

Nomination

Puffinus mauretanicus - Balearic Shearwater³



Geographical extent

OSPAR Regions: II, III, IV, (V)

Biogeographic zones: 1,2,4,6-9,11,13

Region & Biogeographic zones specified for decline and/or threat: As above

This species breeds only in the Balearic Islands, where it nests on the small islands and coastal areas of Formentera, Ibiza, Mallorca, Cabrera and Menorca (Arcos and Oro, 2003). During the breeding season, the species forages mainly along the eastern Iberian coast, with the largest concentrations occurring off the Ebro Delta (Louzao *et al.*, 2006a). After the breeding season, the species moves into the Atlantic, dispersing northwards along the coasts of Portugal and north-western Spain to the traditional post-breeding grounds in the Bay of Biscay, off the coast of western France (Le Mao and Yésou, 1993). Although the species has long been a regular visitor to the western English Channel and – to a lesser extent – the North and Celtic Seas (Mayol-Serra *et al.*, 2000), there is increasing evidence for a northwards shift in its core post-breeding range (Wynn and Yésou, 2007; Wynn *et al.*, 2007). Some birds over-winter in the Atlantic (off south-west UK, in the Bay of Biscay and off the coast of Morocco), but most individuals return to the Mediterranean in the autumn (Mayol-Serra *et al.*, 2000), where large gatherings of birds winter off the coast of eastern Spain.

Application of the Texel-Faial criteria

P. mauretanicus was nominated for inclusion on the OSPAR List with particular reference to the global importance, rarity, decline, and sensitivity criteria, with information also provided on threat.

Global regional/importance

Although the species' breeding colonies and main wintering grounds are in the Mediterranean, the majority of the global population disperses into the OSPAR Area during the post-breeding period (Le Mao and Yésou, 1993). Individuals start leaving the Mediterranean in late May with passage through the Strait of Gibraltar peaking in June, so by the end of July the bulk of the population is in the Atlantic (Mayol-Serra *et al.*, 2000). The return passage to the Mediterranean begins in September and peaks in October–November, although late individuals are still recorded passing through the Strait of Gibraltar between December and April (Mayol-Serra *et al.*, 2000).

The OSPAR area is hence of global importance for the species during the summer months (particularly June to October), when a high proportion of the total population occurs along the coasts of Portugal, north-western Spain, western France and southern/western Britain and Ireland.

Rarity

The global breeding population of this species is small. The most comprehensive census to date, based on surveys carried out between 2000–2005, gave an estimate of 2,000–2,400 breeding pairs at 24 colonies (Rodríguez Molina and McMinn Grivé, 2005; Viada, 2006). The total global population – including a significant number of 'floating' non-breeding birds – is currently believed to number in the region of 10,000 individuals (Wynn and Yésou, 2007).

Decline

Several breeding colonies on Cabrera and Formentera have disappeared completely in the last few decades, and numbers at long-term monitoring sites have also declined (Mayol-Serra *et al.*, 2000; Oro *et al.*, 2004; Rodríguez Molina and McMinn Grivé, 2005; Viada, 2006).

Estimates of adult survival based on capture–recapture data for 374 individuals ringed during 1997–2002 at two focal colonies in Mallorca (0.78 ± 0.03) are unusually low for a Procellariiform (Oro *et al.*, 2004). Since both colonies were free of mammalian predators, the low adult survival between years is likely to be a consequence of at-

³ *Puffinus mauretanicus* was formerly treated as a subspecies of *P. yelkouan* (and before that *P. puffinus*), but is now considered to deserve specific status (e.g. Austin, 1996; Heidrich *et al.*, 1998; Brooke, 2004).

sea mortality away from the colonies (Oro *et al.*, 2004). A model based on the demographic parameters derived from the study suggested that the population was declining by an average of 7.4% per year, and mean extinction time for the global breeding population (calculated using population viability analysis) was estimated at just over 40 years (Oro *et al.*, 2004).

At-sea censuses have shown declines, with numbers wintering off the coast of north-eastern Spain declining from 10,000–11,000 birds in the early 1990s to just over 5,000 individuals during the winter of 2002–2003 (Gutiérrez, 2003). Similar reductions have been observed within the OSPAR area in the traditional post-breeding quarters off western France, where 8,000–10,000 individuals were regularly recorded in the 1980s, compared to no more than half this number during surveys in 1999–2000 (Yésou, 2003). Although this decline may in part be explained by changes in the species' post-breeding distribution, the increasing number of individuals recorded further north in recent years does not compensate for the birds 'missing' from the Bay of Biscay (Yésou, 2003; Wynn and Yésou, 2007). While the recorded rates of decline in these at-sea concentrations do not reach the dramatic levels suggested by Oro *et al.* (2004), they represent significant reductions in numbers, and are cause for concern.

As a consequence of its rapidly declining population, the species faces a very high risk of extinction and is currently classified as Critically Endangered (Arcos and Oro, 2004; IUCN 2007).

Sensitivity

This species has very low *resistance*, with several aspects of its behaviour and ecology making it very sensitive to the adverse effects of human activities. Its very small breeding range (<10 km²) and nesting behaviour make it very vulnerable to predation by introduced mammals, habitat loss and degradation, and other forms of human disturbance or persecution (Aguilar, 1999; Arcos and Oro, 2004). Away from the breeding colonies, the species' tendency to congregate in large numbers in coastal waters, often near important harbours, makes it vulnerable to oil spills, particularly in the moulting quarters (Aguilar, 1999; Mayol-Serra *et al.*, 2000). Its diet of small shoaling pelagic fish, particularly clupeids and engraulids (Le Mao and Yésou, 1993; Louzao *et al.*, 2006b), and tendency to aggregate in the most productive waters (Louzao *et al.*, 2006a), also make the species susceptible to interactions with commercial fisheries (Arcos *et al.*, in press). These interactions include by-catch on long-lines

causing direct mortality, and reduction of natural prey due to overfishing. In addition, the species makes extensive use of trawling discards, which represent over 40% of its energy requirements during the breeding season (Arcos and Oro, 2002). Planned reductions in discarding rates could lead to food shortage; moreover, discards represent an extra source of mercury and other pollutants (Arcos *et al.*, 2002), resulting in the unusually high levels shown by the Balearic Shearwater (Ruiz and Martí, 2004; Arcos *et al.*, 2004).

The species also has very low *resilience*. Individuals do not breed until at least their third year, they are long-lived (the longevity record is 23 years) and reproduce slowly, and hence are very sensitive to human activities increasing adult mortality, such as long-line fishing (Aguilar, 1999; Arcos and Oro, 2004; Oro *et al.*, 2004). The Procellariiformes are one of the avian orders that show a particularly high risk of extinction (Genovart *et al.*, 2007).

Threat

The species currently faces threats at its breeding grounds and in its non-breeding quarters, both of which have an impact on the population summering in the OSPAR Area.

Predation of eggs and chicks by rats, and of adults by introduced mammals such as domestic cats and mustelids, is a significant threat at some breeding colonies (Mayol-Serra *et al.*, 2000; Ruiz and Martí, 2004; Arcos and Oro, 2004). Harvesting of the species for human consumption was historically a major threat, but is now of lesser concern (Aguilar, 1999). Development of its coastal habitat means that the number of suitable nesting areas is limited, with the species probably now occupying sub-optimal sites (Aguilar, 1999). The potential impact of competition with Cory's Shearwaters *Calonectris diomedea* for nest cavities is unclear (Aguilar, 1999). The use of lights for certain fishing practices, leisure craft and urban lighting near colonies may disturb breeding birds and fledglings (Aguilar, 1999; Gutiérrez, 2003; Ruiz and Martí, 2004). The occurrence of Yelkouan Shearwaters *Puffinus yelkouan* at one colony in Menorca raised concerns that hybridisation with this closely-related species may occur (Genovart *et al.*, 2005), although any genetic impact from this is not currently believed to be a threat (Genovart *et al.*, 2007).

Away from the breeding colonies, the species also faces a number of at-sea threats in the Mediterranean and the Atlantic. Overexploitation and changes in the distribution of its fish prey is a potentially increasing threat (Aguilar, 1999; Arcos and Oro, 2004). In the OSPAR area, the dramatic

decline and local disappearance of pilchard *Sardina pilchardus* and anchovy *Engraulis encrasicolus* populations in the Bay of Biscay – probably as a consequence of recent increases in sea temperature – are strongly implicated in the coincident decline in *Puffinus mauretanicus* numbers in the area (Mayol-Serra *et al.*, 2000; Yésou, 2003; Wynn *et al.*, 2007). The resulting increase in dispersal range and/or decrease in foraging success in the summering quarters may be having an impact on the species' survival (Mayol-Serra *et al.*, 2000; Wynn *et al.*, 2007). The increasing importance for the species of fishery discards (see 'Sensitivity') – potentially in response to the decline in traditional prey species – means that it may also be adversely affected by incoming fishing policies directed at reducing discard rates (Arcos and Oro, 2002; Arcos and Oro, 2004; Louzao *et al.*, 2006b). Although the species appears to be less prone to accidental by-catch on long-lines and in fishing nets than *Calonectris diomedea* (Aguilar, 1999; Belda and Sánchez, 2001), its congregatory behaviour and close association with fishing vessels can result in occasional instances of 'mass mortality' (Arcos and Oro, 2004; Ruiz and Martí, 2004). These events could be difficult to detect in a standard monitoring program, given their occasional nature, but could have a high impact on the Balearic Shearwater population (Arcos *et al.*, in press). The species' tendency to congregate in coastal waters near important harbours – most notably during its post-breeding moult in OSPAR waters – makes the potential threat from oil pollution very significant (Aguilar, 1999; Mayol-Serra *et al.*, 2000). The sinking of the tanker *Erika* off Brittany in 1999, the wreck of the *Prestige* off Galicia in 2002 and the beaching of the *MSC Napoli* off south-west England in 2007 all occurred in important areas for the species (Mayol-Serra *et al.*, 2000; Gutiérrez, 2003; Ruiz and Martí, 2004; Wynn and Yésou, 2007). The impact on the species of other forms of chemical pollution, such as its accumulation of unusually high levels of mercury, remains unquantified (Arcos and Oro, 2004; Ruiz and Martí, 2004; Arcos *et al.*, 2004). Poisoning by toxic phytoplankton may be a threat in some feeding areas, particularly the Mor-Braz area, north of the Loire estuary (Mayol-Serra *et al.*, 2000).

Relevant additional considerations

Sufficiency of data

Trends based on comparisons of breeding population estimates over time may be confounded by differing survey methodologies and effort. Nevertheless, the recent extinction of entire breeding colonies, and the results of the recent

multi-year demographic study at two colonies (Oro *et al.*, 2004) provide clear evidence of an ongoing population decline. Models of this decline were particularly sensitive to changes in adult survival, but this parameter was estimated with a narrow confidence interval, based on capture data from six breeding seasons, so it is likely to be robust (Oro *et al.*, 2004).

Further studies are required to clarify the extent to which the reductions in numbers in the Bay of Biscay and off north-east Spain are the consequence of an overall population decline and/or changes in the species' wintering and post-breeding distributions.

Threats, past and present, at the breeding colonies are relatively well documented (e.g. Aguilar, 1999; Arcos and Oro, 2004), but do not fully explain the rapid population decline or the high levels of adult mortality (Oro *et al.*, 2004). At-sea threats are currently less well understood, however, and further studies are needed to determine their relative importance in the Mediterranean and the OSPAR area.

Changes in relation to natural variability

Inter-annual variability in the availability of small pelagic fish was found to have an influence on the species' overall breeding performance, but current values of breeding success fail to explain the sharp decline of the species (Louzao *et al.*, 2006). Recent changes in the Balearic Shearwater distribution range within the OSPAR area seem to parallel changes in its prey distribution (Wynn *et al.*, 2007).

Expert judgement

There is good evidence of the threats facing this species, including those that would be relevant to the OSPAR Area. Expert judgement is required to assess the likely extent of decline across the OSPAR region for this species, given the severe declines documented at the breeding colonies.

ICES Evaluation [Not yet evaluated]

Threat and link to human activities

Cross-reference to checklist of human activities in OSPAR MPA guidelines

Relevant human activity: Constructions (e.g. Offshore wind-farm); Land-based activities;

Shipping and navigation; Fishing, hunting, harvesting; Tourism and recreational activities⁴.

Category of effect of human activity: Physical – Temperature changes. Chemical – Hydrocarbon contamination. Biological – Removal of target species; Removal of non-target species.

At the breeding colonies, *Puffinus mauretanicus* are threatened by several human activities. Introduced ground predators threaten eggs and chicks, and development of the coast (with associated light pollution) cuts down the availability of suitable nesting habitat for the species.

Away from the breeding colonies and into the OSPAR Area, marine pollution and incidental capture in fishing nets are the main threats that are directly linked to human activities. The species' congregatory behaviour exacerbates the potential effect of both of these threats.

Human activities are also likely to have an indirect impact on the species via climate change effects. Human-induced climate change is leading to increasing sea temperatures, in turn affecting the abundance and distribution of prey fish species. In response the species has to disperse further in the post-breeding season to find adequate food supply, and there is some evidence that there is also a resulting increase in this species' dependence on fishery discards as a food source – bringing the birds into dangerous proximity with fishing vessels and further increasing the likelihood of a 'mass mortality' event.

Management considerations

The species is listed (as *Puffinus puffinus mauretanicus*) in Annex I of the EU Birds Directive, 79/409/EEC. A LIFE Nature project "Recovery Plan for *Puffinus mauretanicus* in the SPA network of the Balearic Islands", carried out between 1998–2001, resulted in a number of conservation actions for the species, including the development of the first Recovery Plan (Ruiz and Martí, 2004). In 1999, a Species Action Plan was prepared for the European Commission by BirdLife International (Aguilar, 1999). In 2000, the species was listed as "in Danger of Extinction" in the Spanish National Catalogue of Threatened Species (Ruiz and Martí, 2004), and the Balearic Government designated three new Special Protection Areas, such that all the Important Bird Areas (IBAs) identified for the species when nesting are now protected. A second Recovery Plan for the species in the Balearic Islands, covering the

period 2004–2010, was formally approved in July 2004 (by Decreto 65/2004), and the species is also the subject of a National Strategy for Conservation in Spain (Anon., 2005). In November 2005, the species was added to Appendix I of the Convention on Migratory Species by the Eighth Conference of the Parties. Ongoing LIFE projects by the BirdLife Partners in Spain (SEO/BirdLife) and Portugal (SPEA) to create inventories of marine IBAs will be the first step towards the effective protection of the species' foraging grounds around the Iberian Peninsula (and the Balearic Islands). However, there has been little other action taken to date for the species in the OSPAR area.

This species requires a wide and well-coordinated conservation and recovery strategy, to study population trends, size and distribution, threats and competition with other bird species. Activities in the OSPAR area should complement those activities both planned and already executed in the Mediterranean (such as protecting breeding and feeding areas, and raising the awareness of local fishermen).

Within the OSPAR area, it is vital to diagnose and ameliorate the threats the species may face as its post-breeding range expands northwards. This species suffers from high adult mortality, and so the threats that are faced in the OSPAR area are likely to be having a significant impact on the overall population of this threatened species. Monitoring and assessment under OSPAR (if this species was listed) could play an important part in coordinating the collection of information about the time spent by Balearic Shearwaters in OSPAR waters. This should include more information about the threats faced by this species in OSPAR waters, and more work to understand these if necessary, for example collation of information on the status of its prey fish species, whether the resource is overexploited by human fishing activity, and how this might impact on the Balearic Shearwater. At present there is limited understanding of exactly where the birds now congregate in Atlantic waters during post-breeding dispersal. Forward modelling of SST data could be used to identify potential future sites of importance in Atlantic waters e.g. SW Scotland.

Gibraltar data from this year show there could possibly be many missing pairs not currently being monitored. More long-term monitoring of key strategic 'flyways' is required, e.g. Gibraltar (increase coverage), Iberian capes, and Moroccan capes. The UK is covered at present by SeaWatch SW – but funding will be required to support this in future years.

⁴ N.B. This activity may mainly be a threat outside the OSPAR Area.

Where possible, consistently-used sites and key flyways within the OSPAR area should be identified and designated as SPAs and/or OSPAR MPAs.

Further information

Nominated by:

BirdLife International

Contact persons:

Kate Tanner, The RSPB/BirdLife International, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK.

Useful references:

Aguilar, J.S. (1999) *Species Action Plan for the Balearic Shearwater Puffinus mauretanicus in Europe*. BirdLife International on behalf of the European Commission.

Anon. (2005) Estrategia para la conservación de la Pardela balear (*Puffinus mauretanicus*) en España. Grupo de Trabajo de la Pardela balear.

Arcos, J.M. and Oro, D. (2002) Significance of fisheries discards for a threatened Mediterranean seabird, the Balearic shearwater *Puffinus mauretanicus*. *Marine Ecology Progress Series* **239**: 209–220.

Arcos, J.M. and Oro, D. (2003) Pardela Balear *Puffinus mauretanicus*. Pp. 88–89 in Martí, R. and del Moral, J.C. (eds.) *Atlas de las aves reproductoras de España*. Madrid: Dirección General de Conservación de la Naturaleza – Sociedad Española de Ornitología.

Arcos, J.M. and Oro, D. (2004) Pardela Balear *Puffinus mauretanicus*. Pp. 46–50 in Madroño, A., González, C. and Atienza, J.C. (eds.) *Libro Rojo de las Aves de España*. Madrid, Spain: Dirección General para la Biodiversidad – SEO/BirdLife.

Arcos, J.M., Ruiz, X., Bearhop, S. and Furness, R.W. (2002) Mercury levels in seabirds and their fish prey at the Ebro Delta (NW Mediterranean): the role of trawler discards as a source of contamination. *Marine Ecology Progress Series* **232**: 281–290.

Arcos, J.M., Hernández, E., Oro, D. and Furness R.W. (2004) Mercury levels in the NW Mediterranean: what do fish and seabirds reveal? 8th Seabird Group International Conference. Seabird Group. University of Aberdeen, UK, April 2004.

Arcos, J.M., Louzao, M. and Oro, D. (in press) Fishery ecosystem impacts and management in the

Mediterranean: seabirds point of view. In Nielsen, J., Dodson, J., Friedland, K., Hamon, T., Highes, N., Musick, J. and Verspoor (eds.) *Proceedings of the fourth World Fisheries Congress: Reconciling fisheries with conservation*. Bethesda, Maryland: American Fisheries Society.

Austin, J.J. (1996) Molecular phylogenetics of *Puffinus* shearwaters: preliminary evidence from mitochondrial cytochrome *b* gene sequences. *Molecular Phylogenetics and Evolution* **6**: 77–88.

Belda, E.J. and Sánchez, A. (2001) Seabird mortality on longline fisheries in the western Mediterranean: factors affecting bycatch and proposed mitigating measures. *Biological Conservation* **98**: 357–363.

BirdLife International (2007) Species factsheet: *Puffinus mauretanicus*. Downloaded from <http://www.birdlife.org>.

Brooke, M. de L. (2004) *Albatrosses and petrels across the world*. Oxford: Oxford University Press.

Del Hoyo, J., Elliott, A. and Sargatal, J., (eds.) (1992). *Handbook of the Birds of the World*, Vol. 1 (Ostrich to Ducks). Barcelona: Lynx Edicions.

Genovart, M., Juste, J. and Oro, D. (2005) Two sibling species sympatrically breeding: a new conservation concern for the critically endangered Balearic shearwater. *Conservation Genetics* **6**: 601–606.

Genovart, M., Oro, D., Juste, J. and Bertorelle, G. (2007) What genetics tell us about the conservation of the critically endangered Balearic Shearwater? *Biological Conservation* **137**: 283–293.

Gutiérrez, R. (2003) The Balearic Shearwater: apparently heading for extinction. *Birding World* **16**: 260–263.

Heidrich, P., Amengual, J. and Wink, M. (1998) Phylogenetic relationships in Mediterranean and North Atlantic shearwaters (Aves: Procellariidae) based on nucleotide sequences of mtDNA. *Biochemical Systematics and Ecology* **26**: 145–170.

IUCN (2007) *2007 IUCN Red List of threatened species*. www.iucnredlist.org.

Le Mao, P. and Yésou, P. (1993) The annual cycle of Balearic Shearwaters and western Mediterranean Yellow-legged Gulls: some ecological

considerations. Pp. 135–145 in Aguilar, J.S., Monbailliu, X. and Paterson, A. M. (eds.) *Status and conservation of seabirds*. Proceedings of the 2nd Mediterranean Seabird Symposium. Madrid: Sociedad Española de Ornitología.

Louzao, M. (2006) Conservation biology of the critically endangered Balearic shearwater *Puffinus mauretanicus*: bridging the gaps between breeding colonies and marine foraging grounds. Palma, Mallorca: IMEDEA, Universitat de les Illes Balears (Ph.D. thesis).

Louzao, M., Hyrenbach, K.D., Arcos, J.M., Abelló, P., Gil de Sola, L. and Oro, D. (2006a) Oceanographic habitat of an endangered Mediterranean Procellariiform: implications for marine protected areas. *Ecological Applications* **16**: 1683–1695.

Louzao, M., Igual, J.M., McMinn, M., Aguilar, J.S., Triay, R. and Oro, D. (2006b) Small pelagic fish, trawling discards and breeding performance of the critically endangered Balearic shearwater: improving conservation diagnosis. *Marine Ecology Progress Series* **318**: 247–254.

Mayol-Serra, J., Aguilar, J.S. and Yésou, P. (2000) The Balearic Shearwater *Puffinus mauretanicus*: status and threats. Pp. 24–37 in Yésou, P. and Sultana, J. (eds.) *Monitoring and conservation of birds, mammals and sea turtles of the Mediterranean and Black Seas*. Proceedings of the 5th Medmaravis Symposium. Malta: Environment Protection Department.

Mouriño, J., Arcos, F., Salvadores, R., Sandoval, A. and Vidal, C. (2003) Status of the Balearic shearwater (*Puffinus mauretanicus*) on the Galician coast (NW Iberian Peninsula). *Scientia Marina* **67**: 135–142.

Oro, D., Aguilar, J.S., Igual, J.M. and Louzao, M. (2004) Modelling demography and extinction risk in the endangered Balearic shearwater. *Biological Conservation* **116**: 93–102.

Rodríguez Molina, A. and McMinn Grivé, M. (2005) Population and distribution of the breeding colonies of Balearic Shearwater *Puffinus mauretanicus* (Lowe 1921). Poster presentation, 2nd International Manx Shearwater workshop, Belfast, UK.

Ruiz, A. and Martí, R. (eds.) (2004) *La Pardela Balear*. Madrid: SEO/BirdLife - Conselleria de Medi Ambient del Govern de les Illes Balears.

Tucker, G.M. and Evans, M.I. (1997) *Habitats for birds in Europe: a conservation strategy for the wider environment*. Cambridge, UK: BirdLife International (BirdLife Conservation Series no. 6).

Viada, C. (2006) *Libro Rojo de los vertebrados de las Baleares (3a edición)*. Conselleria de Medi Ambient, Govern de les Illes Balears.

Wynn, R.B. and Yésou, P. (2007) The changing status of Balearic Shearwater in northwest European waters. *British Birds* **100**: 392–406.

Wynn, R.B., Josey, S.A., Martin, A.P., Johns, D.G. and Yésou, P. (2007) Climate-driven range expansion of a critically endangered top predator in northeast Atlantic waters. *Biology Letters* doi:10.1098/rsbl.2007.0162.

Yésou, P. (2003) Recent changes in the summer distribution of the Balearic shearwater *Puffinus mauretanicus* off western France. *Scientia Marina* **67**: 143–148.