Abstract

During September 2006, the first positive sighting of Antarctic Terns, Sterna vittata, in Australia occurred at Cape du Couedic on the SW corner of Kangaroo Island (KI), South Australia. Previously, the only confirmed occurrences of this species in Australia were two specimens collected from SA and WA.

Initial discovery on 1 September 2006 was of three birds roosting amongst numerous Crested Terns, Thalasseus bergii, and White-fronted Terns, Sterna striata. From this time until the date of last sighting on 26 September 2006, ornithologists came from all over Australia to observe these birds. During this period a total of 10 birds were positively identified and many photographs taken. The record was approved by Birds Australia Rarities Committee (BARC Case 525) on 25 March 2007.

This paper documents the first confirmed record of live Antarctic Terns in Australia and discusses the observations in some detail. Much of the discussion deals with the finer diagnostic features of these birds and searches for clues as to the race and origin of these extremely rare visitors.

INTRODUCTION

The Antarctic Tern is a medium-sized sea tern (length 32-36 cm; wingspan 72-79 cm; weight 140-160 g) similar in appearance to the Arctic Tern, Sterna paradisaea, and the Kerguelen Tern, S. virgata, but is bigger and bulkier, with heavier bill, legs and feet (Higgins and Davies 1996). Breeding (alternate) plumage is distinctive with pale-grey upperparts, extensive and pronounced black cap extending from the nape, crown and face to the forehead. The black cap is separated from the smoky-grey chin and throat by a distinctive white facial streak (Figure 1). Tail and rump are white without obvious black edging to the outer rectrices. Underbody smoky-grey with translucent white remiges and narrow tapering dark trailing-edge to primaries. The, legs and feet are bright red and the tail becomes more deeply forked during breeding due to growth of long outer tail feathers (rectrices - streamers) (Harrison 1983; Higgins and Davies 1996; Environment Australia 2005).

Non-breeding (basic) plumage features pale-grey upperparts, white fore-crown, frons, lores, rump and tail. Underparts white - sometimes smudged with patches of smoky-grey. Hind-crown, nape and sides of face are black with dark red bill, legs and feet (Harrison 1983; Higgins and Davies 1996). (Figure 2).

Current taxonomic classification of this species generally acknowledges five races (Higgins and Davies, 1996). They are listed here with their respective breeding islands.

S. v. vittata Gmelin, 1789 – Southern Indian Ocean (Heard Is, Kerguelen Is, Prince Edward Is, Marion Is, Crozet Is).

S. v. tristanensis Murphy, 1938 – South Atlantic/Southern Indian Ocean (Tristan da Cunha Is, Gough Is / Amsterdam Is, St. Paul Is)

S. v. gaini Murphy, 1938 – South Atlantic (S Shetland Is, Antarctic Peninsula and associated islets).

S. v. georgiae Reichenow, 1904 – South Atlantic (South Georgia Is, South Orkney Is, South Sandwich Is and Bouvet Is).

S. v. bethunei Buller, 1896 – Southern Ocean/South Pacific (Macquarie Is, Stewart Is, Snares Is, Auckland Is, Bounty Is, Antipodes Is and Campbell Is).
Tree and Klages (2004) listed the temperate Indian Ocean population on St Paul and Amsterdam Is as *S. v. santipaula*. Also, some taxonomists split NZ race *S. v. bethunei* into two races – the population at Macquarie Is being classified as *S. v. macquariensis*. This paper does not follow either of these taxonomic classifications – preferring to follow Christidis and Boles (2008) and Higgins and Davies (1996) and lumping those populations within races *tristanensis* and *bethunei* respectively.

The Antarctic Tern is chiefly a circumpolar inhabitant of Antarctic and subantarctic regions to 68 S (Higgins and Davies 1996). It is widespread and breeds on remote subantarctic islands and the Antarctic Peninsula throughout the S Atlantic, S Indian Ocean and islands to the S of New Zealand (Rootes 1988; Harrison 1983; Rounsevell and Brothers 1984; Robertson and Bell 1984; Williams 1984; Weimerskirch et al. 1989; Higgins and Davies 1996; Garnett and Crowley 2000).

An estimated 40 800 pairs (c 92% of the total breeding population) breed in the S Atlantic, chiefly race *gaini* breeding on the South Shetland Is (35 000 pairs) and the Antarctic Peninsula (1500 pairs); race *georgiae* on South Georgia Is (2 500 pairs), South Orkney Is (500 pairs), South Sandwich Is (100 pairs), Bouvet Island (50 pairs) and race *tristanensis* on Tristan da Cunah and Gough Is (1 159 pairs). In the S. Indian Ocean race *vittata* breeds on Kerguelen Is (2 000 pairs), Heard Is (Aust. 100 pairs), Crozet Is (100 pairs) and Prince Edward Is (<15 pairs). Race *tristanensis* breeds on Amsterdam and St Paul Is (400 pairs). The Indian Ocean population is just over 2 630 pairs.

In the S Pacific/Southern Ocean race *bethunei* breeds on southern New Zealand Is (Stewart, Snares, Auckland, Bounty, Antipodes and Campbell Is – 1000 pairs) and Macquarie Is (Aust. c 40 pairs). Pacific Ocean total 1040 pairs. World total population an estimated 44, 455 pairs (Tree and Klages 2004).

Part of the population moves N during the austral winter, moulting into basic plumage and spending the non-breeding season (April-May to Sept -Oct) on the SE coast of S America (Tierra del Fuego N to Rio de Janeiro) and on the W and E coasts and off-shore islands of S Africa to as far N as c 30 S (Blake 1977; Brooke et al. 1988; Higgins and Davies 1996; Tree and Klages 2004).
Brooke et al. (1988) estimated the South Africa wintering population to be in excess of 15,000 birds. Tree and Klages (2004) estimated it to be 12,800 during August 2001, with roosts of up to 4,000 on both Dyer and Dassen Is and in excess of 5,000 on Bird Is.

The Antarctic Tern is a vagrant to Australia. Prior to the record reported in this paper there were only two records, both specimens. An adult in non-breeding plumage, collected at Metricup, WA, 35 km SSW of Busselton, 21 July 1978 (WAMA15670) (Higgins and Davies 1996) and an individual, probably adult, moulting into summer dress, collected on S Casuarina Islet, off SW Kangaroo Island (KI), SA, 23 November 1982 (SAM B36933) (Copley 1996; Higgins and Davies 1996; Baxter and Horton 2008). Finally, a single Antarctic Tern was observed and photographed by ten pelagic birders part way between the edge of the continental shelf and Pedra Branca, S of Tasmania on 29 July 2008 (Wakefield 2008) and this record was also accepted by BARC (Case 582). There are no confirmed records off the NZ mainland (Higgins and Davies 1996).

Breeding takes place mainly between October and March, although this varies with geographical location and changing climatic conditions and food availability (Downes et al. 1959; Higgins and Davies 1996). Only two races breed in Australian territory. *S. v. vittata* breeds on Heard Is (53°05' S; 73°33' E) in the S Indian Ocean (Figure 1). Race *S. v. bethunei* breeds on Macquarie Island (54°39' S; 158°53' E) in the Southern Ocean, 1,500 km SSE of Tasmania. The latter island is approximately half way between Australia and Antarctica.

Antarctic Terns are very similar in appearance to the Arctic Tern, Common Tern, *S. hirundo*, Kerguelen Tern and South American Tern, *S. hirundinacea*. Great care must be taken with identification in the field, particularly with the former two species which are regular non-breeding visitors to the Australasian region during the period November-March. Non-breeding immature birds may be present throughout the year. It helps that Antarctic Terns should be in breeding plumage when these two Northern Hemisphere visitors are in non-breeding plumage. However, during arrival (November) and departure (March), Arctic and Common Terns may have retained/acquired some degree of breeding plumage and are then much more difficult to distinguish from Antarctic Tern. The movements of the Antarctic Tern are not fully understood due to confusion with other terns, especially at the sub-species level (Harrison, 1983; Higgins and Davies 1996; Garnett and Crowley 2000). The non-breeding range of most populations is poorly known (Higgins and Davies 1996).

**THE RECORD**

On Friday, 1 September 2006, three Antarctic Terns, *Sterna vittata*, were observed at Cape du Couedic in Flinders Chase National Park, on the SW corner of KI, South Australia (pers. obs.). They were roosting with c. 1,000 Crested Terns *Thalasseus bergii* and 112 White-fronted Terns *S. striata* on a rocky platform alongside Admirals Arch – a very popular tourist attraction of national and international significance. Also hauled out here were hundreds of New Zealand Fur Seal, *Arctocephalus forsteri*, and a small number of Australian Fur Seal, *A. pusillus doriferous*.

One of the Antarctic Terns was in advanced moult into breeding plumage with almost fully black cap, smoky-grey underparts and a distinctive white facial streak. The other two were in non-breeding plumage, with blackish nape and hind-crown contrasting with pronounced white fore-crown, frons and underparts (pers. obs.). Observation of these birds was from a designated boardwalk and viewing platform constructed by SA National Park and Wildlife (SA NP&W) to protect the integrity of the fur seal colony and surrounds. The closest viewing platform was c.50 m distant
from the terns and with the aid of a 20-60 times zoom Swarovski spotting scope excellent views were afforded. Over the course of three hours (1200–1500 h) important diagnostic features of these birds were noted and digital photographs taken.

These birds were tentatively identified as Antarctic Terns (as opposed to Arctic Terns) by the following diagnostic features.

Mostly silvery-white underwing: observed when wings raised at roost and during short flights triggered by crashing waves and seal movements (underwing of Arctic Tern shows distinctive dark-grey to black edging on leading and trailing edge of the outer underwing).

Two non-breeding plumaged birds had retained bright red bills (Figure 2). (Arctic Tern bill changes from red to black in non-breeding plumage).

At roost two of the three birds had folded wing tips equal to or slightly shorter than the length of the tail. The breeding plumaged Antarctic Tern had tail streamers (outer rectrices) protruding noticeably beyond the folded wing tips as did the birds in primary moult (Figure 3).

The Antarctic Terns were slightly smaller in stature than the White-fronted Terns but had well proportioned bill and legs of a similar length and bulk to that of a White-fronted Tern (Figure 4). (Arctic Tern has short legs in proportion to its body and consequently has a very distinctive squat appearance).

Accompanied by John Cox and Colin Rogers, Cape du Couedic was re-visited the following day on 2 September 2009. Unfortunately, a blustery SE wind had resulted in all of the terns departing from the previous days roost alongside Admirals Arch (now exposed to strong wind) and moving en-masse to the Inner (N) Casuarina Islet c. 300 m. offshore.
Despite this, viewing with spotting scopes throughout the afternoon enabled the smaller red-billed/red-legged terns to be located amongst hundreds of Crested and White-fronted terns and diagnostic features to be observed and discussed in detail. After several hours of viewing and much discussion, positive identification of Antarctic Tern was confirmed. By late afternoon the number of Antarctic Terns identified at roost on the Inner Casuarina Islet had risen to 10 - three adults in almost complete breeding plumage, five adults in non-breeding plumage and two immature birds with black bills and a distinctive grey-brown smudge on the carpal area of the wing (pers.obs.).

Cox and Rogers returned to Cape du Couedic on Sunday 3 September 2009 and were successful in locating a non-breeding plumaged adult Antarctic Tern roosting on a rock platform alongside Admirals Arch. This allowed for much closer scrutiny and for Rogers to secure a series of digital photographs of the bird (similar to Figure 4).

During the 26 day observation period (1-26 September), ornithologists came from all over Australia to observe, photograph and identify these birds. Upon closer inspection of one of the Antarctic Terns still in the process of moulting into alternate (breeding) plumage, it could be seen that the inner primaries (p) were new, fresh and white (underside) whereas those of p9 and p10 were old and worn and had become darker with wear. The comparatively fresh and still growing inner primaries were short enough to expose the tip of p9 and reveal the sharp and narrow “hookback” feature diagnostic of Antarctic Tern (Figure 2). Moreover, post-breeding wing-moult in Arctic Tern does not occur until they reach the south polar ice pack - so it was too early for an Arctic Tern to be in latter stages of wing-moult at this time. Most other Antarctic Terns present had already completed wing-moult and this individual seemed to be somewhat late. However, not too late, as Antarctic Terns may still be moulting into alternate plumage during September-October (Higgins and Davies 1996). Consequently, there is no doubt about the initial identification of Antarctic Tern. BARC (Birds Australia Rarities Committee) have since adjudicated on the submission (Case No 525) and the eight-member committee unanimously accepted the record on 25 March 2007.

The species was last seen at Cape du Couedic at 1600 hours on Tuesday 26 September 2006 when four breeding plumaged adults were observed roosting on a rock platform near Admirals Arch (pers. obs.). Two further reports of this species at Admirals Arch during September 2007 remain unconfirmed. One and then two birds (with a number of White-fronted Terns) were reported by a KI tour guide on 18 and 22 September respectively (Baxter 2007).

Antarctic Terns are extremely rare vagrants to Australia, only two dead birds having been found prior to this sighting. Dr. Tony Robinson, NP&W Scientific Officer, collected a desiccated specimen from the summit of the Outer (S) Casuarina Islet off Cape du Couedic, FCNP, KI on 23 November 1982 (Copley 1996; Robinson et al. undated unpublished manuscript). This significant discovery was the first record of an Antarctic Tern for SA and is now registered as SAM B36933 (Figure 5). The first record for Australia was a specimen collected after a winter storm at Metricup, a small town on the SW coast of WA, in 1978 (Johnstone and Storr 1998; O’Connor 2007).

It is likely that this species may have been overlooked by some observers in the past. An unconfirmed observation was reported by KI eco-tour guide Ken Grinter at Cape du Couedic on 12 November 2001. Grinter described it as a “small tern with bright red bill and red legs”. It was roosting on a rock platform near Admirals Arch with Crested Terns (Grinter 2001). Grinter, who was the only person to see the bird, did not
take detailed field notes, photos or any other observers to see the bird and consequently the birds exact identity remained unknown (K. Grinter pers. comm.). BARC deemed the observation ‘not accepted’.

WA birdwatcher Frank O’Connor, said that he had seen red-billed, red-legged terns in the SW of WA during winter and spring. They definitely were not Common Terns (F. O’Connor, pers. comm.). In retrospect, he thought that it was possible that one (or more) of these birds may have been an Antarctic Tern.

DISCUSSION

Possible race and origin of the KI Birds

After confirming the presence of several Antarctic Terns, attention was then directed towards determining the race to which the birds belonged. Did they originate from breeding islands in the S Indian Ocean (race vittata), S pacific/Southern Ocean (race S. v. bethunei), Amsterdam and St Paul Is in the temperate waters of the Indian Ocean (race S. v. tristanensis) - or were they race S. v. georgiae and/or S. v. gaini from the S Atlantic?

Past studies suggest that the Antarctic Terns visiting KI during 2006 are unlikely to be race georgiae or gaini as these races are thought to be mostly sedentary at their breeding grounds (del Hoyo et al. 1996; Parmelee 1988; Higgins and Davies 1996; Tree and Klages 2004). Race georgiae inhabits the South Georgia, South Sandwich and South Orkney Is complex in the S Atlantic, situated c. halfway between Cape Horn and the Antarctic Peninsula on the W side of the Drake Passage. Although small numbers of race georgiae have been identified as wintering in S Africa (Tree and Klages 2004), it must be realized that it is only half the distance to travel to that destination (c. 5 000 km ENE directly across the S Atlantic), than it is to reach KI.

Much of what has been stated about race georgiae also applies to race gaini. It too breeds in the S Atlantic Ocean on South Shetland Is, the Antarctic Peninsula and associated islets. It too is 10-15 000 km distant from KI. Moreover, race gaini has never been recorded wintering in South Africa (Tree and Klages 2004). In fact, there is evidence to suggest that this population is quite sedentary and does not seem to undertake a pronounced post-breeding migration at all (Cooper 1976; Tree and Klages 2004). Some birds may move to southern S. America (Higgins and Davies 1996). Antarctic Terns that inhabit the more southerly and colder Antarctic Peninsula region mostly moult on their breeding grounds. An early account of these seemingly resident peninsular terns leaves little doubt that at least part of the tern population wintered on the W side of the Antarctic Peninsula (Holdgate 1963). This sedentary phenomenon may also largely apply to race georgiae which breeds on Antarctic islands close to those occupied by race gaini.

There were two views put forward initially as to the origins of these birds. One was that the birds may have originated from St Paul and Amsterdam Is in the Indian Ocean, c.5 000 km due W of KI (race tristanensis). The other suggested that they had originated from the New Zealand Group of subantarctic islands in the S Pacific/Southern Ocean (including Macquarie Is), c.2 500 – 3 000 km SE of KI (race bethunei).

However, although situated in the far S of the Indian Ocean, Heard Is and Kerguelen Is (race: vittata) are about the same distance (c. 5 000 km) from KI as Amsterdam and St Paul Is (race: tristanensis). The main difference is that St Paul and Amsterdam Is, situated c. halfway between S. Africa and KI, are on close to the same latitude as KI (37 S), whereas Heard Is and Kerguelen Is are truly subantarctic islands at latitude 50 S and beyond. Importantly, races vittata and tristanensis are known to undertake regular post-breeding migrations from their breeding grounds to winter further N. They form the bulk of the estimated 10 000+ Antarctic Terns wintering on offshore islands and coastline of southern S Africa each year.
Limited band and leg flag recoveries from S Africa have largely been of race *vittata* from Heard Is and Kerguelen Is (Tree and Klages 2004; Tree et al. 2009).

The only absolutely definitive way to determine race would be by DNA analysis of blood and/or tissue samples. However, capture of one or more birds for sampling was not considered feasible at KI as for much of the time they were roosting on the inaccessible Inner Casuarina Islet some 300m offshore. When roosting alongside Admirals Arch (a very popular tourist destination) the terns were amongst large numbers of fur seals and access was restricted to designated boardwalks and platforms in order to mitigate disturbance in this extremely public and wildlife sensitive area.

Nevertheless, the subtle differences in physical characteristics of each race can also provide important clues to identification. Close scrutiny of diagnostic features is necessary to separate one race from another. The birds at Cape du Couedic were studied very closely in the field and also from a rich array of close-up photographs. Features such as overall body size, plumage characteristics and colouration, comparative tail and wing length, bill and leg size were just some of the features studied. Tail length in comparison to wing length was perhaps the most important factor. Two or more of the birds at Cape du Couedic had tail feathers (outer rectrices: tail streamers) protruding beyond the closed wing tips. This feature was observed in the field and well illustrated in photographs (Figures 2, 3 and 4).

Only one race of Antarctic Tern has a tail that protrudes noticeably beyond the folded wing tips - the long tailed race - *S. v. tristanensis*. Typically Antarctic Terns have the tail equal to or extending only slightly beyond the closed outer primaries but those of race *tristanensis* have longer more deeply forked tails and
shorter wings than the other four sub-species (Tree and Klages 2004). HANZAB states that at rest, tail-streamers fall close to wing-tips in most subspecies, but well beyond wing-tips in race tristanensis (Higgins and Davies 1996). Biometric comparison of wing-tail ratio of all races of Antarctic Tern is illustrated in Table 1.

If these birds were tristanensis, as comparative tail/wing length suggests (Figure 4), particularly in the birds in almost complete breeding plumage, then the birds at Cape du Couedic have come from the Amsterdam – St Paul Is in the temperate zone of the Indian Ocean and/or the Tristan da Cunah – Gough Island Group in the South Atlantic. The former island group is situated midway between KI and S. Africa (5 000 km W of KI) and on much the same latitude (37 S - KI 35 S). The Tristan da Cunah Island Group are twice as far away, in excess of 2 000 km SW of South Africa and 10 000 km from KI. It would seem most logical therefore that if the birds were in fact race tristanensis, they had probably originated from St Paul and Amsterdam Is This race is known to migrate away from its breeding grounds each winter as several thousands visit South Africa each year (Tree & Klages 2004). Moreover, KI receives a strong westerly air stream throughout winter (the “roaring forties”) and it would seem plausible that during post-breeding departure and/or winter feeding offshore, some of the post-breeding population may at times be caught up in this wind system and blown E as vagrants to the extreme S coast of Australia.

An additional feature of the KI Antarctic Terns indicating race tristanensis were their comparative long bills and legs. Although the Antarctic Terns were slightly smaller in stature than the White-fronted Terns, they had bills of similar length. Indeed, their bills appeared to be somewhat heavier and more robust than those of the White-fronted Terns (pers. obs., Figure 4).

Figure 4. Antarctic Terns moulting into breeding plumage: lowest bird showing outer retrices (tail streamers) extending noticeably beyond folded wing tips. Note strong robust bill and legs of similar proportions to the White-fronted Tern top right. David Harper.
Race *tristanensis* is typified by its longer heavier culmen and tarsus (Higgins and Davies 1996; Tree and Klages 2004). Previous samples of bill and tarsus measurements taken from races of Antarctic Tern show that *tristanensis* has the longest bill and legs (Table 1). A small sample of adult male *gaini* (4) showed it to have the second largest bill with race *bethunei* third. However, post-breeding populations of race *gaini* are thought to be quite sedentary around breeding grounds with limited movement across Drake Passage to winter on E coast of nearby South America (Higgins and Davies 1996). Race *bethunei* has the second longest tarsus after *tristanensis* (Table 1). Higgins and Davies (1996) provide further confirmation of this, stating that although race *vittata* has a significantly longer wing than *bethunei*, it has a smaller bill and tarsus. So, it would seem that although *bethunei* has a slightly smaller bill and tarsus than *tristanensis*, its bill and leg characteristics are perhaps substantial enough for it to be a possible match for the birds observed at Cape du Couedic.

The possibility that the KI Antarctic Terns may have been race *bethunei* was also suggested by the presence of White-fronted Terns at Cape du Couedic at that time. White-fronted Terns

Figure 5. Antarctic Tern specimen SAM B36933 collected from summit of Outer (S) Casuarina Islet, Cape du Couedic, KI, November 1982. Colin Rogers.
### Table 1.

Comparison of the morphometrics of the Kangaroo Island specimen SAM B 36933 (shaded) with published measurements and museum specimens of the different subspecies (races) of Antarctic Tern. Wing length refers to the outermost primary p10; tail length refers to the outermost rectrice; bill length refers to the exposed culmen. Data obtained from: South Australian Museum (Bxxxxx) courtesy of P. Horton; Higgins & Davies 1996 (HD96); Tree and Klages 2004 (TK04); R. K. Brooke unpublished data (RKB). Locality codes: KI = Kangaroo Island, SA; NZ MacQ = Snares, Auckland, Campbell and Macquarie Is; MacQ = Macquarie Is; Heard, Kerg = Heard Is and Kerguelen Is; Winter S Afr = overwintering in South Africa; Islands = Tristan da Cunha, Gough Is., St. Paul & Amsterdam Is.

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<th>Bill Length</th>
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<td>134.8</td>
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<td>16.6</td>
</tr>
</tbody>
</table>

*Note:* Table values are means (mm) with standard deviation (St. dev. mm) and range (Minimum - Maximum mm). Sample size (N) for each location is provided.
are a winter visitor to southern Australia from breeding grounds in NZ and subantarctic islands further south. Previous to 2006 the species had been rarely reported from KI and the few records were generally of single birds (Baxter 1995). However, during September 2006 an unprecedented number of White-fronted Terns congregated at Cape du Couedic, with a maximum count of 263 on 14 September 2006 (pers. obs.). This was one of the largest concentrations of White-fronted Terns ever seen on land in SA. The White-fronted Tern/Antarctic Tern association at Cape du Couedic was quite extraordinary. It prompted the thought that the two species may have originated from the same breeding islands and had remained together whilst on a post-breeding passage. If this were the case then they would have originated from breeding islands to the S of New Zealand, about 2 000 km SE of KI. Perhaps they had been assisted by the ever present SE Trade winds that blow consistently from the S Pacific towards KI throughout summer and autumn. These birds may have become caught up in this wind system immediately after breeding (April/May) and had arrived in Australian waters during early winter and had remained undetected until observed at Cape du Couedic on 1 September.

Garnett and Crowley (2000) state that race *bethunei* (including Macquarie Is population) may be partly migratory – with some birds staying in the breeding area throughout the year whilst others may disperse as far N as Australia and New Zealand. Some consider *bethunei* to be non-migratory (Tree and Klages 2004). However, little is known about the post-breeding movements of this race (Higgins and Davies 1996).

**Biometrics of specimen SAM B36933**

Thoughts then turned towards the Antarctic Tern specimen housed in the SA Museum (SAM B36933) and whether it had been subjected to DNA analysis to ascertain its race and place of origin. This desiccated specimen is moulting into summer dress (Figure 5), (has white on forehead and crown) and was collected from the summit of the Inner Casuarina Islet, just two km S of Cape du Couedic, on 23 November 1982. Dr. Philippa Horton, Curator of Birds at the SA Museum, had previously sent a skin and feather tissue sample to scientists in S Africa for DNA testing. Unfortunately, plans for DNA analysis on this specimen and a broad cross-section of other races did not eventuate due to lack of funding. However, another post-doctorate study is planned for the future and it is hoped that this genetic analysis will positively identify the race of SAM specimen B36933 (P. Horton, pers. comm.).

In the meantime, attempting to work out the subspecies of the SA Museum specimen (B36933) from measurements and plumage characteristics presented itself as an interesting alternative option, albeit not a definitive one. Robinson et al. (undated, unpublished manuscript) examined the specimen and provided the
following observations and measurements. Of the primaries, 1-8 are new and full grown, p9 still growing and p10 old. The tail is fully-grown but does not extend beyond the wing-tips. Measurements (mm): wing: both p10 broken off at tips, right 243.0, left 230.2, estimated length of complete right p10 c 268; tail 73.0 to tips of median rectrices, 139.3 to tips of outermost rectrices; bill 33.2; tarsus 17.5 (Table 1). Biometric analysis and comparison of wing, tail, bill and tarsus measurements (albeit relatively small sample sizes) provides some insight into physical size differences between the various races of Antarctic Tern. In an attempt to find a clue as to the origin of the live birds observed at Cape du Couedic during September 2006, the following analysis and discussion compares biometrics and plumage characteristics of SAM skin B36933 (from Outer Casuarina Islet, Cape du Couedic, KI) with those of samples previously collected from races of Antarctic Tern.

After analysing measurements of Antarctic Tern races (Table 1), the best match with SAM B36933 proved to be another SA Museum specimen. Labelled B1111, it is an adult breeding plumaged female *bethunei* from Macquarie Is (Table 1). It is close to a perfect match. Overall, the measurements favour either races *bethunei* or *vittata* as the best match with B36933. Races *tristanensis*, *georgiae* and *gaini* are not a good match at all – being substantially different in most features.

Horton also compared plumage characteristics of B36933 with two adult SAM specimens of race *bethunei* from Macquarie Is. B1111 is an adult, alternate plumage female; B1113 is an adult, basic plumage female. HANZAB states that the tail in *bethunei* is mostly white, sometimes with a faint dusting of pale grey on the outer webs of T5 and T6 whereas in *vittata* the outer webs of the outer three rectrices are pale grey (Higgins and Davies 1996). However, it also states that race *bethunei* from Macquarie Is have more extensive pale grey on the outer webs of the outer three rectrices, more like *vittata*. The two skins of *bethunei* from Macquarie Is do have pale grey on the outer webs, but on B36933 it is noticeably darker grey on T6 and T5 and a closer match with tail colour described for race *vittata* (P. Horton, pers.comm.) (Figure 6). From these comparisons it would seem that on tail colour B36933 most closely resembles *S.v.vittata* (and to a lesser extent *S.v.bethunei* from Macquarie Is), but without DNA (or many specimens for comparison) we cannot be certain.

It would be interesting to examine the beach derelict from WA. From the description and diagrams by John Darnell in the WA Handbook, the WA specimen has a wholly white tail as described by HANZAB for birds of race *bethunei* originating from the NZ sub-Antarctic islands (so quite unlike the tail of B36933).

**CONCLUSION**

The specimen collected in November 1982 confirmed that Antarctic Terns occasionally visit KI in winter. The discovery of a flock of 10 Antarctic Terns at Cape du Couedic gives credence to earlier unsubstantiated field reports. Although identification of the Antarctic Terns is beyond doubt the origin of the birds on KI during September 2006 is still open to conjecture. There are three possibilities to consider with a reasonable probability: *S.v.vittata*; *S. v. tristanensis* and *S. v. bethunei*.

The field characteristics of the birds seen in September, particularly the long tail streamers, suggests *S. v. tristanensis*. In that case these birds originated either from the Amsterdam – St Paul Isl in the Indian Ocean or the Tristan da Cunah – Gough Island Group in the South Atlantic.

The presence of a large flock of White-fronted Terns from New Zealand at the same location as the Antarctic Terns naturally led to the conjecture that the Antarctic Terns originated...
from sub-antarctic islands off New Zealand. In that case they would be race *bethunei*. However, although it is plausible that *bethunei* could turn up in Australia the field characteristics of the birds seen in September 2006 are consistent with *tristanensis* rather than *bethunei*.

The identification of Antarctic Terns in Australia by race is further complicated by the biometric analysis of the single specimen (SAM B36933) collected from outer Casuarina Islet, Cape du Couedic in November 1982. The biometric analysis of this specimen suggests that it is a good fit for race *bethunei* from Macquarie Is. However the biometrics with worn feathers come from a single individual and do not rule out *vittata* so the identification of specimen SAM B36933 to race remains uncertain until the necessary DNA analysis is completed.

Thus although the birds seen in September 2006 had field characteristics consistent with *tristanensis*, there is no reason to rule out the appearance of *bethunei* or even *vittata* in Australian waters.

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**REFERENCES**


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