffinus mauretanicus*, off Scilly, date unknown.

Ireland alone, although this figure doubtless involves significant duplication as birds are (i) often highly mobile and move between sites, and (ii) show an overall northward dispersal throughout the autumn. For example, peak counts in southern England during 2001 and 2003 generally occurred in late July and early August, whereas farther north, e.g. in Wales, peak counts were typically from late August to early October. Although duplication is clearly an issue, it is also likely that many will have gone unrecorded at locations with little observer coverage.

Individual day-counts of 100–250 birds from key sites in southwest Britain in the last decade confirm that an absolute minimum of 1–2% of the global population of Balearic Shearwaters are present during 'influx' years in this region, with the possibility that actual numbers may be an order of magnitude higher. More recently, a count of 110 Balearic Shearwaters moving west off Porthgwarra on 29th–30th July 2006 indicates that significant numbers (>1% of the world population) are continuing to penetrate into northeast Atlantic waters and this has obvious implications for the species' conservation status in the region. Although numbers reported from countries north of 55°N are less significant (fig. 11), the trend in these areas is also upward, perhaps suggesting that they may also hold important concentrations at some time in the future.

Farther south, large numbers still concentrate sporadically in the traditional post-breeding quarters along the French Biscay coast, a recent estimated peak of 6,500 birds in 2003 (fig. 12) representing a staggering 65% of the estimated world population. In some ways it is unfortunate that Balearic Shearwaters are such highly gregarious birds, as their habit of congregating in relatively small areas makes them potentially susceptible to threats such as oil spills and displacement by offshore development, e.g. windfarms. Improved understanding of their current post-breeding distribution is crucial if suitable 'at sea' conservation measures for the species are to be put in place. International co-operation should improve the acquisition of information about this species but also the study of the parameters which control its distribution and numbers (Yésou 2006). Indeed, co-operation at international level is called for by the Convention on Migratory Species; since November 2005 the Balearic Shearwater has been listed under Annex I of this convention (UNEP/CMS/Resolution 8.29), which compels signatory parties to facilitate concerted actions for the conservation of species listed under Annex I. Consequently, it is essential that a Europe-wide monitoring scheme is imple-

mented as soon as possible to identify key sites and to investigate whether the observed distribution changes are ongoing.

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**Postscript:** In order to improve the assessment of the numbers of Balearic Shearwaters visiting UK waters, researchers at the National Oceanography Centre, Southampton, have recently teamed up with several UK-based conservation bodies to set up the SeaWatch SW Project. The aim is to provide a central recording base for the species in UK waters, and to undertake round-the-clock, effort-based surveys from the southwest tip of the UK mainland between July 15th and October 15th, over a period of several years. Full details on project background, latest results, and how to get involved can be found at http://www.seawatch-sw.org