

CRC REEF RESEARCH TECHNICAL REPORT

POPULATIONS, MOVEMENTS AND SITE FIDELITY OF BROWN AND MASKED BOOBIES ON THE SWAIN REEFS, GREAT BARRIER REEF, AS SHOWN BY BANDING RECOVERIES

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FOREWORD

Seabirds are a significant fauna of the Great Barrier Reef. About 700 000 pairs of 22 species are estimated to breed on the Reef islands, including significant proportions of many of the Australian breeding populations. However, life is becoming more problematic for seabirds on the Reef. In a number of places they now share their breeding islands with resort guests, campers and day visitors. Some, such as black noddies and wedge-tailed shearwaters appear to be coping and in places even increasing in numbers in the presence of people. However, the large majority are very sensitive to human disturbance and breeding numbers have declined on a number of islands, in some places resulting in abandonment of original breeding locations.

The scale of threats to seabirds on the Great Barrier Reef appears to be ever-expanding. Modern technology and mass transportation is providing for ever-increasing numbers of people to experience the wonders of the Reef. Although the changing Reef visitation scene may have adverse impacts on seabirds, the impacts may not be readily apparent. The main criterion for identifying an adverse impact that is underway is a decline in the number of birds present. Often this can only be revealed through long-term studies of populations. Such is the nature of the Swains Reef seabird data analysed in this report commissioned by the CRC Reef Research Centre.

My first contact with Paul O'Neill was in 1992, when he spoke of a desire to analyse the wealth of data from the remote Swains Reef area which had been assiduously collected over the years by Professor Harold Heatwole and his co-workers. Although I have not met Professor Heatwole, time has proven that both he and Paul had the necessary commitment and dedication for the project to succeed. Under funding from CRC Reef, Paul spent six months in the United States of America working on the data with Professor Heatwole and his colleagues. The analyses combined with their excellent field knowledge of the Swains has enabled the value of the accumulating data to be realised.

All involved with the project should be commended. The results will be most useful in future planning and management of the seabirds in this special Reef area.

Tony Stokes
Threatened Species Program
Great Barrier Reef Marine Park Authority

1. SUMMARY

Significant declines in the population size of the brown booby (*Sula leucogaster*) have recently been reported from the Swain Reefs (Heatwole et al. in review), as indicated through direct censuses of the populations over a period of more than ten years. During the same period of time, the population of the sympatric masked booby (*Sula dactylatra*) did not vary greatly. This paper reports on an extensive mark/recapture program of the same populations. The two species were banded and recaptured in the area for more than ten years.

Strong breeding colony fidelity has been demonstrated for both species in other parts of the world, leading to the suggestion that little gene flow occurs between geographically separate populations. These suggestions are supported by the present analysis of banding recoveries from the Swain Reefs, and other locations on the Great Barrier Reef and in the Coral Sea. In both these species, strong breeding colony fidelity appears to occur within the regional populations scattered over this broad area, but breeding site fidelity is weaker within the breeding populations of the closely spaced meta-population in the Swain Reefs. This suggests that some flexibility in management of human visitation is possible where closely spaced meta-populations of these species occur, but that displacement of a regional population may result in permanent loss, with little chance of re-colonisation from other regional populations.

Most of the extra-limital recaptures of both species were young birds. Masked boobies banded in the Swain Reefs were mostly recaptured along the Queensland coast, whereas brown boobies were mostly recaptured along the coasts of Papua New Guinea and in the Solomon Islands. This may indicate that only the young birds of these species disperse large distances, and that there are substantial differences in the between-species dispersal patterns. These differences may be relevant in explaining why a significant population decline occurred in the brown booby and not in the sympatric masked booby, but this requires further work.

2. INTRODUCTION

Two species of the family Sulidae, the brown booby (*Sula leucogaster*) and the masked booby (*Sula dactylatra*) occur and breed sympatrically on the small coral sand cays of the Swain Reefs, Queensland, Australia (Fig. 1). Subtle differences in breeding habitat preferences, prey and foraging habits, have apparently evolved in ways that allow these congeneric species to co-exist in close proximity (Nelson 1978).

Both species occur around the tropical oceans of the world, with the brown booby reportedly the most widespread and common booby species (Nelson 1978; Marchant & Higgins 1990), although this status has been questioned (Harrison 1990). The masked booby breeds on 11 islands on the Great Barrier Reef, eight of which occur in the Swain Reefs (Limpus & Lyon 1981, King 1993; O'Neill & Heatwole 1996, Heatwole et al. in review). The brown booby breeds on 24 Great Barrier Reef islands, including nine in the Swain Reefs (Limpus & Lyon 1981, Lane & Heatwole 1991; King 1993; O'Neill & Heatwole 1996, Heatwole et al. in review). The brown booby extends its geographical range beyond that of the masked booby on the Great Barrier Reef, breeding on East Hoskyn, and East and West Fairfax Islands in the Capricorn and Bunker Group, 210 kilometres to the south of the Swain Reefs.

Both species are known to disperse or migrate for long distances (Nelson 1978), and in Australia have been reported to move northward from breeding sites, particularly as young birds or when not breeding (Marchant & Higgins 1990). One possible implication of such long-distance movements is that gene flow may occur regularly between sub-populations within each species. It has been suggested, however, that very little gene flow occurs between many booby colonies because of strong breeding site fidelity (Anderson & Ricklefs 1992). Colony fidelity in both species has been observed in many parts of the world (Nelson 1978), although no information is available from Australia.

Trends in population sizes of both species in the Swain Reefs have recently been compiled (Heatwole et al. in review). Over a ten year period the Swain Reefs population of the brown booby declined markedly, while that of the masked booby remained stable. Reductions in prey availability, linked to El Niño-induced changes in sea surface conditions, were identified as possible influences, with the masked booby perhaps less affected because of differences in feeding ecology. Breeding in both the masked and brown booby was interrupted on Christmas Island (Schreiber & Schreiber 1984), and in the masked booby in the Galápagos (Gibbs et al. 1987) during the 1982-83 El Niño Southern Oscillation.

This paper analyses data collected while banding and recapturing masked and brown boobies in the Swain Reefs, Australia, from 1985 to 1994. In particular, these data were investigated for further evidence of the brown booby population decline indicated by direct censusing (Heatwole et al. in review), and for evidence of colony fidelity and dispersion as suggested by the literature.

Figure 1: Map showing locations of the Swain Reefs cays.

3. METHODS

Masked and brown boobies breed on nine coral cays within the Swain Reefs complex (see Heatwole et al. in review), although only seven are included in the current study. Riptide and Distant Cays are further north and more remote than the other cays, and could not be accessed regularly. The remaining seven cays, Bell, Bacchi, Thomas, Price, Frigate, Bylund and Gannet, were visited at six-monthly intervals (July and January) for ten years. For various reasons, however, trips were not completed in July 1990, January 1991, January 1992, January 1993 and January 1994. An additional trip in March 1994 was completed. Banding was carried out on the trip in July 1989, but records were incomplete.

Banding was carried out at night, timed to coincide with the rising tide to allow access over the reef flat and enough time to complete the work before the ebbing tide again exposed the reef.

Brown and masked boobies were captured by hand while temporarily confused by the light of headlamps. The banders systematically worked the width and length of each island, capturing as many birds as possible. Birds sitting on eggs or chicks without down were not captured, however, as the risk of mortality was considered too great. After banding was completed on the island, attempts were made to capture birds on the beach. Large numbers of birds, particularly brown boobies, were sometimes present in this area. The capture rate was generally low, however, because they were not attached to nest sites and tended to take flight on approach.

Captured birds were recorded as either chicks (young birds still at nest), immatures (fledged, but without adult plumage) or adults, based on the plumage patterns described by Nelson (1978). Using these categories, chicks are less than one year old, immatures between one and three years, and adults greater than three years of age. It was accepted that adult plumage is attained between 32 and 33 months in both brown and masked boobies (Marchant & Higgins 1990).

Capture effort was considered to be equivalent for each capture period. This was difficult to gauge accurately, but the same capture procedure was used on every trip and the skills of the principal bander and catcher were equivalent. Capture success was probably lower on moonlit nights as birds took flight more readily.

Birds were banded on the right tarsus using stainless steel bands provided by the Australian Bird and Bat Banding Scheme (ABBBS). These strong bands showed no tendency to work loose or corrode even after ten years, and we therefore assume that little band loss occurred during the period of the study.

Data were lodged with the ABBBS in Canberra. Estimates of population size were calculated for both species at each sampling time, using only data from birds banded as adults. Model A of the Jolly-Seber mark-recapture procedure was used, which allows probabilities to vary over sampling periods for data that contain only one age class (Pollock et al. 1990).

4. RESULTS

4.1. Numbers of birds banded, recapture rates and age at first breeding

During the period 1985 to 1994, 2044 brown boobies and 1817 masked boobies were banded on the Swain Reefs cays (Table 1, Appendices 1 to 16). From these total numbers of banded birds, 339 brown booby and 728 masked booby recaptures (including multiple recaptures) were made during the same period. Only 287 brown boobies (14%), compared with 530 masked boobies (29%), were recaptured at least once. Masked boobies were recaptured up to four times (five individuals), and brown boobies up to three times (six individuals). Recapture rates of the masked booby (total recaptures and recaptures at least one, two or three times), were significantly higher (χ^2 , $df=1$, $P<0.01$) than for the brown booby (Table 1).

Table 1: Total numbers of brown and masked boobies banded and recaptured in the Swain Reefs during 1985-1994*. Figures in parentheses are percentages of the total number banded. Statistics refer to tests for differences in recaptures between species.

	Brown Booby	Masked Booby	χ^2	df	P
Total number of birds banded	2044	1817			
Total number of recaptures	339 (16.5)	728 (40.1)	264.38	1	<0.01
Number of birds recaptured at least once	287 (14.0)	530 (29.2)	132.97	1	<0.01
Number of birds recaptured at least twice	45 (2.2)	157 (8.6)	83.62	1	<0.01
Number of birds recaptured at least three times	6 (0.2)	36 (2.0)	24.30	1	<0.01
Number of birds recaptured at least four times	0 (0.0)	5 (0.2)	3.72	1	>0.05

*8 summer trips, 9 winter trips.

The recapture data were sorted by age at banding and by species (Table 2), to check for age- or species-dependent influences on recapture rates. The proportions of recaptures within each of the three banding age groups were significantly higher (χ^2 , $df=1$, $P<0.01$) for the masked

booby than for the brown booby. For both species, the rate of recapture for birds first banded as adults was significantly higher (χ^2 , $df=1$, $P<0.01$) than for those birds first banded as young birds. The recapture rate for those birds where the banding age was not known was intermediate between the two, which probably indicates that these birds at time of banding were a mix of the two age groups.

Table 2: Numbers of brown and masked boobies banded as young birds (age up to 3 years) or adults (age >3 years) in the Swain Reefs during 1985-1994, and recaptured at least once. Figures in parentheses are proportions (%) of the total numbers banded.

	Brown Booby		Masked Booby	
	Total banded	Recaptured	Total banded	Recaptured
Banded as young	723	32 (4.4)*†	734	117 (15.9)*††
Banded as adults	1130	233 (20.6)**†	910	369 (40.6)**††
Banding age unknown	191	22 (11.5)	173	44 (25.4)

* $\chi^2 = 51.37$ $df = 1$ $P < 0.01$.
 ** $\chi^2 = 117.01$ $df = 1$ $P < 0.01$.
 † $\chi^2 = 93.03$ $df = 1$ $P < 0.01$.
 †† $\chi^2 = 95.26$ $df = 1$ $P < 0.01$.

No significant differences (χ^2 , $df=1$, $P<0.05$) in recapture rates between the sexes were detected within either species (Table 3). Significant differences (χ^2 , $df=1$, $P<0.01$) occurred between the species in both males and females, however, indicating that the observed differences in recapture rates between species were not sexually dependent.

Table 3: Numbers of male, female and unsexed masked and brown boobies banded and numbers recaptured at least once in the Swain Reefs during 1985-1994. Figures in parentheses are proportions (%) of the number banded.

	Females		Males		Sex Unknown	
	Banded	Recaptured	Banded	Recaptured	Banded	Recaptured
Brown Booby	515	124 (24.1)*†	660	141 (21.4)*††	869	22 (2.5)'
Masked Booby	442	206 (46.6)**†	443	224 (50.6)**††	932	100 (10.7)'

* $\chi^2 = 1.08$ $df = 1$ $P > 0.05$. ** $X^2 = 1.24$ $df = 1$ $P > 0.05$.
 † $\chi^2 = 52.44$ $df = 1$ $P < 0.01$. †† $X^2 = 100.76$ $df = 1$ $P < 0.01$.
 ' $\chi^2 = 46.57$ $df = 1$ $P < 0.01$.

Information on age at first breeding was gained from those birds banded as chicks (less than one year old). Two individuals (one of each species) were captured while breeding in their third year of life (Table 4). These data indicate a slight peak in breeding for the brown booby occurring during the fourth year of life, and a better defined peak at around seven years for the masked booby.

Table 4: Numbers and ages of birds when first recaptured while breeding. These birds were all banded as chicks (age < 1 year).

	Age (years) at first known breeding							
	2	3	4	5	6	7	8	9
Brown Booby	0	1	3	1	1	0	1	0
Masked Booby	0	1	3	6	10	11	8	0

The total numbers of recaptures of nesting birds were similar between species, but there was a significantly higher percentage (χ^2 , $df=1$, $P<0.01$) of nesting masked boobies recaptured than nesting brown boobies (Table 5). There were some noticeable between-species differences in recapture rates of nesting birds on some islands. On all cays except Bacchi and Bylund, a greater percentage of nesting masked boobies were recaptured nesting than were brown boobies. No nesting masked boobies were banded on Bacchi Cay, and no nesting brown boobies were recaptured nesting there. On Bylund Cay, a greater percentage of nesting brown boobies were recaptured nesting than were masked boobies.

Table 5: Numbers of brown and masked boobies banded while nesting, and subsequently recaptured while nesting on the same cays. Numbers in parentheses are recaptures expressed as percentages of the total numbers banded while nesting.

Site	Brown booby		Masked booby	
	Total numbers of nesting birds banded	Number recaptured nesting on same island at least once (%)	Total numbers of nesting birds banded	Number recaptured nesting on same island at least once (%)
Bacchi Cay	6	0	0	0
Bell Cay	70	10(14.3)	15	12(80.0)
Bylund Cay	37	8(21.6)	21	3(14.3)
Frigate Cay	220	66(30.0)	81	41(50.6)
Gannet Cay	238	36(15.1)	216	78(36.1)
Price Cay	144	15(10.4)	81	17(21.0)
Thomas Cay	105	32(30.5)	36	13(36.1)
TOTALS	820	167(20.4)*	450	164(36.4)*

* $\chi^2 = 38.16$ $df = 1$ $P < 0.01$

4.2. Movements of boobies within the Swain Reefs

Most recaptures of birds banded in the Swain Reefs have occurred in the same area, and mostly on the same islands. However, small numbers of both booby species were recaptured on islands within the Swain Reefs different from the islands on which they were banded.

In Table 6, the numbers of brown boobies recaptured on islands different from their island of banding were sorted according to their nesting status at time of banding and recapture. Small numbers of non-breeding birds were observed moving between all islands within the Swain Reefs (Table 6a). Four brown boobies were observed on Frigate Cay and subsequently on

Price Cay. Six non-breeding birds were observed to move from Frigate Cay to other islands. Six birds moved to Price Cay and three to Frigate Cay. Four brown boobies moved between Bell Cay and the other islands, a distance of over 110 kilometres.

Table 6: Brown boobies recaptured on islands in the Swain Reefs different from their island of banding.

(a) Number captured when not nesting at either one or both sites

Banding Site	Recapture Site	Distance (kms)	Number
Bacchi Cay	Bell Cay	118.5	1
Bacchi Cay	Frigate Cay	11.6	1
Bacchi Cay	Thomas Cay	1.9	1
Bell Cay	Frigate Cay	120.8	2
Bell Cay	Price Cay	123.6	1
Bylund Cay	Gannet Cay	22.0	1
Frigate Cay	Bylund Cay	5.4	1
Frigate Cay	Price Cay	6.0	4
Frigate Cay	Thomas Cay	11.4	1
Gannet Cay	Bell Cay	127.6	1
Gannet Cay	Price Cay	21.6	1
Thomas Cay	Bacchi Cay	1.9	2
TOTAL			17

(b) Number captured nesting on two different islands

First nest site	Second nest site	Distance (kms)	Number
Bylund Cay	Frigate Cay	5.4	3
Bylund Cay	Thomas Cay	16.2	1
Gannet Cay	Price Cay	21.6	1
Price Cay	Thomas Cay	17.4	1
Thomas Cay	Bell Cay	116.7	1
Thomas Cay	Frigate Cay	11.4	1
Thomas Cay	Gannet Cay	38.2	1
TOTAL			9

(c) Number captured nesting on an island different from natal island

Natal island	Nesting island	Distance (kms)	Number
Frigate Cay	Gannet Cay	27.3	1
Frigate Cay	Price Cay	6.0	2
TOTAL			3

A total of nine brown boobies were observed to nest on more than one island (Table 6b). Four birds moved their nest site from Bylund Cay, three of these went to Frigate Cay and one to Thomas Cay. Three birds also moved nesting location from Thomas Cay to other islands in the area. More birds (four) moved to Frigate Cay than to any other island. One bird that nested on Thomas Cay moved over 116 kilometres to nest on Bell Cay, but all other birds that shifted nesting islands moved less than 40 kilometres. Three brown boobies were observed breeding on islands different from their natal island (Table 6c). All three birds moved from Frigate Cay, two to breed on Price Cay (six kilometres away) and one to breed on Gannet Cay (27.3 kilometres away).

Table 7: Masked boobies recaptured on islands in the Swain Reefs different from their island of banding.

(a) Number captured when not nesting at either one or both sites

Banding Site	Recapture Site	Distance (kms)	Number
Bacchi Cay	Thomas Cay	1.9	1
Bell Cay	Bylund Cay	120.3	1
Bell Cay	Frigate Cay	120.8	1
Bell Cay	Gannet Cay	127.6	1
Bell Cay	Price Cay	123.6	2
Bell Cay	Thomas Cay	116.7	1
Bylund Cay	Frigate Cay	5.4	1
Bylund Cay	Gannet Cay	22.0	1
Bylund Cay	Price Cay	3.5	8
Bylund Cay	Thomas Cay	16.2	1
Frigate Cay	Gannet Cay	27.3	1
Frigate Cay	Price Cay	6.0	1
Frigate Cay	Thomas Cay	11.4	1
Gannet Cay	Bacchi Cay	38.9	1
Gannet Cay	Bell Cay	127.6	2
Gannet Cay	Frigate Cay	27.3	3
Gannet Cay	Price Cay	21.6	3
Gannet Cay	Thomas Cay	38.2	3
Thomas Cay	Bylund Cay	16.2	1
Thomas Cay	Frigate Cay	11.4	2
Thomas Cay	Gannet Cay	38.2	1
TOTAL			37

(b) Number captured nesting on two different islands

First nest site	Second nest site	Distance (kms)	Number
Bylund Cay	Thomas Cay	16.2	1
Gannet Cay	Frigate Cay	27.3	1
Price Cay	Frigate Cay	6.0	1
Price Cay	Gannet Cay	21.6	1
TOTAL			4

(c) Number captured nesting on an island different from natal island

Natal island	Nesting island	Distance (kms)	Number
Bylund Cay	Price Cay	3.5	1
Bylund Cay	Thomas Cay	16.2	1
Frigate Cay	Bell Cay	120.8	1
Frigate Cay	Bylund Cay	5.4	1
Frigate Cay	Price Cay	6.0	1
Gannet Cay	Price Cay	21.6	1
Price Cay	Bell Cay	123.6	1
Price Cay	Frigate Cay	6.0	1
Thomas Cay	Price Cay	17.4	1
TOTAL			9

The masked booby recorded slightly different patterns of movement than the brown booby within the Swain Reefs area (Table 7). A greater number of non-breeding masked boobies (37) than brown boobies (17), were captured on two different islands (Table 7a). A total of 11 masked boobies moved from Bylund Cay to other islands, with eight of these moving to Price Cay. A total of 12 birds moved from Gannet Cay to other islands, with three moving to each of Frigate, Price and Thomas Cays. Six birds moved more than 110 kilometres from Bell Cay to other islands in the Swain Reefs, and similarly one moved 127.6 kilometres the other way, from Gannet Cay to Bell Cay.

Only four masked boobies (Table 7b), compared with nine brown boobies (Table 6b), were observed to move their nesting from one island to another. Two masked boobies moved their nest site from Price Cay, and two moved to nest on Frigate Cay from other islands. No masked boobies that changed breeding islands moved further than 27.3 kilometres.

A greater number of masked boobies than brown boobies (nine compared to three) were observed nesting on islands different from their natal islands. A total of three masked boobies were observed to move from Frigate Cay (their natal island), to nest on other islands, and two moved from both Bylund Cay and Price Cay to nest elsewhere (Table 7c). Four of the total nine masked boobies observed to breed on islands different from their natal island moved to Price Cay to nest. Two birds moved from their natal islands of Frigate and Price Cays to breed at Bell Cay, both distances of more than 120 kilometres. All the other movements from natal islands were over distances of less than 22 kilometres.

During the period of the study, most masked and brown boobies captured more than once while nesting, were recaptured on the same islands (compare Tables 6b & 7b with Table 5). By comparison, only small numbers were detected nesting on more than one island.

The numbers of brown boobies observed to return to their natal island and breed were significantly lower than the numbers of masked boobies (Table 8). This was despite similar numbers of young brown boobies and masked boobies (723 compared to 734) being banded during the course of the study. More than half of the recaptures of young masked boobies occurred on Gannet Cay.

Table 8: Numbers of banded brown and masked boobies known to return to their natal island and breed.

Site	Brown booby	Masked booby
Bacchi Cay	0	0
Bell Cay	1	2
Bylund Cay	0	2
Frigate Cay	0	2
Gannet Cay	0	17
Price Cay	0	3
Thomas Cay	0	2
TOTALS	1*	28*

* $\chi^2 = 23.74$, $df=1$, $P < 0.01$

4.3. Extralimital band recoveries

Of the 2044 brown boobies and 1817 masked boobies banded in the Swain Reefs, only one brown booby was recaptured at a breeding site outside of the Swain Reefs. This bird, a female, was recovered dead on North East Cay, Saumarez Reefs in September 1990. It was banded on Frigate Cay while attending a nest with a single chick, in January of the same year. North East Cay is approximately 140 kilometres to the east of Frigate Cay, and was visited in 1960 by Hindwood et al. (1963), and at various times by the Australian National Parks and Wildlife Service. Up to 74 brown booby nests have been recorded there (K. Hulsman *pers comm.*).

Large numbers of masked boobies (5,089) and brown boobies (930), were banded at other locations in the Coral Sea and on the Great Barrier Reef during the period of the study (Table 9).

Table 9: Numbers of brown and masked boobies banded at other sites in eastern Australia since 1980 (information supplied by the Australian Nature Conservation Agency, Canberra, March 1995).

Site	Brown booby	Masked booby
Coral Sea	127	4295
Raine Island	764	728
Gulf of Carpentaria	27	0
Saumarez Reefs	12	66
TOTAL	930	5089

A total of 12 brown boobies and 18 masked boobies originally banded in the Swain Reefs were recovered or recaptured extraliminally, at sites other than breeding colonies (Table 10). The locations of these recoveries are shown in Figure 2. The most obvious feature of these recoveries is the geographical grouping by species. Most of the brown boobies were

recovered in the Coral Sea, New Guinea or the Solomon Islands. All the masked booby recoveries, except one, were from the Great Barrier Reef or from along the Queensland and New South Wales coastlines. The exception was a masked booby found dead on an island near Bougainville Island, Papua New Guinea (band number 131-51692). Many of the band recoveries were from dead beach-washed birds.

Table 10: Records of brown and masked boobies that were banded in the Swain Reefs, but recovered elsewhere. The 121- and 131- prefixes in the band numbers denote brown and masked boobies respectively. In the age columns, '1' means less than one year old, '+1' means between one and three years old, and '+3' means at least three years old. 'U' means unknown.

Band number	Date of banding	Date of recapture	Age at banding	Age at recapture	Sex	Recapture notes
121-25230	18.02.86	01.06.86	1	+1	U	Dead at Alotau, Milne Bay Province, PNG
121-25236	18.02.86	23.09.88	+1	+3	U	At sea, 80nm NE East Diamond Island
121-25334	20.02.86	14.09.89	+3	+3	F	Pancake Creek
121-25349	20.02.86	12.06.86	1	+1	U	Makarinda Village, Central Province, PNG
121-25596	27.01.87	?10.87	+3	+3	M	Juaiju Village, Oro Province, PNG
121-29917	27.07.87	?09.87	+1	+1	U	Blacket Str., S. of Kolobangara, Solomon Is.
121-29946	27.01.88	17.06.93	+3	+3	F	At sea 80km NE of Port Moresby, PNG
121-29963	30.01.88	19.05.98	1	+1	U	At sea near Tarawai Island, East Sepik, PNG
121-30035	31.01.88	27.05.98	1	+1	U	At sea, Gatokae Island, Solomon Islands
121-32052	11.01.90	27.04.91	1	+1	U	Dead, Koil Island, Wewak, Sepik Prov., PNG
121-32070	11.01.90	10.09.90	+3	+3	F	North East Cay, Saumarez Reef, Coral Sea
121-32148	14.01.90	19.07.90	1	+1	U	SE of Modewa Bay, Milne Bay Province, PNG
121-32650	12.07.92	?12.92	+3	+3	M	Dead at Eurong, Fraser Island
131-51669	22.07.85	14.09.90	1	+3	U	At sea north-east of Percy Islands
131-51692	22.07.85	25.12.86	1	+1	U	Dead, island NW of Bougainville Island, PNG
131-55047	11.07.86	06.06.92	+3	+3	F	Lakatoi Reef, east of Mackay
131-55057	13.07.86	03.01.87	1	+1	U	No. 9 Ribbon Reef
131-55113	15.07.86	23.11.87	U	U	U	Moore Reef
131-55202	16.07.86	12.01.87	1	+1	U	Dead on beach near Abbot Point, Bowen
131-55235	17.07.86	02.01.87	1	+1	U	Big Hill Beach, Near Port Macquarie, NSW
131-55239	17.07.86	01.12.90	+3	+3	F	On beach at Dundowran, Hervey Bay
131-55272	17.07.86	08.01.87	1	+1	U	Dead, Swansea Heads Pilot Station, NSW
131-55292	17.07.86	25.10.86	1	+1	U	At sea between Percy and Great Keppel Is.
131-57814	17.01.89	24.01.90	1	+1	U	At sea between Daru and Australian border
131-57947	15.07.89	01.08.93	U	+3	M	Dead on beach at Yeppoon
131-69373	12.07.92	04.01.93	1	+1	U	Skirmish Point, Bribie Island
131-69373	12.07.92	05.01.93	1	+1	U	Mudjimba Beach, Sunshine Coast
131-69373	12.07.92	03.02.93	1	+1	U	Dead at Victoria Point, near Brisbane
131-69640	11.12.93	16.03.94	1	1	U	At sea near Gould Reef
131-69655	11.12.93	04.02.94	1	+1	U	Shoreline near Mackay
131-69794	12.07.92	24.12.92	1	+1	U	Dead at Brisk Bay, Bowen

Figure 2: Locations of extralimital recoveries of masked and brown boobies that were banded in the Swain Reefs.

Although the sex of most extralimital recaptures was unknown because of the young age at which they were banded, both males and females were recaptured. All the northern recaptures of the brown booby occurred between the months of April and October, which is outside their peak nesting period in the Swain Reefs (Heatwole et al. in review). Similarly, most of the masked booby recaptures occurred in summer months, which is outside their peak nesting period.

All extralimital masked boobies recovered more than 500 kilometres from the Swain Reefs were less than three years old. All brown boobies recaptured in northern Coral Sea waters were less than four years old except one (band number 121-29946), which was at least seven years old when recaptured in Papua and New Guinea.

4.4. Population size estimates

Because the small numbers of recaptures on individual islands made population estimates for each island unreliable, Jolly-Seber estimates of total population size for each species were calculated using data combined for all islands for the birds that were banded as adults (Table 11). Large standard errors for the brown booby estimates indicate they are unreliable. The population estimates for both species were plotted against the numbers of birds counted during concurrent daytime censuses (Heatwole et al. in review) (Fig. 3). The estimates and the counts were not correlated (r , $df=12$, $P>0.05$, Fig. 3), but the Jolly-Seber estimates were mostly larger than the (presumably more accurate) censuses. No seasonal (winter/summer) relationships were apparent (Fig. 3).

Table 11: Population estimates for brown and masked boobies produced using the Jolly-Seber method (model 'A' in the program JOLLY, Pollock *et al.* 1990). N is the population estimate and SE(N) is the standard error of the estimate. N/A indicates that not enough data were available to produce an estimate.

Sampling date		Brown booby		Masked booby	
		N	SE(N)	N	SE(N)
July	1985	1901.8	1367.2	615	194.4
February	1986	1153.8	207.9	340	44.5
July	1986	251.3	228.9	1298	230.8
January	1987	1033.0	210.9	967	144.8
July	1987	1924.0	N/A	1833	368.1
January	1988	1492.1	617.8	889	475.8
July	1988	1480.0	1931.1	891	151.5
January	1989	1767.8	827.9	1297	576.4
July	1989	1448.3	534.3	617	394.3
January	1990	1168.7	906.6	1407	364.8
July	1991	12602.3	916.4	1319	304.7
July	1992	555.2	284.8	837	194.4
July	1993	1634.0	2259.0	554	152.9
December	1993	524.3	316.5	604	N/A

Figure 3: Population estimates (Jolly-Seber) plotted against population counts for the brown and masked booby in the Swain Reefs. Data from all islands are combined. Both X and Y axes are \log_{10} scales. Broken line is $x=y$. Black dots are summer data, open dots are winter data. There is no correlation between population estimate and population count for either species (brown booby: $r=0.288$, $df=12$, $P>0.05$; masked booby: $r=-0.312$, $df=12$, $P>0.05$).

5. DISCUSSION

5.1. Population change

A significant decline in the population of brown boobies in the Swain Reefs occurred in the years between 1980 and 1995 (Heatwole et al. in review). However, the decline was not detectable using the Jolly-Seber methods referred to in this report. This was probably mostly due to limitations associated with the six-monthly sampling periods, which appears inadequate for this type of analysis and for these two species. Also, the magnitude of decline in the brown booby prevented the collection of adequate data, because so many banded birds were being removed from the system (Heatwole et al. in review). The much lower recapture rates for the brown booby perhaps reflect these losses.

The lower recapture rate of banded brown boobies was clearly not dependent on sex, as there was no significant difference between recapture rates in males and females. However, there were some significant differences in recapture rates related to age. Significantly smaller percentages of brown boobies banded as young birds (less than one year old) were later recaptured, compared to birds banded as adults. This is not unexpected, as the survival rates of young birds is typically low, before increasing to higher and nearly constant levels among adults (Gill 1994). The recapture rates of young masked boobies were also significantly

lower than were those of adults, but the magnitude of the recapture rates of young birds differed between species. The percentage of young masked boobies later recaptured was nearly four times greater than the percentage of young brown boobies later recaptured. In adult birds, the masked booby recapture rate was only twice that of the brown booby. This raises the possibility that much of the observed decline in the brown booby population was caused by very high mortality amongst young birds.

Extralimital recaptures indicate that most brown and masked boobies that disperse great distances, do so before sexual maturation. These data also show that young brown boobies from the Swain Reefs tended to disperse north and east as far as the Solomon Islands and Papua New Guinea. Young masked boobies were found to disperse mostly along the Queensland coast and the Great Barrier Reef. The lower recapture rate of young brown boobies, and the decline in the brown booby population, may be associated with this geographical difference in dispersal areas.

Heatwole et al. (in review) suggested that the decline in the brown booby population in the Swain Reefs was linked to reductions in food availability, possibly resulting from a succession of severe El Niño events. However, it was difficult to explain why there was not a similar decline in the sympatric masked booby. It is possible that differences in food availability occurred between the dispersal areas, with more severe food reductions in the area apparently favoured by immature brown boobies (Coral Sea). Alternatively, there may have been an elevated mortality of immature brown boobies caused by changing human factors in the northern Coral Sea, such as fishing methods or intensity. This type of information is not available.

The age at which a species first breeds will obviously affect the time it takes for reduced recruitment to affect population size. From the limited data available, the modal age of first breeding for the brown booby was found to be four years, compared with seven years in the masked booby. Increased mortality of young birds is therefore likely to manifest as a reduction in the adult population of the brown booby more quickly than in the masked booby. Even if reduced food availability and resultant recruitment were experienced by both the brown and the masked booby, the effect on their populations may have been different. In the ten-year period between 1985 and 1995, the average age of masked boobies in the Swain Reefs may even have increased, without noticeably affecting population size. However, while the average lifespans of masked and brown boobies are unknown, the recapture rates suggest that adult life expectancy may also be lower for the brown booby. This may be normal, but it

indicates that increased adult mortality of brown boobies in the Swain Reefs may also have been a factor in the observed population decline.

Although these findings are inconclusive, they have identified a number of possible explanations for population decline in the brown booby in the Swain Reefs. A clearer understanding of factors influencing population change will only be gained by further investigation. Even though breeding sites appear relatively secure in the Swain Reefs, influences on the populations when dispersed elsewhere are possibly significant, but not well understood. Continuation of the existing program will improve our understanding of population dispersal patterns and longevity, although banding and recapture of masked and brown boobies at six-monthly intervals has proven inadequate for reliable estimates of population size. Comparative studies of diet may provide a clearer understanding of factors influencing population size and survivorship. Other demographic factors are generally more difficult to study because of problems with regular access, but a study of population genetics would at least determine the degree of isolation of the populations of the two species in this region.

5.2. Population isolation

The extralimital recoveries show that some brown and masked boobies moved great distances from their breeding colonies in the Swain Reefs. Even though most far distant recaptures were of young birds (age less than four years), this is not conclusive evidence of a more sedentary adult lifestyle. Young birds may have been captured more often because, due to lack of experience, they were more likely to suffer from starvation than adults and be found in a weakened state.

While large geographical movements of brown and masked boobies are probably a population dispersal mechanism, the data presented in this report suggest that dispersal of breeding birds to other breeding colonies in the region does not regularly occur. The only bird banded in the Swain Reefs and recaptured at another breeding site was the brown booby found dead on North East Cay in the Saumarez Reefs, only 140 kilometres east of the Swain Reefs. This lack of recaptures at other breeding sites occurred despite substantial banding and recapture efforts throughout the region.

Within the closely spaced islands of the Swain Reefs, masked boobies mostly came back to their natal islands to breed, although about a third of birds banded as young were later

recaptured breeding on other islands. More masked boobies were found to move from their natal island and breed on another, than move breeding locations after they had already nested at a particular site. The situation is not as clear for the brown booby because of the relatively small number of recaptures. However, more brown boobies were recaptured breeding on islands different from their natal island, than on their natal island. More brown boobies were also found to move their breeding from one island to another, than to move from their natal island and breed elsewhere. These differences suggest that the masked booby is more site-faithful to its natal islands than is the brown booby, which is more inclined to search for breeding site alternatives but become faithful to these after they have been used. While this is speculative, it has been shown that birds of both booby species regularly change breeding locations within the Swain Reefs group.

Gene flow within the meta-populations of both booby species in the Swain Reefs is probably substantial, but data from the present study suggest gene flow may be limited between the various populations scattered around the Coral Sea region. Re-colonisation of sites that lose breeding populations would probably, therefore, be an uncertain and lengthy process. It has previously been suggested that this might occur in seabirds that exhibit a high level of site tenacity (Drury 1979). Resilience and adaptation have allowed brown and masked boobies to survive in a tropical environment, although their breeding success and survival in many areas is thought to be tenuous (Harrison 1990). Even subtle changes in breeding or feeding habitats, therefore, can possibly have catastrophic effects on survival. This has important implications for management. Populations of these two species which are geographically isolated from other breeding colonies must be managed to avoid all human disturbance, as the chance of re-colonisation appears to be low. Public access should only be considered to minor colonies within closely spaced meta-populations, where re-colonisation from adjacent islands is a possibility.

6. CONCLUSION

This study summarizes results of a ten year banding program on masked and brown boobies in the Swain Reefs. It shows that both species generally return to the Swain Reefs to breed, after periods of dispersal. While most birds return to the same islands to nest, substantial numbers relocated within the Swain Reefs complex. Brown boobies showed stronger site fidelity to breeding location than masked boobies, although masked boobies are more likely to return to their natal island to nest. While population size estimates were inconclusive, probably due to small sample size, geographical differences in the dispersal areas of the two species were detected.

Questions concerning the degree of genetic isolation of these and other seabird species on the Great Barrier Reef, require further investigation. Data presented in this paper suggest that some genetic divergence within populations of masked and brown boobies in the Coral Sea region may have occurred. Until better information is available, managers need to treat discrete seabird breeding colonies on the Great Barrier Reef as genetic isolates, and recognise that displacement of colonies through human use may result in permanent loss.

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Appendix 1: Total numbers of brown boobies banded and recaptured in the Swain Reefs between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	6	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	8	-	-	-	-	-	-	-	1	ND	-	-	-	-	-	-	-
	+3	205	3	44	-	36	1	4	1	-	ND	7	2	4	1	1	2	3
7/85	1	18		1	-	-	-	-	-	-	ND	-	1	-	-	-	-	-
	+1	39		2	-	-	-	-	-	1	ND	-	1	-	-	-	-	-
	+3	73		8	2	7	2	4	2	-	ND	-	2	-	-	-	-	-
2/86	1	54			1	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	20			-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	258			2	37	-	5	3	4	ND	8	3	4	3	-	3	-
7/86	1	42				1	-	-	-	-	ND	1	-	1	-	-	-	-
	+1	23				-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	14				1	-	1	1	-	ND	-	-	-	-	-	-	-
1/87	1	70					2	-	-	-	ND	-	-	2	1	-	1	-
	+1	2					-	-	-	-	ND	-	-	-	-	-	-	-
	+3	155					1	3	-	2	ND	10	1	5	4	-	1	1
7/87	1	2						-	-	-	ND	-	-	-	-	-	-	-
	+1	10						-	-	-	ND	-	-	-	-	-	-	-
	+3	9						-	-	-	ND	-	1	-	-	-	-	-
1/88	1	86									ND	-	-	-	1	-	-	-
	+1	-									ND	-	-	-	-	-	-	-
	+3	50							1	ND	5	2	1	1	-	-	-	-
7/88	1	-									ND	-	-	-	-	-	-	-
	+1	4									ND	-	-	-	-	-	-	-
	+3	18									ND	1	-	-	-	-	1	-
1/89	1	65									ND	-	-	1	-	-	-	-
	+1	89									ND	-	-	1	-	-	1	-
	+3	39									ND	4	-	1	-	-	-	2
	U	1									ND	-	-	-	-	-	-	-
7/89	1	ND										ND	ND	ND	ND	ND	ND	ND
	+1	ND										ND	ND	ND	ND	ND	ND	ND
	+3	ND										ND	ND	ND	ND	ND	ND	ND
	U	187										3	3	3	4	3	4	2
1/90	1	35											-	-	-	-	-	-
	+1	65											-	-	1	-	-	1
	+3	85											-	-	2	-	1	2
7/91	1	1													-	-	-	-
	+1	2													-	-	-	-
	+3	25													-	1	-	-
7/92	1	31														-	-	-
	+1	1														-	-	-
	+3	52														2	-	1
	U	3														-	-	-
7/93	1	6														-	-	-
	+1	1														-	-	-
	+3	42															-	2
12/93	1	6															-	-
	+1	-															-	-
	+3	17															-	1
3/94	1	5																-
	+1	3																-
	+3	40																3
7/94	1	29																-
	+1	1																-
	+3	47																-
Totals		2044	3	55	5	82	6	17	7	9		39	16	23	21	4	15	18

Appendix 2: Numbers of brown boobies banded on Bacchi Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	1	-	-	-	1
7/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
2/86	1	7	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/86	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/90	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		52												1				1

Appendix 3: Numbers of brown boobies banded on Bell Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	17	1	3	-	-	1	2	1	-	ND	-	1	-	-	-	-	-
7/85	1	11	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	46		3	2	-	1	3	2	-	ND	-	2	-	-	-	-	-
2/86	1	8	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	8	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	26			1	-	-	1	2	-	ND	-	-	-	-	-	-	-
7/86	1	16	-	-	-	-	-	-	-	-	ND	-	-	1	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	13	-	-	-	-	-	1	1	-	ND	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	1	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	ND	-	1	-	-	-	-	-
1/88	1	21	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		209	1	6	3		3	7	6			5	1					

Appendix 4: Numbers of brown boobies banded on Bylund Cay and recaptured between 1985 and 1994. (ND = no data)

Date	Age	Number	Number of recaptures from banding year (Month/Year)															
			7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	17	-	4	-	2	-	-	-	-	-	-	-	-	-	-	-	-
7/85	1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2/86	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/86	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/87	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/89	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/90	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		59		5		2						2	2					1

Appendix 5: Numbers of brown boobies banded on Frigate Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	1	ND	-	-	-	-	-	-	-
	+3	69	2	19	-	20	-	-	-	-	ND	2	-	1	1	1	1	-
7/85	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	11	-	1	-	-	-	-	-	1	ND	-	-	-	-	-	-	-
	+3	7	-	2	-	3	1	-	-	-	ND	-	-	-	-	-	-	-
2/86	1	25	-	-	1	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	8	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	67	-	-	-	15	-	1	1	2	ND	1	1	3	2	-	-	-
7/86	1	14	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	15	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/87	1	70	-	-	-	-	2	-	-	-	ND	-	-	1	-	-	1	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	66	-	-	-	-	-	3	-	-	ND	8	-	5	2	-	-	-
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	6	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	42	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	11	-	-	-	-	-	-	-	-	ND	-	2	2	1	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	25	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	52	-	-	-	-	-	-	-	-	ND	-	-	1	-	-	-	-
	+3	17	-	-	-	-	-	-	-	-	ND	2	-	-	-	-	-	-
	U	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	109	-	-	-	-	-	-	-	-	-	2	2	3	1	3	3	-
1/90	1	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	10	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
7/92	1	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	26	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		778	2	22	1	38	3	4	1	4		15	5	16	9	5	6	

Appendix 6: Numbers of brown boobies banded on Gannet Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	11	-	1	-	3	-	2	-	-	ND	-	-	-	-	-	1	2
7/85	1	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	21	-	1	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	16	-	2	-	3	-	1	-	-	ND	-	-	-	-	-	-	-
2/86	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	107	-	-	1	15	-	2	-	2	ND	3	1	1	1	-	1	-
7/86	1	1	-	-	-	-	-	-	-	-	ND	1	-	-	-	-	-	-
	+1	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	1	-	-	-	-	ND	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	70	-	-	-	-	-	-	-	2	ND	1	1	-	1	-	-	-
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	28	-	-	-	-	-	-	-	1	ND	5	-	-	1	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	1	-	-	-	-	-	-
1/89	1	15	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	10	-	-	-	-	-	-	-	-	ND	-	-	1	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
	U	6	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
1/90	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
3/94	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		407		4	1	22		5		5		12	2	52	3		2	6

Appendix 7: Numbers of brown boobies banded on Thomas Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	73	-	17	-	11	-	-	-	-	ND	4	1	-	-	-	-	-
7/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
2/86	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	1	-	-	-	-	ND	2	-	-	-	-	-	-
7/86	1	10	-	-	-	1	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	6	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
1/89	1	6	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	1	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		140		17		13						7	1				2	

Appendix 8: Numbers of brown boobies banded on Price Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	17	-	-	-	-	-	-	-	-	ND	-	-	1**	-	-	-	-
7/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	1	-	1	-	-	-	-	-	ND	-	-	-	-	-	-	-
2/86	1	13	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	57	-	6	-	1	-	-	-	-	ND	2	1	-	-	-	2	-
7/86	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	1	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	1	1	1	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	1*	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	1
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	23	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	14	-	-	-	-	-	-	-	-	ND	-	-	1*	-	-	-	-
	+1	24	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
	+3	7	-	-	-	-	-	-	-	-	ND	1	-	-	-	-	-	1
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	55	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	1
1/90	1	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	16	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
	+3	21	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	U	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
7/94	1	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		399		1		7		1				3	1	3	6	2	6	11

* Banded on Frigate Cay

** Banded on Bell Cay

Appendix 9: Total numbers of masked boobies banded and recaptured in the Swain Reefs between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	5	-	-	-	-	-	1	1	-	ND	-	-	-	-	-	-	-
	+3	38	10	3	3	2	7	-	2	-	ND	-	3	1	3	3	1	-
7/85	1	115		1	1	-	1	-	1	-	ND	-	8	6	5	4	2	-
	+1	4		-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
	+3	237		47	28	31	15	3	22	4	ND	2	14	20	11	9	14	2
2/86	1	8			-	-	-	-	-	-	ND	-	1	-	-	-	1	-
	+1	3			1	-	-	-	-	-	ND	-	-	-	1	-	-	-
	+3	35			7	5	1	2	3	1	ND	-	4	1	1	1	1	-
7/86	1	142				10	1	1	-	-	ND	-	7	7	9	2	11	1
	+1	1			-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	151				17	11	1	10	4	ND	1	12	8	16	9	8	1
1/87	1	7					-	-	-	-	ND	-	-	-	-	-	-	-
	+1	3					-	-	-	-	ND	-	1	-	-	-	-	-
	+3	75					2	1	10	2	ND	3	3	4	3	4	3	-
7/87	1	59						2	1	-	ND	-	1	1	3	-	2	2
	+1	3						-	-	-	ND	-	-	-	-	-	-	-
	+3	95						1	13	2	ND	-	3	3	9	9	4	1
	U	1						-	-	-	ND	-	-	-	1	-	-	-
1/88	1	27							4	1	ND	-	-	-	-	-	-	-
	+1	4							-	-	ND	-	-	-	-	-	-	-
	+3	5							1	1	ND	-	-	-	-	-	-	-
7/88	1	62								2	ND	-	-	1	2	-	1	-
	+1	4								-	ND	-	-	-	-	-	-	-
	+3	44								1	ND	-	1	3	8	4	5	-
1/89	1	18									ND	1	-	-	-	-	-	-
	+1	72									ND	-	-	-	2	1	-	1
	+3	8									ND	-	1	-	-	-	1	-
7/89	1	2										1	-	-	-	-	-	-
	+1	ND										ND	ND	ND	ND	ND	ND	ND
	+3	ND										ND	ND	ND	ND	ND	ND	ND
	U	171										2	7	14	8	8	13	1
1/90	1	3											-	-	-	-	-	-
	+1	32											-	1	-	-	-	-
	+3	2											-	-	-	-	-	1
7/91	1	14												-	-	-	-	-
	+1	5												-	-	-	-	1
	+3	42												2	4	3	2	-
7/92	1	62														1	-	2
	+1	-														-	-	-
	+3	60													6	1	6	-
	U	1													-	-	-	-
7/93	1	2														-	-	-
	+1	5														-	-	-
	+3	45														4	3	-
	U	1														-	1	-
12/93	1	50															6	-
	+1	-															-	-
	+3	35															5	-
3/94	1	18																-
	+1	-																-
	+3	26																-
7/94	1	1																-
	+1	-																-
	+3	12																-
Totals		1817	10	51	40	65	38	12	68	18		10	66	72	93	62	93	11

Appendix 10: Numbers of masked boobies banded on Bacchi Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
2/86	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/86	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		6									1							

Appendix 11: Numbers of masked boobies banded on Bell Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	1	1	-	ND	-	-	-	-	-	-	-
	+3	3	2	2	2	-	2	-	-	-	ND	-	-	-	-	-	-	-
7/85	1	1	-	-	-	-	-	-	1	-	ND	-	1	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	21	-	3	4	-	2	-	3	-	ND	-	3	-	-	-	-	-
2/86	1	2	-	-	-	-	-	-	-	-	ND	-	1	-	1	-	-	-
	+1	2	-	-	1	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	5	-	-	2	-	1	-	1	-	ND	-	2	-	-	-	-	-
7/86	1	3	-	-	-	-	-	-	-	-	ND	-	1	1	1	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	1	-	ND	-	1	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	1	-	-	-	-	-	-	1	-	ND	-	-	-	1	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	1	-	ND	-	1	1	-	-	-	-
1/88	1	-	-	-	-	-	-	-	1*	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	1	-	ND	-	-	-	-	-	-	-
7/88	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		55	2	5	9		5	1	11			10	3	3				

* Banded on Gannet Cay.

Appendix 12: Numbers of masked boobies banded on Bylund Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	-	-	-	-	1	-	-	-	ND	-	-	-	-	-	-	-
7/85	1	12	-	-	-	-	1	-	-	-	ND	-	-	-	-	1	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	1*	-	-	-	ND	-	-	-	-	1*	-	-
2/86	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/86	1	20	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	3	-	-	-	-	1	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	21	-	-	-	-	-	-	-	-	ND	-	-	-	1	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	33	-	-	-	-	-	4	-	-	ND	-	-	-	6	9	3	1
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	11	-	-	-	-	-	-	1	-	ND	-	-	-	1	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	ND	-	-	-	1	-	-	-
1/89	1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	13	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/92	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
12/93	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		164					4		4	1					11	13	6	1

* Banded on Bell Cay

Appendix 13: Numbers of masked boobies banded on Thomas Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	14	-	-	-	-	4	-	2	-	ND	-	3	-	2	1	-	-
7/85	1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	1	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
2/86	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	1	-	-	-	-	-	1	-	ND	-	-	-	1	-	-	-
7/86	1	10	-	-	-	1	-	-	-	-	ND	-	3	-	2	1	1	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	14	-	-	-	2	3	-	1	1	ND	-	2	-	-	1	3	-
1/87	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	7	-	-	-	-	-	-	1	-	ND	-	2	-	1	-	-	-
	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	7	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/89	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND
	U	6	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
7/92	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		122	1	1	3	7	5	1				11		6	4	7		

Appendix 14: Numbers of masked boobies banded on Frigate Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	2	1	-	-	-	-	-	-	-	ND	-	-	1	1	1	-	-
7/85	1	11	-	1	-	-	-	-	-	-	ND	-	1	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	57	5	9	2	7	2	9	1	ND	-	1	7	2	1	4	-	-
2/86	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	1*	-	-	-	-	-
7/86	1	39	-	-	-	3	-	-	-	-	ND	-	-	1	3	-	2	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	34	-	-	-	1	8	-	3	2	ND	-	1	-	5	-	2	-
1/87	1	6	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	2	-	-	-	-	1	1	-	-	ND	1	-	1	-	-	-	-
7/87	1	16	-	-	-	-	-	-	-	-	ND	-	-	1	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	19	-	-	-	-	-	3	1	ND	-	-	1	1	-	1	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	1*	-	-	-
1/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	8	-	-	-	-	-	-	1	ND	-	-	1	-	-	-	1	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	1	-	-	-
1/89	1	6	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	10	-	-	-	-	-	-	-	-	ND	-	-	-	1	-	-	-
	+3	2	-	-	-	-	-	-	-	-	ND	-	1	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	16	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-
1/90	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	5	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
7/92	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/93	1	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
3/94	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		301	1	6	9	6	16	3	15	5		1	6	14	15	3	12	

* Banded on Thomas Cay.

Appendix 15: Numbers of masked boobies banded on Gannet Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	10	6	-	1	2	-	-	-	-	ND	-	-	-	-	1	1	-
7/85	1	78	-	-	1	-	-	-	-	-	ND	-	4	5	4	3	2	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
	+3	120	38	13	29	-	-	9	2	ND	2	7	11	7	7	7	7	1
2/86	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	24	-	3	5	-	1	1	1	ND	-	-	1	-	1	1	1	-
7/86	1	45	-	-	2	-	1	-	-	ND	-	1	1	-	1	4	-	-
	+1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
	+3	99	-	-	14	-	1	5	1	ND	1	8	8	11	8	3	1	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	70	-	-	-	-	-	10	2	ND	2	3	3	3	4	3	-	-
7/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1*	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/88	1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/88	1	35	-	-	-	-	-	-	-	-	ND	-	-	-	1	-	1	-
	+1	3	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	25	-	-	-	-	-	-	1	ND	-	-	3	5	4	4	-	-
1/89	1	4	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	49	-	-	-	-	-	-	-	-	ND	-	-	-	1	1	-	1
	+3	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	1	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	2	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	101	-	-	-	-	-	-	-	-	1	5	10	5	7	9	-	-
1/90	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/91	1	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	19	-	-	-	-	-	-	-	-	-	-	1	3	1	2	-	-
7/92	1	47	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	31	-	-	-	-	-	-	-	-	-	-	-	4	1	5	-	-
	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	17	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-
12/93	1	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
3/94	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		874	6	38	18	52	3	25	7		7	28	43	45	42	54	3	

* Banded on Bylund Cay.

Appendix 16: Numbers of masked boobies banded on Price Cay and recaptured between 1985 and 1994. (ND = no data)

Banding Information			Number of recaptures from banding year (Month/Year)															
Date	Age	Number	7/85	2/86	7/86	1/87	7/87	1/88	7/88	1/89	7/89	1/90	7/91	7/92	7/93	12/93	3/94	7/94
1/85	1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	7	2	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/85	1	8	-	-	-	-	-	-	-	-	ND	-	2	1	1	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	42	-	2	-	5	1	1	-	-	ND	-	3	2	2	-	2	1
2/86	1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	2	-	1	-	-	1	-	-	-	ND	-	1	-	-	-	-	-
7/86	1	24	-	-	-	-	1	-	-	-	ND	-	2	4	3	-	4	1
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
1/87	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	1	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/87	1	17	-	-	-	-	-	2	-	-	ND	-	1	-	1	-	1	2
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	34	-	-	-	-	1	4	1	-	ND	-	-	1	1	-	-	-
1/88	1	22	-	-	-	-	-	3	1	-	ND	-	-	-	-	-	-	-
	+1	1	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	1	-	ND	-	-	-	-	-	-	-
7/88	1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	ND	-	1	-	1	-	1	-
1/89	1	5	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+1	13	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
	U	-	-	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-
7/89	1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+1	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	+3	ND	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND
	U	32	-	-	-	-	-	-	-	-	-	1	-	3	1	-	2	1
1/90	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	12	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	+3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
7/91	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	+3	7	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
7/92	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	14	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-
	U	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	U	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
12/93	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/94	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/94	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	+3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals		295	2		3		6	5	8	3		1	11	12	13		13	7