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SEABIRD RECORDS FROM TONGA — AN ACCOUNT BASED ON THE LITERATURE AND RECENT OBSERVATIONS

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ABSTRACT

The previous sparse literature on Tongan seabirds is reviewed and is expanded by records made on 60 voyages through the area here described as Tongan waters.

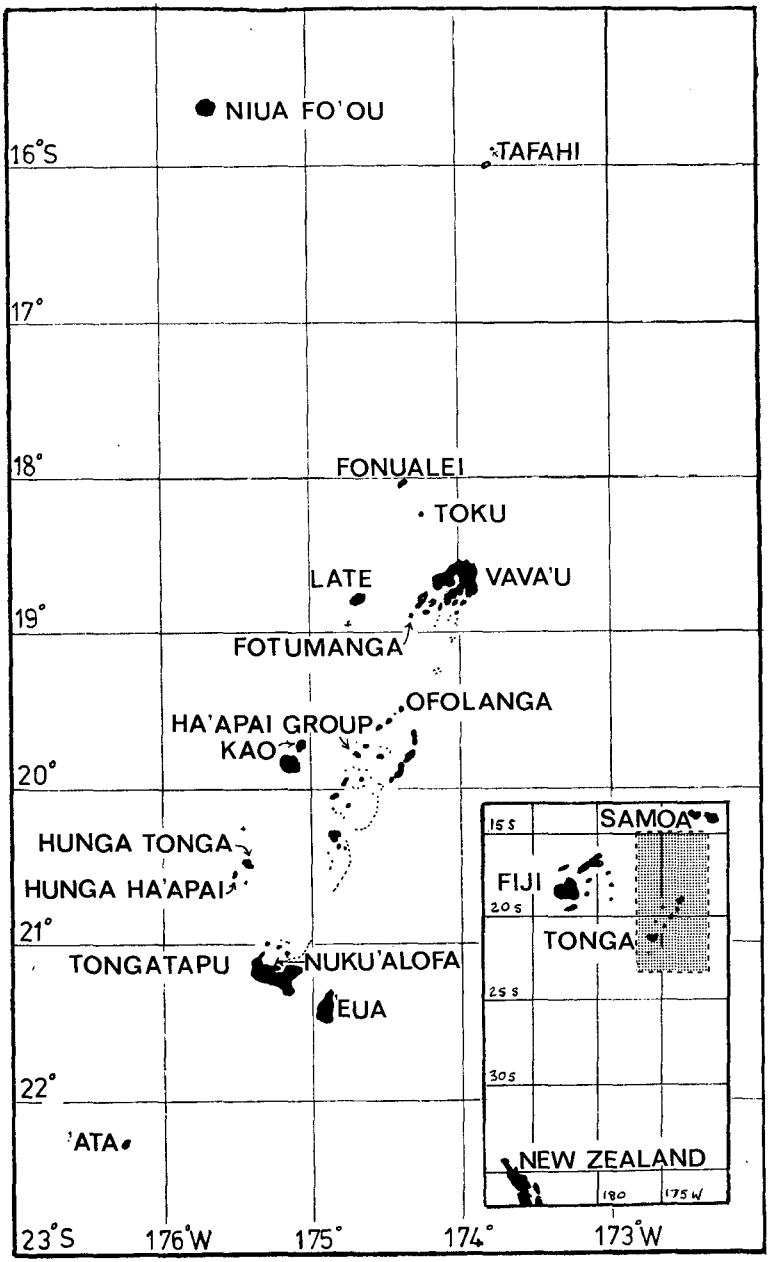
Of the 37 species thought to occur, 5 are passage migrants; breeding has been confirmed in 8 species and could occur in a further 8; 8 species are thought to be visitant; and the status of another 8 requires confirmation.

INTRODUCTION

Few places in the world can have had as little systematic bird study as Tonga, and this is especially true of the seabirds. The scattered literature that exists is difficult to find and when traced often contains little of interest. This paper reviews such literature as could be found and incorporates it with recent observations made on 60 voyages through Tongan waters.

In this paper Tongan waters are defined as that sea area bounded by 15° and 24° South latitude, and 172° and 176° West longitude. This area abuts the sea area defined as Fijian waters by Clunie *et al.* (1978). The *Pacific Islands Pilot* (1969) contains a full description of the islands of Tonga and the meteorology of the area .

Since 1973 I have made 60 voyages through Tongan waters, three to seven in each month of the year. The 18 voyages made before


NIUA FO'OU
16°S
TAFAHI
17°
18°
FONUALEI
TOKU
LATE
VAVA'U
19°
FOTUMANGA
OFOLANGA
HA'APAI GROUP
KAO
20°
HUNGA TONGA
HUNGA HA'APAI
21°
TONGATAPU
NUKU'ALOFA
'EUA
22°
'ATA
23°S
176°W
175°
174°
173°W
SAMOA
15 S
FIJI
20 S
TONGA
25 S
30 S
NEW ZEALAND
180
175 W

1973 were partly summarised in a previous paper (Jenkins 1973). The more recent 60 voyages have usually consisted of a transect through the north of the area when the ship was going from Fiji to Samoa, followed by a further transect from Samoa to Tonga, and a final transect from Tonga to New Zealand. Five voyages have been made from Fiji to Tonga and then north to Samoa before returning to Tonga and New Zealand.

To avoid endless repetition of latitudes and longitudes, positions are recorded using the "square" system adopted by the Australasian Seabird Group. That is, the basic degrees only are used. Throughout the paper positions are given as, say, 20/175W, which means that the sighting occurred in 20°S latitude and 175°W longitude. Since all latitudes used in this paper are south, the indicator S has been omitted. The area defined as Tongan waters includes 45 squares, of which 26 have been visited, most of them regularly.

My observations are mostly those made since 1973. Before 1973 different tracks were followed, and only two voyages were made to the south of Tongatapu. However, where relevant, important records made before 1973 have been included.

Since all records from the south of Tongatapu have been made on voyages coming from north to south, they are more likely to show the true northerly limits of the southern ship-following species than are northbound voyages.

For nomenclature of the albatrosses and petrels I have followed Harper & Kinsky (1978).

HISTORY

The literature on Tongan birds can conveniently be divided into three phases; the records of the early explorers starting with Cook's voyages; the largely German research of the late 19th century; and the modern studies starting with the work of the Whitney South Sea Expedition.

Early explorers

The first recorded visit of Europeans to Tongatapu was that of Abel Tasman in 1643, but the first birds were not recorded until some 130 years later during the visits of Captain Cook. The Forsters on Cook's second voyage described 15 species from Tonga, including three seabird species. The second voyage ships were in Tonga in 1773. During Cook's third voyage a specimen of *Sterna bergii* was collected (Medway 1979). Hombron & Jacquinot, the natural scientists of the French South Pole Expedition under the command of Dumont d'Urville in the ships *Astrolabe* and *Zelee,* were the first naturalists to visit Vava'u. They recorded one new species of landbird but no new seabirds (Hartlaub, 1854).

Titian Peale with the United States Exploring Expedition commanded by Charles Wilkes, collected 9 species in Tonga. All were

TABLE 1 — Seabirds recorded up to 1859.

Species	FORSTER (1844)	ANDERSON (1777)*	GRAY (1859)
Phaethon aethereus	-	-	X
Phaethon rubricauda	-	-	X
Sula leucogaster	X	-	-
Sula sula	-	-	X
Sterna bergii	-	X	-
Sterna dougallii	-	-	X
Gygis alba	X	X	X
Anous stolidus	X	X ?	X

* in Beaglehole (1967)

already known and the only seabird was *Gygis alba* (Hartlaub 1852). G. R. Gray (1859) provided what is in effect a summary of the knowledge of Tongan seabirds to that time, and Table 1 sets out the knowledge at the end of the first phase of exploration.

19th century collecting

The second or German-dominated phase of Tongan seabird exploration opened with the publication of Finsch & Hartlaub's *Beitrage zur Fauna Centralpolynesiens* in 1867. The book does not add to the eight seabird species known at the end of the first phase. In 1869 Finsch & Hartlaub described a collection of birds obtained from Tonga by the Museum Godeffroy, though there were no seabirds in this collection.

Dr Eduard Graffe (1870), when collecting in Tonga, recorded some habits of *Gygis alba.* From descriptions given by local people he suggested the presence of *Sterna bergii* and a species of *Anous.* This was probably *A. minutus,* which is frequently seen close inshore and could have been more familiar to the local people than *A. stolidus.* He also reported being told of a tropicbird which he assumed was *P. aethereus* but which was more probably *P. lepturus.* Graffe's report of the *Teiko,* which he said " breeds in burrows and is therefore probably a *Puffinus* or *Thalasedroma* species," is the first mention of a shearwater or petrel from Tonga. It is interesting to note that Carlson (1974) stated that the present Tongan name of Audubon's Shearwater *(Puffinus lherminieri)* is *Teiko.* A bird which from local descriptions Graffe thought could have been a *Diomedea* was subsequently identified by Finsch (1877) as *Sula leucogaster.*

In 1870 Finsch & Hartlaub published *Zur Ornithologie der Tonga-inseln* which set out the then current knowledge of Tongan birds, where and when they were first recorded, and a description of 18 species collected by Graffe for J. C. Godeffroy of Hamburg. They cast doubt on species added to the Tongan list by Latham and Gray, of which they said: " In addition Latham lists four other species allegedly from Tonga, and G. R. Gray in his admirable ' List of the Birds of the tropical islands of the Pacific (1859)' added another eight, which reached the British Museum not always accompanied by the vital collector's verification. The total number of birds from Tonga amounts to 33, six of which, however, must be considered as not having been completely proven." Seabirds considered not proven were Latham's *Sterna bergii* which had, in fact, been collected in Tonga in 1777, Gray's *Phaethon rubricauda* and *Sula sula,* both of which occur in Tonga, *Phaethon aethereus,* which was subsequently reported only by Layard (1876), and *Sterna dougallii,* which has not been reported from Tonga since.

The only Tongan seabirds recorded by the *Gazelle* Expedition (Cabanis & Reichenow 1876) were *Gygis alba* from the Ha'apai Group, and a bird recorded as *Anous melanogenys* = *Anous minutus.*

While E. L. Layard (1876) was British Consul in Fiji, he recorded birds in Fiji, Samoa and Tonga, greatly adding to the ornithological knowledge of the South-west Pacific. His work in Fiji is briefly described by Heather (1977). Layard added two new species to the Tongan list, *Phaethon lepturus* and *Fregata minor,* though he added to the confusion on the early status of the tropicbirds in Tonga by reporting seeing three species, *P. aethereus, P. rubricauda* and *P. lepturus.* His are the first reports of *P. lepturus* and the last of *P. aethereus,* which had been added to the Tongan list by Gray. Layard noted that although *Sterna dougallii* had been reported by Finsch & Hartlaub, who were in fact repeating Gray's statement, he did not see it.

In July 1874 HMS *Challenger* visited Tongatapu and 30 bird specimens of 9 species were collected. However, none of these were seabirds (Finsch 1881). Moseley (1879) in a book on the voyage does not comment on Tongan seabirds.

HMS *Curacao* visited both Tongatapu and Vava'u in July, 1865 (Brenchley 1873). Birds collected during the voyage through many island groups other than Tonga were described by G. R. Gray in an appendix to Brenchley's book, though none of the specimens described is from Tonga. It appears that Gray did not describe all the specimens obtained as he stated in the appendix " .... it is therefore proposed to notice only those birds that are new or especially rare to science ...." Only a portion of Brenchley's collection reached the British Museum. The principal part, consisting of many things other than birds, was presented to the museum at Maidstone. It would seem that no new seabirds were recorded during this visit.

This phase of the exploration ended with the publication by Finsch (1877) of notes on a collection of birds from 'Eua. The specimens described had been sent from Tonga to the Museum Godeffroy by Hubner, one of the museum's collectors. Seabirds included *Phaethon lepturus, Sula leucogaster, Sterna bergii, Gygis alba,* and one new record, that of *Procelsterna cerulea.*

Finsch's own observations of the birds of the Pacific are contained in his " Ornithological letters from the Pacific " (1880, 1881a, 1883). He did not visit Tonga.

Table 2 summarises the knowledge of Tongan seabirds at the end of the 19th century. It shows 11 species confirmed, 2 about which there was already some doubt, and an unidentified shearwater or petrel.

TABLE 2 — Seabirds recorded up to 1900.

Species	F & H (1867)	Gräffe (1870)	F & H (1870)	Layard (1876)	Finsch (1877)
Puffinus ?	-	X	-	-	-
Phaethon aethereus ?	X	X ?	-	X	-
Phaethon rubricauda	X	-	-	X	-
Phaethon lepturus	-	-	-	X	X
Sula leucogaster	X	-	-	X	X
Sula sula	X	X	-	-	X
Fregata minor	-	-	-	X	-
Sterna bergii	X	X ?	-	X	X
Sterna dougallii ?	X	-	-	-	-
Sterna anaethetus	-	-	-	X	-
Gygis alba	X	X	X	X	X
Anous stolidus	X	-	-	X	X
Anous minutus	-	X ?	-	X	-
Procelsterna cerulea	-	-	-	-	X

The 20th century

Nicoll (1904, 1908) described many seabirds in the South-west Pacific, but though he visited Samoa and Fiji, he did not visit Tonga.

The modern phase of Tongan exploration began with the visit of the Whitney South Sea Expedition in 1925, when for the first time systematic work was done on some of the seabirds. The first Procellariiformes were recorded when *Pterodroma arminjoniana heraldica* was found breeding and a specimen of *Puffinus lherminieri* was collected. New records since the Whitney Expedition are in the form of short notes (Davidson 1931, Jenkins 1967, Cheshire 1974), reports of visits to the area (Fry 1966, Jenkins 1973, Dhondt 1976), or papers on species where Tongan populations play a part (Murphy 1951, 1952, Jenkins 1979).

Mayr (1933) said very little about seabirds and hardly anything about Tonga. In his 1941 paper he said of Tongan birds in general " The total native landbird fauna comprises 18 species, with only five species of Passerines, all the others being widespread and strong flying non-passeres," and " There is on Tonga not one endemic genus and only one endemic species."

An unpublished paper by Carlson (1974), written when he was a Peace Corps Volunteer, was intended as a text book for Tongan schools (F. Clunie, pers. comm.). It contains a full list of bird names in the Tongan language. Carlson gave some very interesting observations of landbirds and of seabirds seen from the land. He also confirmed the breeding of four seabird species. Since he spent little time off-shore, he apparently based his comments on pelagic birds on his own interpretation of previous records, and so the paper is misleading in this respect.

Neither a recent visit to 'Ata to conduct archaeological and geological studies (Anderson 1979), nor that to Fonualei (A. John Halunen, pers. comm.) was accompanied by an ornithologist. Both parties strived to record the birds seen but were hampered by lack of knowledge of Pacific seabirds. Halunen, a United Nations Development Programme marine geologist, landed on Fonualei " .... to collect additional round volcanic stones for precious coral tangle-net dredges." He took the opportunity to walk to the crater rim to note the volcanic activity, and though on the island only about 4 hours, found four species of seabirds breeding.

A further important source of Tongan seabird records which I have been unable to review is contained in the Journals of the Whitney South Sea Expedition. These Journals are kept at the American Museum of Natural History, and extracts have been published in various papers on South Pacific seabirds. Where such extracts have been found they are included in this paper.

Table 3 sets out, as far as it has been possible to trace previous records, the current knowledge of Tongan seabirds. Where Jenkins without a date is given as the authority the record appears in this paper. The table summarises 37 species now recorded from Tongan waters.

DIOMEDEIDAE

I have found only two mentions of albatrosses in the literature. Graffe (1870) was told of a bird with the Tongan name of *gutulei,* which from the description he surmised was a *Diomedea,* but when a specimen was obtained later from 'Eua (Finsch 1877) it was found to be *Sula leucogaster.* Carlson (1974) gave the Tongan name of *katafa* as meaning albatross and stated without evidence that the Royal *(D. epomophora),* Wandering *(D. exulans),* and Black-browed *(D. melanophrys)* are vagrant, appearing rarely.

TABLE 3 — Seabird records up to 1979.

Species	First Recorded	Visitant	Passage Migrant	Breeding Status
Diomedea exulans	Jenkins	Jenkins	-	-
Macronectes sp.	Jenkins 1967	Jenkins	-	-
Daption capense	Jenkins	Jenkins	-	-
Pterodroma e.cervicalis	Jenkins	Jenkins	Jenkins	-
Pterodroma alba	Beck ? 1925	Status uncertain	-	-
Pterodroma rostrata	Jenkins	Status uncertain	-	-
Pterodroma a.heraldica	Beck 1925	-	-	Confirmed Murphy 1952
Pterodroma nigripennis	Jenkins 1973	Jenkins	-	-
Pterodroma leucoptera	Jenkins	Jenkins	-	-
Pterodroma longirostris	Jenkins	Jenkins	-	-
Pterodroma brevipes	Jenkins	Jenkins ?	-	-
Puffinus pacificus	Davidson 1931	-	-	Confirmed Davidson 1931
Puffinus bulleri	Cheshire 1974	-	Jenkins	-
Puffinus griseus	Jenkins	-	Jenkins	-
Puffinus tenuirostris	Jenkins	-	Jenkins	-
Puffinus lherminieri	Murphy 1928	-	-	Suspected Jenkins
Phaethon rubricauda	Gray 1859	-	-	Probable Anderson 1979
Phaethon lepturus	Layard 1867	-	-	Confirmed Carlson 1974
Sula leucogaster	Forster F & H 1870	-	-	Probable Jenkins

TABLE 3 (continued)

Species	First Recorded	Visitant	Passage Migrant	Breeding Status
Sula dactylatra	Jenkins 1973	-	-	Probable Anderson 1979
Sula sula	Forster 1844	-	-	Probable Carlson 1974
Fregata minor	Layard ? 1876	-	-	Probable Anderson 1979
Fregata ariel	Beck 1925	-	-	Probable Sibley & Clapp 1967
Stercorarius S. maccormicki	Jenkins	-	-	-
Stercorarius pomarinus	Jenkins	-	-	-
Stercorarius parasiticus	Jenkins	-	-	-
Sterna bergii	Anderson 1777	-	-	Suspected Jenkins
Sterna fuscata	Whitney Exp. 1925	-	-	Confirmed Whitney Exp. 1925
Sterna anaethetus	Layard 1876	-	-	-
Sterna lunata	Mayr 1945	Status unknown	-	-
Sterna sumatrana	Layard 1876	-	-	Confirmed Carlson 1974
Gygis alba	Forster 1844	-	-	Confirmed Carlson 1974
Anous stolidus	Forster F & h 1870	-	-	Confirmed Finsch 1877
Anous minutus	Layard 1876	-	-	Confirmed Carlson 1974
Procelsterna cerulea	Finsch 1877	-	-	-

In this study the Southern Royal Albatross has not been recorded near the area, but a Northern Royal *(D. e. sanfordi)* was seen once just south of Tongan waters at 24/177W on 15 May 1974.

Observations show that the Wandering Albatross is an irregular winter straggler to southern Tongan waters between July and November.

The sightings were:
In 23 S: one on 11/9/74; one on 11/9/76
In 24 S: one on 31/7/75; one on 9/7/76; two on 28/7/76; two on 17/8/74; two on 2/10/76; two on 20/11/76

All sightings were recorded using a modification of the plumage keys developed by Gibson (1967), the brownness of the inner upperwing being noted on a scale of 1 (all brown) to 5 (all white). All the birds recorded had innerwings that were wholly or almost wholly brown, the plumages generally conforming to Gibson's Figure 3 types A, B, C. This could suggest that they were young birds or birds from the Antipodes Islands (Warham & Bell 1979), the nearest breeding colony. Antipodes Islands birds are known to breed in this brownish plumage.

The nearest sighting of a Black-browed Mollymawk to Tongan waters was that of a subadult at 26/178W on 28 April 1976.

Wandering Albatrosses and Black-browed Mollymawks have been recorded in the Fiji Islands considerably to the north of the sightings here (Clunie *et al.* 1978). This may merely reflect the fact that more ships go to Fiji from the south than to Tonga, providing more opportunities for these birds to be drawn further north.

PROCELLARIIFORMES

GIANT PETREL *Macronectes* sp.

One bird, apparently the first record, was seen on 10 August 1967 in the Ha'apai Group (Jenkins 1967). I have since seen one at the entrance to Nuku'alofa Harbour on 30 July 1975 and another just south of Tongan waters at 24/177W on 31 July 1975. All three birds had dark almost black plumage and very light bills, suggesting that they were the young of the year dispersing from the breeding colonies. The Giant Petrel seems to be an irregular visitor to Tonga during the winter. Their northerly spread into the South-west Pacific during the winter has been shown by Jenkins *et al.* (1977).

CAPE PIGEON *Daption capense*

Cheshire *et al.* (1979) described the spread of the Cape Pigeon to the north of New Zealand during the southern winter but did not record Tongan sightings separately. The records in Table 4 are probably the first for Tonga and include birds seen close to the south of Tongan waters.

These sightings show that the Cape Pigeon occurs irregularly, especially in the south of the area, between July and September.

TABLE 4 — Cape Pigeon records.

Date	Number of birds	Position	Date	Number of birds	Position
July			September		
9.7.76	2	22/176W	1.9.74	1	15/172W
15.7.70	5	23/176W	11.9.76	2	24/177W
30.7.73	2	22/176W	21.9.78	1	15/172W
August					
12.8.73	2	24/177W			

WHITE-NAPED PETREL *Pterodroma externa cervicalis*

Since this petrel migrates to the Central Pacific during the non-breeding season (King 1970), it was expected in Tongan waters on passage. There seem to be no previous records, and of the few here, those seen in December in the south of the area could well be foraging from the Kermadecs. This may indicate that the main migration track of this species is to the east of Tonga. My first record for Tonga was on 26 December 1973 when two were seen just north of Vava'u; all records are included in Table 5.

South of Tongan waters the birds are widespread in summer, and sightings between New Zealand and the Pacific Islands have increased noticeably in recent years. It may be no coincidence that

TABLE 5 — White-naped Petrel records.

Date	Number of birds	Position	Date	Number of birds	Position
March			November		
6.3.75	1	22/176W	17.11.76	1	16/172W
24.3.75	1	22/176W			
June			December		
11.6.78	2	19/174W	7.12.74	1	15/174W
11.6.78	2	21/175W	11.12.74	2	19/174W
12.6.78	1	22/175W	20.12.74	2	20/175W
21.6.78	1	15/173W	26.12.73	2	18/174W
July					
13.7.75	2	20/175W			

this increase has occurred since the goats were cleared from Macauley Island in the Kermadecs in 1966 (Williams & Rudge 1969), which could now be the main breeding island.

PHOENIX PETREL *P. alba* and TAHITI PETREL *P. rostrata*

Eggs thought to be those of *P. alba* were collected on Hunga Tonga by Beck in July 1925 (Murphy 1952). W. R. P. Bourne (pers. comm.) doubts the identity of the eggs and has suggested that they are those of *P. a. heraldica,* which Beck found breeding on the island.

During this study I have found it very difficult to separate *alba* and *rostrata* as the white throat of the former is rarely visible at sea. Therefore I have recorded them as *rostrata/alba* except whenever the underwing was seen clearly enough to note either the presence or absence of the thin white line shown by Murphy (1952). Birds without this white line and therefore thought to be *rostrata* were mostly darker brown than *alba* and they appeared to be bulkier, as noted by Harper & Kinsky (1978). Generally *rostrata* has a very dark head, back and upper-wing, with a clear-cut division on the lower throat between the dark brown of the neck and the white of the belly. In *alba* the brown is less dark and the division on the lower throat less clear-cut. I have not been able to compare a range of skins of these birds, and so the separation in the following sightings is based on the above comments on field observations.

January:	1 *rostrata* at 20/175W on 7/1/79
March:	1 *rostrata/alba* at 21/175W on 24/3/75
April:	1 *rostrata* at 18/174W on 19/3/78
	1 *rostrata* at 21/175W on 16/4/79
	1 *alba* at 15/171W on 27/4/79
May:	1 *rostrata* at 21/175W on 30/5/74
June:	1 *alba* at 22/175W on 26/6/78
July:	1 *alba* at 21/175W on 10/7/78
	1 *rostrata* at 20/175W on 29/7/79
	1 *rostrata* at 19/174W on 26/7/76
	2 *rostrata* at 20/175W on 8/7/76
	1 *alba* at 20/175W on 8/7/76
	1 *alba* at 21/175W on 8/7/76
September:	1 *rostrata* at 22/176W on 1/9/74
October:	1 *rostrata/alba* at 18/174W on 31/10/77
December:	1 *rostrata/alba* at 20/175W on 29/12/74
	2 *rostrata/alba* at 21/175W on 29/12/74

Most of these sightings have been in the south of the area; other than that they form no obvious pattern. It is perhaps surprising that they seem to be present throughout the year.

MOTTLED PETREL *Pterodroma inexpectata*

This trans-equatorial migrant breeds on islands south of New Zealand and migrates as far north as the Bering Sea (Kinsky 1970).

TABLE 6 — Mottled Petrel records.

Date	Number of birds	Position	Date	Number of birds	Position
March					
16.3.78	1	14/171W	22.10.79	1	20/176E
			22.10.79	1	20/176E
April					
23.3.79	1	20/176E	22.10.79	1	20/176E
23.3.79	1	21/176E	25.10.79	1	14/171W
27.3.78	1	19/177E	25.10.79	1	14/171W
May			28.10.77	1	13/171W
10.5.79	2	16/179W	29.10.77	1	13/172W
October			30.10.77	1	18/174W
3.10.79	1	15/175W	30.10.77	1	18/174W
			30.10.79	2	19/174W

I have found no previous records for Tonga, and so the two seen at 18/174W on 30/10/77 may be the first. Table 6 is a full list of sightings about Fiji, Samoa and Tonga, and includes the first for Fiji (Clunie *et al.* 1978) and for Samoa.

From these few sightings the northerly migration appears to be more prolonged than the southerly migration, although in both Mottled Petrels seem to move in ones and twos rather than in flocks. King (1970) noted that in the Central Pacific " usually only one bird was seen at a time, and never more than two together." He also recorded that the southerly migration peak occurred in October.

One observation of possible significance was made well to the south of Tonga at 25/178W on 15 May 1979 of two separate Mottled Petrels flying northwards with migrating Sooty Shearwaters *(P. griseus)*.

KERMADEC PETREL *Pterodroma neglecta*

Kermadec Petrels have often been seen between Tonga and New Zealand, presumably birds foraging from the Kermadec Islands. They do not appear to visit Tonga regularly and I have found no previous records of them in Tongan waters.

Since Kermadec Petrels could be confused with other similar species known to occur in the area, I have tried to exclude the others by recording as Kermadec Petrels only birds seen to have white quills in the upperwing. Records are: March 1975 one at 20/175W; May 1975 three at 18/174W; August 1978 two at 22/176W; October 1979 one at 22/175W; December 1973 two at 22/176W.

TRINIDADE PETREL *Pterodroma arminjoniana heraldica*

Breeding in Tonga was proved at Hunga Tonga, Hunga Ha'apai when Beck and his fellow workers collected " young in the nest " on 24 July 1925 (Murphy 1952). This reference has been used in all books on the area, but I have found no fresh record of *heraldica* until one was caught aboard ship in Tongan waters on 16 July 1966 (Jenkins 1973). This bird was identified by W. R. P. Bourne from photographs and measurements. It was in an intermediate colour phase, which seems rare in Tonga where most of the birds seen are in the light phase. Murphy (1952) said that all 18 specimens collected by Beck and now in the Smithsonian Institution are of the light phase, though he warned that care must be taken with phases when the number of specimens is limited.

Carlson (1974) reported breeding on Fukave Island off Tongatapu. He stated that this colony was only 5-10 years old, having resulted from conservation measures taken by the owners of the island. He also claimed that the birds breed from December to February, which is contrary to other observations and requires confirmation.

My records for 1975 and 1976 are given in Turbott (1977). These and sightings since show that *heraldica* is in Tongan waters in relatively small numbers in the southern winter. They are usually seen in ones and twos with 15 the highest number seen together, this in a mixed feeding flock. All my sightings were between 5 March and 25 September with the exception of two single birds seen just north of 'Ata on 24 December 1979.

These records suggest that *heraldica* is a winter breeder in Tonga, arriving as the Wedge-tailed Shearwater *(P. pacificus)* is leaving the area, using the vacated Wedge-tailed breeding islands of Hunga Tonga and Hunga Ha'apai and moving away as the Wedge-tails return. King (1970) found that in the Central Pacific it " occurred fairly regularly but never in large numbers. It was seen most consistently between October and February — peak numbers were in December." King's birds may have been the Tongan population on migration, but many other Pacific populations could be the source of these Central Pacific sightings.

It would be unusual if the Tongan population were winter breeders as W. R. P. Bourne (pers. comm.) noted " Quite definitely at most sites *P. arminjoniana* seems to breed all the year round. The Whitney material indicates it for the Pacific, Murphy concludes it does so on S. Trindade in the Atlantic in ' Oceanic birds of South America,' and a series of published and unpublished recent observations indicate it does so on Round Island off Mauritius (in sharp contrast to the well defined southern summer breeding of the Wedge-tailed Shearwaters). There is no doubt about it." See *Postscript.*

BLACK-WINGED PETREL *Pterodroma nigripennis*

First recorded in Tongan waters when one was caught aboard ship in the Ha'apai Group on 28 November 1967 (Jenkins 1973). Records since then show that it is not uncommon in the southern summer, when it has been seen between 22 October and 11 June. The small numbers seen about Tonga compared with the much larger numbers seen between Tonga and New Zealand suggest wandering from the Kermadecs rather than a Tongan population. Recently one was seen inside Nuku'alofa Harbour less than a mile from the wharf.

Note: The following three **Pterodroma** species are notoriously difficult to identify at sea. A further complication in Tongan waters is the extreme variability of **brevipes**. The records of **leucoptera, longirostris** and **brevipes** should accordingly be regarded as tentative only.

GOULD'S PETREL *Pterodroma leucoptera*

There do not appear to be any previous records of Gould's Petrel in Tongan waters. Two birds thought to be of this species were seen in 1973, four in 1974, three in 1978, and seven in 1979. Sightings have been made in January, March, April, May, July and December. On 27 April 1979 one landed aboard ship at 16/172W, which I banded and released. Later the identification was confirmed by G. van Tets from photographs and measurements, although the same data suggested to W. R. P. Bourne that "it probably belongs to a local population of *brevipes*, but there is still much work to be done on that group."

STEJNEGER'S PETREL *Pterodroma longirostris*

Petrels thought to be of this species have been seen on three occasions. On 6 July 1976 two were seen that had white foreheads, black caps contrasting with grey backs, and upperwings that showed blackish M markings. On 25 June 1978 one was noted that had a black cap contrasting with a grey back, a white forehead and no sign of a collar. One seen on 20 July 1978 had a very active flight with constant flipping from side to side.

Though not recorded from Tonga previously, this petrel, which breeds at the Juan Fernandez Islands, ranges widely through the Pacific during the non-breeding season.

COLLARED PETREL *Pterodroma brevipes*

Petrels thought to be *brevipes* have been seen on eight occasions: January 1979 one at 19/174W; February 1974 four seen together with Black-winged Petrels at 22/176W; June 1978 one at 19/174W, one at 22/175W, three at 22/176W; September 1978 three at 15/172W; November 1976 two at 16/172W and two at 20/175W. I have found no previous records for Tongan waters, although the Collared Petrel is known to occur in Fiji.

WEDGE-TAILED SHEARWATER *Puffinus pacificus*

During its breeding season this is the most common shearwater in Tongan waters. Observations have shown that it is almost absent from the area during July-September, returning in large numbers by mid-October (Jenkins 1979). There is little in the literature about the breeding sites, although a small colony was recorded by Davidson (1931). Halunen (pers. comm.) found shearwaters which he thought were adult Wedge-tails on the ground during a daytime visit to Fonualei in January 1980. Carlson (1974) said " This bird is also readily seduced by wailing sounds and radio music and in Niuafo'ou and 'Eua, where the bird is known as ' manu'uli,' the people use this trait to their advantage by calling down birds only to whack them out of the air with long sticks to procure themselves a meal." See *Postscript.*

BULLER'S SHEARWATER *Puffinus bulleri*

Common in New Zealand waters, where it breeds at Poor Knights Islands from September to May (Jenkins 1974), after which it migrates to the North Pacific (Falla *et al.* 1979). The few records for Fiji, Samoa and Tonga suggest that the migration path both in and out of New Zealand waters lies well to the east of Tonga.

This large distinctive shearwater was recorded in Tongan waters apparently for the first time on 23 May 1972 when three birds were seen to the west of Vava'u (Cheshire 1974). During this study two birds were seen at 15/173W on 7 May 1975, and one at 20/175W on 14 May 1979. Buller's Shearwater is apparently an uncommon passage migrant through the area, and it has been seen only on its northward migration flight.

SOOTY SHEARWATER *Puffinus griseus*
SHORT-TAILED SHEARWATER *Puffinus tenuirostris*

The difficulty in separating these species when only one or two birds are seen is well known, and many observations were recorded as Sooty/Short-tailed, possible Sooty, etc. However, on many occasions large numbers allowed positive identification.

Both species occur in northern Tongan waters during September-November. Short-tails greatly predominate as their southerly migration path seems to pass close to the north of Samoa and through the Fiji Islands. Few are seen during the northerly migration, which appears to pass to the west of Fiji. King (1970) recorded the southerly migration flight of *tenuirostris* through the Central Pacific but did not see the northerly flight.

Sooty Shearwaters are fewer in northern Tongan waters during September-November as their southerly migration path probably passes well to the south-east of Tonga. They can be seen in large numbers during May as their northerly path appears to pass close to Tonga and just to the east of the Samoas. Both northerly and southerly migration flights were recorded in the Central Pacific by King (1970).

I have found no previous records of these shearwaters in Tongan waters.

AUDUBON'S SHEARWATER *Puffinus lherminieri*

First recorded by Murphy (1928) who reported a male collected 5 miles east of Fotu Manga. King (1967), in a list of Tongan seabirds, suggested that it is a non-breeding migrant. Jenkins (1973) reported a bird which landed aboard ship 7 miles north of Ofolanga Island, and a further sight record north of the Vava'u Group. Carlson (1974) reported birds on various Ha'apai Islands but could not find evidence of breeding.

Since 1973 this small, comparatively sedentary shearwater has been seen in Tongan waters each month, mostly near the Ha'apai Group and near 'Ata. Because the range at sea is usually within 100 miles of the breeding islands (King 1967) it probably breeds at both places.

HYDROBATIDEA

During this study only one storm petrel has been seen in the area. It appeared briefly on 3 March 1975 at 16/172W. It was noted as a large all-dark storm petrel with a white rump which suggests that it could have been either Wilson's *(O. oceanicus)* or Leach's *(O. leucorhoa)*.

PHAETHONTIDAE

[RED-BILLED TROPICBIRD] *Phaethon aethereus*

Gray (1859) described a skin of this species in the collection of the British Museum as being from Tonga. This is apparently the basis of its being recorded as a Tongan bird by Finsch & Hartlaub (1867), although in their Tongan paper of 1870 they cast doubt on the record and marked it " according to Gray." Graffe (1870) said " The *Tavaki* or *Lariki (P. aethereus)* seldom comes to Tongatapu but is common on the rocky islands of Honga or Hoga Hapai." The twin islands of Hunga Tonga and Hunga Ha'apai are now known to be a breeding place of the White-tailed Tropicbird *(P. lepturus)*, and it seems that Graffe did not see either bird but was reporting what he had been told by local people. The present Tongan name for the White-tailed Tropicbird is *tavake* (Carlson 1974).

The only naturalist who has reported seeing this bird in Tonga is Layard (1876). He reported three species of tropicbird *aethereus, lepturus* and *rubricauda* as being present.

It has not been seen during this study and King (1967) and W. R. P. Bourne (pers. comm.) seriously doubt the authenticity of the early records. Until further evidence is obtained it should be dismissed from the Tongan list.

RED-TAILED TROPICBIRD *Phaethon rubricauda*

Gray (1859) recorded this bird from " Tonga Islands (Pylstaarts or La Sola Island)." This is the southernmost island of Tonga and is now known as 'Ata. Finsch & Hartlaub said that it occurred in Tonga in their book of 1867, but cast doubt on it in 1870, marking it " according to Gray." Layard (1876) reported seeing the Red-tailed Tropicbird in Tonga.

More recently Mayr (1945) and King (1967) referred to it as a breeding bird but offered no evidence. Carlson (1974) noted that it was less common than the White-tailed and implied that it may breed on some of the rarely visited islands. Anderson (1979) thought that it might breed on 'Ata where he saw small groups of 2-12 roosting (pers. comm.).

Up to now there is no evidence that it breeds in Tonga although the two records from 'Ata, over 200 years apart, suggest breeding there.

The few sightings at sea show that it is uncommon in Tongan waters, and since 1973 I have seen it only eight times. Records are: 1/3/74 one at 15/176W; 12/5/75 one at 22/176W; 12/6/78 one at 20/175W; 10/7/78 one at 21/175W; 27/8/78 one at 22/176W; 31/8/74 one at 20/175W; 8/9/76 one at 17/173W; 25/10/76 one at 15/174W. Five of these sightings are in the south of the area and so are close to 'Ata.

Red-tailed Tropicbirds are rarely seen in Fijian waters and breeding there has yet to be proved. Tarburton (1978) found the White-tailed breeding at widely separated sites in Fiji, but did not mention even seeing the Red-tailed.

The few Red-tailed Tropicbirds seen in Fijian and Tongan waters could come from 'Ata, if it is indeed a breeding island, or from the known breeding stations at the Kermadecs, Norfolk or Lord Howe. That these birds are capable of such wanderings is shown by the recovery at Gunners Quion Island, north of Mauritius, of a bird banded off Sumatra some 2700 n. miles distant (Jenkins & Robertson 1969).

WHITE-TAILED TROPICBIRD *Phaethon lepturus*

The White-tailed is the common tropicbird of Tonga, although it seems to have been misidentified by the early explorers. It was first noted by Layard (1876) as *P. candidus,* and he obtained an egg thought to be of this species from 'Eua. This record was repeated by Finsch (1877) who referred to the bird as *P. flavirostris.* The next recorded sighting was, apparently, that of Fry (1966) who saw it at Vava'u. King (1967) gave it as a breeding species for Tonga, as did Carlson (1974) who stated that it occurs on all the islands of Tonga, confirming breeding at Tafahi.

During this study, White-tailed Tropicbirds were seen in every square visited, throughout the year with little variation in numbers. Over 90% of observations were of single birds, six being the highest

number seen together. They have not been recorded in the mixed feeding flocks frequently met with in the area. Indeed, on many occasions they were seen to fly past such flocks, apparently ignoring the opportunity to feed. From this and other observations, the main food taken during the day seems to be flying fish, and the birds are often seen diving down to attack fish which are in the air. By day they are regularly seen resting on the sea surface, even in quite rough weather.

SULIDAE

Gray's (1859) Tongan records of boobies seem to be based on Forster's observations and note only one species *Sula (piscatrix) piscator* = *S. sula* as occurring there. His many references to *S. fiber* = *S. leucogaster* and a long list of islands where it was known to occur do not include Tonga. Finsch & Hartlaub (1870) said that *Dysporus sula* = *S. leucogaster* was recorded in Tonga by Forster, and suggested the presence of *Dysporus piscator* = *S. sula* (1867, 1870). Both species were reported by Layard (1876) without comment. A specimen of *Dysporus sula* = *S. leucogaster* was obtained from 'Eua and described by Finsch (1877).

The next reference to boobies in Tonga appears to be that of King (1967) who gave the Brown Booby as breeding and the Red-footed as visitant. Jenkins (1973) reported seeing all three species of South-west Pacific boobies off Vava'u. Carlson (1974) noted Red-footed Boobies breeding at Tafahi and suggested that the Brown Booby may breed at Vava'u. Dhondt ,1976) saw an adult and two immature Red-footed at Vava'u. A. John Halunen (pers. comm.) on a visit to Fonualei in January 1980 recorded "boobies" with young in white fluffy down.

BROWN BOOBY *Sula leucogaster*

These are seen in relatively high numbers between Late and Vava'u and about 'Ata, and since they are present all year, they probably breed at Late, Fonualei and at 'Ata. See *Postscript.*

At sea they are frequently seen sitting on floating logs and other debris, and this habit probably explains why they regularly settle on the buoys and reef markers at harbour entrances.

BLUE-FACED BOOBY *Sula dactylatra*

By far the rarest booby in Tongan waters, the Blue-faced was noticed, apparently for the first time in Tonga, off Vava'u in 1967 (Jenkins 1973). Since then small numbers of both adults and sub-adults have been regularly seen near 'Ata. Sea observations suggest that if breeding does occur in Tonga it would be at 'Ata. Anderson (1979) thought he saw Blue-faced breeding at 'Ata, and he said (pers. comm.) "... Masked Boobies living on the cliff edge at the south of the island. This colony of between 30 and 50 individuals had shallow holes in the soil which I took to be nests. Elsewhere around

the cliff edge small groups (2-4 individuals) of boobies under the foliage and some also seem to be occupving holes and crevices under boulders on the north side about 5 m above sea level."

It is hard to understand why Anderson did not find other species of booby at 'Ata, as both Red-footed and Brown Boobies are seen offshore in much greater numbers and more often than Blue-faced.

Blue-faced Boobies have been recorded in Tongan waters in all months except January, August and October, which suggests that they are present throughout the year.

RED-FOOTED BOOBY *Sula sula*

By far the most numerous booby in Tonga, it is present throughout the year with no obvious peaks. Jenkins (1973) suggested that Late was a breeding island, and further observations support this. The numbers of birds regularly seen near 'Ata suggest that it also is a breeding island. See *Postscript*.

FREGATIDEA

GREATER FRIGATEBIRD *Fregata minor*
LESSER FRIGATEBIRD *Fregata ariel*

Layard (1876) reported *Tachypetes aquilus* = *Fregata minor*, although from the text he seemed to be referring to frigatebirds in general. The first specific reference is that of the Whitney South Sea Expedition. Speaking of *ariel*, they recorded "half a dozen found roosting" and collected a female "with gonads enlarged" at Fatumanga on 8 August 1925 (Sibley & Clapp 1967). King (1967) said that *ariel* may breed but did not mention *minor* in relation to Tonga. Jenkins (1973) said that no frigatebirds had been seen in Tonga. Carlson (1974) said that the status of *minor* was not known and, without evidence, said that *ariel* is much more common in Tonga. Dhondt's (1976) report of an adult female *minor* over Nuku'alofa may be the first definite published sighting of this species from Tonga. Anderson (1979) said that at 'Ata *minor* was commonly seen and that it may breed.

Since 1973 both species have been seen in Tongan waters. To avoid misidentification and the confusion that was noted between these two species in Fiji (Clunie *et al.* 1978), only birds that were seen well and that were clearly adult were allocated to species. Distant birds, immatures and birds which appeared subadult were recorded as ? species. Records are: *ariel* definitely on 20 occasions for a total of 24 birds; *minor* definitely on 7 occasions for a total of 8 birds; ? species on 23 occasions for a total of 109 birds. The large number of ? species includes an observation of about 60 birds seen flying over Fonualei on 29 September 1976.

Both species therefore occur in Tonga, and these observations suggest that *ariel* is more often seen than *minor*. Confirmation is

needed for the probable breeding sites at Fonualei and 'Ata. See *Postscript.*

STERCORARIIDAE

I have found no previous records of skuas, and my own few sightings indicate that they are rare in Tongan waters.

ANTARCTIC SKUA *Stercorarius maccormicki*

A large skua much lighter in overall colour than the Southern Great Skua *(S. skua lonnbergi)* was seen on 7 December 1974 at 15/173W; it was noticeably straw coloured about the neck. Two other birds thought to be of this species have been seen closer to Samoa.

POMARINE SKUA *Stercorarius pomarinus*

One bird was seen on 7 December 1973 and one on 27 December 1973, both near 'Ata at 22/176W; one on 26 October 1977 at 18/173W.

ARCTIC SKUA *Stercorarius parasiticus*

One on 14 May 1979 at 20/175W.

STERNIDAE

The records of the commoner terns and noddies are so numerous that a fuller analysis of their distribution in Tongan waters is in preparation.

CRESTED TERN *Sterna bergii*

The confusion that existed concerning the first record of the Crested Tern from Tonga has been cleared by Medway (1979), who showed that it was first described from Tonga by William Anderson, the surgeon of the *Resolution* during Cook's third voyage, under the name *Sterna crestata.* There is a drawing in the British Museum (Webber folio 121) inscribed " J. Webber del 1777 Friendly Isles " (Lysaght 1959) and Medway (pers. comm.) notes that " A specimen of the Crested Tern from the ' Friendly Islds ' was taken back to England and went into the collection of Sir Joseph Banks. It may have been one and the same bird as that described by Anderson and drawn by Webber."

Finsch & Hartlaub listed the species as present in Tonga in their 1867 book but not in their paper of 1870. It was seen in Tonga by Layard (1876), and Finsch (1877) described a specimen from 'Eua. Mayr (1945) said that it occurs in Tonga. King (1967) said that it may breed. Jenkins (1973) reported small numbers at Nuku'alofa and at Ha'apai. Carlson (1974) noted some behaviour patterns. Dhondt (1976) said it is " regularly seen in small numbers over lagoons and reefs in Tongatapu and Vava'u."

This large tern is rarely seen offshore and my sightings have mostly been in Nuku'alofa Harbour where two or three are always

present. Though it must breed in Tonga, the actual sites have yet to be found. In Fiji, although it is common and much more critical bird study has been done, breeding was not confirmed until 1975 (Clunie *et al.* 1978).

[ROSEATE TERN] *Sterna dougallii*

Gray (1859) recorded it as *S. gracilis* from the " Tonga Islands." Finsch & Hartlaub repeated this in their 1867 book, but in their paper of 1870 they omitted it from the Tongan list marking it " according to Gray," thus casting doubt on Gray's specimen. Layard (1876), who noted that Finsch & Hartlaub gave it as occurring in Tongatapu, apparently did not see it. Gray's doubtful record persists in the literature with suitable warnings that it was unlikely to occur, but the Roseate Tern has not been reported from Tonga since. There is little evidence that it has ever occurred there, and so it should not be on the Tongan list.

SOOTY TERN *Sterna fuscata*

A common bird in Tongan waters, although I have found no early records of its being seen there. The first reports appear to be those of the Whitney South Sea Expedition, and Ashmole (1963) listed Sooty Tern specimens taken by the Whitney Expedition. The labels noted " nesting " 15 August 1925 on Fonualei, 1 August 1925 on Tokulu, 24 July 1925 on Hunga Ha'apai (many nesting on this last). Mayr (1945) said that Sooty Terns occur in Tonga, and King (1967) said that it may breed. Carlson (1974) suggested incorrectly that " It doesn't appear to be as abundant in Tonga as elsewhere." A. John Halunen (pers. comm.), during his short visit to Fonualei on the morning of 31 January 1980, noted " Near the top of the volcano was a very large colony of Sooty Terns. There were many eggs concentrated near the very top, in and near the vent area. Young birds, many of them just able to fly, were concentrated just below the top. It appeared that the young, shortly after hatching, moved down the volcano perhaps 100-200 feet, possibly because of the very large number of individuals incubating eggs in the vent area." Halunen also said that while it had been impossible to get any real idea of numbers, he would guess that the total may have been 100 000+. See *Postscript*.

It is interesting to note the breeding dates on Fonualei, 15 August in 1925 and 31 January in 1980.

Sooty Terns have been seen in almost all squares visited, although they are not present all year and the records need further analysis. The highest numbers have been seen near Fonualei and Toku and I commented on this in a previous paper (Jenkins 1973).

BROWN-WINGED TERN *Sterna anaethetus*
GREY-BACKED TERN *Sterna lunata*

I rather doubt my ability to separate these terns from Sooties at sea when, and if, they flock together in mixed feeding flocks.

The Brown-winged Tern seems to have been first recorded by Layard (1876) as *S. payana*. Mayr (1945) said that the species was reported from Tonga. King (1967) reported it as " visitant — may breed." Carlson (1974) seemed to repeat King's comment without adding to it. During this study only 10 observations have been made totalling 15 birds thought to be of this species, all close to land.

The Grey-backed Tern was first reported in the literature by Mayr (1945), who said it was common in Tonga. King (1967) reported it as " visitant — may breed." Carlson (1974) said that it was known to breed in Tonga. It has not been seen during this study, but this may reflect my inability to identify it.

BLACK-NAPED TERN *Sterna sumatrana*

First recorded in Tonga by Layard (1876) as *S. melanauchen*. Mayr (1945) said that it occurred in Tonga, but the next actual sighting appears to be that of Fry (1966) who saw " three pairs " at the entrance to Vava'u. King (1967) described it as " visitant — may breed." Carlson (1974) gave the first breeding record and commented " . . . but in any case there are probably few colonies of this bird in Tonga. Throughout the Islands I have found only one, possibly two, small breeding colonies in Ha'apai during April. All the nests I observed were placed on rock ledges on a cliff and comprised of small pebbles surrounding a bare rock area where the eggs were laid. The eggs which were laid two to a nest, with a few nests having only one egg, were small, ovate, and pointed at one end with a white base colour covered by blotches of brown, rust and dark grey." Dhondt (1976) recorded three Black-naped Terns at Vava'u. See *Postscript*.

My five records, which were made at or near Nuku'alofa wharf, were 26 August 1978 one probably immature as it had greyish brown marks at the fore-end of the upperwing; 11 September 1978 one adult; 26 September 1978 one which appeared immature; 15 April 1979 one adult; 8 October 1979 one adult.

WHITE TERN *Gygis alba*

First recorded by Forster (1844) as *Sterna candida* during Cook's second voyage. The localities given were Tongatapu and 'Eua, and the second voyage ships were at these islands in October 1773. It was also recorded at Tongatapu by Peale during the American Exploring Expedition (Hartlaub 1852). Forster's observations seem to be the source of the record in Finsch & Hartlaub's 1867 book. In their 1870 paper they repeated this record and added that it had been seen in Tonga by Graffe, although they omitted Peale's record. Graffe (1870) noted the birds in the forests of Tongatapu. Layard (1876) collected specimens at 'Eua and Tongatapu, and Finsch (1877) described a specimen from 'Eua. Fry (1966) reported it as common in Vava'u, and King (1967) gave it as a breeding species. Carlson (1974) said " The White Tern undoubtedly frequents every island in Tonga and probably breeds on most, if not all, of them." Carlson also said " The

main breeding season seems to be in December and January, although no doubt spreads over a few more months." Dhondt (1976) recorded White Terns at Tongatapu.

During this study White Terns have been seen throughout the year and in 22 of the 26 squares visited.

BROWN NODDY *Anous stolidus*

Finsch & Hartlaub (1870) noted that this bird had been found in Tonga by Forster, apparently the source of the record in their 1867 book. The journal of William Anderson contains a mention of " common noddy's " *(sic)* met with in Tonga in 1777 (Beaglehole 1967). This could have been *A. stolidus* if it was appreciated then that two species of noddies occurred there. Layard (1876) saw it, and Finsch (1877) described three specimens collected by Hubner at 'Eua, about which Finsch said " according to Mr Hubner this species breeds on the rocks on the east side of 'Eua." King (1967) recorded it as a breeding species. Jenkins (1973) said it was frequently seen.

Carlson (1974) in an interesting note on noddies in Tonga said " These birds may possibly breed in small numbers throughout the year, but the general breeding season of these two species, as well as most of the seabirds in Tonga, is during the months of December, January, and extending on until the birds are ready to leave the nest. Their breeding sites are mainly restricted to small uninhabited islands or the more secluded areas of those larger islands which are inhabited. Both birds build their nests in trees. The Black Noddy prefers branches of broad-leafed trees or clumps of leaves of pandanus trees, while the Brown Noddy is more commonly found nesting at the base of a coconut leaf or on ledges of rocky cliffs. The nests themselves are well constructed, composed of leaves, and small sticks and twigs, and normally only one egg is laid in each nest . . . Many times both species will breed together on the same island . . ." Dhondt (1976) recorded Brown Noddies in Tongatapu and Vava'u. Halunen (pers. comm.) found that at Fonualei on 31 January 1980 Brown Noddies had young which " ranged in development from totally in fluffy down to plumage complete enough to begin flying." See *Postscript.*

They have been seen throughout the year in 17 of the 26 squares visited during this study, usually further out to sea than the Black Noddy.

BLACK NODDY *Anous minutus*

The first record appears to be that of Layard (1876) who reported it as *Anous leucocapillus,* and said that he had seen the Brown Noddy at sea off the islands and that the Black Noddy was common even in the harbour at Nuku'alofa, an observation that is true today. Fry (1966) recorded the Black Noddy and almost certain breeding because he saw empty nests and immature birds at Vava'u on 26 June 1966. King (1967) recorded it as a possible breeder. Jenkins (1973)

said it was common throughout the Tongan Islands. Carlson (1974) recorded breeding in his note on Tongan noddies. Dhondt (1976) recorded it as "fishing much closer to the coast than the Brown Noddy." See *Postscript.*

In this study it has been recorded throughout the year in 10 of the 26 squares visited and almost always close to land.

GREY TERNLET *Procelsterna cerulea*

Finsch (1877) described two specimens of what he called *Anous albivittatus* = *P. cerulea* from 'Eua and said that it was a new species for Tonga. Mayr (1945) reported it as present in Tonga. Oliver (1955) reported it as breeding in Tonga. King (pers. comm.) noted that "... Oliver's mention of Blue-grey Noddies breeding in Tonga was the source of the listing in my identification manual." In 1973 I reported birds seen near Vava'u which could have been of this species, an observation about which I now have considerable doubt. Carlson (1974) said that its status in Tonga was unknown.

Grey Ternlets have been definitely seen three times during this study. Two of the sightings were near 'Ata where there were four birds on 27 December 1973 and two on 24 December 1979. One bird was seen near Tafahi at 15/173W on 1 March 1978. These appear to be the first records since Finsch (1877). Evidently these ternlets are rare in Tongan waters.

BREEDING ISLANDS

There are known breeding sites in the remoter parts of the inhabited islands, and there are probably several hundred small islets and stacks which could provide sites for small seabird colonies. It is, however, likely to be the larger more distant offshore islands, offering a variety of habitats, that are most important to the survival of the seabird population.

The islands of Kao and Late are uninhabited, although they are visited to collect copra. Both are high, well wooded, and appear to be suitable breeding islands. From observations made at sea it appears that Late could have a large colony of Red-footed Boobies and fewer Brown Boobies. Tofua is thinly populated but birds could breed on its high steep slopes without disturbance.

Sea observations and what little there is in the literature suggest that the most important breeding islands are Fonualei, the twin islands of Hunga Tonga and Hunga Ha'apai, and 'Ata.

Fonualei

This volcanic island rises to a well-defined peak about 182 m high. It suffered a major eruption in 1847. In January 1980 Halunen (pers. comm.) found that "Around the present crater were cracks several inches across from which steam and other gases were being expelled. Sulphur was being deposited near the exhalations. The

floor of the most recent vent was quiet. Some vegetation is growing in the vent area." Referring to Fonualei, the *Pacific Island Pilot* (1969) noted " . . . but no inhabitants are permitted by the Tongan Government to reside there on account of its liability to eruption. The island is visited occasionally by islanders from Vava'u."

Seabirds known to breed on the island include Wedge-tailed Shearwater, " Boobies," probably Red-footed and Brown, Sooty Tern and Brown Noddy. Those thought to breed include Audubon's Shearwater, White Tern, and possibly both Greater and Lesser Frigatebird.

Hunga Tonga and Hunga Ha'apai

The uninhabited islands of Hunga Tonga (149 m above sea level) and Hunga Ha'apai (121 m) lie about one n. mile apart. Both are rocky and steep, with sheer cliffs and thin vegetation.

Seabirds known to breed are Trinidade (Herald) Petrel, Wedge-tailed Shearwater and White-tailed Tropicbirds. Audubon's Shearwater and White Tern probably breed there, and there has been a suggestion that the Phoenix Petrel breeds there also.

'Ata

'Ata was named Pylstaert* by Abel Tasman who, in 1643, was the first European to sight the island. It is well wooded, about 289 m high, and off the southern end has two large stacks, 121 m and 91 m high. These stacks appear to be ideal seabird breeding sites. The *Pacific Islands Pilot* (1969) recorded " The island has been uninhabited since 1865 when the islanders were taken off and re-established on 'Eua Island, in the Tongatapu Group, on the orders of the then King of Tonga, to prevent further depredations by 'blackbirders'." Anderson (1979) described the archaeology of the island.

Seabirds which may breed are Audubon's Shearwater, Red-tailed Tropicbird, Brown, Red-footed and Blue-faced Booby, Greater Frigatebird, Brown Noddy and White Tern.

CONCLUSION

There has never been a full survey of either landbirds or seabirds in Tonga. Little has been published to indicate population numbers, and there is nothing to show whether species known to occur are increasing or decreasing. There is no information on what non-avian predators are present — it has yet to be established what species of rats occur on the various islands.

At present there is no Tongan Wildlife Service. If and when

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* The name Pylstaert is used on the British Admiralty chart. However, the correct Dutch is **Pijlstaert**. The name was given "*because there were* so many **Pijlsteerten.**" **Pijlstaert** literally means arrow-tailed and is used to denote the fledged end of the arrow. If it referred to birds it is difficult to know what species was meant.

such a service is formed, even with outside assistance, time will be needed to ensure the availability of trained personnel before the primary task of surveying hundreds of islands can begin.

Fortunately there are large uninhabited offshore islands where seabird breeding apparently continues unhindered. If one or more of these islands could be declared sanctuaries immediately, the areas concerned would remain undisturbed, in spite of the increasing human population and the need of more land for agriculture, until facilities are available for systematic bird study to begin. Four islands in particular appear to deserve consideration on present information — Fonualei, Hunga Tonga, Hunga Ha'apai and 'Ata.

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Speculation and opinion in this paper are my own.

POSTSCRIPT

Since this paper was prepared I have received the following important notes on Tongan seabirds from David Todd, who was in Tonga for about 14 months during 1978-1980 studying the Niuafo'ou Megapode *(Megapodius pritchardii)* and was able to visit many of the islands of Tonga.

P. a heraldica

Todd saw these birds in " hundreds " flying close to Hunga Tonga and Hunga Ha'apai in August 1979. In February 1979 he saw " large numbers around the small islands to the north of the eastern end of Tongatapu, and between Tongatapu and 'Eua. Two were seen flying high over the southern tip of 'Eua during the day. On 31 March 1979 there were many near Fonualei . . ." It is interesting to note that Fakave, the island where Carlson (1974) suggested that summer breeding occurred, is one of the small islands to the north of the eastern end of Tongatapu. These observations correct my statement that the bird occurs " in relatively small numbers " and indicate summer breeding.

P. pacificus

On 31 March 1979 Todd noted " one almost fledged young was found in one of the many burrows on Fonualei."

Sula leucogaster

He saw them on or near all the islands visited and added " In August 1978 a few were seen on the cliffs at Hufangalupe, Tongatapu. Over 100 were seen around the Hungas during the same month. In February 1979 more than 30 were on the cliffs in the south of 'Eua. On 31 March 1979 more than 50 moulting adults and fledged young were seen on one boulder beach on Fonualei."

Sula sula

Todd saw them throughout Tonga except around Tongatapu and 'Eua. He recorded that " In August 1978 many were in the trees on the two Hungas. It was not possible to land to confirm breeding. On 31 March 1979 they were seen building nests in the trees on Fonualei and Toku."

Fregata sp.

He recorded frigatebirds " throughout Tonga and in cases where I could identify the species, more proved to be *F. minor* than *F. ariel.* On 31 March 1979 male Greater Frigatebirds were seen displaying on Fonualei."

Sterna fuscata

Todd saw " thousands " circling above Hunga Ha'apai on 21 August 1978 and above Fonualei on 31 March 1979.

Sterna anaethetus

Birds thought to be of this species were occasionally seen off Tongatapu and Vava'u in February, March, and May. However Todd said that he could not be sure that the birds were not *lunata.*

Sterna sumatrana

Seen off Tongatapu and Vava'u, and on 17 May 1980 Todd saw an adult feeding a fledged young bird on Onevai Beach off Nuku'alofa.

Anous stolidus

He saw a nest with an egg at Hufangalupe in August 1978, and nests with eggs and young at all stages of development were found at Toku on 31 March 1979.

Anous minutus

Recently fledged young were seen on Toku 31 March 1979.

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SHORT NOTE

NORTHWARD MIGRATION OF SHORT-TAILED SHEARWATERS IN THE TASMAN SEA

On 25 April 1980, the *Union Rotorua,* bound from Sydney to Auckland, encountered migrating Short-tailed Shearwaters *(Puffinus tenuirostris)*. The ship's course was 092° with a speed of 18 knots. From 14.55 to 14.58 hours in position 33°48'S 158°29'E (357 miles east from Sydney Heads), the ship passed across a dense stream of migrating Short-tailed Shearwaters flying very fast at about 40-50 knots, 3-15 m above sea surface. During the 3 minutes at 14.55-1458 hours, birds were counted crossing the bow at a rate of about 1000 per minute. This density of birds extended along their track to the limit of binocular vision. From 14.58 to 1520 hours birds crossing the bow averaged 50 per minute, and thereafter until darkness only occasional small flocks were seen.

All the birds were flying on a course of about 030°, aided by a favourable 25-knot wind from 165°. Their course from the position at 1455 hours would take them about 20 miles south-east from Balls Pyramid, Lord Howe Group, and thence to the south-east corner of New Caledonia.

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