Fregetta storm petrels off Juan Fernández archipelago, Chile, in March 2013 and February 2015

Little is known about the birdlife in and around the waters of Juan Fernández archipelago off Chile. During chumming sessions near Robinson Crusoe Island, also known as Masatierra, in March 2013 (see Shirihai et al 2015ab), we studied the endemic breeding subspecies of White-bellied Storm Petrel *Fregetta grallaria segethi* (hereafter *segethi*). Around Robinson Crusoe, breeding of this subspecies is only proven for nearby Santa Clara Island and perhaps other rocks (Murphy 1936, Brooke 2004). It also breeds in the Desventuradas Islands, Chile (Flores et al 2014).

White-bellied Storm Petrels

More than 90% of all White-bellied Storm Petrels that we observed in March 2013 were around and near Robinson Crusoe Island and up to 93 km eastward. Few were also observed between Robinson Crusoe and Masafuera, at the oceanic ridge (c 80° W) but virtually none were west of this ridge and around Masafuera. Bill Bourne (in prep and pers comm) also saw this species off Robinson Crusoe in May 1983 (a total of 24 birds) but not off Masafuera. We counted at least 103 birds, based on plumage and moult patterns of photographed birds. The largest count involved 30 individuals, mostly during chumming c 37 km east of Robinson Crusoe on 6 March.

Following the success in attracting large numbers and learning about the variation of *segethi* in 2013, Hadoram Shirihai and Hans Jornvall conducted similar chumming operations on 21-22 February 2015, for a total of six hours each day off Robinson Crusoe (22 km south-south-east of the island), during which well over 100 *segethi* were attracted (maximum 38 seen in a single view on 21 February).

We found variation in size and 'bulkiness' within the observed birds to be quite large, which could imply the possibility that more than one breeding population differing in size are involved.

In March 2013, the vast majority of birds were rather small, fitting the size of *segethi* (plate 124-125). Quite intriguingly, however, despite the fact that *segethi* is among the smallest taxa in White-bellied Storm Petrel (table 1; Brooke 2004), some birds appeared chunky (plate 126-127) and were estimated to be at least 15-20% larger than the normally sized *segethi* and White-faced Storm Petrels *Pelagodroma marina* when they were seen feeding side by side (plate 128-129). These latter birds thus approached the size of the largest White-bellied taxon in the Pacific, *F (g) titan* from Rapa Island, Austral Islands, French Polynesia (cf Howell 2014). However, none of the larger type birds that we observed in March 2013, nor White-faced Storm Petrels were seen in February 2015. Although the observed size differences between the few larger birds and the majority of small birds appeared to be clear-cut at sea, we consider it still premature to conclude that these represent different populations/taxa and we favour future confirmation with biometrics when such birds can be handled.

We like to add that observers should be aware that estimating size and bulkiness of these storm petrels on the ocean is often very subjective and that impressions can vary with light and wind conditions and the birds' behaviour. For example, birds during sunny and least windy conditions or when pattering on the ocean surface during feeding often appear larger, whereas during overcast or windy conditions and when in more direct and fluttering flight (like when following boats) birds appear smaller and less bulky. Furthermore, observers should appreciate that, despite minimal sexual differences in White-bellied Storm Petrel, there is moderate size variation between individuals that should be taken into account. Recently fledged juvenile birds often appear chunkier, too. And lastly, when feeding on chum, a wet and oily bill could also appear larger or heavier than it truly is. Therefore, when estimating sizes of birds at sea

TABLE 1 Average measurements (mm) for different breeding localities of White-bellied Storm Petrel *Fregetta grallaria* (both sexes combined). All measurements taken by Vincent Bretagnolle from museum specimens.

Locality	n	Wing length	Tail length	Bill length (to feathers)	Bill depth	Tarsus length
Juan Fernandez	68	159.3	76.3	13.9	3.9	34.5
Lord Howe	9	161.0	78.3	14.3	4.4	37.2
Tristan da Cunha	12	165.3	73.1	14.5	4.0	39.0
St Paul (Indian Ocean)	2	165.5	83.5	14.2	4.4	39.4
Rapa (Pacific Ocean)	49	186.2	87.1	15.4	4.4	41.0

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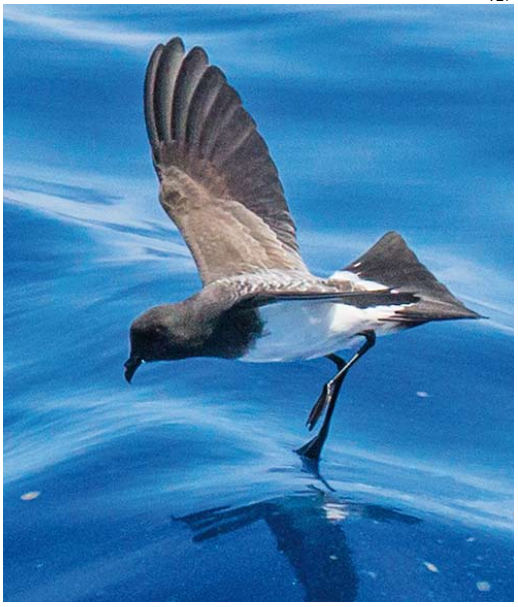

124-127 White-bellied Storm Petrel / Witbuikstormvogeltje *Fregetta grallaria,* off Robinson Crusoe, Chile, 6 March 2013 *(Hadoram Shirihai/©Tubenoses Project)*. During chumming, two types of birds varying in size were observed: rather small-sized type (plate 124-125), also reflected by slim and delicate built and smallish bill (we assigned these to the local subspecies *Fregetta g segethi* although it is still unknown to us whether the *segethi* type represents small-sized birds or rather the larger ones); and another type with distinctly larger and heavier-bodied birds (plate 126-127) showing chunky jizz with notably larger and deeper bill. Note also that large-type birds tend to show stronger patterned upperparts (plate 127), with mantle/back heavily marbled by white-and-black scales. However, we found much individual variation in development of these scales in both size types, which also depended on feather wear and moult.

128 White-bellied Storm Petrels / Witbuikstormvogeltjes *Fregetta grallaria,* off Robinson Crusoe, Chile, 6 March 2013 *(Hadoram Shirihai/©Tubenoses Project)*. Small (left) and large type (right) side by side. Latter constantly appearing distinctly larger overall, at sea estimated to be at least 15-20% larger than small type. **129** White-bellied Storm Petrels / Witbuikstormvogeltjes *Fregetta grallaria,* off Robinson Crusoe, Chile, 6 March 2013 *(Hadoram Shirihai/©Tubenoses Project)*. Small type (two birds at centre) appearing about same size as White-faced Storm Petrels *Pelagodroma marina*, both being clearly smaller by at least 15-20% than large type (rightmost bird). At sea, large type constantly appearing heavier/deeper-bodied and notably larger headed, and also clearly longer and broader winged. As stated in main text, however, only when these storm petrels could be handled for biometrics it will be possible to determine whether these size differences are indeed representing different populations or taxa, rather than extreme individual variation. Note also large bird on right showing stronger-patterned upperparts, with heavy white-and-black scales.

all such influences should be taken into account, and estimations and comparisons should be done during prolonged chumming and observation sessions; especially size comparisons with other species are highly important, as was possible during our observations.

Most of the observed birds were fresh or only moderately worn, suggesting that these were breeders starting or perhaps in the middle of the breeding season, which fits the known breeding period in the austral summer/autumn. On Santa Clara [Island], fresh eggs were found in January and fledglings in June (Brooke 2004), indicating a long breeding season. This, together with the fact that chicks of various ages were found in January (Murphy 1936), further indicate extended breeding activity during the year, or support the notion that several seasonal populations of White-bellied Storm Petrel exist in Juan Fernández archipelago. Nevertheless, it is still a long way before such puzzle can be resolved, as first we will need to go back to the *segethi* type specimen, collected on the coast of Chile (Philippi & Landbeck 1860, Archiv Naturgeschichte 26, pt 1, p 282), away of any breeding location, to see if it matches any potential geographical variation in size and breeding location or season, within both Juan Fernández archipelago and the Desventuradas Islands.

Segethi is also characteristic in having some dark streaking below, and especially in February 2015 we studied this phenomenon closely. Among the 60 birds randomly checked at sea or in images, 80% showed some degree of flank streaking, which varied from some single isolated streaks (plate 131) to birds with moderate to quite extensive streaking (plate 132-133), with the latter two types comprising c 15% of the streaked birds, often detectable at sea.

Dark storm petrel

The most interesting observation in March 2013 refers to a dark storm petrel, seemingly related to White-bellied Storm Petrel, off Masafuera on 12 March 2013 (plate 134). Shirihai et al (2015b) provided a full account of this intriguing storm petrel. The bird appeared considerably smaller (miniature) and with a different jizz than a White-bellied present during the same chumming session.

A dark morph prominently occurs in the nominate subspecies *F g grallaria* (hereafter *grallaria*) that breeds on Lord Howe Island, Australia (pers obs; Murphy & Snyder 1952, Serventy et al 1971, Van Tets & Fullagar 1984, Spear & Ainley 2007; plate 135). This morph was even described as a separate species by Mathews (1914) but soon after

130 White-bellied Storm Petrels / Witbuikstormvogeltjes *Fregetta grallaria segethi* (collected off or on Robinson Crusoe, Chile, 3 January 1914 (right) and 19 December 1913), American Museum of Natural History, New York, USA, 25 October 2014 *(Hadoram Shirihai/©Tubenoses Project)*. Note variation in flank streaking, corresponding to birds photographed at sea (cf plate 131-133).

recognized as a dark morph by Hartert (1926). Furthermore, intermediately patterned birds also occur on Lord Howe, as well as on the Kermadecs, New Zealand (pers obs; Serventy et al 1971, Tennyson & Taylor 1990). A dark morph has, however, never been recorded in *segethi* (eg, Murphy 1936, Brooke 2004, Spear & Ainley 2007, Howell 2012; Bruce Robertson pers comm). Our sighting is also remarkable because it occurred off Masafuera, away from the known breeding grounds in the Juan Fernández archipelago. We are aware of only one record of a dark-morph *Fregetta* away from the Pacific, namely south of Africa (Ryan et al 1987).

The bird was in rather well-advanced moult, unlike the other 'normal' White-bellied Storm Petrels we observed. This suggests that it may belong to a population that breeds during a different time of the year. Because we suspected to have seen a second individual off Masafuera, the dark morph may not relate to a vagrant or an aberrant bird but instead to a local population. Alternatively, our bird

131-133 White-bellied Storm Petrel / Witbuikstormvogeltje *Fregetta grallaria,* off Robinson Crusoe, Chile, 21 February 2015 *(Hadoram Shirihai/©Tubenoses Project)*. *F g segethi* of Juan Fernández archipelago also varies in dark streaking on flanks, a feature found in c 80% of birds, but with moderate to extensive streaking (plate 132-133) occurring in only c 15% of birds. All birds showed here are estimated to be of small type.

may have been a vagrant of the dark morph of *grallaria* from Lord Howe, considering its strong resemblance in plumage to the latter (cf plate 134-135) and which is the only subspecies for which a dark plumage has been documented. If so, the Masafuera bird originated from at least 10 500 km away (in a straight line from Lord Howe to Masafuera). More chumming sessions as well as night trapping on Masafuera are required to elucidate the status of this dark storm petrel.

Conclusion

Summarizing, we observed three types of White-bellied Storm Petrel around the Juan Fernández archipelago, differing in size, plumage and moult pattern. Most of them were the local *segethi* but a few were estimated to be much larger in size and 'bulkiness' than that subspecies. The dark morph was the smallest of all storm petrels observed. These findings should stimulate extensive research into the White-bellied Storm Petrel complex of the archipelago, both in the field and in museums.

Other seabird observations

Last but not least, during the two-day chumming operations in February 2015 we also discovered that all of the Juan Fernández archipelago's breeding tubenoses (see Shirihai et al 2015a) can be seen off Robinson Crusoe in good numbers. Especially surprising was the high number of Stejneger's Petrel *Pterodroma longirostris* (in total 44 seen, of which 12 photographed). The latter findings further show that there is still much to be learnt about occurrence and variation of petrels in and around the archipelago.

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134 Storm petrel / stormvogeltje *Fregetta*, off Masafuera, Chile, 12 March 2013 *(Hadoram Shirihai/©Tubenoses Project*). Possible dark morph White-bellied Storm Petrel *F grallaria*. This bird was not only dark plumaged, it was also clearly tiny in size and showing advanced moult, making it highly striking altogether.

135 White-bellied Storm Petrel / Witbuikstormvogeltje *Fregetta grallaria grallaria*, dark morph, Lord Howe, Australia, 5 December 2009 *(Matthew Rodgers)*

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