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The status of Great-winged Petrel *Pterodroma macroptera* in the south-west Atlantic Ocean, with notes on separation from dark-morph Trindade Petrel *P. arminjoniana*

by Fernanda Caminha Leal Valls, Maurício Tavares, Robert Louis Flood & Leandro Bugoni

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Summary.—Great-winged Petrel *Pterodroma macroptera* is currently considered uncommon in the south-west Atlantic Ocean. However, via a compilation of all recent records available, we found evidence of a regular, wider distribution from breeding colonies in Tristan da Cunha and Gough towards South America. We review these records, report a new beach stranding in Brazil, which is the northernmost record in the south-west Atlantic, and discuss the problems of at-sea separation of Great-winged Petrel from the darkest-plumaged Trindade Petrel *P. arminjoniana*.

Great-winged Petrel *Pterodroma macroptera* breeds on islands in subantarctic waters, at the Tristan da Cunha group (including Gough), the Crozets, Marion, Prince Edward, the Kerguelen group, and on islands off Western Australia (Shirihai 2007, Flood & Fisher 2015). Typically, it ranges at sea between 35° and 55°S, from the South Atlantic to south-west Australia (BirdLife International 2018, Howell & Zufelt 2019), but is considered uncommon in the south-west Atlantic Ocean (e.g., Flood & Fisher 2015, Howell & Zufelt 2019). However, records since 1959 indicate a wider regular distribution reaching South America (and south of the breeding islands; Table 1). Our compilation includes records from 20°W to South America based on the published literature, one seen in February 2020 beyond the shelf break about halfway between Uruguay and the Falkland Islands (RLF pers. obs.), and from eBird (2021).

In addition, on 24 May 2019 a beached Great-winged Petrel (Fig. 1) was collected on Tramandaí beach (30°02'S, 50°08'W), in northern Rio Grande do Sul state, southern Brazil (Fig. 2). Notable for being the northernmost continental record, it was found during a beach monitoring survey following a storm associated with a cold front. Several other Procellariiformes were also found, including Cory's *Calonectris borealis* and Great Shearwaters *Ardenna gravis*. Dissection and biometrics were undertaken in December 2019. The specimen is an immature female, aged by a well-developed bursa of Fabricius, and sexed by microscopic evaluation of the gonads. The lack of evidence of past or active moult aged it as a juvenile (Bugoni & Furness 2009). Overall, the bird was brownish black, with a greyish chin and blackish bill. Underwings were dark with contrasting pale grey reflective larger coverts and remiges. Legs and toes were blackish.

Biometrics were taken using a flexible tape and vernier callipers (Fig. 1): total body length 408 mm, wing length 305 mm (and fairly slim), tail length 130 mm, culmen length 34.9 mm, height of bill at its base 15.5 mm, width of bill at its base 17.1 mm, tarsus 44.8 mm and middle toe 63.6 mm. Bill length was measured from the tip of the mandibular unguis because the maxillary unguis was missing (a minimum value only for reference, Fig. 1b). Wingspan was estimated at 1,040 mm by doubling the value for the right-hand wing. Body mass after drying and cleaning was 361 g.

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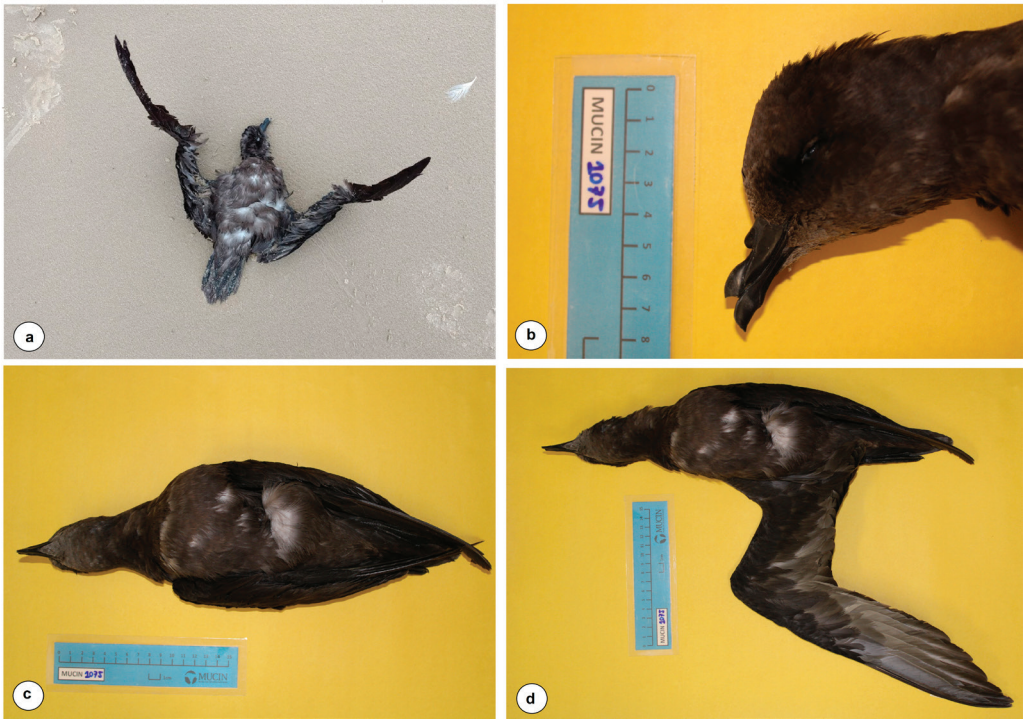


Figure 1. Great-winged Petrel *Pterodroma macroptera* collected in Rio Grande do Sul, Brazil (MUCIN 1075): (a) when found, on 24 May 2019, on Tramandaí beach, (b) head, in lateral view, lacking final portion of the maxillary unguis, (c) ventral view, and (d) ventral view and left underwing, with larger coverts and remiges appearing grey, contrasting with the rest of the brownish-black underwing-coverts (Maurício Tavares)

To confirm the identification, we compared our measurements to those of Great-winged, Trindade *Pterodroma arminjoniana* and Kerguelen Petrels *Lugensa brevirostris* in Flood & Fisher (2015); see Table 2. The data are consistent only with Great-winged Petrel. Compared to Trindade Petrel, Great-winged Petrel body length and wingspan are both 5% longer and wing length 6% longer (Luigi *et al*. 2009); vs. Kerguelen Petrel, Great-winged Petrel body and wing lengths are both 17% longer (Table 2; Maurício *et al*. 2014).

In addition, ectoparasites were collected for qualitative analysis, tissue and organ samples were taken for the Banco Nacional de Amostras de Albatrozes e Petréis (Brazilian Albatross and Petrel Sample Bank), and back and breast feathers for trace element analysis. The gastrointestinal content indicated no debris in the esophagus, pro-ventricle, ventricle, and intestine cavities. Cephalopod beaks were found in the proventricle (n = 1) and ventricle (n = 12); these were identified as three upper and eight lower beaks, from eight different specimens, of which two were *Histioteuthis* sp. There was no subcutaneous fat, and pectoral musculature was slightly thick, especially the supracoracoideus muscle, which was very slim, consistent with an emaciated specimen. The complete skeleton, primaries, and rectrices are deposited at the Museu de Ciências Naturais, Universidade Federal do Rio Grande do Sul, Imbé, Rio Grande do Sul, registration number MUCIN 1075.

Separation of Great-winged Petrel from dark-morph Trindade Petrel

Great-winged Petrel and dark-morph Trindade Petrel with largely dark underwings are tricky to identify (Flood & Fisher 2015), especially in the South Atlantic where they are sympatric. The latter breeds on Ilha da Trindade (20°30'S, 29°19'W; Leal *et*

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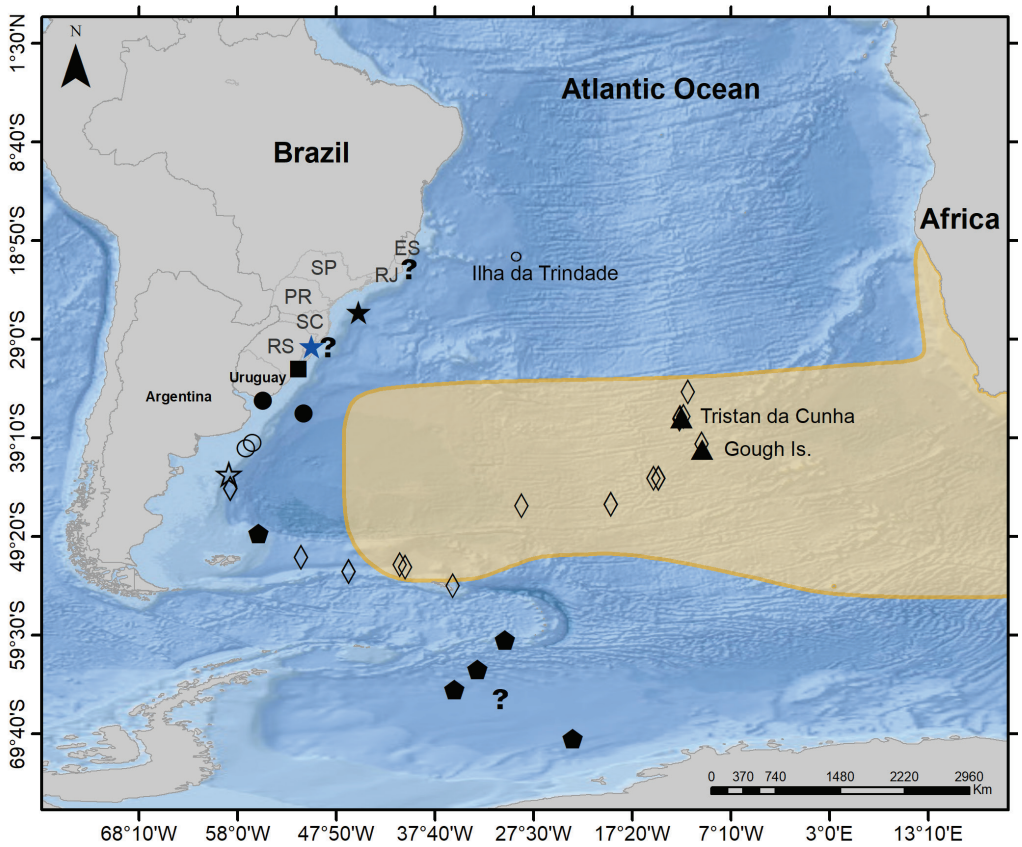


Figure 2. Great-winged Petrel *Pterodroma macroptera* distribution (shown in dull yellow) based on BirdLife International (2018). New record on the Brazilian coast reported herein (blue star); the only previous documented record in Rio Grande do Sul (RS) state, in southern Brazil (filled square); two records in Uruguay (filled circles); three records in Argentine waters (unfilled circles); the most recent record in the south-west Atlantic, in February 2020 (unfilled star); and records in the Falklands, South Georgia, and Southern Ocean waters are all shown (pentagons). Documented records in the central and south-west Atlantic from eBird (2021) (unfilled diamonds) and questionable records from Harris & Hansen (1974) and Mazar Barnett & Pearman (2001) are indicated by ?. Breeding colonies in the Atlantic at Tristan da Cunha and Gough are indicated (filled triangles). The case study individual identified as Trindade Petrel *Pterodroma arminjoniana* photographed in 2019 in Brazilian waters (filled star) is depicted in Fig. 3. Brazilian states: Espírito Santo (ES), Rio de Janeiro (RJ), São Paulo (SP), Paraná (PR) and Santa Catarina (SC).

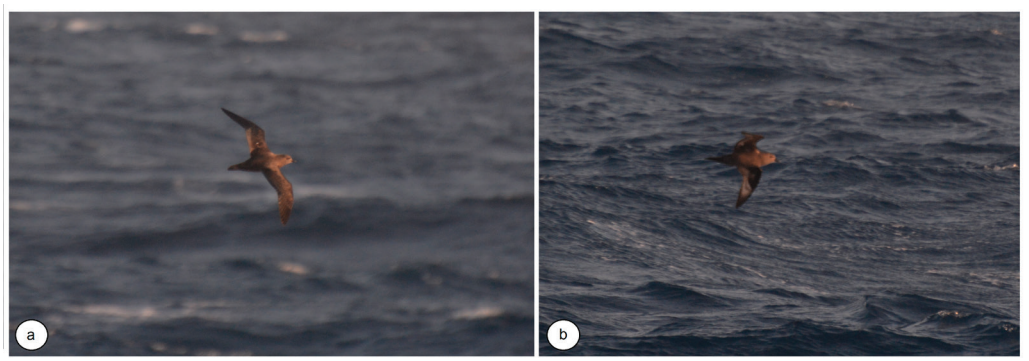


Figure 3. Trindade Petrel *Pterodroma arminjoniana* off the Brazilian continental shelf, August 2019: (a) all-dark upperparts and (b) underside showing the underwing pattern with whitish at the bases of the primaries and greater primary-coverts (Fernanda C. L. Valls)

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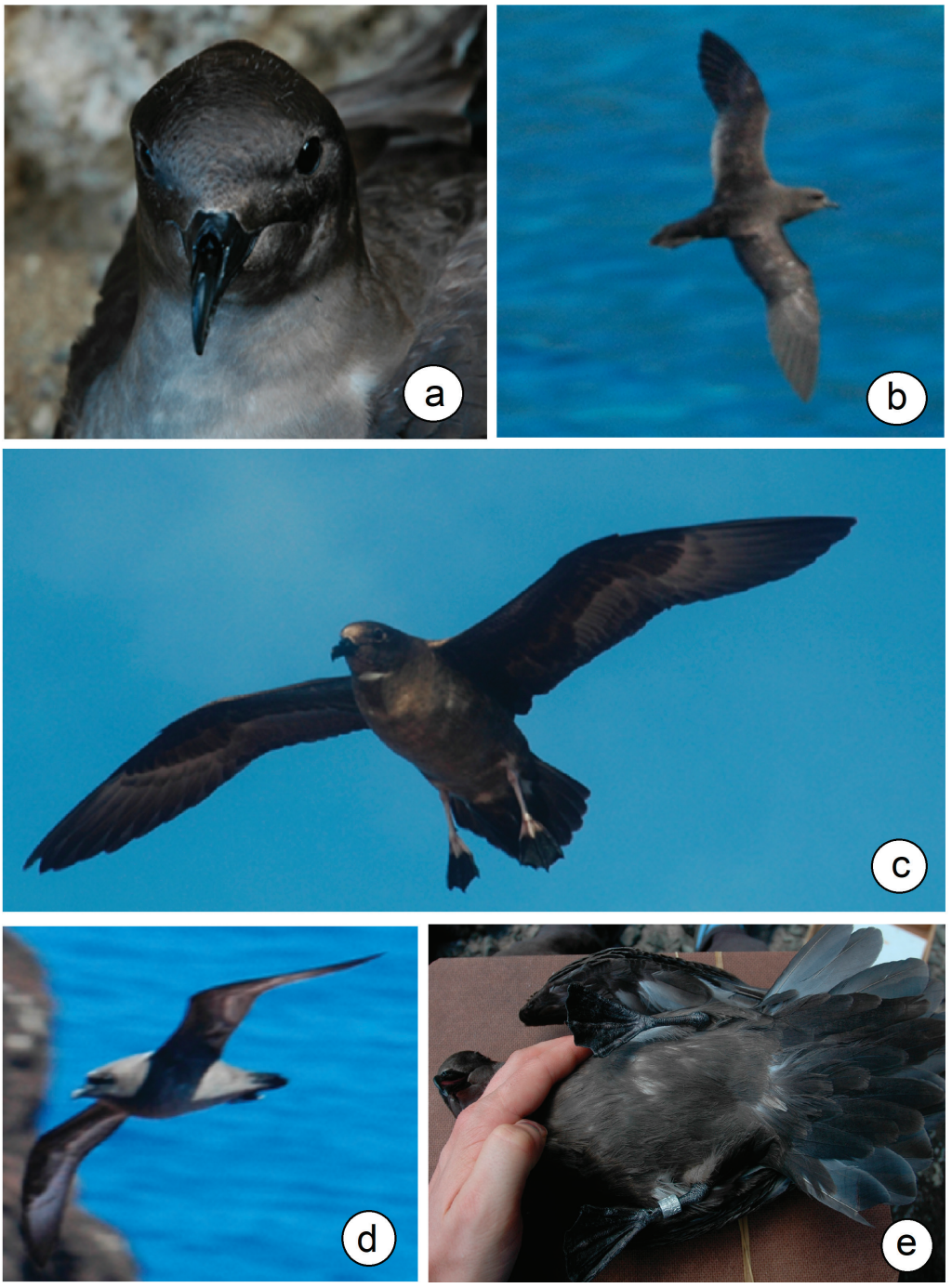


Figure 4. Dark-morph Trindade Petrels *Pterodroma arminjoniana*, Ilha da Trindade, South Atlantic: (a) small squarish head of an intermediate to dark morph; (b) all-dark upperparts; (c) dark underwings showing a trace of the pale bases to the primaries and greater primary-coverts; (d) a more typically patterned individual, with a broad whitish panel on the underwing, but the greater coverts are dark distally, forming a narrow crescent on the tips of the greater primary-coverts; and (e) dark underparts and the blackish legs, feet and toes (Leandro Bugoni)

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TABLE 1

Records of Great-winged Petrels *Pterodroma macroptera* in the south-west Atlantic Ocean (west of 20°W). No. of observations or 'X' is used to indicate presence. * = questionable records; ** = supported by photographs.

Date	Location	Coordinates	No. of birds (X = present)	Source
Dec 1959	south of South Georgia	60°S, 30°W	3	Mazar Barnett & Pearman (2001)
Apr 1960	Argentine continental shelf	40°S, 57°W	1	Mazar Barnett & Pearman (2001)
Jan 1970	Argentine continental shelf	39°21'S, 56°20'W	3	Mazar Barnett & Pearman (2001)
Sep 1973*	Brazilian continental shelf	20°S, 39°W–24°S, 42°W	3	Harris & Hansen (1974)
Sep 1973*	Brazilian continental shelf	29°07'S, 47°44'W	3	Harris & Hansen (1974)
Apr 1977	South Georgia waters	-	1	Mazar Barnett & Pearman (2001)
Feb 1980	South Georgia waters	-	1	Mazar Barnett & Pearman (2001)
Aug 1982	Falkland Islands	49°S, 55°W	3	Mazar Barnett & Pearman (2001)
Aug 1982	Falkland Islands	49°S, 55°W	6	Mazar Barnett & Pearman (2001)
Mar 1985	South Georgia waters	-	1	Mazar Barnett & Pearman (2001)
Feb 1990	Cape Pembroke, Falkland Islands	-	1	Mazar Barnett & Pearman (2001)
Feb 1992	Argentine continental shelf	39°02'S, 57°03'W	1	Mazar Barnett & Pearman (2001)
Jan 1994	Southern Ocean	64°09'S, 30°10'W–65°12'S, 25°41'W	25	Mazar Barnett & Pearman (2001)
Feb 1994*	Southern Ocean	67°59'S, 26°24'W–67°52'S, 26°57'W	2	Mazar Barnett & Pearman (2001)
Feb 1994	eastern Weddell Sea	69°05'S, 21°24'W	64	Montalti *et al*. (1999)
Feb 1994	Southern Ocean	66°08'S, 33°09'W	1	Mazar Barnett & Pearman (2001)
Dec 1995	north of South Georgia	-	1	Mazar Barnett & Pearman (2001)
May 2003	Uruguayan coast	34°50'S, 55°56'W	1	Jiménez *et al*. (2012)
Mar 2004	Rio Grande do Sul, Brazil	33°09'S, 52°39'W	1	Bugoni (2006)
Mar 2007	Uruguayan waters	36°04'S, 51°00'W	1	Jiménez *et al*. (2012)
Apr 2012	north of Shag Rocks, South Georgia	-	1	Flood *et al*. (2012)
Apr 2012	South Georgia and north-east of Falkland Islands	-	10	Flood *et al*. (2012)
Apr 2012**	South Georgia and South Sandwich Islands	52°28'S, 40°46'W	X	eBird (2021)
Apr 2012**	South Georgia and South Sandwich Islands	52°16'S, 41°18'W	X	eBird (2021)
Apr 2012	South Georgia/Falkland Islands	-	2	Flood *et al*. (2012)
Apr 2012	north of Falkland Islands	-	3	Flood *et al*. (2012)
Apr 2012	South America continental shelf	-	3	Flood *et al*. (2012)
Jun 2016**	South Georgia and South Sandwich Islands	54°26'S, 35°51'W	1	eBird (2021)
Mar 2018**	South Georgia and South Sandwich Islands	52°57'S, 46°35'W	1	eBird (2021)
Apr 2018**	South Atlantic	46°11'S, 28°46'W	1	eBird (2021)
Feb 2019**	Argentine continental shelf	44°24'S, 58°44'W	3	eBird (2021)
May 2019	Rio Grande do Sul, Brazil	30°02'S, 50°08'W	1	This study
Feb 2020	beyond the shelf break (Uruguay to Falkland Islands)	43°35'S, 57°42'W	1	RLF pers. obs.

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TABLE 2

Measurements (mm) of Great-winged Petrel *Pterodroma macroptera* specimen (MUCIN 1075) found on Tramandaí beach, Rio Grande do Sul, Brazil, compared to other specimens previously reported in the literature and other potential confusion species such as Trindade Petrel *Pterodroma arminjoniana* (Luigi *et al.* 2009, Leal *et al.* 2019) and Kerguelen Petrel *Lugensa brevirostris* (Schramm 1983, Maurício *et al.* 2014) with their respective samples sizes (*n*). * = indicates mean values from live individuals.

Species	Body length	*n*	Wing lenth	*n*	Tail length	*n*	Height of bill at its base	*n*	Width of bill at its base	Tarsus length	*n*	Culmen length	*n*	Wingspan	*n*	Source
P. macroptera (MUCIN 1075)	408		305		130		15.5		17.1	44.8		34.9		1,040		This study
P. macroptera (MNHN 6235)							15.0					36.7				Jiménez *et al.* (2012)
P. macroptera (CAFURG 360)	400		323		125				15.3	43.5		39.1		1,060		Bugoni (2006)
*P. macroptera**			307 ± 6.8	52						44.4 ± 1.09	53	36.3 ± 0.98	54			Schramm (1983)
*P. arminjoniana**	388.9 ± 15.9	69	286.7 ± 8.8	496	114.8 ± 4.7	480				37.7 ± 1.5	443	29.6 ± 1.3	445	987.1 ± 26.0	69	Luigi *et al.* (2009)
P. arminjoniana males*			298 ± 89.4	10	118 ± 35.4	10	13.2 ± 4.0	10		38.7 ± 11.6	10	30.7 ± 9.2	10			Leal *et al.* (2019)
P. arminjoniana females*			291 ± 87.3	10	112 ± 33.2	10	14.6 ± 14.6	10		40.3 ± 12.1	10	30.3 ± 9.1	10			Leal *et al.* (2019)
L. brevirostris (CAFURG 450)	350		260		138					37.6		27				Maurício *et al.* (2014)
*L. brevirostris**			257 ± 6.4	121						39.5 ± 1.24	121	26.7 ± 1.47	118			Schramm (1983)

al. 2019), *c*.1,200 km east of the coast of the Brazilian state of Espírito Santo, and its at-sea range is reasonably well known (Leal *et al*. 2017, Ramos *et al*. 2017). During its year-round breeding, Trindade Petrel reaches the Subtropical Convergence zone and even subtropical waters off southern Brazil, Uruguay, and Argentina (Leal *et al*. 2017). Our compilation of Great-winged Petrel records (Table 1) demonstrates that its at-sea range overlaps quite extensively with that of Trindade Petrel. Thus, correct at-sea identification is essential to determine the distributional limits of Great-winged Petrel.

On 31 August 2019, at 07.00 h, during a seabird census onboard the research vessel MV *Searoute*, a long-winged 'all-dark' *Pterodroma* was observed and photographed (Fig. 3) nearly 200 km off the state of Santa Catarina, southern Brazil (26°42'S, 45°17'W), and *c*.600 km beyond the most northerly Great-winged record in southern Brazil, but well south of the northernmost claim, off Espírito Santo, mentioned by Harris & Hansen (1974) (Fig. 2). As dark-morph Trindade Petrel is known to occur in the area (Leal *et al*. 2017, Ramos *et al*. 2017), the August 2019 *Pterodroma* makes an interesting identification case study.

The side of the vessel used to census seabirds was chosen to avoid backlit effects on birds that can make identification difficult (Tasker *et al*. 1984). Ocean depth was 2,250 m, the wind north-northwest 14 knots, or 4 on the Beaufort scale. The survey formed part of the Projeto de Caracterização Ambiental da Bacia de Santos coordinated by Petrobras.

At first glance, the bird resembled a Sooty Shearwater *Ardenna grisea*, having long wings and an 'all-dark' body. Sooty Shearwater, Great-winged Petrel and dark-morph Trindade Petrel can be confused with one another (Flood & Fisher 2015). However, the bird's buoyant flight style and wings bent at the carpal joint recalled a *Pterodroma* rather than a shearwater. Photographs revealed a fairly heavy and short bill, unlike the relatively long- and

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slim-billed shearwater. Dark-morph Soft-plumaged Petrel *Pterodroma mollis* and 'all-dark' Kerguelen Petrel potentially occur in the area, but were easily eliminated by structural and plumage characteristics (e.g., Maurício *et al*. 2014, Flood & Fisher 2015). The only other 'all-dark' *Pterodroma* petrel considered plausible is dark-morph Trindade Petrel (Fig. 4).

Dark-morph Trindade and Great-winged Petrels are similar-sized medium-large *Pterodroma* (Flood & Fisher 2015) with long, fairly slim wings, and 'all-dark' upperparts and underparts. The challenge of separating Great-winged from the darkest Trindade Petrels with restricted white in the underwing (e.g., Fig. 4) is not widely appreciated and may have led to misidentifications. For example, it is reasonable to query the three Great-winged Petrels on a single day in September off Espírito Santo and Rio de Janeiro (Harris & Hansen 1974), at the same latitude as Ilha da Trindade and well within the distribution of Trindade Petrel (Leal *et al*. 2017, Ramos *et al*. 2017).

Separation requires careful study of the underwing pattern and structure. The basic colour of 'all-dark' Trindade Petrel is dark greyish brown to blackish brown, typically with a complex 'dark-and-whitish' underwing pattern. In some cases only the bases of the primaries and greater primary-coverts are whitish, indistinctly paler (Fig. 4), or not pale. The darkest birds are brownish black, even including the legs and toes (Luigi *et al*. 2009; Fig. 4e). Trindade Petrel is the 'rangier' of the two, with a small squarish head, steep sloping forehead, long caudal projection, and medium-length tail normally held closed so that it tapers to a point (Fig. 4; Flood & Fisher 2015). Great-winged Petrel is basically brownish black, but the underwing has reflective larger coverts and remiges that may contrast pale grey (Howell & Zufelt 2019). It is less 'rangy' than Trindade, with a larger head, longish caudal projection and mid-length wedge-shaped tail that is normally held partly open. Trindade Petrels without the typical underwing pattern, thus like Great-winged Petrel, must be identified using structure alone.

Photographs of the August 2019 *Pterodroma* (Fig. 3) show a blackish-brown bird with whitish bases to the underside of the primaries and greater primary-coverts. It is vital to establish if the whitish markings result from reflected light as in the Great-winged Petrel photographs in Howell & Zufelt (2019: 140). In our photographs, the whitish is well defined in clear contrast with a dark crescent on the distal 'third' of the greater primary-coverts. This is a plumage characteristic and not an artefact of reflected light. General colour is unreliable as the photographs were taken in the early morning. The main structural characteristic evident is a long caudal projection and a tail that tapers to a point. Although the photographs are not sharp, the pattern of the underwing and the structure of the rear end are sufficient to prove that the bird was a Trindade Petrel.

Conclusions

Our compilation of records indicates that Great-winged Petrel regularly occurs in offshore south-west Atlantic waters, north as far as the Subtropical Convergence Zone in southern Brazil. These are not shown as areas of regular occurrence in field guides (e.g., Flood & Fisher 2015, Howell & Zufelt 2019). Our case study illustrates the challenge of separating Great-winged and the darkest Trindade Petrels. Continued at-sea studies and systematic beach surveys for stranded individuals will help to confirm the status of these species in the south-west Atlantic. Beach surveys are regular (e.g., Valls *et al*. 2015, Tavares *et al*. 2020), but systematic censuses of pelagic seabirds are scarce (Mott & Clarke 2018). We recommend greater effort in systematic at-sea surveys in the south-west Atlantic with a special focus on these species.

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