

'All-dark' *Oceanodroma* storm-petrels in the Atlantic and neighbouring seas

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ABSTRACT The occurrence of 'all-dark' *Oceanodroma* storm-petrels in the Atlantic and neighbouring seas is examined. The principal findings are that: the occurrence of Leach's Storm-petrel *O. leucorhoa* with an entirely dark rump has yet to be proven; a 'small, all-dark' storm-petrel is almost certainly a Swinhoe's Storm-petrel *O. monorhis*; the sole 'large, all-dark' storm-petrel record is a Matsudaira's Storm-petrel *O. matsudairae*; and, with the exception of freak vagrancy events, Least *O. microsoma*, Ashy *O. homochroa*, the two Pacific forms of Leach's with dark-rumped variants *O. l. chapmani* and *O. l. socorroensis*, Markham's *O. markhami*, Black *O. melania* and Tristram's Storm-petrels *O. tristrami* are extremely unlikely to occur in the Atlantic. A selection of photographs of North Atlantic Swinhoe's Storm-petrels is presented.

One quiet grey morning early in the course of the voyage, Beck remarked that he would like to lower a boat for birds. 'But there are no birds here señor,' said the skipper, waving an arm around the circle of blank water. Nevertheless, a skiff was sent down, and Captain Charlie manned the oars. For two miles or more he pulled straight ahead, while Beck methodically tossed flecks of oil and grease and scraps of meat in the boat's track. Then they doubled on their course, and to Charlie's amazement the long food-line was soon dotted with unfamiliar, dainty sea-sprites, which skipped and danced like butterflies along a blossoming hedge-row.

Robert C. Murphy (Murphy 1925) recounting exploits of Rollo H. Beck off Peru

This paper investigates the occurrence of 'all-dark' *Oceanodroma* storm-petrels in the Atlantic and neighbouring seas. It examines theories and supporting evidence that attempt to identify the species involved. Eight species of *Oceanodroma* storm-petrel occur in 'all-dark' plumage: Least Storm-petrel *O. microsoma*, Ashy Storm-petrel *O. homochroa*, Swinhoe's Storm-petrel *O. monorhis*, Leach's Storm-petrel *O. leucorhoa*, Markham's Storm-petrel *O. markhami*, Black Storm-petrel *O. melania*, Matsudaira's Storm-petrel *O. matsudairae* and Tristram's Storm-petrel *O. tristrami*. Bulwer's Petrel *Bulweria bulwerii* is included

since it may be mistaken for an 'all-dark' storm-petrel.

Of the smaller species, Least breeds during the northern summer and only in Mexico, on the San Benito islands off the Pacific coast of the Baja California peninsula and on several islands in the Gulf of California, with post-breeding dispersal mainly south to Panama, less commonly as far south as Peru. Ashy breeds during the northern summer on islands from Cape Mendocino, California, to the Todos Santos islands off the northwest Baja peninsula, with the majority on the Farallon Islands and Channel Islands off California; it is largely

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sedentary, occurring throughout the year over waters of the continental slope near the breeding islands. Swinhoe's breeds in the northern summer on islands off the coasts of Japan and the Korean Peninsula, migrating after breeding mainly to the northern Indian Ocean. The nominate form of Leach's breeds during the northern summer in the northwest and northeast Atlantic, and in the northeast and northwest Pacific, migrating after breeding mainly to regions of tropical convergence. Leach's *O. l. socorroensis* breeds during the northern summer on Isla Guadalupe off the Pacific coast of Baja California, but its post-breeding dispersal is poorly understood. Leach's *O. l. chapmani* breeds during the northern summer on the Coronado and San Benito islands off Baja California, and disperses south to waters off Central America, and perhaps farther south.

Of the larger species, Markham's breeds late in the southern winter, and the only confirmed breeding location is on the Paracas peninsula, Peru, though birds are found offshore from Mexico to central Chile. Black breeds in the northern summer on islands from southern California to the Gulf of California, with post-breeding dispersal south as far as southern Peru. Matsudaira's breeds late in the northern winter on Iwo and the Ogasawara Islands, south of Japan, migrating after breeding mainly to the northern Indian Ocean. Tristram's breeds in the northern winter in the northwest Hawaiian group and islands south of Japan and may disperse north after breeding. Bulwer's Petrel breeds mainly in the northern summer, on islands throughout a disjunct pan-oceanic range, but mostly in tropical waters.

It is known from tape-lured captures that Swinhoe's Storm-petrel frequents the Atlantic and neighbouring seas in small numbers during June–September at least. Offshore and at-sea sightings of 'all-dark' storm-petrels occur in most years, some of which must surely be Swinhoe's. However, as Rob Hume argued (in Cubitt 1995), all potential species warrant consideration. Here, they are investigated in two groups, 'small' and 'large'.

'Small, all-dark' Oceanodroma storm-petrels
Sightings of 'small, all-dark' storm-petrels in the Atlantic and neighbouring seas may be explained by one or more of the following five possibilities.

1. *Least, Ashy, and/or dark-rumped Leach's Storm-petrel vagrancy from the eastern Pacific*
Spear & Ainley (2007) attempted to define the marine habitat affinities of various storm-petrel forms; they suggested that all forms covered (excluding Humboldt Current endemics) were distinct from one another in their association with different oceanic parameters (including wind speed, sea-surface temperature, and thermocline depth and strength). For Least and Leach's (*O. l. chapmani* and *O. l. socorroensis*), this was partially related to an association with warm waters of the Costa Rica Current, especially in the Gulf of Panama. The obvious oceanic route from these waters to the Atlantic is via the southern tip of South America, a 10,500-km trek over the cold, northward-flowing Humboldt Current and unsuitable oceanic parameters. The American landmass creates a wall to the east and it is unlikely that storm-blown individuals would find their way across Panama given the direction of prevailing surface winds and storm tracks in that region (D. G. Ainley *in litt.*). There is a slender chance of single vagrancy across the Pacific and through the Indian Ocean but it must be most unlikely that Least or Leach's from the eastern Pacific will reach the Atlantic.

Ashy shows an affinity for cooler water and has no tendency to migrate, making only local movements within the California Current. Warm equatorial waters 'block' the species moving south to cool waters of the Humboldt Current, while the American landmass and prevailing surface winds create a significant barrier to the east. Again, it is hard to imagine this species ever reaching the Atlantic.

2. *Dark-rumped Leach's Storm-petrels (unknown colony/unknown form) in the tropical Atlantic*

Leach's in the North Atlantic is currently known to breed no farther south than Massachusetts, USA (41°N), although it regularly prospects and even nests in tiny numbers in the southern oceans (Imber & Lovegrove 1982; Randall & Randall 1986). In principle, an unknown colony or even an undiscovered form of dark-rumped Leach's could breed in the tropical Atlantic. There is, however, little evidence to support this theory (the few possible records are listed in table 2, p. 372) and, even though there is little search effort in the region, it is most likely that no such population exists.

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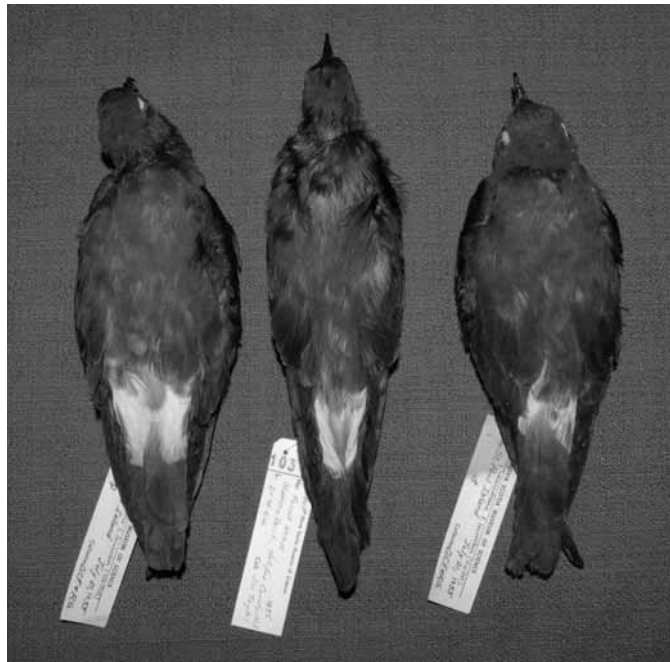
3. Dark-rumped Leach's Storm-petrels from North Atlantic breeding populations

Field guides suggest that Atlantic-breeding Leach's occur with an extensively and perhaps a wholly dark rump (e.g. plate 186), although the probability of encountering one is not quantified. Dark-rumped variants are analysed below based on data received from: (i) field observers, (ii) ringers, and (iii) museum staff. Each dataset has a caveat: (a) judging the extent of darkness in the white rump of a Leach's in flight is tricky at moderate distance and in the stormy conditions that cause wrecks; (b) a close inspection of the rump patch of Leach's in the hand is not the main focus of ringers; and (c) each taxidermist has their own style in presenting rump and uppertail-coverts, while plumage condition of old skins sometimes is poor. To some extent, examining the data together overcomes individual caveats and raises confidence in overall findings.

The 'dark-rumped Leach's' phenomenon divides into two types: (a) *dark-rumped*, where the rump is extensively dark; and (b) *ghost-rumped*, where the rump is neither dark nor white, but pallid. It is uncertain whether 'ghost-rumped' is a distinct plumage variant or an artefact of wear. Formation of dark in the rump is reviewed in Appendix 1.

(i) Field observations

In Europe, northwest England is a hotspot for field observation of autumn wrecks of Leach's. Records kept for Seaforth, Lancashire & N



Katherine Ogden © Nova Scotia Museum of Natural History

186. Leach's Storm-petrels *Oceanodroma leucorhoa*, all collected in the Atlantic, Nova Scotia Museum of Natural History. Note how the extent of dark in the white rump patch varies across the three specimens. The right-hand bird, collected on 21st July 1955 on St Paul Island, Nova Scotia, is quite extensively dark-rumped and scores 8 on the Ainley scale (see Appendix 2).

Table 1. Details of large wrecks of 50 or more Leach's Storm-petrels *Oceanodroma leucorhoa* recorded off Seaforth, Lancashire & N Merseyside, to the end of 2008 (T. Vaughan *in litt.*)

Date	No.	Observation of dark-rumped birds
16th September 1978	60	None
30th September 1978	200	None
13th September 1980	51	None
14th September 1987	377	None
7th October 1988	80+	None
8th October 1988	50+	None
20th September 1990	60	None
21st September 1990	120	None
22nd September 1990	600+	None
24th September 1990	300+	One partially dark-rumped & one ghost-rumped
27th September 1995	60	None
13th September 1997	133	None
15th September 2001	100+	None
20th September 2004	60+	None
21st September 2004	150+	None
22nd September 2004	300+	None
1st October 2005	50+	None
8th December 2006	190	None
1st October 2008	107	None
Total (poss. duplication)	3,048+	One partially dark-rumped & one ghost-rumped

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Merseyside, document only one extensively dark-rumped and one ghost-rumped Leach's in 30 years of wrecks involving c. 3,000 birds (Vaughan 1990; A. J. Conway, P. Kinsella & T. Vaughan *in litt.*). Table 1 lists wrecks of 50 or more birds off Seaforth. At least 88 'mini-wrecks', involving fewer than 50 birds per wreck, were witnessed but these did not contain any extensively dark-rumped or ghost-rumped birds (T. Vaughan *in litt.*). No white was apparent in the rump of an individual seen 200 m off New Brighton, Cheshire & Wirral, on 8th September 2001 (Cheshire & Wirral Bird Report 2001). Of 165 Leach's seen on 15th September off Hoylake, Cheshire & Wirral, one 'seen at ranges down to 20 feet had an all-dark rump but no other plumage or flight differences from a normal Leach's, (C. Schofield *in litt.*). Seawatches off Blackpool since 1963 have recorded over 700 Leach's, of which just one was a dark-rumped bird, seemingly with no white in the rump, on 4th December 2006 (M. Jones *in litt.*).

Elsewhere in Britain & Ireland, during a record count of 900+ Leach's west past Ramore Head, Co. Antrim, on 6th September 1990, two

showed an extensively dark rump and two a ghost rump (McKee 1990). On 12th February 1990, three ghost-rumped Leach's were seen at Burnham-on-Sea, Somerset, one possibly with a restricted pallid area, while another ghost-rumped bird was there on 27th February 1990 (B. Rabbitts *in litt.*).

The picture is similar in North America. N. Brinkley, editor of *North American Birding*, commented that: 'I review very carefully all bird sightings in the USA and Canada, and now south to Panama... and I have never come across a record of a dark-rumped Leach's.' A Leach's seen off Oregon Inlet, North Carolina, on 27th July 1992 showed a pale border highlighting an otherwise dark rump (O'Brien *et al.* 1999), while a ghost-rumped Leach's was off Port O'Connor, Texas, in 1997 (Lasley *et al.* 1997). Comprehensive seawatch statistics like those for Seaforth are simply not available for the east coasts of Canada and the USA, however (B. Patteson *in litt.*).

A North American claim of a wholly dark-rumped North Atlantic Leach's (scoring 11 on the Ainley scale; see Appendix 2) refers to a bird found dead at Oneida Lake, New York, on 7th September 1933, two weeks after a hurricane and seabird wreck on 24th–25th August 1933. It was identified by R. C. Murphy as a moulting Leach's (Sadler 1933), although there is some doubt whether the specimen was genuinely dark-rumped, given that it may have been in poor condition (perhaps missing uppertail-coverts) when eventually seen by Murphy (O'Brien *et al.* 1999; N. Brinkley *in litt.*); since the skin was not preserved, the true significance of this record is unknown.

Three published photographs of extensively dark-rumped Leach's observed at sea were located. One photographed off St Kilda, Outer Hebrides, in 1960 scored between 5 and 6 on the Ainley scale (Bourne & Simmons 1997); one off Sweden in September 1997 scored between 8 and 9 (Blomdahl *et al.* 2003); and one in April 2006 in the equatorial Atlantic scored between 7 and 8 (Flood & Thomas 2007). Another seen in the equatorial Atlantic in April 2005 scored 9 on the Ainley scale, '... and looked excitingly dark at moderate range, but no luck with better and closer views' (S. N. G. Howell *in litt.*).

Morrison (1998) located c. 20 records of



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187. Leach's Storm-petrel *Oceanodroma leucorhoa*. Note missing white rump feathers, revealing black rectrices and restricting the amount of white in the rump.

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extensively dark-rumped Leach's, but did not provide details for all of them. In parallel with the findings here, the majority were logged in autumn, when Leach's are likely to be worn and/or in moult. White tips of worn feathers may be abraded, making the rump look darker, while moulting birds may have rump feathers missing (e.g. plate 187). A partially dark-rumped individual that is worn and/or in moult and *not seen well* could *appear* wholly dark-rumped (Brinkley 1995); such individuals are 'pseudo dark-rumped' and this might explain four of the records referred to above: Oneida Lake on 7th September 1933, New Brighton on 8th September 1997, Hoylake on 15th September 2001, and Morecambe Bay on 4th December 2006.

(ii) *Data from ringers*

An even smaller number of extensively dark-rumped Leach's were reported by ringers, sampling a much larger population. In Britain & Ireland, ten individuals or ringing groups are responsible for ringing 97% of all Leach's Storm-petrels (K. Risely, BTO, *in litt.*) and several of these supplied data for birds handled.

The only known colony of Leach's in Ireland is at The Stags of Broadhaven, Co. Mayo, where c. 300 pairs breed. On average 10–15 Leach's are ringed each year and none with an extensively dark rump has been recorded (D. Clarke *in litt.*).

In Scotland, no wholly dark-rumped Leach's were recorded on St Kilda among c. 3,000 birds handled by R. W. Furness (*in litt.*), nor among c. 600 handled by Steve Votier (*in litt.*) in 2004 and 2008 (some of the 3,000 handled by RWF were in Shetland but most were on St Kilda). North Ronaldsay Bird Observatory ringed 65 Leach's between 1985 and 2007 and two between 1977 and 1984; two had a partially dark rump and none had an extensively or wholly dark rump (A. Duncan *in litt.*). No wholly dark-rumped birds were noted by Sule Skerry Ringing Group among 768 handled on Sule Skerry during 1975–2007, 1,262 on North Rona in 2003–05 and c. 550 on St Kilda in 2004 and 2007 (D. Budworth, A. & J. Blackburn *in litt.*). No wholly dark-rumped birds were noted among 2,320 handled by J. Love (*in litt.*) as follows: North Rona 1,140 (1971, 1972 and 1974), 744 (1993 and 1998) and 266 (2005 and 2006); Foula 40 (1974); St Kilda c. 100 (1979); Flannan Isles 30 (1988). However, small variation in the degree of dark in the centre of the rump was noted and

one had 'quite a lot of dark', yet the rump was still predominantly white. None with a wholly dark rump was noted in 25 ringed on Foula in the mid 1960s and 147 ringed there in 1973–78 (A. R. Mainwood *in litt.*), though some were dusky in the centre of the rump.

In Norway, the Herynken ringing station ringed 754 Leach's, most after 1980. None showed a wholly dark rump, though a small number had a partially dark rump, scoring up to 6 on the Ainley scale (T. Anker-Nilssen *in litt.*).

In North America, extensively dark-rumped Leach's were unknown to ringers in Newfoundland, each of whom had seen well over 10,000 individuals (B. Mactavish in Morrison 1998). B. Montevicchi (*in litt.*) has studied Leach's in Newfoundland for 25 years, encountering many thousands, but none with a wholly dark rump. A. Hedd (*in litt.*) estimates ringing c. 700 adult/subadult birds in Newfoundland during 2003–08 and handled none with a wholly dark rump. O'Brien *et al.* (1999) noted that 'research in Atlantic colonies has never revealed a [wholly] dark-rumped individual (C. Huntington *in litt.*).' A few Leach's exhibiting a 'ghost rump' were noted by C. Huntington in 50 years' research at breeding colonies in the Bay of Fundy, Nova Scotia (N. Brinkley *in litt.*).

(iii) *Museum specimens*

Since Leach's are prone to wrecks and to coming on board ships, skins are liable to occur in a wide variety of museums. Thirty-eight museums were contacted for this analysis, employing the following criteria: (a) geographical location in eastern North America and northwest Europe, (b) museums known to house important collections of Hydrobatidae, and (c) provincial museums near to breeding and wreck sites. With the co-operation of curators, collection managers, and keepers from 34 of the selected museums (see Acknowledgments) a total of 955 skins were scored using the Ainley scale. Scores are an interpretation of how the rump would appear in fresh plumage, taking into account wear and deterioration. Badly deteriorated skins were excluded from the analysis. In many cases, sample digital images facilitated checks, maintaining consistency in evaluation. The great majority of skins scored between 2 and 6 on the Ainley scale (fig. 1). These represent 'typical' Leach's, familiar to field observers and ringers. About 25 skins scored 7. All skins that were

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Geert Brovad © Natural History Museum of Denmark

188. Leach's Storm-petrel *Oceanodroma leucorhoa*. Collected at Narssalik, Greenland, on 16th November 1905. A total of 955 skins were evaluated using the Ainley scale with the co-operation of curators, collection managers, and keepers from 34 museums across North America, northwest Europe and Scandinavia. About 25 skins scored 7 on the Ainley scale, only five scored 8, and just one, this specimen, scored 9; none scored higher than 9. These statistics indicate that extensively dark-rumped Leach's Storm-petrels in the Atlantic are rare.

missing, or were flattened. Careful examination revealed only five skins that scored 8 (e.g. the right-hand bird in plate 186), one that scored 9 (plate 188), and none that scored higher than 9.

Bourne & Simmons (1997) referred to a Leach's skin scoring 10 on the Ainley scale – the specimen, housed at NHM, Tring, was found southeast of St Helena on 22nd January 1964 and left in Ascension by a seaman from a passing ship – and claimed that in-hand inspection revealed barely visible pale on each side of the base of the rump. Re-evaluation by the author yielded a maximum score of 8 (taking wear into account), and this specimen is an example of a pseudo dark-rumped Leach's (plates 189–191).

Table 2 summarises the findings of this investigation. There are just ten field records scoring more than 7 on the Ainley scale. Seven of these were extensively dark-rumped, of which four birds are candidate wholly dark-rumped Leach's. However, all four were recorded in autumn, when wear and moult can make the rump look dark, and thus may have been pseudo dark-rumped Leach's. Moreover, one had been dead several weeks and the specimen may have

scored 8 or above by museum staff were photographed and checked by the author, with a second opinion given by E. A. Fisher. Some were in poor condition, with moth damage or feathers

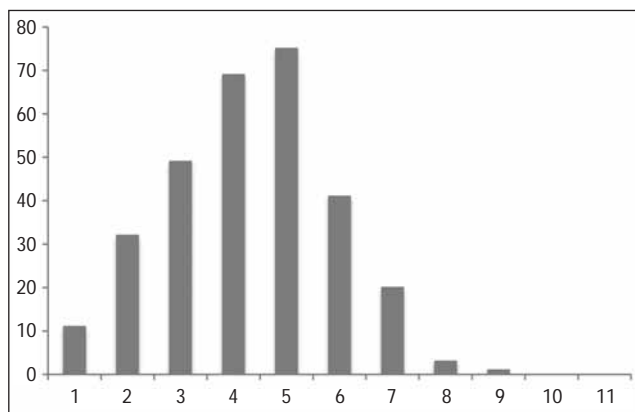


Fig. 1. Number of skins in each class of the Ainley scale from 301 specimens in nine museums that provided Ainley-scale scoring for all skins of Leach's Storm-petrel *Oceanodroma leucorhoa* in their collections: Bristol, Brussels, Copenhagen, Liverpool, Louisiana, Manchester, Paris, Tring and Trondheim.

been in poor condition, while the other three were part of wrecks seen in stormy weather, which makes observation difficult. There are eight field records of ghost-rumped birds. Of thousands of Leach's handled by ringers during the breeding season, when plumage is still fresh, just a few extensively and no wholly dark-rumped Leach's have been noted. Museum skins included just five with a score of 8, one with a score of 9 and none higher, though one scoring 8 was collected in the breeding season. Thus, data from field records, birds trapped for ringing and inspection of museum skins

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yielded no wholly and unequivocally dark-rumped Leach's.

In conclusion, views of a 'small, all-dark' storm-petrel in the Atlantic that confirm a wholly and unequivocally dark rump effectively eliminate nominate Leach's. Given the earlier discussion of Least, Ashy, and Leach's in the eastern Pacific, it is thus highly likely that a 'small', wholly and unequivocally dark-rumped storm-petrel observed in the Atlantic is Swinhoe's (see below), especially in summer, before the possibility of encountering a pseudo dark-rumped Leach's in autumn. Identification can be confirmed by examination of structure, plumage, and flight behaviour, which differ visibly between Swinhoe's and Leach's (e.g. Howell & Patteson 2008). Singling out Swinhoe's sharpens focus on the question of their origin.

4. Swinhoe's Storm-petrel vagrancy from Indian Ocean wintering grounds

Swinhoe's Storm-petrels migrate from their breeding islands off Japan and Korea in September to winter in the northern Indian Ocean. Swinhoe's clearly is a long-distance migrant. There are occasional records west to Somalia (reported in *Sea Swallow*) and south of the equator (e.g. in the Comoro Islands in February 2003, I. Sinclair *in litt.*), in addition to wide-ranging southerly and northeasterly records

(e.g. Takeshita 1992, <http://users.bigpond.net.au/palliser/barc/sub295.html>). Swinhoe's in the southwest of their winter range could follow ocean currents and the prevailing easterly airflow round the southern tip of Africa into the South



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189–191. Leach's Storm-petrel *Oceanodroma leucorhoa*. Plate 189 compares a partially dark-rumped Leach's (left), found southeast of St Helena on 22nd January 1964 (Bourne & Simmons 1997), with one that scores 1 or 2 on the Ainley scale. Note the extent of wear in the remiges and rectrices of the former. Plate 190 also shows the Leach's from St Helena. Note the heavy wear of the rectrices, uppertail-coverts and rump. Some white is evident on the left-hand side of the inner part of the rump but on the remaining inner-rump feathers the white tips are almost completely worn away, leaving dark basal areas and revealing dark feather bases beneath. The outer-rump feathers are also worn, though generally dark. Plate 191 isolates one inner-rump feather of the same bird, revealing the extent of wear of the white tip. It is difficult to score this specimen on the Ainley scale; in fresh plumage the score would have been a maximum of 8, possibly less. In summary, the rump feathers of this bird are heavily worn, restricting the amount of visible white and producing a pseudo dark-rumped Leach's. The date (22nd January) falls within the predicted period for pseudo dark-rumped Leach's described in the text. This specimen might also provide insight into the 'ghost-rumped' phenomenon. The result of wear and ageing apparently yield a largely ghost-rumped appearance.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic**Table 2.** Ghost-rumped, extensively dark-rumped (score greater than 7 on the Ainley scale) and apparently wholly dark-rumped Leach's Storm-petrels *Oceanodroma leucorhoa* in the Atlantic and neighbouring seas; field records and birds handled or trapped in the breeding season (both to the end of 2008), and museum skins.

Key: (e) = estimated, (?) = questionable, GR = ghost-rumped, max. = maximum score.

All museum specimens scored by the author.

Location	Ainley scale	Details
		field records
New York, USA	11 (?)	One dead at Oneida Lake on 7th September 1933 (Sadler 1933)
Somerset	GR	Three off Burnham-on-Sea on 12th February and one on 27th February in 1990 (B. Rabbits <i>in litt.</i>)
Co. Antrim	8 or 9 (e)	Two off Ramore Head on 6th September 1990 among 900 Leach's (McKee 1990)
Co. Antrim	GR	Two off Ramore Head on 6th September 1990 among 900 Leach's (McKee 1990)
Lancashire & N Merseyside	7 or 8	One off Seaforth on 24th September 1990 among 300 Leach's (Vaughan 1990)
Lancashire & N Merseyside	GR	One off Seaforth on 24th September 1990 among 300 Leach's (Vaughan 1990)
North Carolina, USA	7 or 8 (e)	One on a trip off Oregon Inlet on 27th July 1992 (O'Brien <i>et al.</i> 1999)
Texas, USA	GR	One off Port O'Connor in 1997, exact date unknown (Lasley <i>et al.</i> 1997)
Cheshire & Wirral	10 or 11	One off New Brighton on 8th September 1997 (C. Schofield <i>in litt.</i>)
Sweden	8 or 9	One September 1997 pictured in Blomdahl <i>et al.</i> (2003: 81)
Cheshire & Wirral	10 or 11	One off Hoylake on 15th September 2001 (<i>Cheshire & Wirral Bird Report 2001</i>)
Equatorial Atlantic	9	One at c. 5°N 20°W on 12th April 2005 (S. N. G. Howell <i>in litt.</i>)
Equatorial Atlantic	7 or 8	One at c. 2°N 18°W on 2nd April 2006 pictured in Flood & Thomas (2007: 421)
Lancashire & N Merseyside	10 or 11	One in Morecambe Bay on 4th December 2006 (M. Jones <i>et al. in litt.</i>)
handled or trapped in breeding season		
Orkney	7 or 8 (e)	Two between 1997 & 2007 in North Ronaldsay (P. Brown <i>in litt.</i>)
Nova Scotia	GR	A few in 50 years in Bay of Fundy (N. Brinkley <i>in litt.</i>)
museum specimens		
Natural History Museum, Copenhagen	max. 9	One collected at Narssalik, Greenland, on 16th November 1905, see plate 188
Nova Scotia Museum of Natural History	8	One collected at St Paul Island, Nova Scotia, on 21st July 1955, see plate 186
National Museum of Natural History, Paris	8	One collected in the Mediterranean at Pézenas, Hérault, France, on 26th December 1955
National Museum of Natural History, Paris	8	One collected in the North Atlantic at 35°21'N, 29°16'W on 17th October 1963
NHM, Tring	max. 8	One retrieved from Ascension on 22nd January 1964 (Bourne & Simmons 1997), see plates 189–191
National Museums of Scotland, Edinburgh	max. 8	One collected at Newcastleton, Borders, on 7th March 1966

Atlantic (Bourne 1991, 1992; Parkin 1995). Having thus entered the Atlantic, vagrant Swinhoe's may try to migrate northeast, become 'trapped', and end up travelling north into the North Atlantic. There are currently no records of Swinhoe's from southern Africa, but there are two records of unidentified 'small, all-dark' storm-

petrels from Walvis Bay, Namibia (T. Hardaker *in litt.*).

An alternative route from the Indian Ocean into the Atlantic is via the Red Sea and the Mediterranean (Bourne 1967; James & Robertson 1985). 'The records from the Mediterranean off Italy and Spain and one from Eilat, Israel

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lend credence to the latter theory' (O'Brien *et al.* 1999). Morrison (1998) was sceptical because the route involves an overland crossing. Since 1998 there have been four further records off Eilat (September 2000, April 2003, September 2004 and January 2008), with all five birds found dead or dying. These most likely represent a dead end to the Red Sea to Mediterranean Sea passage.

5. Swinhoe's Storm-petrels breeding in the Atlantic

Bretagnolle *et al.* (1991) considered it unlikely that the six captures of Swinhoe's in the northeastern Atlantic up to the end of 1990 could be explained by vagrancy to Europe from wintering grounds in the Indian Ocean. Instead, they suggested that a small, undiscovered breeding colony (or colonies) in the Atlantic was the source. Some trapped birds had vascularised brood patches (plate 192), adding weight to their theory, and the authors pinpointed the Azores or Cape Verde Islands as likely breeding locations, even though sea temperature is slightly warmer than the 17°C around Pacific breeding sites. The Canary Islands, Selvagens, and Madeira were considered less likely given extensive searches for petrels at these sites prior to 1991. However, today, a track record of Swinhoe's captures and suitable sea temperatures favours the last three island groups as likely breeding locations (see table 5).

In summary, the most plausible explanation for 'small, all-dark' storm-petrel records in the Atlantic and neighbouring seas is a small breeding population of Swinhoe's in the Atlantic. How and when this population colonised the Atlantic remains unclear. It could be the result of ongoing vagrancy and/or a fairly recent, single large event, or it could be an ancient relict population (Bretagnolle *et al.* 1991). However, DNA analysis of Tynemouth and some Selvagens birds indicates that Atlantic and Pacific Swinhoe's are inseparable (Dawson 1992; Dawson *et al.* 1995), so any Atlantic population has not been isolated for long (O'Brien *et al.* 1999). Recent in terms of DNA analysis probably means no more than a few centuries, possibly since the Little Ice Age ended in the 1700s.

Entry into the Atlantic was and remains most likely via southern Africa, following climatic and habitat variations after the Little Ice Age.

'Large, all-dark' *Oceanodroma* storm-petrels

'Large' *Oceanodroma* storm-petrels that occur in 'all-dark' plumage are Markham's, Black, Matsudaira's and Tristram's. Claims of 'large, all-dark' storm-petrels in the Atlantic and neighbouring seas may be explained by one or more of the following four possibilities.

1. Size illusion in relation to 'small, all-dark' *Oceanodroma* storm-petrels

On short-range pelagic trips from Scilly, participants typically comment that Wilson's Storm-petrel *Oceanites oceanicus* is 'one-and-a-half times as big' as European Storm-petrel *Hydrobates pelagicus*; and that Leach's (and therefore Swinhoe's) is 'twice as big' as European. Flood & Thomas (2007) used the linear measurement of wingspan to illustrate that this is not the case. The actual wingspan ratios are 1.05 (European: Wilson's – perceived wingspan ratio 1.5) and 1.21 (European: Leach's – perceived wingspan ratio 2.0). Volume may be a more useful index of overall size (which is three-dimensional) – see Howell & Patteson (2008) – but there is a general issue of size illusion among storm-petrel species observed together at sea. Size illusion may cause observers of an unfamiliar 'small, all-dark' storm-petrel, such as a Swinhoe's, to believe that they have



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192. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Ponta da Almadena, Algarve, Portugal, 27th June 1998, showing the vascularised brood patch.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic**Table 3.** Extralimital European records of Bulwer's Petrels *Bulweria bulwerii* formally accepted or acceptance expected by national panels to the end of 2008; see also fig. 2.

No.	Year	Location	Details
1	1898	Italy/France	One between Corsica and Genoa collected exhausted on lightship, 3rd June; specimen at Florence Museum (Bourne 1967; Bricchetti & Fracasso 2003)
2	1967	Bouches-du-Rhône, France	Two off Salin-de-Giraud, 12th May (French national rarities committee – Comité d'Homologation National (CHN))
3	1975	Co. Cork	One off Cape Clear Island, 3rd August (Alibone 1980); may be reviewed by Irish Rare Birds Committee (P. Milne <i>in litt.</i>)
4	1977	Hérault, France	One 10 km off Frontignan, 17th June (CHN)
5	1982	Málaga, Spain	One at sea off Torremolinos, 7th February (Paterson 1997) (pre-dates Spanish national rarities committee – Comité de Rarezas de SEO (CRSEO))
6	1986	Brittany, France	One at sea off Ouessant, 15th January (CHN)
7	1987	Portugal	One, 42°12'N 10°15'W, 21st August (C. Moore; de Juana 1990)
8	1989	Portugal	Ten, 38°04'N 11°17'W, 6th August (C. Moore & P. Holt; de Juana 1991)
9	1991	Sicily, Catania	One past Simeto River Mouth, 9th March (A. Ciaccio and A. Corso, Italian national committees – Commissione Ornitologica Italiana (COI) and Comitato Italiano Rarità (CIR))
10	1991	Portugal	One 38°28'N 11°04'W, one 38°29'N 10°45'W, two 38°33'N 10°31'W and one 38°34'N 10°30'W; all 22nd July (C. Moore; de Juana 1993)
11	1992	Portugal	One, 40°25'N 12°25'W, 15th August (C. Moore; de Juana 1994)
12	1992	Portugal	One, 38°37'N 12°55'W, 23rd August (C. Moore; de Juana 1995)
13	1993	Portugal	Three between 36°23'N 12°25'W & 36°10'N 12°32'W, 7th August (C. Moore & K. Mullarney; de Juana 1995)
14	1994	Portugal	Two 38°30'N 12°57'W, 20th August (C. Moore; de Juana 1996)
15	1994	Portugal	One 36°00'N 12°41'W, 30th August (C. Moore; de Juana 1996)
16	1995	Portugal	One 38°44'N 11°50'W and one 38°45'N 11°46'W, both 13th August (C. Moore; Costa 1997)
17	1995	Zuid-Holland, the Netherlands	One feeding off Westplaat, 21st August (Schaftenaar 1996, disputed by van den Berg & Bosman 2001, under review by Dutch national rarities committee – Commissie Dwaalgasten Nederlandse Avifauna)
18	1996	Portugal	One 40°42'N 11°29'W and one 40°39'N 12°28'W, both 10th August (C. Moore; Costa <i>et al.</i> 1999)
19	1996	Portugal	Two 37°15'N 11°02'W and one 38°00'N 10°15'W, both 20th August (C. Moore; Costa <i>et al.</i> 1999)
20	1997	Hérault, France	One at sea off Sète harbour, 19th May (CHN; <i>Brit. Birds</i> 91: 38)
21	1997	Portugal	One 40°30'N 12°55'W, 15th August (C. Moore; Costa <i>et al.</i> 2000)
22	1998	Portugal	One 38°07'N 9°55'W and one 38°14'N 9°45'W, both 6th August (C. Moore; Costa <i>et al.</i> 2000)
23	1999	Portugal	Sixteen between 37°30'N 11°09'W & 36°57'N 11°29'W on 21st August (C. Moore; Costa <i>et al.</i> 2003)
24	1999	Portugal	One 37°40'N 10°29'W, 26th August (C. Moore; Costa <i>et al.</i> 2003)
25	2000	Portugal	One 36°01'N 12°03'W, 21st August (C. Moore; Costa <i>et al.</i> 2003)
26	2000	Portugal	17 between 36°30'N 12°09'W and 36°49'N 11°51'W, 23rd August (C. Moore; Costa <i>et al.</i> 2003)
27	2002	Portugal	One Banco de Gorringe zone, 25th August (C. Moore; Elias <i>et al.</i> 2004)
28	2004	Portugal	Two Banco de Gorringe zone, 22nd August (C. Moore; Elias <i>et al.</i> 2006)
29	2005	Portugal	Two 36°15'N 12°31'W, 21st August (C. Moore; Jara <i>et al.</i> 2007)
30	2005	Portugal	Two 36°16'N 12°29'W, 24th August (C. Moore; Jara <i>et al.</i> 2007)
31	2006	Cádiz, Spain	One off Tarifa, Cádiz, 19th August (under consideration, CRSEO)
32	2006	Huelva, Spain	One dead at Playa Cristina on 25th October (J. M. M. Garcia, photographed, CRSEO)
33	2007	Tuscany, Italy	One past Marina di Vecchiano on 26th May (Italian national committees – COI and CIR)
34	2007	Spain	One at sea c. 370 km west of Cape Vilán, Camariñas, on 25th July (D. Romai, A. Servidio; under consideration, CRSEO)
35	2008	Portugal	One off Vila Real de Santo António, Faro, on 5th October (under consideration, Portuguese national rarities committee – Comité Português de Raridades)

'All-dark' *Oceanodroma* storm-petrels in the Atlantic

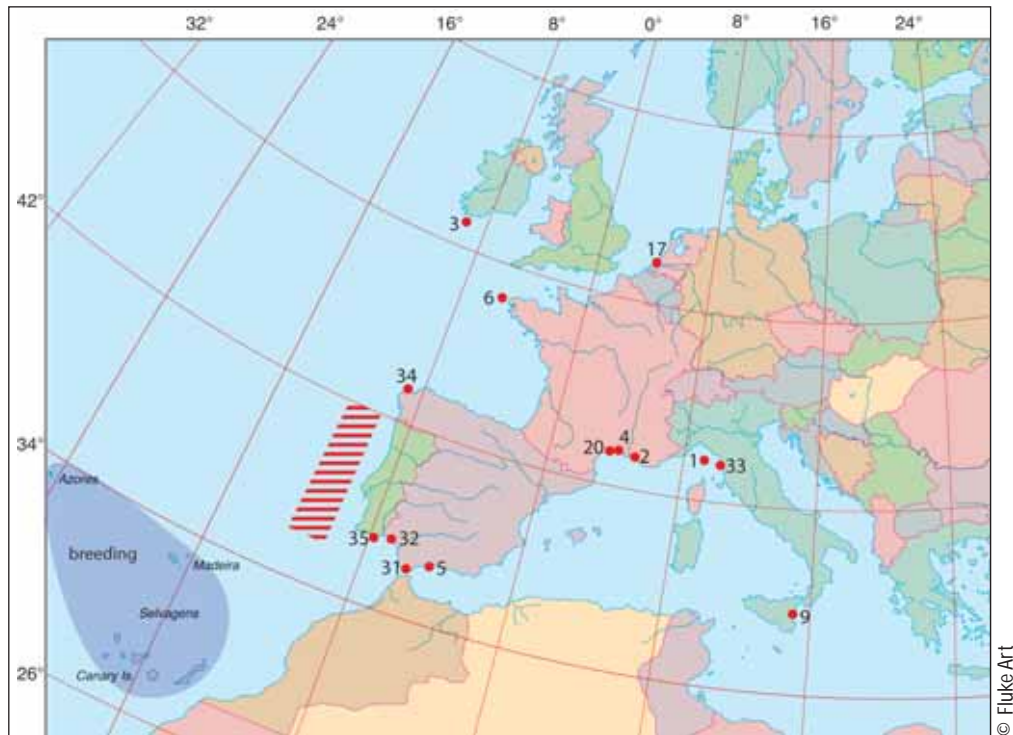


Fig. 2. Extralimital European records of Bulwer's Petrels *Bulweria bulwerii*, details of which are given in table 3. Numbered records relate to entries in table 3; records at sea off Portugal are highlighted by the shaded box, which covers the area 36°N–42°N and 10°W–12°W. The northeast Atlantic breeding grounds are highlighted also.

seen a 'large, all-dark' storm-petrel or a Bulwer's Petrel. For example, it is likely that size illusion played a significant part in the case of the infamous 'Chalice petrel', leading to the belief by some that it was a Matsudaira's (e.g. Gantlett 1988). The prevailing opinion now is that it was a Swinhoe's (see discussion in Force 1997, Hume *et al.* 1997, Young & King 1997 and Garner & Mullarney 2004). It is therefore not surprising to find cases where the first impression of a Swinhoe's led even experienced observers to consider the much larger Bulwer's Petrel (e.g. Brinkley 1995, Howell & Patteson 2008).

Bulwer's Petrel straggles north and east of its Atlantic breeding grounds. Table 3 summarises those European records of extralimital Bulwer's formally accepted by national records committees (see Harrop 2008 for discussion of British records), with most seen in Portuguese waters. There are two Atlantic records off North Carolina, USA (Alderfer 2006), the individual on 8th August 1998 being photographed (LeGrand *et al.* 1999).

2. Misidentification of nightjars

The risk of confusion between Bulwer's Petrel

and nightjars *Caprimulgus* was discussed by Gutiérrez (2006). He highlighted a claim of up to 14 Bulwer's off the mouth of the Tordera river, northeastern Spain, in April 1984 (Eigenhuis 1985). The claim was initially accepted by the Spanish rarities committee, but later rejected because nightjars had not been eliminated. Eigenhuis's response was that if the 14 birds were not Bulwer's, then they were dark-rumped Leach's Storm-petrels (in Gutiérrez 2006). Given the true rarity of extensively dark-rumped Leach's established here, this solution is surely not tenable.

The problem of confusion with nightjars was brought into focus on 8th May 1999, when a bird observed c. 2.5 km off Barcelona, Spain, reminded observers of a Bulwer's Petrel. To their surprise, it was a European Nightjar *Caprimulgus europaeus* (Gutiérrez & Larruy 2002). The bird was reminiscent of a Bulwer's Petrel because of its structure (overall size and long tail), its generally featureless brownish plumage, and the fact that it was foraging over the sea surface together with two European Storm-petrels. However, with good light and close views, the observers saw white wing-flashes

'All-dark' *Oceanodroma* storm-petrels in the Atlantic**Table 4.** Claims of 'large, all-dark' *Oceanodroma* storm-petrels off the south coast of England that could potentially relate to a misidentified European Nightjar *Caprimulgus europaeus*, given the location and date of the record.

Year	Location	Details
1980	Sussex	One off Worthing, 12th May, possibly same 23rd May (Morrison 1998)
1990	Dorset	One off Chesil Cove 14th and 15th May, possibly same 28th–30th May
1991	Devon	One off Prawle Point 27th May, possibly same 31st May (Morrison 1998)
1991	Hampshire	One off Keyhaven, 30th May (Morrison 1998)
1993	Dorset	Two east off St Aldhelm's Head, 10th May (Morrison 1998)
2006	Sussex	One west past Selsey Bill, 30th May (BirdGuides, Rare Bird Alert)

and other features that confirmed identification as a European Nightjar. An alternative misidentification could easily have been Matsudaira's Storm-petrel, given the white wing-flashes of a male European Nightjar.

Examples of migrating or even apparently foraging European Nightjars offshore, mainly during April and May, in the Mediterranean and the Atlantic are not exceptional (Gutiérrez 2006). Furthermore, some observers have noted similarities between the flight behaviour of at-sea European Nightjars and tubenoses. Consequently, accepted records of Bulwer's Petrel in the Mediterranean in May and June off France (1967, 1977 and 1997) and Italy (2007) perhaps warrant review (see table 3).

Gutiérrez (2006) suggested that the confusion risk of European Nightjar at sea in northwest Europe, where it is scarcer, is lower than in the Mediterranean. Even so, there are claims of 'large, all-dark' storm-petrels off southern England in May that may be suspect (table 4). One of these is now considered to have been a European Nightjar by the observer concerned. He witnessed a near-identical event several years later, except that this time the bird flew straight inshore and overhead, revealing its identity as a European Nightjar. The coincidence of the dates and locations of five other claims off southern England suggest that the mistake may have been repeated. Clearly, migrating and foraging nightjars off the coasts of Europe and Africa pose an identification pitfall for all-dark petrels. The same possibility for nighthawks *Chordeiles* in the Americas is worth consideration.

3. Black and/or Markham's Storm-petrel vagrancy from the eastern Pacific

The geographical distribution of the Black Storm-petrel is partially related to an association with warm waters of the Costa Rica Current, especially in the Gulf of Panama (Spear & Ainley

2007). For the same reasons given for Least and Pacific Leach's *O. l. chapmani* and *O. l. socorroensis* (see above), it is improbable that Black will ever reach the Atlantic.

Markham's resides farther south in the Humboldt Current, normally between 13°N and 26°S, though occasionally up to 33°S, off Valparaiso, Chile. Since there are no regular pelagic trips south of Valparaiso, this port tends to mark the southernmost range for many seabirds (A. Jaramillo *in litt.*). However, Cape Horn is a further 2,400 km south, and the fact that Markham's is dispersive within its range rather than migratory (Spear & Ainley 2007) means that it is an unlikely candidate to reach the Atlantic.

4. Matsudaira's and/or Tristram's Storm-petrel vagrancy from the western and central Pacific

The winter range of Matsudaira's in the northern Indian Ocean has considerable overlap with that of Swinhoe's and the two species share the same possibility of vagrancy into the Atlantic. There are two records of Matsudaira's off South Africa that support vagrancy potential. The first record, on 30th July 1988 off Durban on the east coast (Indian Ocean), was accepted by the South African rare birds committee (I. Sinclair *in litt.*). The second, on 25th March 2002, off Cape Town and thus just within the Atlantic, was not submitted since the South African rare birds committee was not operational at the time, but identification is clear-cut given the video-grabs (www.zestforbirds.co.za/mspetrel1.html). Clearly, Matsudaira's remains a candidate for incursion into the Atlantic.

Unlike that of Matsudaira's, the range of Tristram's, including known cases of vagrancy, falls wholly within the Pacific. There are well-documented records for southeast Australia and central California, USA, but none near the Atlantic. Vagrancy of Tristram's into the Atlantic is improbable.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic

In summary, there are very few claims of 'large, all-dark' storm-petrels in the Atlantic and neighbouring seas. Some of these may refer to smaller species whose size has been misjudged, while others may relate to misidentified Bulwer's Petrels or European Nightjars. Black and Markham's from the eastern Pacific can be virtually ruled out in the Atlantic, as can Tristram's from the northwestern Pacific, although vagrancy of Matsudaira's into the Atlantic seems more likely, given two sightings off South Africa and their migration strategy.

On the basis of the evidence available and reviewed in this paper, the occurrence of 'all-dark' storm-petrels in the Atlantic and neighbouring seas seems likely to involve just one species: Swinhoe's Storm-petrel. An Atlantic-bred, wholly and unequivocally dark-rumped Leach's is yet to be proven, although 'pseudo dark-rumped' Leach's in late autumn may be mistaken for truly dark-rumped birds. The final section of this paper presents a summary of known records of Swinhoe's in the region.

Swinhoe's Storm-petrel in the Atlantic and neighbouring seas

Swinhoe's Storm-petrel was first encountered in the Atlantic in 1983 and small numbers have been recorded regularly since then. Confirmation of the identity of trapped individuals in those early years was possible on the basis of morphometrics and purr calls (Bretagnolle *et al.* 1991) as well as DNA analysis



193. The first British records of Swinhoe's Storm-petrel *Oceanodroma monorhis* involved two birds trapped at Tynemouth, Tyne & Wear, in July 1989. This photo shows the second individual, caught on 26th July.

(Cubitt *et al.* 1992; Dawson 1992; Cubitt 1995; Dawson *et al.* 1995). Up to the end of 2008, 24 Swinhoe's have been recorded (see table 5, fig. 3, plates 192–193 and 198–210).

Of the 24 individuals listed in table 5, 16 were trapped, one was captured sick, six were observed at sea, and one was heard only. Records of trapped individuals occurred between 27th June and 30th August, reflecting active ringing programs. Five of these trapped birds were found to have a brood patch: two in Madeira, one in Portugal, one in Spain, and one in northeast England. Four were retrapped in subsequent years: Selvagens (trapped 1983, retrapped 2007), England (trapped 1990, retrapped each year 1991–94), Selvagens (trapped 1993, retrapped each year 1994–96), and Norway (trapped 1997, retrapped 2000 & 2003). These records are mostly associated with warm waters originating from the Gulf Stream that feed the southward-moving Canary Current and northward-moving North Atlantic Current (flowing northeast past Scotland). Records off North Carolina are associated with the warm Gulf Stream.

Given that there have been no fewer than 16 tape-lured and trapped birds in a 25-year period, it is logical that there will have been offshore and at-sea observations during the same period. Conventional thinking

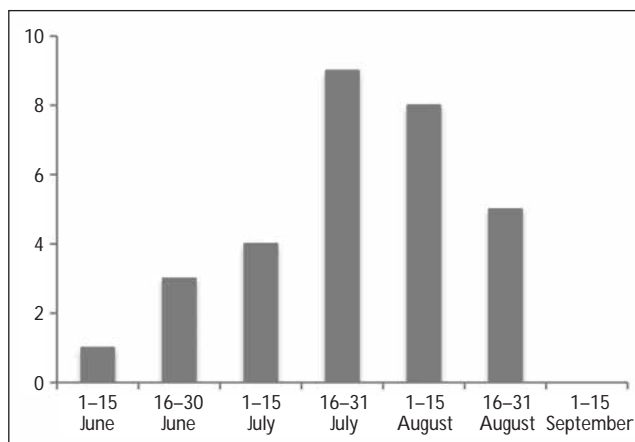


Fig. 3. Half-monthly distribution of records of Swinhoe's Storm-petrels *Oceanodroma monorhis* in the Atlantic and neighbouring seas to the end of 2008 (from table 5), utilising the date of sighting, date heard or, if trapped, the date of first capture in each year it was trapped (where known).

'All-dark' *Oceanodroma* storm-petrels in the Atlantic**Table 5.** Records of Swinhoe's Storm-petrels *Oceanodroma monorhis* in the Atlantic and neighbouring seas to the end of 2008. * Still under consideration by the relevant national records panel.

Year	Location	Details
1983 & 2007	Selvagens, Madeira	One male heard several nights from 29th June, trapped on 8th July (James & Robertson 1985); retrapped 21st August 2007 (Robb <i>et al.</i> 2008)
1985	Co. Clare	One off Bridges of Ross, 15th August (<i>Irish Birds</i> 7: 391–393)
1988	Selvagens, Madeira	One trapped on 30th June (Bretagnolle <i>et al.</i> 1991)
1989	Brittany, France	One trapped at l'île de Banneg, Molène archipelago on 15 July & retrapped on 24 July (Bretagnolle <i>et al.</i> 1991)
1989	Tyne & Wear	One female trapped at Tynemouth on 23rd July (one possible circling trapping area on 19th July) (Cubitt 1995)
1989	Tyne & Wear	One female trapped at Tynemouth on 26th July (Cubitt 1995)
1990–94	Tyne & Wear	One female trapped at Tynemouth on 7th July; retrapped on 31st July 1991, with brood patch; retrapped on 30th July 1992, with brood patch; retrapped on 21st, 28th, & 29th July 1993; retrapped on 24th & 26th July 1994, perhaps same female heard on 12th July (Cubitt 1995)
1991	Selvagens, Madeira	One trapped on 23rd July, with brood patch (Zino <i>et al.</i> 1995)
1991	Genoa, Italy	One captured sick on 11th August, killed in captivity by Yellow-legged Gull <i>Larus michahellis</i> (<i>Riv. Ital. Orn.</i> 65: 63–68)
1993*	North Carolina, USA	One at sea off Oregon Inlet on 20th August (Brinkley 1995; Morrison 1998)
1993–96	Selvagens, Madeira	One trapped (but not ringed) on unknown date in summer 1993, with brood patch and missing leg; possibly same (also with missing leg), trapped on unknown date in summer 1994; retrapped on 30th August 1995 and 29th August 1996 (Zino <i>et al.</i> 1995)
1994	Benidorm, Spain	One (possible male) trapped on 13th July with brood patch (King & Mínguez 1994; Mínguez & King 1995; King <i>et al.</i> 1996)
1996	Rogaland, Norway	One trapped on Revekai, Jaeren, on 13th August (<i>Vår Fuglefauna</i> (Suppl.) 3: 4–23)
1997, 2000 & 2003	Rogaland, Norway	One trapped on Revekai, Jaeren, on 9th August; retrapped on 27th July & 16th August 2000; retrapped on 5th August 2003 (<i>Vår Fuglefauna</i> (Suppl.) 4: 4–31; <i>Ornis Norvegica</i> 24: 3–59; <i>Ornis Norvegica</i> 28: 4–50)
1997	Balearic Islands, Spain	One trapped on Cabrera on 16th August (McMinn & Dietrich 1998)
1998	Algarve, Portugal	One trapped at Ponta da Almadena on 27th June, with brood patch (Bolton 1998)
1998*	North Carolina, USA	One photographed at sea off Cape Hatteras on 8th August (<i>North American Birds</i> 53: 6–10)
2000	Co. Kerry	One trapped on Great Skellig Island on 1st July (<i>Irish Birds</i> 7: 84)
2000	North-east Scotland	One female trapped at Cove Harbour on 5th August (<i>Brit. Birds</i> 94: 457)
2005	Isles of Scilly	One at sea 15 km south of Scilly on 21st July (Flood 2005)
2006	Nordland, Norway	One trapped at Hernyken, Røst, on 13th August (<i>Ornis Norvegica</i> 31); DNA bar-coded (Lifjeld & Johnsen 2008)
2007*	Selvagens, Madeira	One or two females heard in September (R. Matias; Robb <i>et al.</i> 2008)
2008*	North Carolina, USA	One photographed at sea c. 65 km ESE of Cape Hatteras on 2nd June (Howell & Patteson 2008)
2008*	Portugal	One at sea c. 175 km SW of Lisbon on 19th August (K. D. Shaw & R. B. Wynn <i>in litt.</i>)

that dark-rumped Leach's exist and closely resemble Swinhoe's has made claims of the latter difficult for records committees to assess in recent decades. However, as demonstrated in this paper, extensively dark-rumped Leach's are extremely rare, and a wholly and unequivocally dark-rumped Leach's in the Atlantic is yet to be proven. Moreover, current knowledge about at-

sea identification of Swinhoe's confirms that the species is visibly different from Leach's given reasonable views (Howell & Patteson 2008). Now, a quarter of a century after the first Atlantic record, enough is known about the occurrence and identification of Swinhoe's to make a well-documented, offshore or at-sea observation more straightforward to assess.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic

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Appendix 1. Formation of dark in the rump of Leach's Storm-petrel O. leucorhoa.

The extent of dark in the white rump patch of Leach's Storm-petrel is variable and is formed roughly as follows. The specimen in plate 194 has a largely white rump. Note that the innermost rump feathers are dark at their bases and the central outermost rump feathers are dark at their tips. The specimen in plate 195 is partially dark-rumped. The extent of darkness is increased: (a) at the base of the innermost rump feathers, especially those most central, and (b) across the tips of all outermost rump feathers. The white rump patch is somewhat shorter. The specimen in plate 196 is extensively dark-rumped. The extent of darkness is further increased and covers: (a) most of the innermost rump feathers and the bases of some of the next innermost rump feathers, (b) most of the central rump feathers, and (c) most of the outermost rump feathers and the tips of some of the next-outermost rump feathers. The white rump patch is restricted to the sides of the rump. Formation of dark in the rump may be asymmetrical and can vary, though the end result is broadly similar. The impact of wear and moult on darkness of the rump is discussed elsewhere in the article.

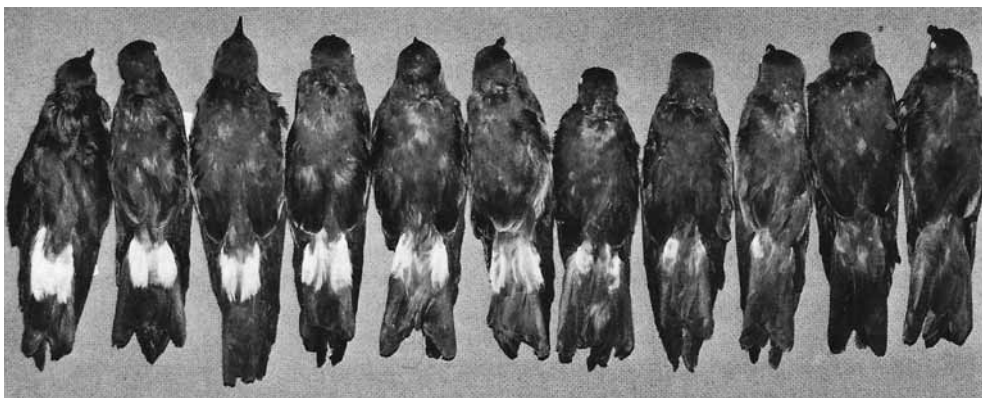


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194–196. Leach's Storm-petrel *Oceanodroma leucorhoa*. Note how the extent of dark in the rump varies between these three specimens scoring, respectively, 1–2, 5 and 7 on the Ainley scale.

Appendix 2. The Ainley scale: darkness in the rump of Leach's Storm-petrel O. leucorhoa.

Ainley (1980) classified darkness in the rump of the Leach's Storm-petrel complex in the eastern Pacific by comparing specimens with a series of 11 reference skins. Each skin represents an approximately equal step in a continuum beginning with all rump feathers entirely white, except for feather shafts (class 1), ending with all rump feathers entirely dark (class 11). The original black-and-white photograph from Ainley (1980) is reproduced as plate 197. The scale is not exact but does offer a yardstick by which to score darkness in the rump of Leach's.



David Ainley

197. The Ainley scale of darkness in the rump of Leach's Storm-petrel *Oceanodroma leucorhoa*. This is the series of reference specimens used by Ainley to show darkness variation in the rump of Leach's in the eastern Pacific. Reproduced from Ainley (1980) with kind permission of the American Ornithologists' Union.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic

Appendix 3. Swinhoe's Storm-petrels *Oceanodroma monorhis* in the North Atlantic.



Vincent Bretagnolle

198. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Selvagens, Madeira, 30th June 1988. Note the pale base of the primary shafts and fairly distinct cream-brown upperwing-covert bar, from trailing edge at the body almost to leading edge at the carpal joint, comprising: greater coverts with outermost feathers increasingly dark-tipped; median coverts with inner feathers all dark and outermost increasingly cream-brown; a pale base to the innermost primary coverts; and a few pale outermost lesser coverts.



Vincent Bretagnolle

199. Swinhoe's Storm-petrel *Oceanodroma monorhis*, l'île de Banneg, Molène archipelago, Brittany, France, 15th July 1989. Note the rather short and deep bill, slightly hooked, with nasal tubes 40% of length, and the wholly dark rump.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic



Colin Bradshaw

200. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Tynemouth, Tyne & Wear, 30th July 1992. Note the upperwing plumage features described in the caption to plate 198 and the entirely dark rump.



Miguel McMinn

201. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Cabrera, Balearic Islands, 16th August 1997. Note the upperwing plumage features described in the caption to plate 198, the short/medium-length tail with medium fork, and the entirely dark rump. This photograph, taken in daylight, shows typical brown hues to the plumage.

'All-dark' *Oceanodroma* storm-petrels in the Atlantic



203 & 204. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Rogaland, Norway; 27th July 2000 (above) and 5th August 2003 (below). Morten Kersbergen



202. Swinhoe's Storm-petrel *Oceanodroma monorhis* (right) with Leach's Storm-petrel *O. leucorhoa*, Great Skellig Island, Co. Kerry, 1st July 2000. The contrast in rump pattern between the two birds is striking. Alyn Walsh



205. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Cove Harbour, North-east Scotland, 5th August 2000. Harry Scott

'All-dark' *Oceanodroma* storm-petrels in the Atlantic



208. Swinhoe's Storm-petrel *Oceanodroma monorhis*, off North Carolina, USA, 2nd June 2008. The creamy-brown upperwing-covert bar and (at this range) the pale bases to the primary shafts are contrasting plumage features, while the rump is completely concolorous with the tail and back. Gareth Knass



207. Swinhoe's Storm-petrel *Oceanodroma monorhis*, off Cape Hatteras, North Carolina, USA, 8th August 1998. Note the relatively long, medium to wide wings, 'hands' attenuated, tips blunt. Wings are held rather outstretched, yielding moderately angular leading edges and less angled trailing edges. The cream-brown upperwing-covert bar is prominent as the only contrasting plumage feature. Note typical brown hues to the plumage. Brian Patteson



206. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Nordland, Norway 13th August 2006. Tycho Anker-Nilssen



210. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Selvagens, Madeira, 21st August 2007. Note typical brown hues to the plumage and the smoky-grey head. Rafael Matias



209. Swinhoe's Storm-petrel *Oceanodroma monorhis*, Nordland, Norway 13th August 2006 (same bird as in plate 206). In close-up, the head is smoky-grey and the rump and tail uniformly dark. Tycho Anker-Nilssen