Population assessment of the Chatham mollymawk at The Pyramid, December 2001

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ABSTRACT

The Chatham mollymawk (*Thalassarche eremita*) breeds only at The Pyramid, a small islet in the Chatham Islands group, New Zealand. Because of difficult access, weather and sea conditions, the island is rarely visited, and fewer than 100 days of research into the breeding status of the Chatham mollymawk had been achieved before this expedition. Building on census work done in 1999 and 2000, the visit in 2001 confirmed that there are between 5304 and 5333 nest sites recorded on the island. A mean 62% (range 53–68%) of nest sites hatch chicks. However, allowing for those sites not used for breeding, or having failed before hatching, there are indications that possibly 60–79% of eggs hatch, while 5–10% of chicks may die before fledging. Based on samples of banded adults the oldest bird is 34+ years old and the preliminary mean adult annual survival rate is 0.868.

Keywords: Chatham mollymawk, albatross, *Thalassarche eremita*, population, productivity, survival, The Pyramid, Chatham Islands.

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1. Introduction

The Chatham mollymawk *(Thalassarche eremita)* (Fig. 1) is a rare member of the albatross family which breeds only at The Pyramid (44°26′S, 176°14′W). This small rocky islet (Fig. 2) is the most southern of the Chatham Islands group, east of New Zealand. Because of the difficult access, the Chatham mollymawk (nomenclature based on Nunn et al. 1996; Robertson & Nunn 1998; Croxall & Gales 1998) has remained relatively unknown since its initial description in 1930, based on a specimen collected by the Whitney South Sea Expedition on 2 March 1926 (Murphy 1930). The Pyramid is a privately owned island, and special permission for landing must be obtained from the owners (Robertson 1991).

By the end of 2000, only 91 days had been spent ashore for researchers' visits and monitoring expeditions (C.J.R. Robertson unpubl. data). As well as the difficult access, camping on the island is hazardous, with extremes of weather and sea conditions during most long visits, while the survey party must be landed from a small fishing vessel on to the steep rocky shore, along with all tentage and supplies, including water.

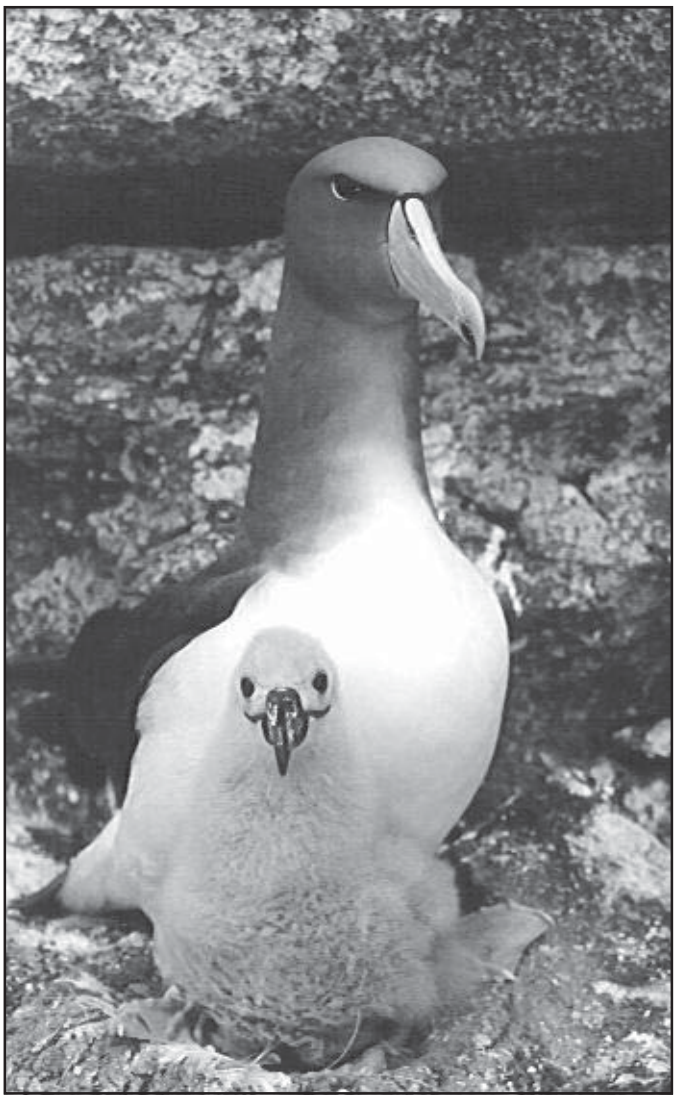

Figure 1. Chatham mollymawk adult and chick at the nest.

Classified by the IUCN as Critically Endangered (Croxall & Gales 1998; BirdLife International 2000), primarily because of its sole breeding site, it is one of only two albatrosses to have this critical classification. During the 1980s, extreme climatic events in the Chathams area markedly degraded what is normally a very fragile habitat on the steep rocky slopes of The Pyramid. Vegetation declined, and reduced water retention meant that during long dry spells the nests were more prone to collapse.

During the 1990s, there were a number of instances of the Chatham mollymawk being caught in various fisheries (longlines and trawl), in the New Zealand Exclusive Economic Zone and also along the coasts of Chile and Peru, where satellite tracking of birds undertaken between 1997 and 2000 indicates that they spend the winter (Robertson et al. 2000). Previous evidence has shown that substantial numbers of chicks were harvested from The Pyramid at various times in the past 150 years (Robertson 1991). There are continuing anecdotal reports (and some evidence ashore at The Pyramid on 5 February 1997) of continuing sporadic takes of small numbers of chicks.

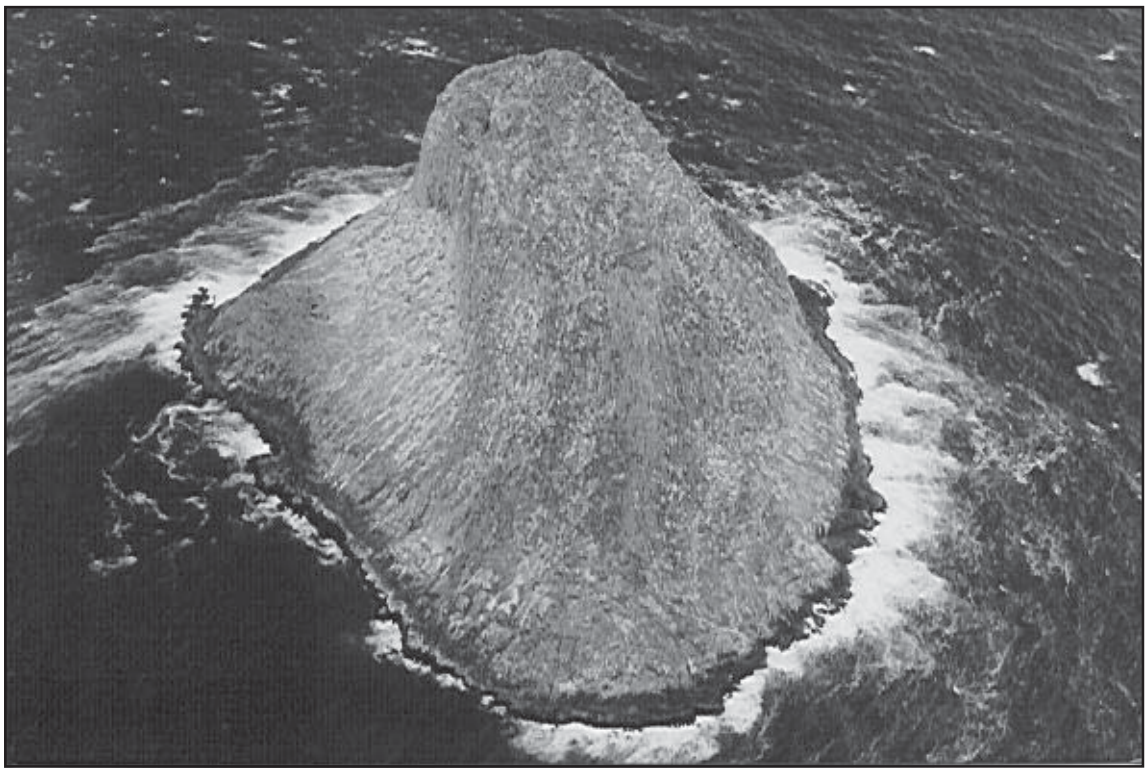

Figure 2. Aerial oblique view of The Pyramid from the north.

There is no evidence of past population trends, though a comparison of aerial photographs from the 1970s with those from the 1990s shows little variation in the proportion of the island being used as nesting habitat. However, allowance needs to be made for the fact that it is not possible to see all nesting areas from aerial photographs.

Previous estimates of the breeding population size were made by Dawson (1973), and by Robertson (1974, 1991) from aerial photographs during the 1970s. These estimates suggested the existence of from 3200 to 4200 breeding pairs. In December 1999, D. Bell and P. Scofield undertook the first complete ground count, obtaining a tally of 5333 nest sites. The count was repeated in 2000 at the same time of the season by D. Bell and P. Bell.

With so little time having been spent on the Pyramid to study the Chatham mollymawk, our knowledge of its breeding cycle on the island is somewhat fragmented. The breeding adults probably return to the island before breeding from about 10 to 20 July. Laying of their single egg throughout the colony occurs between 20 August and 30 September. Hatching commences from 27 October and finishes (incorrectly stated in Robertson 1991) about 7 December (Tennyson et al. 1993; the present authors, pers. obs.). Most eggs still in nests checked after 4 December have been addled and sloppy.

Chicks fledge after an estimated 140+ days, with most fledging occurring during the latter part of March. Incubation and feeding stints are shared by both parents and are rarely longer than 5 days. This means that, in the short time expeditions may be on the island, breeding individuals can be regularly recorded at study nest sites. The youngest bird recorded to have returned to The Pyramid was aged 4 years and first breeding has been recorded at 7 years.

During 2001, World Wide Fund for Nature New Zealand Inc. and Wild Press agreed to jointly fund an expedition directed by C.J.R. Robertson to continue a series of monitoring counts, recoveries of banded birds of known age, and assessments of productivity. These had previously been undertaken by C.J.R. Robertson and funded by the Department of Conservation, until early 2000, and subsequently by Wild Press in December 2000. Some of these earlier data have been conjoined with information gathered during this field survey undertaken by D. Bell and P. Scofield from 30 November to 9 December 2001, and reported on here. This expedition was transported to The Pyramid from Owenga by the fishing vessel *Scania.* Equipment and stores were landed on the island on 30 November 2001 (Figs 3, 4).

Figure 3. Expedition departing Owenga on *Scania*.

Figure 4. Landing equipment at The Pyramid. D. Bell ashore; K. Dix driving zodiac; R. Goomes transferring equipment.

2. Methods

Chatham mollymawks have been banded on The Pyramid both as adults and chicks since the 1970s. All adult banding has been confined to areas A & B on the camp flat and slope (Fig. 5). Since 1995 the adults banded have all been at

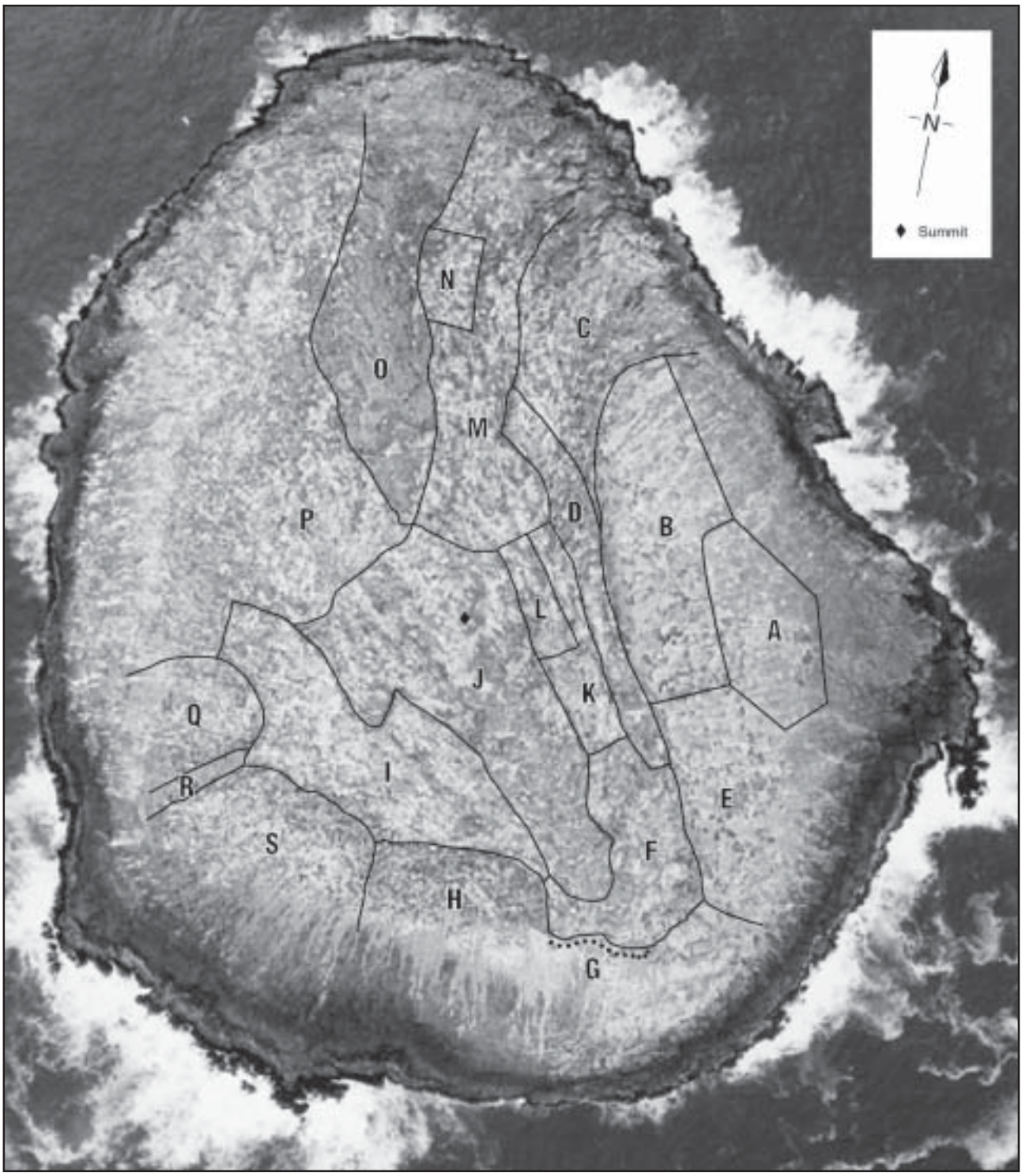

Figure 5. Plan view of survey areas for Chatham mollymawk studies on The Pyramid. General names for the area codes are listed in Table 1.

marked nest sites, and have had either large single-colour bands or colour combinations to assist recovery. Three cohorts of chicks were banded in February for consecutive years from February 1993 (545, 877, 696 chicks, respectively).

During the expedition, all banded birds were caught, or sighted using colour combinations, and their breeding status was recorded along with the location of recovery. Each recovered bird was marked with a spot of paint on the head to ensure that capture only occurred once.

Since 1997, all visits have assessed the breeding status of a sample of nests in similar areas in different parts of the island. This has provided an indication of the likely level of productivity for the season. These samples have been taken over part of each of the following regions during a traverse through the nesting area – areas A, B, D, E,G, I, J, K, L, M, N, P (Fig. 5).

Since 1999 each expedition has also attempted to visit and count every identifiable nest site on the island. Each nest is visited, its status recorded and the nest marked with a spot of paint to ensure single counting. D. Bell has participated in all three of these counts undertaken so far, and P. Scofield in two. Some areas can only be accessed using a range of rock climbing techniques, including ropes. D. Bell has estimated that they have not been able to reach about 20 nests in each of the years when full counts have been made. These additional nest sites were examined using binoculars and have been included in the three counts, but their nesting status was inferred by behaviour and not a direct check of the nest contents. Full census counts of nest sites were undertaken over a total of 3 days, depending on weather conditions. Movement on the island when the surface is wet becomes almost impossible and extremely dangerous.

TABLE 1. COUNTS OF CHATHAM MOLLYMAWK NEST SITES ACCORDING TO AREA (FIG. 5) FOR THREE YEARS 1999–2001.

LOCATION	AREA CODE	TOTAL NEST SITES 1999	2000	2001
Cave	G	224	204	235
Camp slope and flat	A + B + E	213	226	242
Western ledges	I	825	873	774
South basin	F	205	163	213
Bells ledge	D	220	167	207
Main slope	M + N	718	690	699
Yellow spur	O	156	132	125
Moriori ledge	K + L	245	237	289
North slopes	P	1198	1179	1035
Round rock basin	Q	180	222	224
Summit ridge	J	641	611	717
Inaccessible basin	H	101	103	100
The steeps	C	152	208	174
Yellownose basin and ridge	S + R	255	311	270
Annual total		5333	5326	5304

During the 2001 expedition, specific study areas were consolidated, or added for future use.

- In area A, there were 55 nests marked with a yellow numbered tag glued to the solid rock substrate (Fig. 6). This was the area where adults were banded in September 1974 and marked study nests were started in 1995. The banded birds here provide an annual assessment of mortality in adults.

Figure 6. Checking banded adult on study nest 27. Note nest marker glued to rock at top right of picture.

- In 2001, a further 60 nests were marked on the slope above the camp flat in area B. All nests were marked with red numbered tags glued to the rock by the nests. The breeding adults associated with these nests were banded with metal bands on the right leg, and single red, blue or green coloured bands on the left leg to indicate the location.
- Area N on the main slope has the boundaries of the area marked with plain green tags glued to the rock. The area contained 64 nest sites when marked and, like areas A, B and L, can be used for comparing breeding status between different parts of the breeding season.
- Area L on the Moriori ledge has had its boundaries similarly marked with plain green tags and contained 91 nest sites when the boundaries were marked.

The two special areas (L, N) have not had any adult birds or individual nests marked within their boundaries, so any banded birds found should be from the cohorts of chicks (see above). If only a day visit is possible and the whole island cannot be assessed, areas A, B, L, N are suitable for a quick assessment of productivity for the island. All 4 areas are readily accessible, given access to the appropriate landing area and calm dry weather conditions.

3. Results

This expedition was designed to repeat nesting censuses completed in the previous two years and to recover as many banded birds as possible to refine estimates of mortality among birds of known age and those marked originally as adults of unknown age.

Throughout the time on the island the dry and calm weather conditions enabled the team to reasonably attempt all tasks. It is not possible to traverse the island in wet conditions. However, relatively calm conditions on some days probably restricted the number of band recoveries from adolescent birds and those banded birds which may have been breeding in some of the more inaccessible parts of the island (calm conditions cause birds to remain longer at sea). It was noted that on the windier days following these calmer conditions more adolescents and birds occupying empty nests were present. The time spent marking and banding the breeding birds in the new study area B also restricted the amount of time available for searching other parts of the island.

3.1 COUNT OF NEST SITES

The number of nest sites counted on the island compared very favourably with those from the previous two seasons (Table 1). As there are no specific markers on the island to designate most of the regions in order to reduce visual pollution (Fig. 5), it is expected that there may be variations within regions between years (this effect is reduced by the use of the same personnel). Some of the variations are quite large, but as the overall total is very similar between years, it is probable that the main variation is one of variable interpretation of the area boundaries. The only discrete location is the Cave at Area G, and this illustrates how the number of nests in a confined area may vary from year to year. Most of that variation would be with small and insignificant nest mounds (probably built by young newly prospecting birds), which may not be maintained in the following season. The majority of nests in the cave are not much exposed to erosion during the year and some archaic nests approach a metre in height (Fig. 7).

3.2 PRODUCTIVITY ASSESSMENTS

Since 1997 (Table 2) each expedition has randomly checked a random sample of nests during traverses through eight specific parts of the island to provide a sample indicator of the productivity (hatched chicks available to fledge), not only for different parts of the island with different exposure to weather conditions, but for the island as a whole.

From 1999 these sample counts can be compared with the total nest site count as an indicator of sampling reliability. Sample counts were made separately from the census counts undertaken from 1999 to 2001. Four sets of sample counts have been taken during the last week of November and the first fortnight

Figure 7. Checking nests in the Cave (area G). Note large archaic pedestals.

of December from 1997 to 2001. Assuming that 95% of eggs still present at that time were infertile or dead, then the sample counts indicated that a mean of 37.5% of nest sites were empty by the end of hatching (range 30–44%). Included in Table 2 are the complete nest site counts for the three years 1999–2001, when again the counts were undertaken in the last week of November and the first two weeks of December. For these three years the mean was 38% of all nest sites being empty (range 32–47%).

Other data in Table 2 show the proportions obtained from samples taken at other times of the breeding season. The most important of these are the figures from 1997. Between late October and early December 1997 the proportion of

TABLE 2. PERCENTAGE SEASONAL PROPORTIONS OF CHATHAM MOLLYMAWK NESTING STATUS FROM BOTH SAMPLE AND TOTAL (*) STATUS COUNTS.

DATE	EGGS %	CHICKS %	EMPTY %	TOTAL NESTS IN SAMPLE
Feb 97	0	53	47	695
Oct 97	70	1	29	317
Dec 97	3	56	41	1381
Nov 98	63	1	36	1339
Dec 99	10	56	34	1154
Dec 99	7	48	41	*5333
Dec 00	3	71	27	1000
Dec 00	4	61	35	*5326
Dec 01	3	68	30	898
Dec 01	3	67	29	*5304

empty nests had increased from 29% to 47%. This difference of 18% probably represents nesting failure during that latter part of the incubation period. No data are available to assess what the level of nest failure might be during the early stages of incubation.

The data for February 1997 (Table 2) indicate the probable proportions of chicks (53%) to empty nests (47%), at a later stage of the breeding season, from the sampled areas. If one of the sampled areas where chicks had recently been taken (illegally 'harvested') is removed from the sample, the empty nest proportion drops to 44%. It is ***not*** suggested that harvesting may have taken 3% of the chicks in that year, as the number was probably closer to 40 birds on the basis of the evidence on the ground in a confined area.

3.3 RECOVERY OF BANDED BIRDS

Only one bird banded as a breeding adult in 1974 was recovered. This individual would have been 34+ years old, assuming commencement of breeding at 7 years. Overall some 51 adult banded birds were recovered, with most having been banded in 1995. Of the three cohorts of known-age birds banded from 1993 to 1995, 157 were recovered, with the cohorts returning 33, 62, and 62 individuals, respectively.

Once collated with previous recovery data, the full set of recapture and recovery histories was analysed using Burnham's (1993) live and dead encounters modification of the Cormack–Jolly–Seber model implemented in the mark–recapture program MARK (White & Burnham 1999). The results given here are from the computer simulation model that was assessed to best fit the data, where survival and probability of recapture varied with year, but other variables remained constant.

The current mean survival estimate per annum for adults is 0.868, SE 0.013, with a 95% confidence limit of 0.840–0.892. Only a concentrated effort in future to recover birds, plus the increased sample size of the 140 adults banded during the 2001 expedition, will provide more stability in these figures. Within the sample there are years when survivorship seems to have been very good in contrast to some significantly poor years. Fortunately there is no evidence of any significant movement of adults from the areas where they were banded. The change to colour combinations for some of the birds will also improve the chances of recapture.

3.4 AGE OF BREEDING

The terrain of the island makes the finding of banded birds that have become breeders very difficult in the short time that the expedition can be ashore. Though the age of first breeding across cohorts seems to start at 7 years old, quite large numbers of birds previously seen are not being recovered in their seventh and eighth year. It is possible that this may indicate higher levels of mortality about the time of birds commencing breeding for the first time, but it is more likely that some of these missing birds may be breeding, and are less

likely to be recovered than when they were standing about as adolescents. The island is not evenly searched and some of the more remote areas may have had only one visit. With the incubation and guarding stints averaging 2–3 days the probability of resighting is reduced accordingly.

4. Discussion

The Chatham mollymawk restricts its breeding to The Pyramid. The most recent previous estimates of its population size were based on aerial photographs which have subsequently proven to be incapable of adequately recording all nest sites due to the terrain. The counts of nest sites from the 1999–2001 expeditions provide a very stable assessment of the number of sites on the island. The number of nest sites does ***not***, however, equate to breeding pairs.

Observations at the island suggest that breeding birds which fail in their nesting attempt remain substantially occupying and defending their site until about late December (roughly the end of the chick guard stage). It is probable that this is a mechanism to ensure that their claim to the limited territory available is strong enough next season to repel any first-time occupiers of a new site.

It also suggests that, if annual mortality of adults is about 14%, at least as high a proportion of nest sites will fail in any year (no egg laid) due to insufficient time to consolidate a new pairing of birds on the site. Using this assumption, the maximum number of breeding pairs on the island in most years would seem likely to be close to 4575 breeding pairs.

The suggested failure of 18% in late incubation (Table 2, from the samples taken in October and December 1997), when combined with possible non-nesting of 14% equates closely with the mean of 38% empty nest sites from both sample and total counts in early December. The difference of 6% could be expected to be an indication of the proportion of nesting failures at the start of the incubation period.

Overall, this would then equate to a possible productivity of eggs to hatched chicks of 60%, 72%, and 79%, respectively, for the three years of total nest site counts. However, the data from February 1997 suggest that between 5% and 10% of hatched chicks may not survive the period from hatching to fledging.

Within the complexities of assessing any population as little known as that of the Chatham mollymawk, it seems probable on the evidence at this stage that there is a reasonably stable breeding population on The Pyramid, but that our present imperfect knowledge of survivorship based on the existing banded samples seems lower than can be expected from studies of other mollymawks (Tickell 2000). To balance that, if our assumptions above are correct regarding productivity, the Chatham mollymawk has one of the higher levels of productivity in the albatross family.

It is of concern, however, that the Chatham mollymawk has been caught as bycatch to fishing operations in such a wide variety of fisheries, both during its

breeding season, and overseas on the coasts of Chile and Peru during the non-breeding season. The most significant unknown factor is the location of young adolescents throughout the 4–6 years following fledging before they return to the breeding colony, and what level of bycatch the Chatham mollymawk is incurring outside of New Zealand waters.

It is not known whether they remain in South American waters during the summer months. Interestingly Jahncke et al. (2001) note that the highest incidence of albatross bycatch in Peru is in the summer – when Chatham albatrosses should be in New Zealand waters. Though their survey of fishers was unable to determine the species of albatross being taken, they suggested that Chatham mollymawks may be one of the species at risk. However, Spear et al. (1995) noted that the closely related Salvin's mollymawk *(Thalassarche salvini)* is also present in Peruvian waters at the same time during the winter, although generally closer inshore than Chatham mollymawks.

The proposal by WWF (NZ) Inc and Wild Press to continue this monitoring programme for another two years is to be commended, especially as the survey team have demonstrated their ability to accurately count throughout the total breeding area. The inclusion of a further sample survey earlier in the season during the incubation period will enable the firming up of estimates for the likely losses of eggs before hatching, and ensure a better estimate of the probable breeding population. The continuation of maximum effort to recover banded birds will allow better calculations of the annual mortality for different age classes.

5. Acknowledgments

The Pyramid is a privately owned island and we are especially grateful to the owners, who have allowed this research and monitoring to be undertaken over a period of 25 years. To those intrepid expeditioners and companions, who have survived living on (and occasionally swimming off) the island while collecting valuable data since 1974 – Alan Wright, Rodney Russ, Gary Nunn, Hans Rook, Paul Bell – our thanks for helping to provide the baseline for comparison today. A large number of people have assisted with land and sea transport and landings, not only for this expedition (Chippy Lanauze and *Scania*), but variously since 1974, and without their co-operation in often marginal conditions, the lifestyle of this albatross would be even less clear. The Department of Conservation Chatham Islands Area Office generously provided a shore and radio base for the 2000 and 2001 expeditions, transport to and from the wharf, a zodiac for landing, and staff assistance with landing expedition equipment on the island. Jeremy Rolfe composed the area map for the island, based on an aerial photograph supplied by the Department of Conservation, Canterbury Conservancy. The 2000 expedition was funded by Wild Press, and the 2001 expedition conjointly by WWF (NZ) Inc. and Wild Press.

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