

Booby *Sula* colonies in the Mascarene area (Indian Ocean): extinctions, myths, and colour morphs

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In a recent discussion on the significance of the distribution of two colour morphs of the Red-footed Booby *Sula sula* in the western Indian Ocean, Le Corre (1999) claimed that all but three known colonies (some now extinct) consisted largely (80%+) of white morphs, amongst which he included Rodrigues, Mauritius and Agalega. The three exceptions cited were Europa (Mozambique Channel) and the Glorieuses (with 80+% white-tailed brown morphs = 'brown' hereafter), and Tromelin (33% brown). He inferred from this distribution that there was little mixing between the colonies, with high proportions of brown morphs and those dominated by white morphs, unlike the situation in the Pacific Ocean. Earlier, Stoddart (1981) had also assumed that colonies without a specific reference to colour-morphs consisted largely of white birds, although in the standard work on the genus, Nelson (1978) was very cautious in interpreting colony records, and gave only very limited indications of Red-foot colour morph distribution in the Indian Ocean; he was apparently unaware of the colony on Europa. The Red-footed Booby populations on Rodrigues, Mauritius and Agalega cited by Le Corre are extinct or never existed. The only boobies of any kind still surviving are Masked Boobies *S. dactylatra* which still nest in small numbers on Serpent Island off Mauritius (Feare 1978, Safford 1993, Bell *et al.* 1994, pers. obs. 1999). The situation on each island, outlined below, is very different; all three are currently part of the Republic of Mauritius. Brief comments on St. Brandon (=Cargados Carajos) and Réunion are added.

Rodrigues

Amongst the large numbers of seabirds breeding on the islets in the lagoon when the island was first described were two species of booby - known in the eighteenth century as the 'boeuf', largely white, and the 'tra-tra', largely brown or grey (Cheke 1987). For a long time these were considered to be white and brown morphs of the Red-footed Booby (e.g . Staub 1973), though the white bird was also tentatively referred to the Masked Booby (Bourne 1968) or even the Cape Gannet *S. (Morus) (bassana) capensis* (Milne-Edwards 1875) despite being reported to nest in trees. Nelson (1974, 1978)

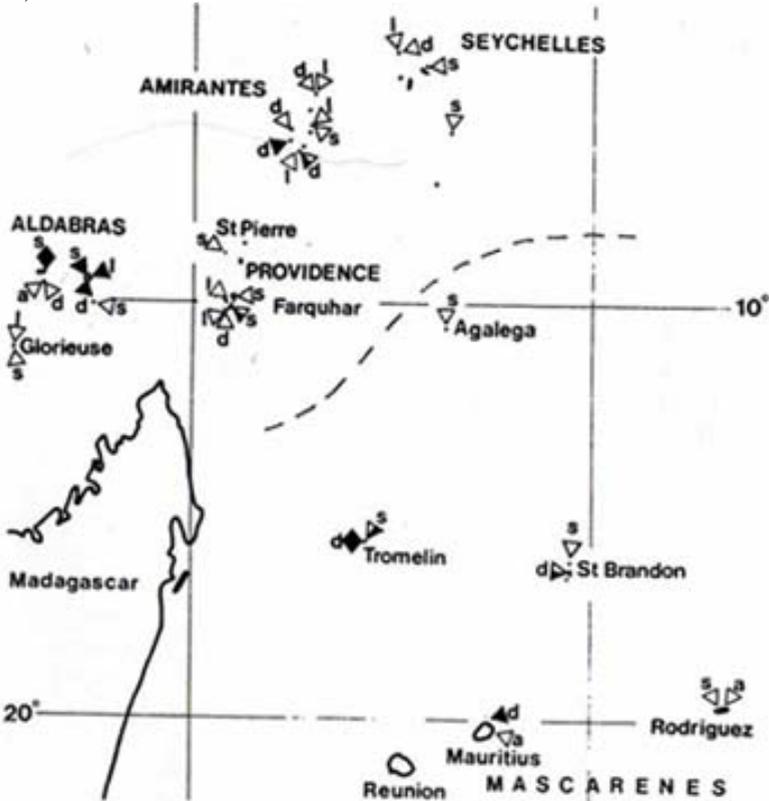


Figure 1. Past and present distribution of booby colonies in the western Indian Ocean (omitting Europa, Mozambique Channel). Solid diamond - colony increased; Solid triangles - no known change in colony size; Open triangles - colony extinct; split triangles - colony reduced. Species codes: a - *Sula abbotti*, d - *S. dactylatra*, l - *S. leucogaster*, s - *S. sula*.

Adapted and updated from Feare (1978). Seychelles/Aldabra area data unadjusted, apart from *S. leucogaster* (no longer occurs on Desnoeufs Island, Amirantes, and probably no longer occurs on Farquhar Atoll - Feare pers.comm.) and *Sula sula* which has increased on Aldabra (A.Burger pers.comm). Mascarene area data from this paper & Le Corre (1996 - Tromelin).

recognised that Tafforet's description of the 'boeuf' best fitted Abbott's Booby *S. (Papasula) abbotti*, which was confirmed later (Cheke 1987) by further study of old texts (Tafforet 1726, Pingré 1763) not fully available to Nelson. In the meantime Bourne (1976) had tentatively referred an illustration of a subfossil bone of a large booby from Rodrigues, originally ascribed to the Red-footed Booby (Milne-Edwards 1873) to Abbott's Booby; the actual bone "cannot be traced" (Bourne, *loc. cit.*). The last recorded occurrence of a 'boeuf' was in 1832, when a specimen was collected for Col. Dawkins on behalf of Charles Telfair (Telfair 1833) - however, on being exhibited at the Zoological Society in London it was identified as "the lesser gannet of Dr. Latham, the *Sula candida*, Briss. and *Pelecanus piscator*, Linn. (ed. note following Telfair, *ibid.* - i.e. a white-morph Red-footed Booby. The name 'boeuf' comes from the resemblance of the birds' call to that of cattle (Tafforet 1726, Pingré 1763); only Abbott's Booby has a mooing call of this kind (Nelson 1974, 1978, Cheke 1982).

Two early travellers described the 'tra-tra' in sufficient detail for identification to be attempted. The first was Leguat (1707), who described only one species which he called by the standard French name 'fou' (=booby or gannet, but often used in the past for other easily caught seabirds, Cheke 1982). After recounting how they were regularly robbed by Frigate Birds *Fregata* sp., he described the 'fous' as "having the back chestnut and the belly white, the beak pointed, four inches long, very large at the head end and a little toothed along the edges, the legs short, the feet more or less as a duck's and pale yellow". Tafforet (1726), wrote that "the *tra-tra*, so-called because it always calls in that way, is a bird which is not as big as the *boeuf* and has a beak similar to the *boeuf*'s, and is coloured grey a bit white on the belly; they perch and make their nests in the trees and incubate in turns but they are in bigger quantity than *boeufs*, when they are little they are all white with the beak all black, and when they are big [=adult] they are grey and the beak greenish" [my translation]. The French astronomer Guy Pingré, on the island for the transit of Venus in 1761 (Pingré 1763), whose account of the 'boeuf' was very accurate (Cheke 1987), unfortunately only described nestling 'tra-tras', so his account adds nothing on the question of colour morphs. 'Fous'/boobies were reported by numerous subsequent visitors (e.g. Gardyne 1846, a recently discovered account), but none, including Newton (1865) or Slater (1975), gave a plumage description. There are only three extant specimens: two collected in 1845, labelled as from Col. M. Lloyd but probably collected by Thomas Corby (Cheke 1987: 51) are in Cambridge: one is white, the other brown (dark head & belly, white tail, possibly sub-adult; R.P. Prys-Jones pers. comm., M. de L. Brooke *in litt.*). The remaining specimen, collected by Slater in 1874 (Sharpe 1879), in The Natural History Museum collection in Tring, is another white morph adult (pers. obs.). The brown bird is exactly like one of the Bewsher specimens allegedly from Mauritius (see below). Brooke (1976, 1978) claimed that Layard had collected both Red-footed Boobies and Masked Boobies on Sandy Is., Rodrigues in 1856 - however, Layard was in fact collecting on Tromelin, then also known as 'Sandy Island', as Brooke himself (1981) later acknowledged. By 1916 Red-footed Boobies no longer bred on Rodrigues (Cheke 1987).

It is clear from Tafforet's account that his 'tra-tras' were brown morph Red-footed Boobies, clearly contrasted with the larger, rarer 'boeuf' (Abbott's Booby). Leguat's description is confusing, even suggesting Brown Boobies *S. leucogaster* (C. Feare *in litt.*), though clearly not a white form. However a few sentences earlier he noted that 'fous', frigates, and tropic-birds (*Phaethon spp.*) nested up trees, whereas other seabirds nested on the sand - eliminating Brown Boobies. That three of the four known specimens are (or were) white is perhaps not surprising. Telfair's collectors were seeking a 'boeuf' (a white booby) so either accidentally obtained a white-morph Red-footed Booby, or the name had by then transferred to that form, Abbott's Booby having died out; his specimen is lost (see Wheeler 1997). Corby (a surveyor, not an ornithologist) probably saw two sorts, so collected one of each. Slater was keen, but no expert, and may have collected a white bird assuming it to be the fully adult version of the boobies he saw; in his own notes (Slater 1875) he used the name ' *S. dactylatra* ' (i.e. Masked Booby) although he clearly described them nesting in trees, and the specimen itself is labelled ' *Anous stolidus* Booby' (pers. obs.) ! Redressing the balance, I argue below that two brown-morph birds collected by Bewsher were obtained in Rodrigues and not Mauritius as labelled.

Rodrigues should therefore be added to the list of colonies with brown morphs predominating. It may be significant that, apart from Europa (22°S), this colony at 20°S was the most southerly in the western Indian Ocean.

Mauritius

Nelson (1978) did not mention Mauritius in his discussion of Red-footed Booby distribution, but Hartlaub (1877), Oustalet (1897), Meinertzhagen (1912), Rountree *et al.* (1952), Newton (1958), Watson *et al.* (1963) and Feare (1978), followed by Le Corre (1999), asserted that Red-footed Boobies used to breed on islets around Mauritius. There is no real evidence for this (Cheke 1987), but I will re-examine the claims here in more detail.

Although there were dozens of reports of the land fauna, only one early visitor to Mauritius reported boobies. In 1668 John Marshall saw a pair of probable Abbott's Boobies nesting up a tall tree, and in neighbouring seas saw 'boobos' "as big as a kite with a long bill and are of a reddish greene and some part white colour" - which could, at a stretch, have been Red-footed Boobies (Cheke 1987). Bourne (1976) re-examined sub-fossil bones from Mauritius that Newton & Gadow (1893) had simply called 'gannet', and identified them as Abbott's Booby (undiscovered when the material was first studied).

In the 18th (La Caille 1763) and early 19th centuries (Desjardins, in Oustalet 1897) the French word 'fou' was used interchangeably with 'fouquet', to describe, not boobies, but petrels or shearwaters (Cheke 1982, 1987), causing confusion to later writers. Oustalet (1897) thought Desjardins was referring to boobies, despite the birds described "nesting in holes under rocks" (i.e. Wedge-tailed Shearwaters *Puffinus pacificus*, Cheke 1987). Following Milne-Edwards (1882), Oustalet also assumed Quoy & Gaimard's (1824) 'fous' seen off Mauritius in 1818 were Red-footed Boobies, but

they had only reported birds 'similar' to European and South African gannets (i.e. white *Sula* with dark wing-tips). Their birds thus remain unidentified, though they were probably Masked Boobies, the Indian Ocean species closest in appearance to true gannets ('*Morus*' spp.). Meinertzhagen (1912) confused Ile Plate in the Seychelles with Flat Island off Mauritius, and citing Oustalet's (1897) remarks about Ile Plate, claimed that Red-footed Boobies nested on Flat island - this is despite having visited the islet twice himself and finding no seabirds (details in his diaries kept at Rhodes House, Oxford). Hartlaub (1877) noted a 'young' Red-footed Booby from Mauritius in Vienna, but the specimen in fact comes from Agalega (Cheke & Lawley 1983, and below). Guérin (1940-53) blithely added the other northern islets (Serpent, Round, Gunner's Quoin) to the alleged breeding sites of Red-footed Boobies, and as late as 1950, Rountree (1951) said they 'probably bred'. Guérin (1940-53) also asserted that there were four Red-footed Booby specimens in the Mauritius Institute museum; Rountree *et al.* (1952) quietly (and correctly, pers. obs.) reassigned them to Masked Boobies. Finally in 1952, Rountree *et al.* (1952), following his co-author Jean Vinson's visit to the islets (Vinson 1950), confirmed that they 'probably no longer nest on any of these islets today'. In fact no observer at any time ever actually saw or reported Red-footed Boobies nesting in or around Mauritius (Cheke 1987).

There are however three further museum specimens listed as having been collected in Mauritius.

The first, in Paris, presented by Delisse in 1837, is mentioned without further detail by Milne-Edwards (1882), Oustalet 1897 and Rountree *et al.* (1952). This specimen, accessioned on 6 June 1837, is labelled as from 'Ile de France', i.e. Mauritius (C. Jouanin *in litt.*). Theodore Delisse was one of the party that accompanied Bojer on his visit to Agalega in 1835 (Pourcelet 1994, and see below), and it seems most probable that that is where he collected the booby. A list of birds presented to the Paris museum in June 1837 by a M 'Delisle' consists largely of seabirds, but also includes two 'ibis vert', all allegedly from Mauritius (Jouanin *in litt.*). There have never been any ibises breeding in Mauritius (Cheke 1987), but there is a small colony of Glossy Ibis *Plegadis falcinellus* on Agalega (Cheke & Lawley 1983). The rest of the list includes (all in French, not Latin) frigate birds sp., boobies ('fou blanc'), noddy sp., another tern ('sterne dos noir = ? *Sterna fuscata*) and two migrant waders. All the seabirds in the list would, in 1835, have been easily obtained on Agalega, but not on Mauritius, where frigates no longer bred and terns and boobies (only Masked) could have been procured only on Serpent Island, on which there is no recorded landing before 1844 (Lloyd 1846, Vinson 1950). M 'Delisle' and M Delisse seem likely to have been one and the same person, and I suggest all the birds were collected in Agalega in 1835, with the specimens being imprecisely labelled as was not unusual at that time.

The other two specimens, in the Natural History Museum at Tring, are from bird and snail collector C.E. Bewsher, who had supplied them originally to the The Shelley Museum (George Shelley's collection). They are undated but must be 1868-79, when Bewsher was based in Mauritius (limiting dates of mentions in the *Transactions of the Royal Society of Arts & Sciences of Mauritius*). One is an adult

brown morph, the other a sub-adult (white tail, but brown head & belly) also of the brown morph (pers. obs.). While Bewsher could somehow have collected a couple of vagrants around Mauritius, it is more likely that he procured the birds on his visit to Rodrigues (in 1874, Bouton 1875, Griffiths 1994). The ex-Shelley Museum accession includes (pers. obs.) a frigate-bird *F. ariel*, one each of the two noddies and a Sooty Tern. All five species were readily obtainable in Rodrigues, while only the terns could have been collected, with difficulty, on Mauritius (Serpent Island; see above).

Finally Layard (1863) collected an unidentified 'gannet' egg, allegedly on Round Island. The egg no longer survives (Brooke 1978), but there are two Masked Booby skins from the same collecting trip (Brooke 1976), so the egg was presumably from a Masked Booby, and actually collected on Serpent Island.

On present evidence Mauritius should be deleted from the breeding distribution of the Red-footed Booby. There is only one confirmed record of a vagrant: Temple (1976) saw a single bird off the coast in June 1973. The Masked Boobies from Serpent Island can regularly be seen at sea around the northern islets of Mauritius (pers. obs. 1973-1999), and along the west coast (Temple 1976); 50 pairs were estimated in November 1992 (Safford 1993), while 200 birds were counted in September 1993 (Bell *et al.* 1993).

Reunion

Watson *et al.* (1963) unaccountably listed as occurring on Réunion both Masked ('possibly breeds') and Red-footed Boobies ('apparently does not breed ... grey-phase adults have been recorded'). Nelson (1978) and Feare (1978) were wisely cautious about this - in fact until 1976 no boobies of any species had been recorded, let alone bred, in Réunion (Gruchet 1976, Barré 1983). Gruchet (1976) correctly identified an immature sulid captured off the town of St. Paul, and photographed alive on 10 March 1976, as a Cape Gannet *Sula (Morus) (bassana) capensis*, though Barré (*loc. cit.*) and Probst (1997) thought it was a young Masked Booby. Despite his earlier reference, Barré *et al.* (1996) omitted this record from the Réunion handbook. Probst (*loc. cit.*) reported sight records of Masked Boobies off Le Port in 1995.

It would appear that Watson *et al.* (1963) accidentally transposed information from Mauritius, though they also gave the expected information under that island; their book contains no references.

Agalega

Scientists rarely visit Agalega, and detailed information on its original biota is minimal (Cheke & Lawley 1983, Guého & Staub 1983). Although several early visitors and colonists mentioned the (then) abundant 'fous' and their behaviour (*ibid.*), no plumage descriptions were given, but the birds were always stated to nest up trees. There are no records after 1848 (*ibid.*). The only sulid labelled as taken on the island is a Red-footed Booby left to the Vienna museum by the botanist Wenceslas Bojer, who visited the island in 1835 (Cheke & Lawley, *loc. cit.*). In 1844 Bojer presented a

series of birds, including a 'fou', to the Société d'Histoire Naturelle de l'île Maurice (Bouton 1846), but this specimen has not survived (pers. obs. in the Mauritius Institute museum). However I believe the 1837 Paris specimen also originated in Agalega, as the collector, Delisse, was with Bojer on the island in 1835 (Pourcelet 1994, see above).

Le Corre (1999) gave Cheke & Lawley (1983) as the source in his table where he claimed Agalega was inhabited by largely (80%+) white morph birds; in fact we did not mention colour morphs at all. When researching the biological history of the island (*ibid.*), I examined all the known literature and manuscripts pertaining to it; visitors never mentioned more than one kind of 'fou', nor their colour. The Vienna specimen was originally identified as an immature and labelled '*Sula alba*', suggesting that Bojer considered that adults were white; however the bird is in fact a brown morph adult (F. Steinheimer *in litt.*). The Delisse bird in Paris is an adult white morph (C. Jouanin *in litt.*). The evidence is too poor to assess the proportion of brown-morph birds, so the colony should be treated as 'unknown' in that respect.

Staub (Guého & Staub 1983) suggested Abbott's Booby might also have nested on Agalega, but this, while possible, is entirely speculative; without hard evidence Agalega should not be included in the former distribution of this species.

St. Brandon (=Cargados Carajos)

These atolls lie between Rodrigues and Tromelin, well south of Agalega, so might have been expected to have a high proportion of brown-morph birds in the Red-footed Booby colony. Newton (1956, 1958) is the only visitor who counted the proportions of brown and white morph before the birds on Ile Albatros disappeared - reporting one (1956) or 2 (1958) brown morph pairs amongst 25 active nests in January 1956. The nests were heavily predated by cats (Newton 1958), and the birds had ceased to breed by 1964 despite the eradication of cats (Staub & Guého 1968). No birds were seen at Albatros, not even at sea, during visits in 1965 (Staub & Guého *loc. cit.*), 1971 (Williams & Rowlands 1980) or 1975 (Newlands 1976). However a single pair was nesting on Grande Capitaine islet in 1968 (Staub 1976: '1958' in error, F. Staub *in litt.*), so the birds may yet recolonise, possibly from Tromelin, the nearest surviving colony. None were seen in 1996 (Swinerton *et al.* 1996).

The colony of Masked Boobies on Ile du Nord used to number around 200 pairs (Newton 1958, Staub & Guého 1968, Staub 1976, Williams & Rowlands 1981), but in 1996 Swinerton *et al.* (1996) only saw around 30 pairs. Predation on all local seabirds by Seychellois fishermen was causing concern in the mid- 1970s (Newlands 1976), and was still a serious problem in 1996, with deep ocean fishing boats also implicated (Swinerton *loc. cit.*).

Discussion

Historical data indicate that white-tailed brown morph birds were predominant in the now extinct Rodrigues colony of Red-footed Boobies, and that they were also present in the extinct Agalega population, but in an unknown proportion. There was

no Red-footed Booby colony on or around Mauritius. These results do not alter Le Corre's conclusion that Indian Ocean populations are or were genetically isolated from each other; indeed they emphasize it, in that the St. Brandon colony, with a very low proportion of brown birds, is now seen to have been midway between two colonies with high percentages of brown morphs (Tromelin & Rodrigues). Le Corre also considered the darker morph might be a protection against kleptoparasitism by frigate-birds and skuas *Catharacta (skuua) antarctica*. There were large colonies of frigates at Rodrigues, St. Brandon and Agalega (Staub 1973, Staub & Guého 1968, Cheke & Lawley 1983), but their colour morph ratios were very different. Skuas are regular but scarce winter visitors (Staub 1976, pers. obs.), but must always have been too rare, relative to the frigate populations, to have had much effect. Oceanographic factors, only touched on by Le Corre, may be of greater significance. According to Pocklington (1979), Europa and Rodrigues are in a zone where warm water in the austral summer is replaced by cooler southern water in the winter, whereas St. Brandon and Tromelin are in a zone of mixed water in winter; around Agalega the water is permanently warm and of 'intermediate salinity'.

Summary details of other booby populations on these islands update the reviews by Fearn (1978) and Stoddart (1984). Abbott's Booby has been extinct in the Mascarenes for at least two centuries, while the Masked Booby hangs on at two colonies, that on Serpent Island (Mauritius) being small but stable, while the St. Brandon colony is declining and under threat from human predation.

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