THE STATUS OF BIRDS AT THE BOUNTY ISLANDS

By C. J. R. ROBERTSON and G. F. van TETS

ABSTRACT

Members of the first party to camp on the Bounty Islands in 170 years report on the ecology, behaviour and history of the penguin, mollymawk, cape petrel, prion, shag and tern that breed there and on the giant petrel, skua, gull and starling that stray there.

INTRODUCTION

Previous reports on the flora and fauna of the Bounty Islands have been based on observations from ships and landings of a few hours duration on Depot, Tunnel and possibly some of the other islands.

From 7 to 20 November 1978 a three-man party (C. J. R. Robertson, D. Horning and G. F. van Tets) camped on Proclamation Island. This was the first party to camp on the Bounty Islands for 170 years and the first biologists to do so at all. A photographic survey to record numbers and distribution of birds and mammals, made by helicopter from HMNZS *Waikato* on 7 November, provided data for islands not landed on. Further photographs taken during an RNZAF Orion flight on 29 November were also used. Both DH and CJRR visited Depot and Tunnel Islands by swimming. GFvT used a telescope to observe activity and faunal distributions on other islands.

The party made specific collections and studies during the expedition:

1. DH: Extensive underwater collections and studies of marine material, terrestrial plants, and invertebrates.
2. CJRR: Breeding ecology and behaviour of the Salvin's Mollymawk *(Diomedea cauta salvini)* and collections of birds and eggs.
3. GFvT: Breeding ecology and behaviour of the Bounty Island Shag *(Leucocarbo campbelli ranfurlyi)*, and collections of bones.

This paper covers general observations on the birds of the islands.

HABITAT

The Bounty Islands are a group of bare rocky islands discovered by Captain William Bligh of HMS *Bounty* on 19 October 1788 while he was on his way to Tahiti to collect bread-fruit trees for the West Indies. Most of the rocks are covered by a polished film of hard

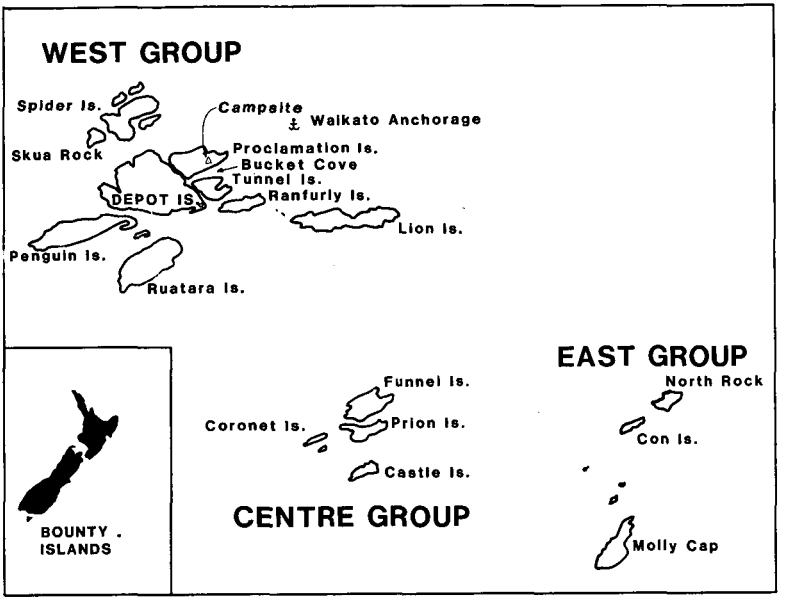

FIGURE 1 — Map of the Bounty Islands

guano, which may account for the ' white spots like patches of snow ' reported by Bligh (1792). Resting spots for fur seals lack the white film and are stained brown, with a rough pitted surface. Rainwater pools and channels are encrusted with precipitation layers of a phosphate compound several centimetres thick. Relatively flat and hollow areas have accumulations of a brown organic mud formed from the decay of carcasses, excreta, food scraps and seaweed. The seaweed is brought ashore by shags for nesting material. Land vegetation consists only of lichens and green algae on a few sheltered vertical rock faces. These conditions are consistent with the report by Bligh (1792) that he did not see verdure on any of the islands.

Above the wash of storm waves broad slopes and ledges are occupied by dense concentrations of penguins, mollymawks and prions. Lower down are concentrations of seals, a few of which stray higher up the islands. Narrow cliff-side ledges and alcoves are occupied by Cape Pigeons, shags and terns. Shags roost and nest also on some skyline ridges. Giant petrels, skuas and gulls roost on Skua Rock and the western half of Lion Island, which are relatively free of other kinds of birds. Gulls also roost on cliff ledges elsewhere. At the main bird colonies skuas and gulls are mobbed by prions in the air and attacked by penguins on the ground. Figure 1 shows the islands in the group.

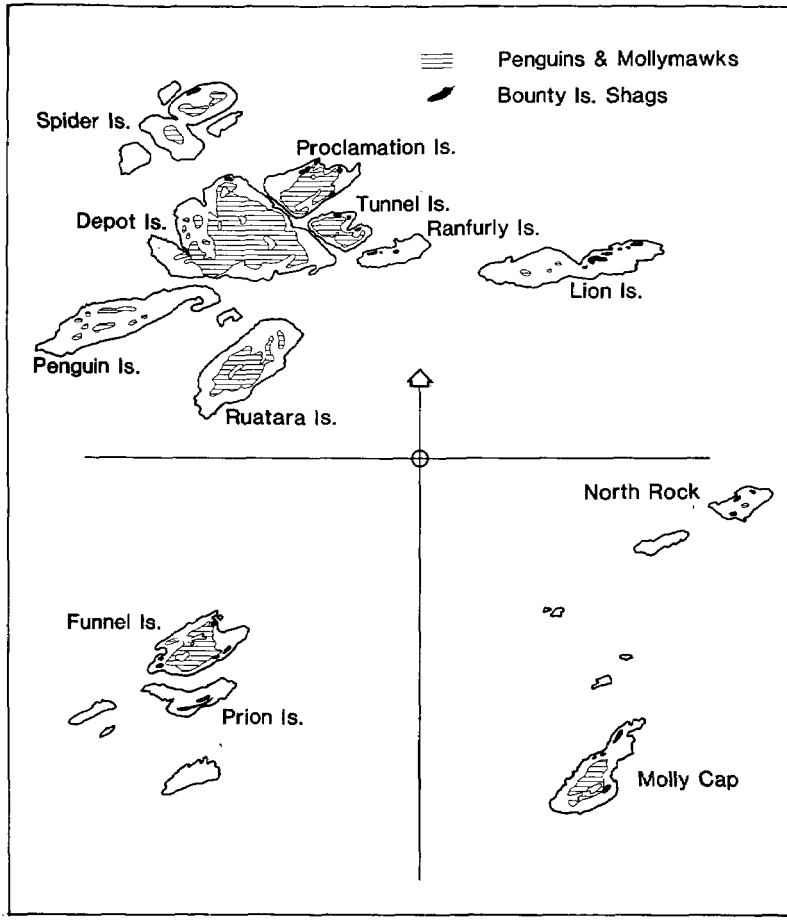

FIGURE 2 — Distribution of Erect-crested Penguins, Salvin's Mollymawks and Bounty Island Shags at the Bounty Islands

SYSTEMATIC LIST

ERECT-CRESTED PENGUIN *Eudyptes sclateri*

When Cook was near the Bounty Islands (Beaglehole 1961) (see Fig. 3), penguins with red bills were seen on 2 December 1773 and penguins were heard on 15 November 1774. Penguins were also seen on 19 September 1788 when Bligh discovered the islands. Reischek (1888) reported as breeding on the Bounty Islands in February 1888 the same three species of penguins he had seen at the Antipodes Islands: *Eudyptes pachyrhynchus, E. chrysocomus* (sic) and *E. filholi.* He gave no indication of their breeding status at the Antipodes.

Reischek's report for the Bounty Islands and Antipodes is of doubtful reliability as his visits were brief and in trying conditions. For example, he stated that no depot (provision) had been placed on the Bounty Islands, and yet he was travelling with Captain Fairchild who had installed a depot there two years earlier. These two island groups were visited after the Snares, Auckland and Campbell Islands and the activities included transhipping penguins from one island to another. He records that at the Antipodes " after exchanging some of our live-stock, by taking on fresh penguins and letting others go that we had taken from the Snares, we steamed to the Bounty Islands." Therefore, some confusion may well have occurred.

Reischek gave no descriptions of the penguins and presumably he used the names and descriptions of Buller (1882: 100 & plate 37). Buller (1888: 291) referred his *E. chrysocomus* to *E. pachyrhynchus* and his *E. filholi* to *E. chrysocome*. With Reischek at the Bounty Islands was W. Dougall (=Dugald in Reischek), one of whose photographs is reproduced in Buller (1888: 293 with comments on 200 & 288). The photograph shows a mixed group of penguins and molly-mawks, both with chicks about two-thirds adult height. The penguins clearly have the stubby bills and erect crests of *E. sclateri*, which Buller (1888: 289) named on the basis of a bird in the London Zoo from the Auckland Islands. Buller placed the photograph with the text for *E. chrysocome*, but on page 200 he called the penguins *E. pachyrhynchus*. Ogilvie-Grant (1898) recorded an immature skin of *E. chrysocome* and an adult skin of *E. sclateri* from the Bounty Islands. Hutton *in* Ogilvie-Grant (1905: 552) reported that *E. chrysocome* does not breed at the Bounty Islands and that *E. sclateri* is very common there and, according to Bollons, starts to breed during the middle of September. Since then only *E. sclateri* has been found to breed there, and there appears to be no published evidence that *E. chrysocome* has bred at the Bounty Islands, as is stated in various checklists, handbooks and field guides.

On 7 November 1978 we found Erect-crested Penguins on single large eggs, with freshly discarded small first eggs nearby. Nests consisted of loose accumulations of mud and debris that tended to wash away during rain showers. Females were about two-thirds the height of males. Near these nests the penguins screamed so loudly when we passed that it was painful to our ears. Males not on nest duty ran over and bit our legs. Penguins that had lost their eggs accepted onions, apples and oranges as substitutes. We did not see any chicks or hatching eggs by the time we left the Bounties for the Antipodes Islands on 20 November.

At the Antipodes hatching of Erect-crested Penguins had begun about 15 November (B. D. Bell, pers. comm.) and was completed there by 24 November when CJRR found no eggs still viable in the colony near the Antipodes Island camp. When we arrived at the Bounty Islands on 7 November, egg laying seemed to have been com-

pleted 7-10 days earlier, judging from the size of embryos in the eggs and the clean state of the shells. The considerable difference in breeding cycle within the same species but in colonies only 100 miles apart warrants further investigation, especially as the later breeders, those on the Bounty Islands, are to the north.

At the Bounty Islands, dense schools of 50-300 penguins arrived from at least 10 a.m. to dusk in Bucket Cove, between Proclamation, Tunnel and Ranfurly Islands. The schools were tightly packed and skittish, porpoising and diving in various directions before splitting up and dashing towards the landings. In heavy seas the penguins would leap from the crest of a wave and land feet first on the rocks, often to be washed off again. Only once was a penguin seen floating in the Cove that might have been killed during a landing attempt.

The penguins were as numerous as the mollymawks and prions, and their densities were comparable to those in Dougall's 1888 photograph and those taken in January 1968 and shown in Darby (1970: 174 & 176). We estimate that 115 000 pairs of penguins are on the Bounty Islands. See under Salvin's Mollymawk for discussion of nesting density and methods of calculation.

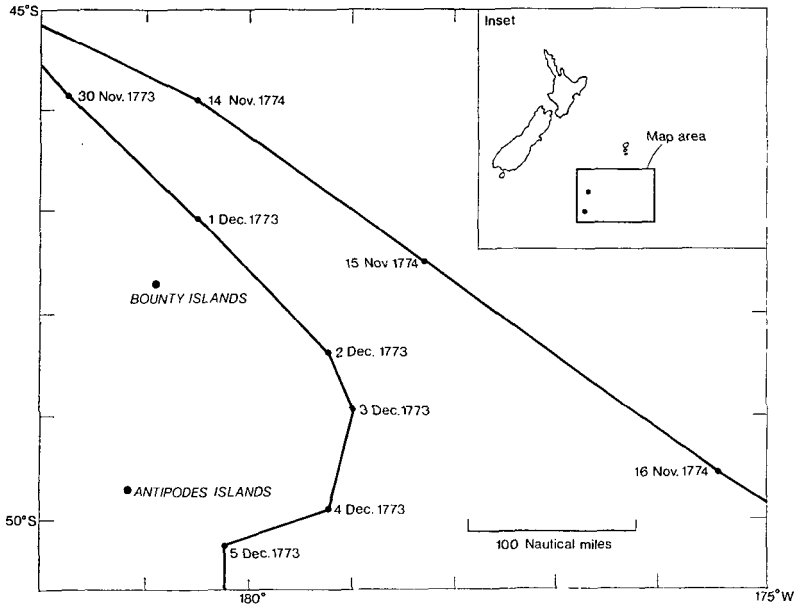

FIGURE 3 — Location of ship tracks made by Captain Cook near Bounty and Antipodes Islands based on noon positions

SALVIN'S MOLLYMAWK *Diomedea cauta salvini*

Grey albatrosses were seen on 2 December 1773 when Cook was near the Bounty Islands (Beaglehole 1961) (see Fig. 3). Bligh did not record any albatrosses when he discovered the islands on 19 September 1788, although he saw a great many two days later, 150 nautical miles to the east. Reischek (1888) reported two species of mollymawks, *D. melanophrys* and *D. chlororhyncha,* on the Bounty Islands, but Dougall's photograph in Buller (1888) shows only *D. c. salvini,* which is called *D. melanophrys* by Buller. Again, the validity of Reischek's account must be questioned, for earlier in the trip he recorded the same two species breeding on the cliffs of Campbell Island. They were at Campbell Island for only two days, and he probably did not visit the mollymawk colonies as he made no comment about their chicks. These identifications may therefore be based more on information from other sources than on direct observation. Hutton (*in* Ogilvie-Grant 1905: 558-559), on the basis of information from Bollons, stated that both *D. cauta cauta* and *D. c. salvini* bred at the Bounty Islands, with *cauta* starting at the end of August. Subsequently only *D. c. salvini* has been found to breed at the Bounty Islands.

On 7 November 1978 we found Salvin's Mollymawks on single eggs, some of which were starting to hatch, and when we left on 20 November, 45% of occupied nests still contained whole or pipping eggs. The nests consisted of columns of dried mud (Fig. 4) reinforced by moulted penguin feathers and some bird bones. Several layers of earlier seasons' dead chicks could be seen in some nests. The mean width of 35 nests was 37 cm. The form and heights of pedestals varied with the underlying terrain, ranging from an established solid column to little more than a lip stuck on the rock.

Mean pedestal heights for the sample were 85 mm for the

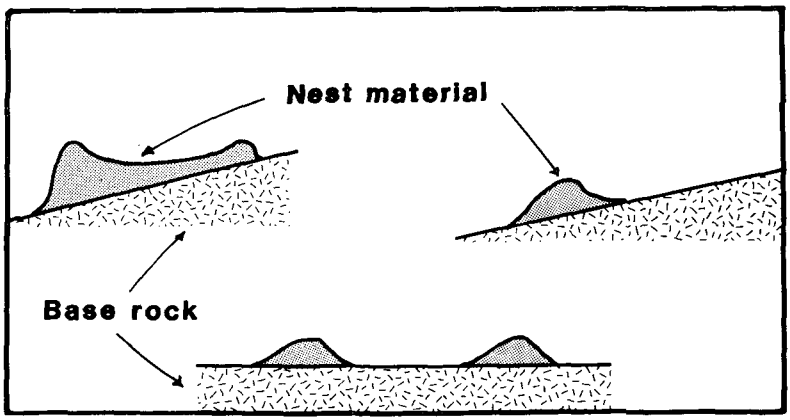

FIGURE 4 — Typical Salvin's Mollymawk nest structures

FIGURE 5 — A flat nesting area of mixed Salvin's Mollymawks and Erect-crested Penguins

lowest side of the pedestal to 155 mm for the highest side with an overall range for all sides of 15 to 247 mm. The highest pedestal seen and measured was 400 mm. The mean depth of the bowl for 35 pedestals was 35 mm.

To construct pedestals, the mollymawks used their bills to collect rain-softened mud from gullies and depressions and carried it up to 2 m to their nests. Nest centres averaged 1.2 m apart on flattish ground.

Only the bare, unfractured rocky tops of the islands can truly be called flat. Flattish areas are generally of rather broken terrain made up of loose rock slabs and creviced solid rock. Lower slopes were predominantly occupied by nesting penguins and, near seal rookeries, by penguin roosts. Flatter areas and gullies of the middle and upper part of the islands contained an even mix of mollymawks and penguins. Tops of rock slabs, inaccessible to penguins but in the lee of prevailing winds, were mainly used by mollymawks.

Figure 6 is a representation of the density of penguin and mollymawk nests on a typical flat area such as that shown in Figure 5. Penguins occupy the lower stratum, with no built up nests, below the mollymawk "high rise" on raised pedestals. Mean densities were 1 nest/1.9 m² for *D. c. salvini* and 1 nest/1.4 m² for *E. sclateri* in mixed colonies. In areas occupied solely by *D. c. salvini,* the nest

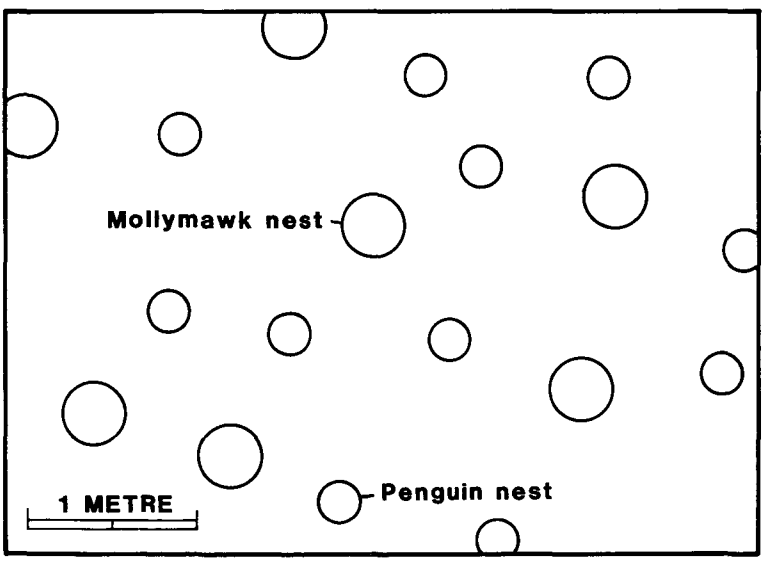

FIGURE 6 — The density of penguin and mollymawk nests on a typical flat area

density remained unchanged, but in areas occupied solely by *D. c. sclateri,* it increased to 1 nest/0.8 m².

Based on the nest densities we estimate that there were 0.5 pairs per square metre of *D. c. salvini* and 0.9 pairs per square metre of *E. sclateri.*

The photogrammetric branch of the Lands and Survey Department calculated a total area of 38 445 m² for Proclamation Island, which was the island most studied. By plotting the breeding areas of birds from visual mapping and air photographs (Fig. 2), we calculated the populations as shown in Table 1. The estimates for the whole island group are 76 000 pairs for *D. c. salvini* and 115 000 pairs for *E. sclateri.*

A sample of 42 eggs of *D. c. salvini* measured in the field, 34 at Bounty Islands and 8 on the Western Chain of the Snares Islands, has mean dimensions of 104 ± 4 mm x 67 ± 2 mm. This compares with a sample of 107 eggs of *D. c. eremita* from the Chatham Islands (CJRR, unpub., 1974) with mean dimensions of 102 ± 4 mm x 67 ± 2 mm and a sample of 74 eggs of *D. c. cauta* from Albatross Island (CJRR, unpub., 1981) with mean dimensions of 105 ± 4 mm x 67 ± 2 mm (± is standard deviation).

TABLE 1 — Breeding population of Salvin's Mollymawk, Erect-crested Penguin, and Bounty Island Shag, expressed in pairs

ISLAND	Mollymawks	Penguins	Shags
West Group			
Proclamation	8 656	15 580	20
Tunnel	5 027	9 048	30
Depot	35 380	63 684	11
Ruatara	9 185	16 533	-
Penguin	1 247	2 244	-
Ranfurly	-	-	66
Lion	-	476	165
Spider	4 006	7 211	12
Centre Group			
Funnel	8 240	-	64
Prion	-	-	70
Coronet	-	-	20
East Group			
Molly Cap	4 611	-	40
North Rock	-	187	71
TOTALS ESTIMATED	76 352	114 963	569

TABLE 2 — Contents of nests of **D. c. eremita** on Chatham Islands and nests of **D. c. salvini** on Bounty Islands, expressed as percentages.

	6.11.74 *eremita*	9.11.78 *salvini*	19.11.74 *eremita*	19.11.78 *salvini*
Egg	88	72	34	23
Hatching	10	17	8	25
Chick	2	11	68	52
n =	52	35	47	31

A study group of 35 nests containing eggs was chosen at random from various habitats and visited each day. One bird in each pair was marked with a patch of indelible dye on the forehead so that incubation and guard stints could be measured.

At the start of the study on 9 November 1978, four of the sample nests had chicks almost completely hatched indicating that hatching had begun on 3-5 November. The mean interval for hatching from pipping of the egg was 5 days. There are few data on the length of incubation for any *D. cauta* mollymawks.

P. M. Sagar visited the Western Chain of the Snares Islands on 21 November 1976. He reported (pers. comm.) that the majority of nests of *D. c. salvini* contained chicks with ages ranging from 3 days to unguarded. At our departure from the Bounty Islands on 20 November there were no chicks unguarded. As other mollymawks have a guard stage of about 3 weeks this probably indicates that breeding at the Bounty Islands is about 7-10 days behind that for the Snares Islands.

There is no published information as to when egg laying starts for any of the subspecies of *D. cauta*. Plomley (1966) recorded that many eggs of *D. c. cauta* were obtained by sealers on 14 September 1832 at Albatross Island in Bass Strait. On 18 September 1974, CJRR found some 90% of eggs had been laid by *D. c. eremita* at the Chatham Islands. One egg laid on that day was recorded as a chick on 19 November — 66 days later. Two eggs showed no sign of hatching after 63 and 64 days.

At Albatross Island in Bass Strait Gabriel (1896) found *D. c. cauta* eggs with embryos in all stages of growth on 31 October 1895 and estimated the incubation period to be about 8 weeks. Armstrong (1910) noted that the eggs were " far advanced in incubation " on 6 November 1909; and Ashworth & Le Souef (1895) noted that most eggs were hatched and all young were being brooded between 26 November and 1 December 1895. At Albatross Island in 1981, N. Brothers and CJRR (unpub.) recorded an incubation range of 68-75 days with a mean of 72 days for a sample of 15 *D. c. cauta* eggs.

Egg dimensions for *D. cauta* are similar to those of *D. m.*

TABLE 3 — Length of attendance at the nest of Salvin's Mollymawk when incubating, hatching and feeding chicks.

Days	Complete stints	Days	Incomplete stints
1	7	1+	18
2	10	2+	13
3	16	3+	10
4	9	4+	5
5	6	5+	8
6	3	6+	7
7	1	7+	0

Mean complete periods = 4.2 days

melanophrys, for which Tickell & Pinder (1975) recorded an incubation range of 65-72 days with a mean of 68 days. The range of hatching for *D. c. eremita* at the Chatham Islands indicates an egg-laying period of about 3 weeks. Tickell & Pinder (1975) recorded a guard stage of 21 days for *D. m. melanophrys* after hatching.

Figure 7, which sets out a probable breeding pattern for the *D. cauta* ssp., assumes a 3-week spread of laying and a 68-day incubation period.

Observations, although over a short period, gave a general indication of the length of incubation and guard stints at the nest by parents. Table 3 shows the distribution frequency of 52 complete and 61 incomplete stints.

Chicks were weighed and the culmen measured from the day of hatching. Figure 8 shows the daily weights of chicks during the

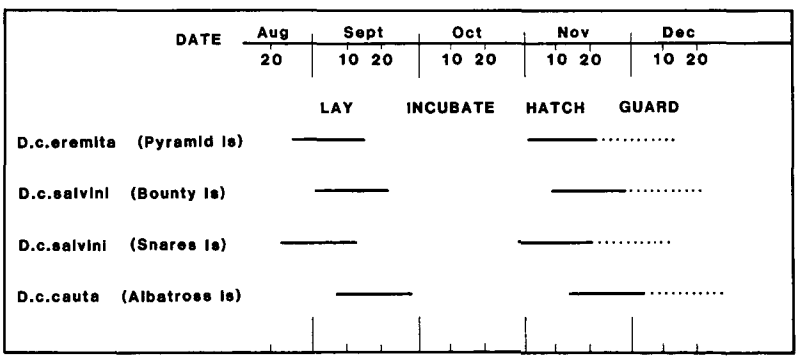

FIGURE 7 — Calculated spans of egg laying, incubation, hatching and guard stages in the breeding of **Diomedea cauta** ssp.

TABLE 4 — Measurements (mm) of live or freshly dead Salvin's Mollymawk

Males (n = 17)	Mean	Range
Culmen length	129 mm	124 - 135
Tarsus	92 mm	85 - 95
Wing	577 mm	555 - 600
Tail	222 mm	210 - 235
Weight	4.00 kg	3.3 - 4.9
Females (n = 12)		
Culmen length	127 mm	123 - 135
Tarsus	90 mm	87 - 95
Wing	574 mm	555 - 590
Tail	219 mm	210 - 228
Weight	3.59 kg	3.3 - 3.7

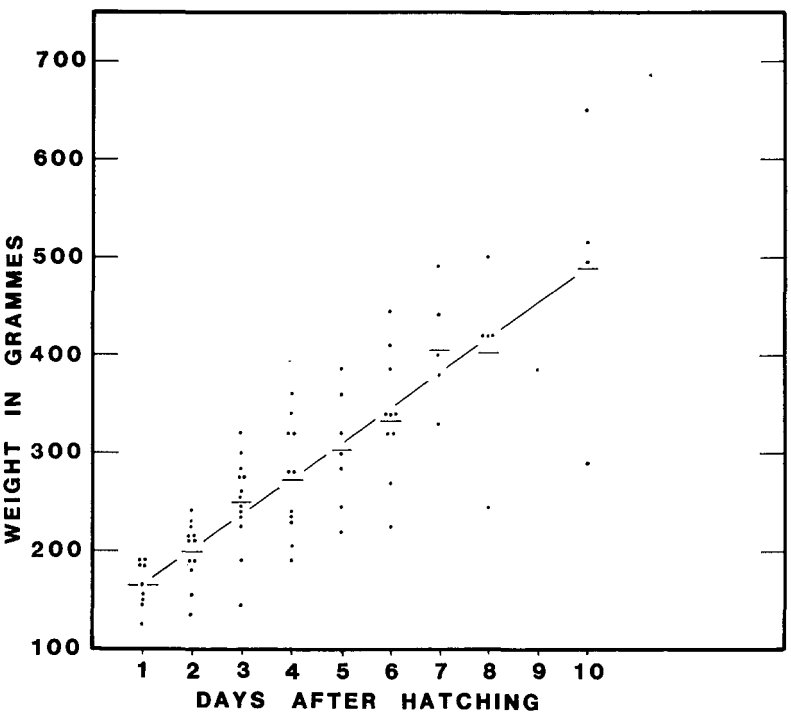

FIGURE 8 — Weights of Salvin's Mollymawk chicks for ten days after hatching

ten days following hatching. Although wide fluctuations are to be expected in the daily weights of chicks, some chicks increased at much better rates than others. Figure 9 shows the individual growth rates for five chicks and the associated guard periods for individual parents. There is some evidence that parents ran short of food to feed chicks when the guard period exceeded three days, but one adult that came in for only one day failed to maintain the weight growth of its chick.

A total of 17 males and 12 females was measured, either live from nest sites or freshly dead and deposited with the National Museum. As in other mollymawks, in live birds the skull width provides a

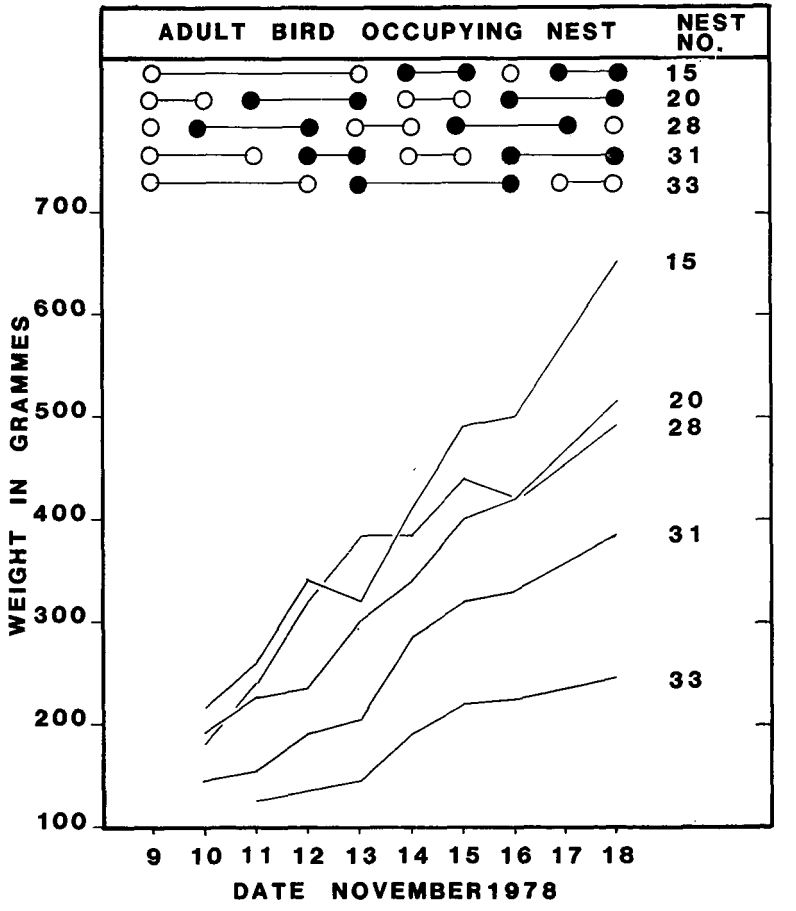

FIGURE 9 — The influence of parental presence and feeding on chick growth rates in Salvin's Mollymawk

useful method, in association with weight or culmen length, for demarcating the sexes.

GIANT PETREL *Macronectes* sp.

'Giant fulmars' were first reported offshore at the Bounty Islands in February 1926 by R. H. Beck and J. C. Correia of the AMNH Whitney South Sea Expedition (Darby 1970: 175). We saw at least five giant petrels on 9 and 15 November 1978 and at least one on 7, 8 and 16 November. They were all dark-plumaged immatures which we were unable to identify to species. Nearest breeding ground for *Macronectes halli* is Antipodes Island and for *M. giganteus* is Macquarie Island. They roosted with the skuas on Skua Rock and the western half of Lion Island. Five giant petrels fed two at a time on a dead penguin floating in Bucket Cove. They threatened one another with arched wings and snapping bills.

CAPE PIGEON *Daption capense*

'Pintadoes' were reported on 2 December 1773 in the vicinity of the Bounty Islands by Cook (Beaglehole 1961) (see Fig. 2). They were not reported again at the Bounty Islands until February 1926, when Beck and Correia saw them offshore, and in January 1968, when Darby (1970: 177) found them breeding on almost inaccessible ledges of precipitous cliffs.

When we arrived on 7 November 1978 we saw only one Cape Pigeon. On 8 November we saw five, including three on nests, and on 9 November we saw an egg in one of the nests, which when collected on 19 November, contained a small embryo. This seems to indicate that laying starts during the second week of November. Cape Pigeon numbers gradually increased to 36, with most of them on nest sites on, or visible from, Proclamation Island. At the Antipodes a freshly laid egg was recorded (B. D. Bell pers. comm.) between 19 and 22 November 1978. On 15 November at least 30 congregated to feed on a dead penguin floating in Bucket Cove, from time to time making brief panic flights away from the carcass. On 19 November at least six fed on the remains of a mollymawk floating in Bucket Cove.

The nests of the Cape Pigeons were in alcoves and horizontal fissures of the seaside cliffs. One nest was made of dried mud and debris, about 225 mm wide and up to 150 mm high. This nest was similar to but not as regular in shape as, those of the mollymawks. However, other nests were merely scrapes of stone chips. Single birds were seen flying along the cliffs as if looking for nesting sites and landing at likely ledges with a purring *courr* call. At a nest containing an egg the pair greeted each other with a chirping *churr* call. The bird on the nest was presented by its mate with bits of mud and debris.

FULMAR PRION *Pachyptila crassirostris*

Reischek (1888) reported that *Prion turtur* nested during February 1888 at the Bounty Islands. Mathews (1912) named prions from

the Bounty Island *crassirostris* as a new subspecies of *Pachyptila turtur*. It is doubtful whether the lectotype AMNH 527264 (Hartert 1926: 355), which is from the Reischek collection, was in fact from the Bounty Islands because the dates and location are incorrect (cf. Greenway 1973: 222). The systematics of prions, including the *P. turtur* - *P. crassirostris* complex, are in a state of flux because of inadequate samples of breeding birds from the islands they nest on. Ecologically, *P. crassirostris* differs from *P. turtur* by nesting in natural cavities rather than in burrows (cf. Law & Burstall 1953: 17, Fleming 1939, Darby 1970, Fullagar *in* Slater 1970: 167, and Fleming & Baker 1973).

Between 7 and 20 November 1978, we found Fulmar Prions courting out in the open throughout the day with a peak of activity in the middle of the day. The calls of presumed males were four-syllabled with an emphasis on the first or second syllable. They sounded like the following phrases in a clipped Oxford accent: ' What-*not*-to-do,' ' *Not*-prof-it-able ' and ' *Not*-poss-si-ble." Fights were seen between prions making four-syllabic calls. The response by presumed females to the four-syllabic calls was a somewhat slurred and cooing call with equal emphasis on three syllables, sounding like *Co-ver-up* and *Coore-corr-corr.* These calls differed from those of *P. turtur,* which sounded to GFvT at Stephens Island, Cook Strait, as *Cup-a-curr,* and to Fullagar (*in* Slater, 1970: 167) as *Kuk kuk coo-er,* a soft evenly phrased cooing uttered quickly and usually several times in close succession.

No nests were seen completely in the open, and the main localities were in angled rock fissures and under slabs or piles of rock. The nests were small dried pellets of mud with or without an overlay of penguin quills and small mollymawk body feathers. In suitable " caves " and overhangs, nests were often as little as 0.3 m apart. Of two eggs collected on 19 November, one was little incubated and the other contained a large embryo with no sign of feather development. This may suggest that egg laying started at about the beginning of November.

A sample of 31 eggs measured 46 ± 2 mm x 33 ± 1 mm. This is similar to 13 eggs of *P. crassirostris* ssp. from the Western Chain of the Snares Islands, which measured 46 ± 1 mm x 33 ± 1 mm (P. M. Sagar, pers. comm.), and 30 eggs of *P. c. pyramidalis* from the Pyramid, Chatham Islands, which measured 46 ± 2 mm x 33 ± 1 mm (CJRR, unpub.). Measurements of six Fulmar Prions collected were included in those published by Harper (1980).

Although the prions were impossible to census, as they formed a subterranean population wherever suitable habitat occurred, we estimated that they were as numerous as the mollymawks, about 76 000 pairs (see Table 1).

Unlike Fulmar Prions in the Chatham Islands but like those

of the Western Chain of The Snares (Fleming & Baker 1973), the Bounty Island prions moved about freely in daylight, and the open-air courtship indicates an absence of effective predators. Any skua or gull venturing over the island in daylight caused " mobbing " flights with seemingly all prions on the surface taking off and flying about, and had a tight group of about 100 prions closely pursuing it. Once the intruder was out of range prions returned to the surface and resumed displaying and calling. Unlike other prion species, these birds ceased vocalisation at night, a complete reversal of the normal diurnal pattern.

Beck recorded that in late February 1926 prions were everywhere under the rocks but he made no mention of birds sitting on the surface. This may indicate that by then " courting " is completed.

An immature male fur seal was seen holding a prion in its mouth by its wings and toying with it. Eventually the prion escaped, flew around for a while and then landed back near the seal. A foraging flock of prions in Bucket Cove was seen to peck small items off the sea and some of them dived from the water surface and were briefly submerged. They also foraged together with Cape Pigeons in rough water over Blackfish Shoal. Three prions were seen hovering over giant petrels and Cape Pigeons feeding on a penguin floating in Bucket Cove.

BLACK-BELLIED STORM-PETREL *Fregetta tropica*

Beck and Correia reputedly found Black-bellied Storm Petrels nesting on 26 February 1926 at the Bounty Islands, according to Darby (1970). However, a re-examination of the MS of the journals of Beck and Correia does not confirm this. Single Black-bellied Storm Petrels were seen at sea near and to the north of the Bounties, but none was recorded ashore. We are not aware of anyone else having recorded them there. During November 1978, we saw them from HMNZS *Waikato* in the vicinity of the Bounty Islands, but we did not see them on the islands or find remains of storm petrels or of their eggs in rock crevices.

BOUNTY ISLAND SHAG *Leucocarbo campbelli ranfurlyi*

The following quotations from Ogilvie-Grant (1905: 543, 544, 572) describe the discovery of the Bounty Island Shag.

> " Towards the end of 1897 a communication was sent to the Earl of Ranfurly, Governor of New Zealand, requesting him, if possible, to obtain examples of birds from that Colony and the adjacent islands for the British Museum (Natural History). With this object in view, Lord Ranfurly ordered a large number of jars of various sizes to be made, and forwarded them filled with formaline solution to a few gentlemen who had undertaken to assist him. On the 19th December, 1900, Lord Ranfurly started in the Government steamer ' Hinemoa ' for the Bluff, and visited the outlying islands — namely, the Snares, Campbell, Auckland,

Antipodes, and Bounty. Capt Hutton, the Curator of the Christchurch Museum, was his guest, and, from his knowledge of natural history, largely assisted in the formation of the collection made during this trip."

". . . as this was a sea-trip, aquatic birds naturally formed a large part of the collection. Cormorants being especially numerous. One of these, obtained on the Bounty Islands, proved to belong to a species hitherto undescribed, and was named **Phalacrocorax ranfurlyi.** Lord Ranfurly had asked the captains of the various British cruisers in New Zealand waters to get any specimens obtainable, and he had also written to the Resident of the Cook and Harvey Islands with a view to obtaining the birds found on those groups. Subsequently Commander J. P. Rolleston, of H.M.S. 'Archer,' procured living specimens of **P. ranfurlyi** from the Bounty Islands . . . ."

". . . some of which reached New Zealand alive, but were subsequently killed and forwarded to England with other birds in formaline."

The holotype skin of *Leucocarbo ranfurlyi* (Ogilvie-Grant 1901), an adult male, is registered as 1901.10.21.50 in the British Museum (Natural History) (Warren 1966: 242). Subsequently visitors reported that the Bounty Island Shag bred on narrow ledges of the sea cliffs (Oliver 1955, Darby 1970). It is the only kind of shag that has been reported from the Bounty Islands, and it has not been recorded elsewhere. The description of two shags seen in 1950 at Bollon's Island, Antipodes Islands (Warham & Bell 1979), could also fit several other species of shag.

Before 9 a.m. on 7 November a foraging flock of about 300 shags was seen from HMNZS *Waikato*. Up to half of these may have been non-breeding birds. This was the largest number of shags seen at any one time.

From 7 to 20 November we found all stages from courting to well-advanced incubation, but no chicks. Hatching had begun by 19 November in one of ten eggs we examined that day. The hatching egg and five others were collected for the National Museum of New Zealand. During the Auckland Islands Expedition of 1972/73, GFvT had found the incubation period of four first eggs of *Leucocarbo colensoi* to be 28, 28, 29 and 32 days. Therefore, *L. ranfurlyi* may have started laying eggs during the middle of October. Egg laying of *L. colensoi* in the Auckland Islands starts in November and of *L. campbelli* at Campbell Island in August or September.

Based on photographs taken by helicopter on 7 November and on observation by telescope from Proclamation Island from 7 to 20 November, 569 pairs of nesting shags were distributed as shown in Figure 2 and Table 1. Most nests were on narrow cliff-side ledges, and a few were on narrow skyline ridges of Lion and Coronet Islands. The nests were 35 cm wide and up to 15 cm high with the centres of adjacent nests as little as 1 m apart. The nests were mainly made

of a brown alga, *Marginariella,* which grew in a band at least 10 m below sea level. The shags dived for the alga during heavy seas, presumably the surge helping them to break off strands a metre or more long. The alga became sticky, staining the white breasts of the shags brown, before it dried out glued to the nest structure. The nest structure also contained cone-like epiphytes that grow on *Marginariella,* feathers, stones, debris and mud. Tussock grasses, which form the bulk of the nests of shags at Auckland, Campbell and Macquarie Islands, were not available at the Bounty Islands.

Up to three eggs were found in a clutch. A sample of 20 eggs of *L. ranfurlyi* measured in the field and in the collection of the National Museum of New Zealand has mean dimensions of 64 ± 2 mm x 41 ± 2 mm. These are slightly larger than the mean dimensions of a sample of 32 eggs of *L. colensoi* (GFvT, unpub.) measured in the field at Enderby Island, Auckland Islands, which were 60 ± 3 mm x 39 ± 2 mm.

In mated pairs females left the nesting area shortly after dawn to go foraging and returned during the middle of the day. Males left some time after the return of their mate and foraged during the afternoon. Many were seen flying back at dusk from far out to sea. Before they left they regurgitated a green or pink pellet of food remains and pebbles with a soft *Gock-gock-gock . . .* sound. They also dived a few times for seaweed to augment the nest before flying out to sea to go foraging. The pellets contained beaks of a small cephalopod, bones and earstones of a small fish, fragments of snail shells, snail shells containing tiny hermit crabs, sea urchin spines, coral fragments, pebbles, tapeworms, and bits of kelp and dirt.

From nine *L. ranfurlyi* collected on 19 November, the following remains were in the following number of stomachs: fish (8), snail shells (8), cephalopods (4), isopods (4), hermit crab (1), crab (1), sea urchin (1), coral (3), stones (5), and nematodes (2). The hermit crabs were in snail shells and cavities of coralline concretions. Thirty-five stones, including eight coralline concretions, in the shag stomachs ranged from 0.2 to 1.5 g and had a mean weight of 0.5 ± 0.3 g. Because of the surge around the islands, the stones, shells and bits of coral probably came from sheltered sea caves or very deep water. DH saw and collected similar hermit crabs from bare, vertical rock walls below the brown alga zone.

The shags foraged out to sea and around the islands. To dive from the water surface, they usually jumped higher than a body length above the water. On shore they rested on ledges and in alcoves of cliffs and on skyline ridges. Like other subantarctic shags they did not spread their wings to dry.

Externally the sexes are alike, except that males are slightly larger than females. The adult plumage is black with a blue sheen above and white below. The black-and-white border starts at the side of the throat. The upper wing-coverts are dark brown with a

green sheen and narrow indistinct borders. White alar patches are prominent in some and poorly developed in others. White scapulars have not been recorded. White back patches, which range from prominent to poorly developed on at least a few males, are lacking on more than 90% of the adults. The holotype male has one white feather on each side (Ogilvie-Grant 1901). In *P. colensoi,* white back patches are restricted also to a few males. White patches have not been recorded on *P. campbelli.* Some birds have a white axillary line along the front of the humeral area of the under wing. Some males have a second white line further back on the inside of the under wing. The bill is brown or pink with a dark ridge and a light tip. The face is red, orange and/or purple with a red-orange, purple or pale brown eye ring. The throat is orange red. Instead of caruncles above the base of the upper bill, there is a variable amount of orange-yellow at the unfeathered proximal ends of the upper and lower bill, resembling in some but not all birds the patterns of *L. colensoi* and *L. campbelli.* The iris is light brown. The legs and feet are pink with variable amounts of grey smudges around the top of the tarsus and on the toes, which have dark brown nails.

Immatures differ by being brown above and white below. A few have brown spots on the white foreneck. J. P. Rolliston collected on 15 January 1903 a juvenile male, presumably a specimen in the British Museum (Natural History) (Ogilvie-Grant 1905), and an immature female, A.03.24 in the Otago Museum, that both have a broad brown band across the foreneck as in *L. campbelli* and some *L. colensoi.* None of the *L. ranfurlyi* seen in 1978 had such brown bands.

We did not see any juveniles or nestlings. F. W. Hutton and J. P. Rolliston (*in* Ogilvie-Grant 1905) described the soft part colours of juveniles as follows: " The young in first plumage has the iris pale brown, skin round eye and lores brown, gular pouch grey, and the bill and feet brownish-flesh-colour." It is possible that this description was based on only the above-mentioned juvenile male.

The measurements in Table 5 are by GFvT from three dry skins in the Canterbury Museum, 16 in the National Museum of New Zealand, including 12 we collected, and two in the Otago Museum. The weights are from specimen labels.

Males make soft purring and ticking sounds audible only a few feet away, and females are silent except for soft, almost inaudible, puffing sounds heard only during a copulation.

When the shags are on or near a nest site their forehead crest remains up and the nape line, formed by depressing the crown feathers and raising the neck feathers, is prominent and continuous along the hyoids to the front of the throat.

As in other Phalacrocoracidae, males choose the nest site, which they defend against other males and on which they advertise for a mate. Females choose a male and his nest site and approach

TABLE 5 — Measurements of dry skins of **Leucocarbo ranfurlyi**

Males	No	Mean	Range
Culmen length	11	59 mm	56 - 62
Tarsus	10	69 mm	67 - 71
Wing	11	294 mm	285 - 300
Tail	11	127 mm	117 - 134
Weight	7	2.5 kg	2.3 - 2.9
Females			
Culmen length	8	55 mm	52 - 59
Tarsus	10	67 mm	65 - 70
Wing	10	278 mm	272 - 287
Tail	8	116 mm	107 - 137
Weight	6	2.5 kg	2.0 - 2.7

him cautiously. After she is accepted she builds the nest, mainly with material he brings to her, and copulation takes place on the nest. During incubation extra material is brought to the nest by both parents before and after nest relief. Birds of both sexes on the nest site have the closed wings drooped down beside the body, thus exposing the back, whereas birds outside the nest site have the wings folded well up, covering the back. Male-advertising displays are performed by males to attract a mate and after pair formation by males and sometimes females to call their mate. The displays cease when eggs are in the nest. Recognition displays are done by the bird on the nest site to acknowledge the arrival of a potential or actual mate. Some recognition displays follow or may be fused on to the end of a male-advertising display.

The male-advertising of *L. ranfurlyi* (see Fig. 10) consists of *Gargling*, in which, with the body upright, the bird swings its head back through a vertical arc until crown and nape touch the rump, and it then swings its head back to the starting position. Sometimes, birds do Gargling from a sitting position with the breast being raised or while standing on both feet or only one foot. During this display the bill usually opens as the head reaches the rump and snaps shut as the head returns to the forward position. Sometimes the bill remains closed and at other times the bill remains wide open for several displays in succession and during the subsequent Forward-gaping. During Gargling, the tail is raised almost vertically and the wings droop down beside the body. Once a male made a soft *hargh* call about 1.5 m away, which would have been inaudible from much further away.

Recognition consists of *Forward-gaping* and *Nest-worrying*. During Forward-gaping, the bird directs its wide-open bill forward and

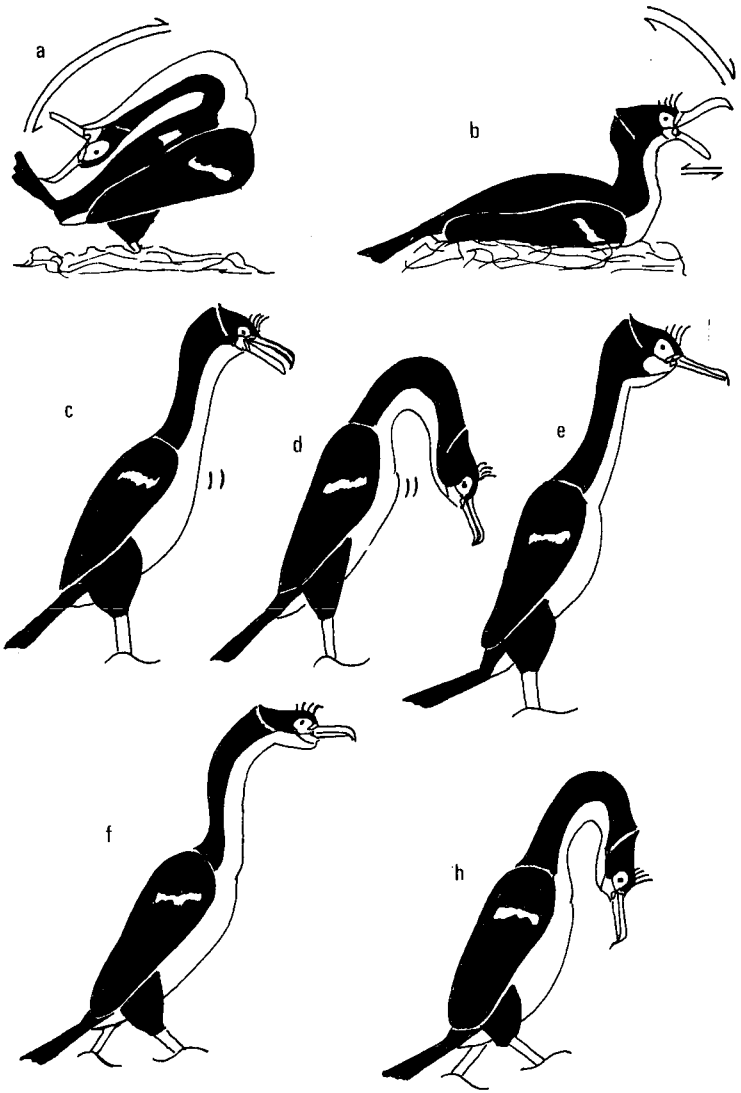

FIGURE 10 — Behaviour patterns of the Bounty Island Shag. (a) Gargling; (b) Forward-gaping, (c) Pre-take-off, (d) Pre-hop, (e) Post-landing, (f) Kink-throating, (h) Penguin-walking. Drawn from field sketches by GFvT.

sometimes somewhat upward and moves it back, forth and sideways above the front of the body. Males make a soft *he-he-he* . . . sound and females are silent.

In *Nest-worrying,* a bird worries the nest material with the bill. It makes no sound. Sometimes it worries the tail of its mate beside the nest instead. Scars of this behaviour can be seen on the tails of some museum specimens and should not be confused with hunger bars.

Another greeting display performed by both the bird on and the bird beside the nest site is *Head-lowering.* In it the head is lowered and raised in front of the body with the bill closed and horizontal. Usually the body is horizontal and the tail down below the horizontal. Often it is done by both birds in synchrony.

A bird threatens intruders with a wide open bill, a bulging throat, and by moving the head back and forth and sideways with irregular sinusoidal neck movements. Sometimes, males utter a soft *borr-borr-borr* . . . Females threaten silently.

When there is no cause for alarm cormorants and shags leave their nesting area slowly and deliberately with a characteristic posture of head and neck, the *Pre-take-off* posture. In this posture, *L. ranfurlyi* holds the head high with closed or slightly open bill sloping slightly downwards. Usually the neck is almost vertical with a slight arching of the whole neck holding the head somewhat forward. The breast and abdomen pulsate, while males sometimes make a ticking *t-t-t* . . . and females make no sound. Males also make this sound and pulsate their breast when they are about to rise from their nest and let their mate take over incubation.

Kink-throating is the main display of cormorants and shags when approaching the nest site and it often continues for a while after landing. It is also used when birds are mandibulating nest material near the nest site. Kink-throating, which is very like the food-begging of chicks, consists of a forward protrusion of the hyoid or tongue bones, giving the throat a characteristic kink. When Kink-throating near the nest, males of *L. ranfurlyi* sometimes make a soft *herr-herr-herr* . . ., *corr-corr-corr* . . ., or *horr-horr-horr* . . . sound, and females are silent.

During pair formation there is also a *Post-landing* posture, which is most elaborate in females approaching an advertising male cormorant or shag. It is an exaggerated recovery after landing, in which the posture of head and neck is highly species specific and so presumably serves as a guard against hybridisation. In the *Post-landing* posture of *L. ranfurlyi,* the bird raises its head with the bill horizontal and the throat bulbed. Its neck and body are almost vertical and the tail is down below the horizontal. It makes no sound. The *Hop* is a characteristic display of cormorants and shags near the nest site. In essence it is an abbreviated symbolic flight which starts with a Pre-take-off posture and ends with a Post-landing posture. All gradations

occur such as flying from one part of the nesting colony to another, *Circle-flying* away and back to the nest site, hopping from one perch to another, hopping only a few inches, and Pre-take-off posture alternating with a Post-landing posture without the feet leaving the ground (van Tets 1965). In some species of cormorants and shags, the *Pre-hop* and *Post-hop* postures differ from the *Pre-flight* and *Post-landing* postures, but in *L. ranfurlyi* only the Pre-hop posture is different, the neck being arched and the closed bill being directed vertically downward. In males sometimes a soft ticking *t-t-t* . . . starts and a soft *aw-orgh* ends a Hop, but females are silent.

Penguin-walking is done by *Leucocarbo* shags, including the Bounty Island Shag, when walking through or near their nesting colony, especially by males gathering nesting material and by females in search of a mate. The bird walks with the upper neck arched and the closed bill pointed vertically downward. It forms a ridge of feathers along the nape line by depressing its forehead crest and crown feathers and by raising its upper neck feathers. It folds the wings tightly on top of the back and holds the tail down below the horizontal. Sometimes when a bird is leaving the nest the Penguin-walking is preceded by a Pre-hop posture and when it ends near the nest it may be followed by either Kink-throating or a Post-landing posture.

Authors differ on whether *L. ranfurlyi* is related to the *L. carunculatus* or the *L. campbelli* group of *Leucocarbo* shags. By having an orange-yellow gape instead of a pair of orange-yellow caruncles on the base of the upper bill and by lacking a blue eye ring, *L. ranfurlyi* clearly belongs to the *L. campbelli* group: the subgenus *Nesocarbo* Voisin 1973. In their nesting ecology and behaviour the *Nesocarbo* shags differ from most other kinds of *Leucocarbo* shags by nesting on the sides of cliffs rather than on exposed relatively level ground.

L. ranfurlyi differs from *L. campbelli* and *L. colensoi* by being larger, having very rarely a dark foreneck; having a variable pattern of yellow at the gape, having various facial colours, and having a light brown iris. *L. campbelli* differs from *L. ranfurlyi* and *L. colensoi* by having a dark foreneck with a sharp border between the dark neck and the white breast. *L. colensoi* differs from *L. ranfurlyi* and *L. campbelli* by having a variable amount of white and dark feathers on the foreneck and having a prominent pink or pale shiny-purple eye ring that contrasts with a dark purple face. *L. ranfurlyi, L. campbelli* and *L. colensoi* differ also in details of their behaviour patterns, as will be reported elsewhere. We, therefore, regard them as three distinct species rather than as subspecies of *L. campbelli* or *L. carunculatus.*

SOUTHERN GREAT SKUA *Stercorarius skua lonnbergi*

Port Egmont Hens (= Catharacta skuas) were seen on 2 December 1773 when Cook was near the Bounty Islands (Beaglehole 1961). Since then the only published record of skuas at the Bounty Islands

was of a couple seen offshore on 26 February 1926 by Beck and Correia (Darby 1970 and Beck MS).

While we were on the Bounty Islands, Southern Skuas seen were as follows: one 7 November, two 8 November, four 9 November, seven 11 November, eight 12 November, ten 15 November, eight 17 November and one 18 November. These numbers indicate that they were transients, as suggested by Oliver (1950: 320). They were mainly seen resting on Skua Rock and the western end of Lion Island, which are relatively low, rounded and exposed to the highest storm waves. Elsewhere over the islands the skuas were mobbed by prions in the air and attacked by penguins and mollymawks. One skua was seen several times lifting a deserted egg in its bill as if to judge its weight before hacking it open with a closed bill and eating its contents. The same skua went to a fresh dead mollymawk and ripped bits off it until chased by penguins. All skuas were in new dark plumage similar to those at the Antipodes Islands.

SOUTHERN BLACK-BACKED GULL *Larus dominicanus*

According to Darby (1970), Black-backed Gulls were first found on the Bounty Islands on 26 February 1926 by Beck and Correia, and she wondered about the status of Dominican and Red-billed Gulls, thus implying that she saw both there on 12 January 1968. We are not aware of any other records of Red-billed Gulls *(L. novaehollandiae)* at Bounty Islands and can find no reference in Beck's manuscript.

When we arrived on 7 November, HMNZS *Waikato* attracted at least 20 Southern Black-backed Gulls. One pair was building and occupying a nest on the eastern end of Lion Island at least from 13 to 18 November. The distribution of pairs appeared to be four on Lion Island, one on Ranfurly Island, one on Coronet Island and two or three on Prion and Castle Islands. On 17 November 6 adults, 2 subadults and 10 juveniles were roosting on ledges on the western side of Proclamation Island. On 20 November ten, including four subadults, followed HMNZS *Waikato* from the Bounty Islands to the Antipodes Islands. There may be a regular interchange of gulls between these islands, which are only a few hours' flying apart. At the Bounty Islands the gulls foraged at sea and along the shores. They were not as vigorously mobbed by prions as the skuas and appeared better able to avoid attacks by penguins than skuas. A gull that landed on Tunnel Island caused intense aggressive screaming from surrounding penguins as it moved around near nests. An adult joined a group of giant petrels and Cape Pigeons feeding on a penguin floating in Bucket Cove.

ANTARCTIC TERN *Sterna vittata bethunei*

A " white kind of gull with a forked tail " was seen when Bligh discovered the Bounty Islands on 19 September 1788. Bethune in 1895 collected the first terns from the Bounty Islands, one of which is the lost type of *bethunei,* the subspecies that breeds on the subantarctic

islands near New Zealand (cf. Murphy 1938). Neither Beck nor Correia recorded terns in their diaries for the 1926 visit. On 12 January 1968 Darby (1970) found Antarctic Terns breeding on almost inaccessible ledges of precipitous cliffs.

We saw fish-flights on 8 and 10 November, and on 18 November DH found two nests with one egg each on ledges of Depot Island. We saw two plumage stages among non-adult terns roosting on narrow ledges of a perpendicular cliff of Proclamation Island: (a) black bill and legs, and white/pale grey crown with black sides paling to grey on nape; (b) red bill and legs, white crown with grey stripe from eye to nape. Both forms had white plumage between the eye and base of the bill. Presumably they were immatures and subadults of the Antarctic Tern. The terns rested mainly on small ledges and in cavities of steep cliffs. They were seen foraging over the sea around and between the islands, including the narrow gorges between Proclamation, Tunnel and Depot Islands. CJRR photographed a tern ashore on Proclamation Island going into horizontal rock fissures to feed on amphipods. The terns foraged in groups of up to six. Because of their mobility it was hard to estimate how many there were, but we gained an impression of about 20 adults and immatures.

STARLING *Sturnus vulgaris*

A Starling was seen on 26 February 1926 by Beck and Correia on Depot Island and flying between islands (Darby 1970 and Beck MS). We saw at least one adult in the gorge between Proclamation and Tunnel Islands. It was the only land bird recorded on the islands.

CONCLUSIONS

Species composition of the birds breeding on the Bounty Islands was very simple with only single representation at the subfamily level. Only the shag is restricted to breeding on the Bounty Islands.

The lack of land vegetation other than lichens and algae may be explained by the hard substrate, high phosphate levels, extensive runoff and salt-laden spray combined with the very high density of nesting penguins and mollymawks. The birds breeding at the Bounty Islands, therefore, are those that can manage without substantial amounts of land vegetation and soil. The shags used marine algae instead of tussock grasses to build their nest; and the mollymawks were using moulted penguin feathers instead of their normal vegetation to reinforce their mud nests. There were no burrowing petrels, and surface-nesting scavenger/predators such as *Macronectes* and *Stercorarius* need a more sheltered and less crowded habitat for breeding. Other than a stray Starling, there were no landbirds.

ACKNOWLEDGEMENTS

We are indebted to the captain and crew of HMNZS *Waikato* for logistic support; to the late Wim Vestjens for identifying food remains in shag stomachs; to Dr John Calaby for help in finding early

references to the Bounty Islands; to Frank Knight for drawing the map of Figure 2; to R. H. Taylor, J. Newton, G. Woodward for Air photos; and to P. Stewart for Lands and Survey photogrammetric section area calculations.

The Bounty Islands Party formed part of the B.A.A.S. Expedition of 1978, which visited a number of subantarctic island groups, organised by the New Zealand Wildlife Service and authorised by permit from the Lands and Survey Department.

LITERATURE CITED

ASHWORTH, H. P. C.; LE SOUEF, W. H. D. 1895. Albatross Island and the Hunter Group. Vict. Nat. 11: 134-144.
ARMSTRONG, W. J. T. 1910. On Albatross Island. Emu 9: 155-157.
BEAGLEHOLE, J. C. (ed.) 1961. *The journals of Captain James Cook on his voyages of* discovery. II. The voyage of the Resolution and Adventure 1772-1775. Cambridge University Press for the Hakluyt Society.
BLIGH, W. 1792. A voyage to the South Sea. London: Lords Commissioners of the Admiralty.
BULLER, W. L. 1882. Manual of the birds of New Zealand. Wellington.
BULLER, W. L. 1888. A history of the birds of New Zealand. 2nd Ed. Publ. by author.
DARBY, M. 1970. Natural history of the Bounty Islands. Animals 13: 171-177.
FLEMING, C. A. 1939. Birds of the Chatham Islands. Emu 38: 380-413.
FLEMING, C. A.; BAKER, A. N. 1973. The Snares Western Chain. Notornis 20: 37-45.
GREENWAY, J. C. 1973. Type specimens of birds in the American Museum of Natural History. Bull. AMNH 150: 209-345.
HARTERT, E. 1926. Types of birds in the Tring Museum. B. Types in the general collection VII, Tubinares. Novit. zool. 33: 344-357.
HARPER, P. C. 1980. The field identification and distribution of the prions. Notornis 27: 235-286.
JOHNSTONE, G. W.; MILLEDGE, D.; DORWARD, D. F. 1975. The White-capped Albatross of Albatross Island: numbers and breeding behaviour. Emu 75: 1-11.
LAW, P. G.; BURSTALL, T. 1953. Heard Island. ANARE Int. Rep. 7.
LE SOUEF, W. H. D. 1895. Notes on birds found nesting on Albatross Island in Bass Strait, Australia. Ibis (7) 1: 413-423.
MATHEWS, G. M. 1912-1913. Birds of Australia. Vol. 2. London: Witherby.
McNAB, R. 1975. The old whaling days. Christchurch: Golden Press.
MURPHY, R. C. 1938. On pan-antarctic terns. Birds collected during the Whitney South Sea Expedition 37. Am. Mus. Novit. 977: 1-17.
OGILVIE-GRANT, W. R. 1898. Cat. Birds. Brit. Mus. 26: 329-687.
OGILVIE-GRANT, W. R. 1901. **Phalacrocorax ranfurlyi,** n.sp. Bull. BOC 11: 66-67.
OGILVIE-GRANT, W. R. 1905. On the birds procured by the Earl of Ranfurly in New Zealand and the adjacent islands. Ibis (8) 5: 543-602.
OLIVER, W. R. B. 1955. New Zealand birds. Reed.
PLOMLEY, N. J. B. (ed.) 1966. " Friendly Mission " — The Tasmanian journal and papers of George Augustus Robinson 1820-1834. Hobart. Tas. Hist. Res. Assn.
REISCHEK, A. 1888. Notes on the islands to the south of New Zealand. Trans. NZ Inst. 21: 378-389.
SLATER, P. (ed.) 1970. A field guide to Australian birds, non-passerines. Adelaide: Rigby.
TICKELL, W. L. N.; PINDER, R. 1975. Breeding history of the Black-browed Albatross **Diomedea melanophris** and Grey-headed Albatross **D. chrysostoma** at Bird Island, South Georgia. Ibis 117: 433-451.
Van TETS, G. F. 1965. A comparative study of some communication patterns in the Pelecaniformes. AOU Ornith. Monograph 2: 1-88.
VOISIN, J-F. 1973. Notes on the blue-eyed shags (genus **Leucocarbo** Bonaparte). Notornis 20: 262-271.
WARHAM, J.; BELL, B. D. 1979. The birds of Antipodes Island, New Zealand. Notornis 26: 121-169.
WARREN, R. L. M. 1966. Type specimens bds. BM(NH) 1: 242.

C. J. R. ROBERTSON, *Wildlife Service, Department of Internal Affairs, Private Bag, Wellington, New Zealand;* G. F. van TETS, *CSIRO, Box 84, Lyneham, ACT, Australia.*