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The first genetically confirmed record of Band-rumped Storm-petrel in Europe away from the breeding grounds

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Abstract

Hurricane Lothar, in December 1999, saw the displacement of many marine species into central Europe, including a Band-rumped/Monteiro's/Cape Verde Storm-petrel *H. castro/monteiroi/jabejabe*, the first record for Switzerland and, indeed, central Europe. Using a toepad sample from the specimen, genetic data showed the bird to be a Band-rumped Storm-petrel *Hydrobates castro* from the North Atlantic, while the presence of a brood patch and the lack of moult suggest that the individual belonged to the winter (cold season)

breeding population, 'Grant's Storm-petrel' *H. [castro] undescribed*. This finding is consistent with three coastal or near-coastal records in Europe identified as Grant's Storm-petrel, while the phenology of that population suggests that most European records of Band-rumped/Monteiro's/Cape Verde Storm-petrel away from breeding grounds may be Grant's Storm-petrel.

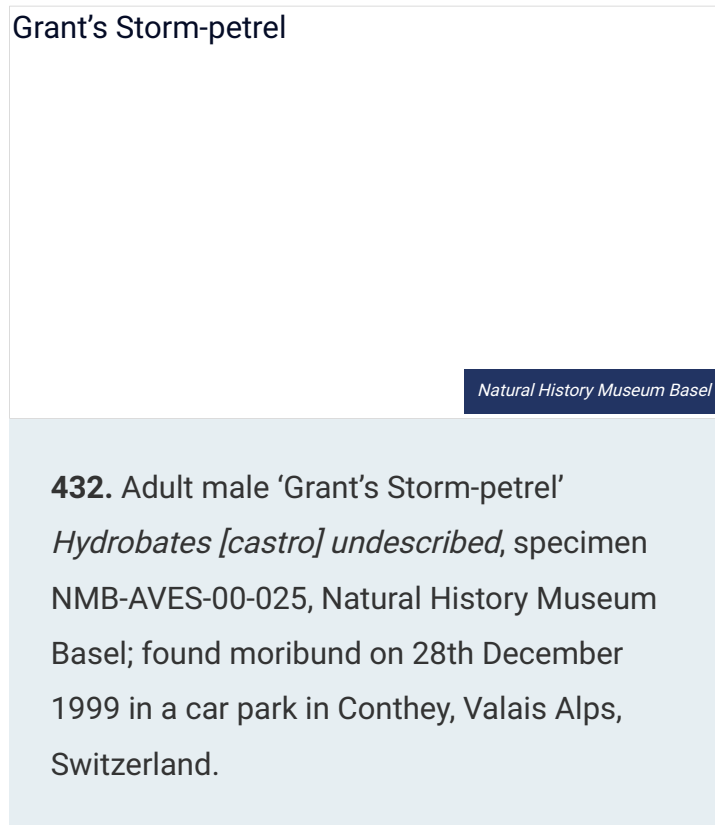
Editorial comment For an overview of the vernacular names used in this paper, see [here](#).

Introduction

The occurrence of pelagic bird species away from the sea in the interior of a continent is highly unusual; the final days of 1999 were, therefore, truly exceptional. On 26th–27th December, Hurricane Lothar swept across central Europe, leading to a massive influx of pelagic birds. There were no fewer than 43 records of European Storm-petrels *Hydrobates pelagicus* in Switzerland as well as nine Brent Geese *Branta bernicla*, five Great Skuas *Stercorarius skua* and 38 Kittiwakes *Rissa tridactyla* (Maumary *et al.* 2000; Winkler & Kestenholz 2001). The most exceptional record, however, was a Band-rumped/Monteiro's/Cape Verde Storm-petrel (considered to be one single species at the time), found moribund on 28th December 1999 in a car park in Conthey, Valais Alps (46°14'N 7°18'E), a site 490 m.asl. The bird was accepted as the first for Switzerland and for central Europe, the body being retained as a mounted specimen in the Natural History Museum Basel collection (NMB-AVES-00-025) (Loye *et al.* 2001).

Since then, the complex has been split into three species – Band-rumped Storm-petrel *H. castro*, Monteiro's Storm-petrel *H. monteiroi* and Cape Verde Storm-petrel *H. jabejabe* – and it was unclear which of these the Swiss bird was. The group breeds on tropical and subtropical islands in the Atlantic and Pacific, namely on the Berlengas, Madeira, Azores, Selvagens, Canaries, Cape Verde, Ascension, St Helena, São Tomé, Galapagos, Hawaii and Japan (Rodríguez *et al.* 2003; Slotterback 2021). The population breeding during the summer (warm season) on the Azores was found to be genetically, vocally and morphologically distinct, not only from the sympatric winter (cold-season) breeders there but also from the other populations in the complex

(Monteiro & Furness 1998; Friesen *et al.* 2007; Bolton *et al.* 2008; Silva *et al.* 2016; Taylor *et al.* 2019). After its formal description (Bolton *et al.* 2008), it is now widely accepted as a species on its own, Monteiro's Storm-petrel (e.g. Gill *et al.* 2024), and the storm-petrels of the Azores are considered as a case of allochronic speciation, where sympatric species are reproductively isolated by temporal segregation of the breeding period (Taylor & Friesen 2017). Additionally, the breeding population on Cape Verde was shown to be genetically and vocally distinct (Bolton 2007; Friesen *et al.* 2007; Robb *et al.* 2008; Friesen 2015; Taylor *et al.* 2019) and is now also widely treated as a separate species, Cape Verde Storm-petrel (Sangster *et al.* 2012; Gill *et al.* 2024).



Based chiefly on difference in vocalisation and an apparent difference in morphology (Nunes 2000), Robb *et al.* (2008) suggested that the summer breeders on the Selvagens, Desertas and Canary Islands ('Madeiran Storm-petrel') constitute a different species from the winter breeders of the North Atlantic ('Grant's Storm-petrel'). This may represent an additional case of allochronic speciation within the complex. However, separation of these two

populations is barely reflected in genome-wide variation, with only the summer breeders of the Selvagens showing low levels of genomic differentiation from the other North Atlantic populations in the Band-rumped/Monteiro's/Cape Verde Storm-petrel complex (Taylor *et al.* 2019).

Furthermore, South Atlantic and at least two of the Pacific populations, currently considered to be Band-rumped Storm-petrels, may deserve species status as indicated by genome-wide variation (Taylor *et al.* 2019).

In addition to providing details on the identification of the Swiss bird to species and population level, we provide an overview of records of Band-rumped/Monteiro's/Cape Verde Storm-petrels in Europe away from their North Atlantic breeding grounds.

Materials and methods

Molecular analyses

A partial fragment of the mitochondrial control region of the Swiss Band-rumped Storm-petrel (NMB-AVES-00-025) was sequenced for comparison with published sequences (Friesen *et al.* 2007; Smith *et al.* 2007; Silva *et al.* 2016). DNA from a piece of a toepad of the museum specimen was extracted using the QIAamp DNA Micro Kit (Qiagen) with an adapted digestion protocol that ensures high quantities of DNA (Lutgen & Burri 2020). Importantly, a digestion time of 40 hours was applied and an additional 20 µl of Proteinase and 180 µl buffer ATL were added after the first six hours of digestion. The primers OcL61 and H530 (Friesen *et al.* 2007) were used and PCR reaction volumes were 25 µl containing 12.5 µl GoTaq Hot Start Green Master Mix (Promega), 2 µl genomic DNA, 2 µl of each primer with a concentration of 10 µM and 6.5 µl ddH₂O using a standard reaction protocol (Schweizer & Shirihai 2013) applying an annealing temperature of 55°C. PCR was done with a SensoQuest thermal cycler and sequencing was performed in both directions using PCR primers LGC Genomics (Berlin). Sequence alignment was performed applying the MAFFT algorithm 7.450 (Kato *et al.* 2002; Kato & Standley 2013) implemented as a plug-in in Geneious 2024.0.5 (www.geneious.com) using default settings. To infer phylogenetic

relationships, a maximum likelihood (ML) search was performed with RAxML 8.2.11 (Stamatakis 2014), again implemented as a plug-in in Geneious with a sequence of Leach's Storm-petrel *H. leucorhous* EU252071 used as an outgroup.

Morphology

Standard measurements were taken from the dead bird by RW with a calliper and table balance before dissection, during which gonadal morphology was also examined.

Occurrence data

We sent a survey about the status of Band-rumped/Monteiro's/Cape Verde Storm-petrels and a request for information on previous records to all European rarities committees in February 2024 via the mailing list of the Association of European Records and Rarities Committees (AERC) and received responses from ten countries.

Results

Molecular analyses

The final alignment was 319 base pairs long and contained 232 control region haplotypes covering the entire breeding range of the Band-rumped/Monteiro's/Cape Verde Storm-petrels and Leach's Storm-petrel outgroup (fig. 1). The topology of the resulting best-scoring ML tree was similar to those presented in previous studies (e.g. Friesen *et al.* 2007) with the haplotypes of birds from the Galapagos and Ecuador, and most of the Monteiro's Storm-petrels and Cape Verde Storm-petrels forming monophyletic clades. In contrast, North Atlantic-breeding Band-rumped Storm-petrels (i.e. Madeiran and Grant's) and those from Ascension Island, Hawaii and Japan showed no consistent phylogeographic pattern nor a separation into winter and summer breeders. The Swiss specimen (NMB-AVES-00-025, GenBank Accession number PQ346658) nested within this Band-rumped Storm-petrel cluster, though was closest to another haplotype from an individual collected during the summer breeding period on Selvagem

Grande, Madeira, Portugal (i.e. a Maderian Storm-petrel; Silva et al. 2016).

fig 1

Fig. 1. Best-scoring maximum likelihood tree based on 232 control region haplotypes covering the entire breeding range of the Band-rumped/Monteiro's/Cape Verde Storm-petrels *Hydrobates castro/monteiro/jabejabe*, with Leach's Storm-petrel *H. leucorhous* as an outgroup. Labels indicate GenBank accession numbers and geographic locality information. The haplotypes of birds from the Galapagos and most of the Monteiro's and Cape Verde Storm-petrels formed monophyletic clades. In

the clade comprising haplotypes of Band-rumped Storm-petrel from the North Atlantic, those found in winter breeders are marked with a black star, while those found in summer breeders with a red star (if data available). North Atlantic breeders (and those from Ascension and some from Japan) showed neither any consistent phylogeographic pattern nor a separation into winter and summer breeders. The Swiss specimen (NMB-AVES-00-025) was nested within this cluster and was closest to another haplotype found on Selvagem Grande.

Morphology

Examination of the specimen revealed that it was an adult male, with small testes 2.4 x 1.8 mm in size and thus not sexually active on the date of its demise. However, it had a brood patch indicating that nesting had been terminated recently (see also discussion). There were no signs of active moult, e.g. the primaries and secondaries were of the same age (plate 432). The bird weighed 46.4 g, with wing length (maximum chord) of 154 mm, tail length of 73 mm, tail fork of 6.1 mm, head length of 21 mm, culmen length of 15.1 mm, tarsus length of 23.6 mm, femur length of 16 mm and sternum length of 26.1 mm.

Occurrence in Europe away from the breeding grounds

Records of vagrant Band-rumped/Monteiro's/Cape Verde Storm-petrel accepted by rarities committees in Europe are given in table 1 and summarised in fig. 2. Most of these records came from (mainland) Spain, with up to four birds observed together in the Bank of Galicia, where Band-rumped/Monteiro's/Cape Verde Storm-petrels are reported to be 'quite common during the post-breeding period' (Gonzalo Pardo de Santayana, Comité de Rarezas Spain, pers. comm.).

Table 1. Records of Band-rumped/Monteiro's/Cape Verde Storm-petrel *Hydrobates castro/monteiro/jabejabe* in Europe away from the breeding grounds. Records marked with an asterisk have been identified to species level.

country	date	location	source	comment
Finland				
	19/01/1993	Iisvesi, Suonenjoki	Nikander et al. (1994)	picked up exhausted, d
France				
	16/08/1984	2 miles off Sables d'Olonne, Les Sables-d'Olonne, Vendée,	Alauda 57 (4): 266, updated Ornithos 17 (6): 368; Sébastien Reeber and Sylvain Reyt pers. comm.	
	07/10/1984	Chomérac, Ardèche	Alauda 54 (4): 288, updated Ornithos 17 (6): 368; Sébastien Reeber and Sylvain Reyt pers. comm.	found dead
	17/09/2005	Digue du Clipon, Loon-Plage, Nord	Ornithos 14 (5): 270, updated Ornithos 17 (6): 368; Sébastien Reeber and Sylvain Reyt pers. comm.	
	25/10/2006	Pointe du Château Mauga L'Île-d'Yeu, Vendée	Ornithos 15 (5): 319, updated Ornithos 17 (6): 368; Sébastien Reeber and Sylvain Reyt pers. comm.	
	25/01/2009	Etang de Thau, Méze, Hérault	Ornithos 17 (6): 368; Sébastien Reeber and Sylvain Reyt pers. comm.	
	30/04/2009	Les Ecouges, Saint-Gervais, Isère	Ornithos 23 (6): 306; Sébastien Reeber and Sylvain Reyt pers. comm.	found dead
	17/11/2021*	At sea	Gil-Velasco et al. (2023)	GPS-tagged 'Grant's S Ireland and Great Britain'
	06/11/2023	Quatre-Routes-du-Lot, Gourdon, Lot	Sylvain Reyt pers. comm.	found dead
	07/11/2023	Tranche-sur-Mer, Les Sables-d'Olonne, Vendée	Sylvain Reyt pers. comm.	found dead
Germany				
	03/12/2000	Seeburger See, Kreis Göttingen, Niedersachsen	Deutsche Seltenheitenkommission-Dokumentationsstelle für seltene Vogelarten (2006)	
	29/10/2006	Wangerooze, Kreis Friesland, Niedersachsen	Deutsche Seltenheitenkommission-Dokumentationsstelle für seltene Vogelarten (2009)	
Great Britain				
	28/07/2007	Sea area Sole, 13 km SE of Scilly, At sea	Hudson & the Rarities Committee (2011)	
	16/09/2007	Pendeen Watch, Cornwall	Hudson & the Rarities Committee (2012)	
	03/09/2009	Pendeen Watch, Cornwall	Holt et al. (2021)	
	22/08/2020	Pendeen Watch, Cornwall	Holt et al. (2021)	
	16/11/2021*	At sea	Gil-Velasco et al. (2023); Bacon et al. (In prep)	GPS-tagged 'Grant's S France and Ireland, No
	22/10/2022	Porthgwarra, Cornwall	Bacon et al. (2023)	
Ireland				
	18/07/1931	Blackrock Lighthouse, Co. Mayo	Harry Hussey pers. comm.	Natural History Museum
	16/11/2021*	At sea	Gil-Velasco et al. (2023)	GPS-tagged 'Grant's S

Spain			
03.07.1994	Baiona, Pontevedra, Galicia	Gonzalo Pardo de Santayana pers. comm.	
30.07.1994	Baiona, Pontevedra, Galicia	Gonzalo Pardo de Santayana pers. comm.	
24.10.2002	Club del Mar de San Amaro, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	
07.08.2010	Banco de Galicia, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	
18.08.2010	Banco de Galicia, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	2 individuals
19.08.2010	Banco de Galicia, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	3 individuals
20.08.2010	Banco de Galicia, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	4 individuals
21.08.2010	Banco de Galicia, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	3 individuals
24.08.2010	Banco de Galicia, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	4 individuals
01.10.2011	Offshore, Vigo, Pontevedra, Galicia	Gonzalo Pardo de Santayana pers. comm.	
25.09.2019	Offshore, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	3 individuals
27.09.2019	Offshore, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	2 individuals
21.09.2019	Offshore, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	
22.09.2019	Offshore, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	2 individuals
26.09.2019	Offshore, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	3 individuals
25.09.2019	Cariño, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	
25.09.2023	Offshore Fisterra, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	
29.09.2023*	Offshore Malpica, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	accepted as Band-rumped
29.09.2023*	Offshore Malpica, A Coruña, Galicia	Gonzalo Pardo de Santayana pers. comm.	Accepted 'Grant's Storm
Switzerland			
28.12.1999*	Conthey, Valais	Loye et al. (2001); this publication	'Grant's Storm-petrel'

Only four records were identified to species level: two from Spain – one as Band-rumped Storm-petrel and one as Grant's Storm-petrel; one – a GPS-tagged Grant's Storm-petrel that had been caught and tagged in its nesting burrow in the Canary Islands – that was recorded entering Irish, British and then French waters (Gil-Velaso et al. 2023); and the Swiss bird detailed in this paper.

Discussion

Based on the results of the DNA analysis, the identification of the Swiss bird can be confirmed as a Band-rumped Storm-petrel (and not a Monteiro's or Cape Verde Storm-petrel) – the first such generally confirmed record in Europe away from the breeding grounds.

The bird was genetically closest to an individual collected during the summer breeding period from Selvagem Grande. However, given that there is no clear structure in the analysed mtDNA control region haplotypes among winter and summer breeders from Selvagens (cf. fig. 1), our genetic data does not allow allocation to any particular seasonal population.

The presence of a brood patch indicates that the bird had recently terminated nesting (or breeding activity, at least, since some storm-petrels are known to develop brood patches when visiting colonies even in years when they do not nest). This, in combination with no signs of active moult, strongly suggest that the bird is adult Grant's Storm-petrel. Madeiran Storm-petrel, breeding during the summer on the Selvagens, Desertas and possibly the Canary Islands, would not be expected to show signs of recent breeding activity in December, and all ages would be expected to be actively undergoing wing moult, with adult Madeiran Storm-petrels undergoing wing moult September–June and immature Madeiran Storm-petrels undergoing their first wing moult slightly earlier, in July–February (Howell *et al.* 2010; Howell 2012). In contrast, adult Grant's Storm-petrels undergo wing moult from February to August (Bolton *et al.* 2008), with immatures apparently undertaking their first wing moult December–June.

The identification as a Grant's Storm-petrel might not be too surprising – the population has the widest breeding distribution within the complex in the North Atlantic and breeds close to the Portuguese mainland on Farilhões Islet in the Berlengas Archipelago, where 400 to 800 breeding pairs are present (Keller *et al.* 2020). Indeed, Grant's Storm-petrels may prove to be present regularly off the western European mainland during foraging trips, as indicated by GPS-tagged birds (Gil-Velasco *et al.* 2023).

The two records from Spain accepted to species level both come from September, a peak month for occurrence away from the breeding grounds in

Europe (fig. 2). Along with the Swiss record from December, this may suggest that most records of Band-rumped Storm-petrels in Europe away from the breeding grounds are Grant's Storm-petrels.

fig 2

Fig. 2. Records of Band-rumped Storm-petrel *H. castro* in Europe away from the breeding grounds, with four records identified to species level, including the Swiss record, in blue (see text).

Robb *et al.* (2008) argued that, based on the measurements given in the original description of Band-rumped Storm-petrel, involving a bird from Desertas, the name *castro* should be applied to the summer-breeders from Desertas, Selvagens and Canary Islands, i.e. Madeiran Storm-petrel. Hence, Grant's Storm-petrel remains formally unnamed. However, given that only the Madeiran Storm-petrels on the Selvagens were shown to display low levels of genomic differentiation from the other North Atlantic populations of Band-rumped Storm-petrels, it is doubtful if Grant's Storm-petrel is a separate species despite the distinct vocal differences. At least the Madeiran Storm-petrels on the Selvagens might comprise a case of incipient allochronic speciation, thus be at an early stage of the speciation process.

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