Counting mollymawks on Campbell Island

Campbell mollymawk arguing with its neighbour. *Photo: P. Moore*

Counting mollymawks on Campbell Island

A guide to techniques and field procedures

DEPARTMENT OF CONSERVATION TECHNICAL SERIES 16

Peter J. Moore

Published by
Department of Conservation
P.O. Box 10-420
Wellington, New Zealand

Keywords: Campbell Island, albatross, mollymawk, colonies, Campbell mollymawk, grey-headed mollymawk, census, counting techniques, comparisons, replication, zones

Department of Conservation Technical series presents instructional guide books and data sets, aimed at the conservation officer in the field. Publications in this series are reviewed to ensure they represent standards of current best practice in the subject area.

ISSN 1172–6873
ISBN 0–478–21833–8

This publication originated from work done under Department of Conservation Investigation no. 2050, carried out by Peter Moore, Science & Research Unit, Department of Conservation, Wellington. It was approved for publication by the Manager, Science & Research Unit, Science Technology and Information Services, Department of Conservation, Wellington.

Cataloguing-in-Publication data
Moore, Peter J. (Peter John), 1960-
Counting mollymawks on Campbell Island : a guide to techniques and field procedures / Peter J. Moore. Wellington, N.Z. : Dept. of Conservation, 1999.
1 v. ; 30 cm. (Department of Conservation technical series, 1172-6873 ; 16.)
Includes bibliographical references.
ISBN 0478218338
1. Sea birds—New Zealand—Campbell Island. 2. Diomedea—New Zealand—Campbell Island. I. Title. II. Series: Department of Conservation technical series ; 16.
598.42099399 20
zbn99-042533

CONTENTS

Abstract 5

1. Introduction 6

2. Background 7

3. Methods 11

3.1 Colony counts 11
3.1.1 Count categories 11
3.1.2 Species 11
3.1.3 Count types 11
3.1.4 Count comparisons and replication 16
3.1.5 Seasonal counts 16
3.2 Count zones 17
3.2.1 Bull Rock South 17
3.2.2 Bull Rock North 18
3.2.3 Hookers Peninsula 19
3.2.4 Hookers Finger 19
3.2.5 Courrejolles Isthmus 20
3.2.6 Eastern Colonies 20
3.2.7 Courrejolles Peninsula 21
3.2.8 Isle de Jeanette Marie 22
3.3 Area dimensions 22
3.4 Internest distances 22
3.5 Disturbance of wildlife 23

4. General notes on field work on Campbell Island 24

4.1 Team responsibilities 24
4.1.1 General duties of team and team leader 24
4.1.2 Required knowledge, skills, and experience 25
4.2 Health and safety 25
4.2.1 Responsibilities 25
4.2.2 Hazards arising directly from field work tasks 25
4.2.3 Communications 26
4.3 Notes on Campbell Island for prospective field staff 27
4.3.1 General 27
4.3.2 Accommodation 28
4.3.3 Social 28
4.3.4 Suggested gear list 29

5. Acknowledgements 29

6. References 30

Appendix 1

Suggested instructions for tests of count variability 33

Appendix 2

Photographs, maps and diagrams of mollymawk colonies 37

Abstract

There are several mollymawk colonies at the north of Campbell Island. These are mixed associations of Campbell mollymawk *Thalassarche impavida* and grey-headed mollymawk *Thalassarche chrysostoma*. Comparisons of photographs suggest the populations have declined since the 1940s. However, the species are not easily distinguished from photographs and coverage of the colonies was incomplete. Ground counts were conducted in 1995–97 to remedy this and establish a population baseline. This report outlines the techniques used for counting mollymawks on Campbell Island and through the use of photographs and maps describes colony sectors and boundaries for dividing up the census. The census is conducted early in the incubation period (8–18 October). The occupied nest was the main count category for all counting methods and this was divided into birds on eggs or on empty nests for counts where every nest was visited. Count methods varied from the more intensive counts where every nest was visited and the birds marked during the counting process, to less intensive counts and views of inaccessible parts or whole colonies from vantage points. These were termed nest visit, ledge, view down, binocular view down, binocular view across and telescope view counts. Methods of count comparisons and replications are suggested to test for variability and accuracy.

1. Introduction

There is concern that some of the world's albatross species have declined in numbers, and for some, such as wandering albatross *Diomedea exulans*, this has been linked to human fishing activities (Weimerskirch & Jouventin 1987, Croxall et al. 1990, Gales 1993, 1998, Weimerskirch et al. 1997). High numbers of albatrosses and other seabirds have been killed on tuna long-lines in the New Zealand region and, although some mitigation procedures have reduced the catch rate, bycatch has continued in recent years (Murray et al. 1993, S. Bartle pers. comm.; Ministry of Fisheries bycatch data). Albatrosses that were caught in consistently high numbers in most years were the wandering albatross species and Campbell mollymawk *Thalassarche impavida*. In the New Zealand region, it was acknowledged by Department of Conservation staff who were responsible for preparing a draft seabird action plan that there was a general paucity of data on population size or trends for our albatross species (M. Imber, G. Taylor pers. comm.).

It appeared from photographs of mollymawk colonies on Campbell Island taken since the 1940s that populations had declined there (Moore & Moffat 1990). Because mixed species assemblages could not be separated in the photographs and coverage of colonies was incomplete, it was necessary to conduct ground counts. This occurred during three mollymawk breeding seasons in 1995–97.

The purpose of this report is to standardise mollymawk census methods by outlining reliable and repeatable count methods, to make it easier for future workers to repeat and/or interpret the counts of 1995–97, and thus allow the monitoring of future population trends. A separate report deals with aspects of mollymawk photography, photopoints, and counts from photographs (Moore & Blezard 1999a). Data supplements containing photograph count data conducted by Peter Moore (in 1990), Alastair McLean (in 1993), and Reg Blezard (in 1997 and 1998) are presented in Moore & Blezard (1999b).

2. Background

Campbell Island lies at 52 degrees south latitude, about 660 km south of New Zealand and 350 km south-east of the Auckland Islands. There are six albatross species breeding on the island, including three mollymawks (Table 1). This report follows the taxonomy proposed by Robertson & Nunn (1998) and used by Gales (1998) and Croxall & Gales (1998). This taxonomic revision has separated the previous 14 species into four genera and 24 species, although this is still to be finalised (Robertson & Nunn 1998). Old and new names of albatrosses found on Campbell Island are listed in Table 1.

In 1995–96 the Science & Research Division (now Science & Research Unit) of Department of Conservation began a study (S&R Investigation no. 2050) of the population status and trends of the mollymawks and royal albatross *Diomedea epomophora* on Campbell Island (Moore et al. 1997a). The main aims were to assess both short and long-term trends in their populations using reliable and easily repeatable census methods. As mollymawks are accidentally caught during fishing activities, the investigation was funded in part by the Conservation Services Levy, which is a cost recovery mechanism placed on the fishing industry, set up by the 1994 amendment to the Fisheries Act (1983). The work complemented a study by Sue Waugh which concentrated on the foraging ecology and population dynamics of mollymawks on Campbell Island (Waugh et al. 1999).

The most numerous mollymawk on Campbell Island is the Campbell mollymawk (Fig. 1a), which is endemic to Campbell Island (Bailey & Sorensen 1962,

TABLE 1. CAMPBELL ISLAND ALBATROSSES, THEIR PREVIOUS (MARCHANT & HIGGINS 1990, TURBOTT 1990) AND PROPOSED TAXONOMY (ROBERTSON & NUNN 1998)

PREVIOUS NAME	PREVIOUS TAXONOMY	PROPOSED NAME	PROPOSED TAXONOMY
Southern royal albatross	*Diomedea epomophora epomophora*	royal albatross	*Diomedea epomophora*
Antipodes wandering albatross	*Diomedea exulans antipodensis*	Antipodean albatross	*Diomedea antipodensis*
Light-mantled sooty albatross	*Phoebetria palpebrata*	Light-mantled mollymawk	*Phoebetria palpebrata*
Black-browed mollymawk	*Diomedea melanophrys melanophrys*	Black-browed mollymawk	*Thalassarche melanophrys*
NZ black-browed mollymawk	*Diomedea melanophrys impavida*	Campbell mollymawk	*Thalassarche impavida*
Grey-headed mollymawk	*Diomedea chrysostoma*	Grey-headed mollymawk	*Thalassarche chrysostoma*

Figure 1. The three mollymawk species found on Campbell Island.
(a) *(Above)* Campbell mollymawk—note the large dark 'eyebrow' and honey-coloured iris.
(b) *(Right)* The black-browed mollymawk.
(c) *(Below)* Grey-headed mollymawk.
All Photos: P. Moore

Robertson 1980). There are also a few members of the more widespread and closely related black-browed mollymawk *T. melanophrys* (Moore et al. 1997b) (Fig. 1b), which has a widespread subantarctic breeding distribution and numbers over 680,000 breeding pairs (Gales 1998). Black-browed mollymawks are recognisable by their dark iris, compared with the more honey-coloured iris of the Campbell mollymawk (Fig. 1). Both are annual breeders. The biennial breeding grey-headed mollymawk (*T. chrysostoma*; Fig. 1c), has a widespread breeding range and numbers about 92,300 pairs (Gales 1998; annual nest estimate).

Some populations of black-browed mollymawks have decreased, for example a colony at Kerguelen Island decreased by 25% from 1978–87 apparently as a result of fishing activities (Weimerskirch et al. 1989). At Bird Island, South Georgia the black-browed mollymawk population declined by over 30% since 1976, most of this change occurring after 1989 (Croxall et al. 1998). However some other populations are stable or increasing in size (Gales 1998). Population trends of grey-headed mollymawks are less well known, because their biennial breeding habit and variable breeding success combine to give annual nest number fluctuations of up to 45 % (Prince 1985). However, at South Georgia, their main breeding centre, numbers decreased by an estimated 1.8% per annum since 1975 (Prince et al. 1994) or an overall decrease of 13–21% (Croxall et al. 1998).

On Campbell Island there are several major mollymawk colonies and scattered small colonies at the north of the island (Fig. 2). Most are mixed associations of

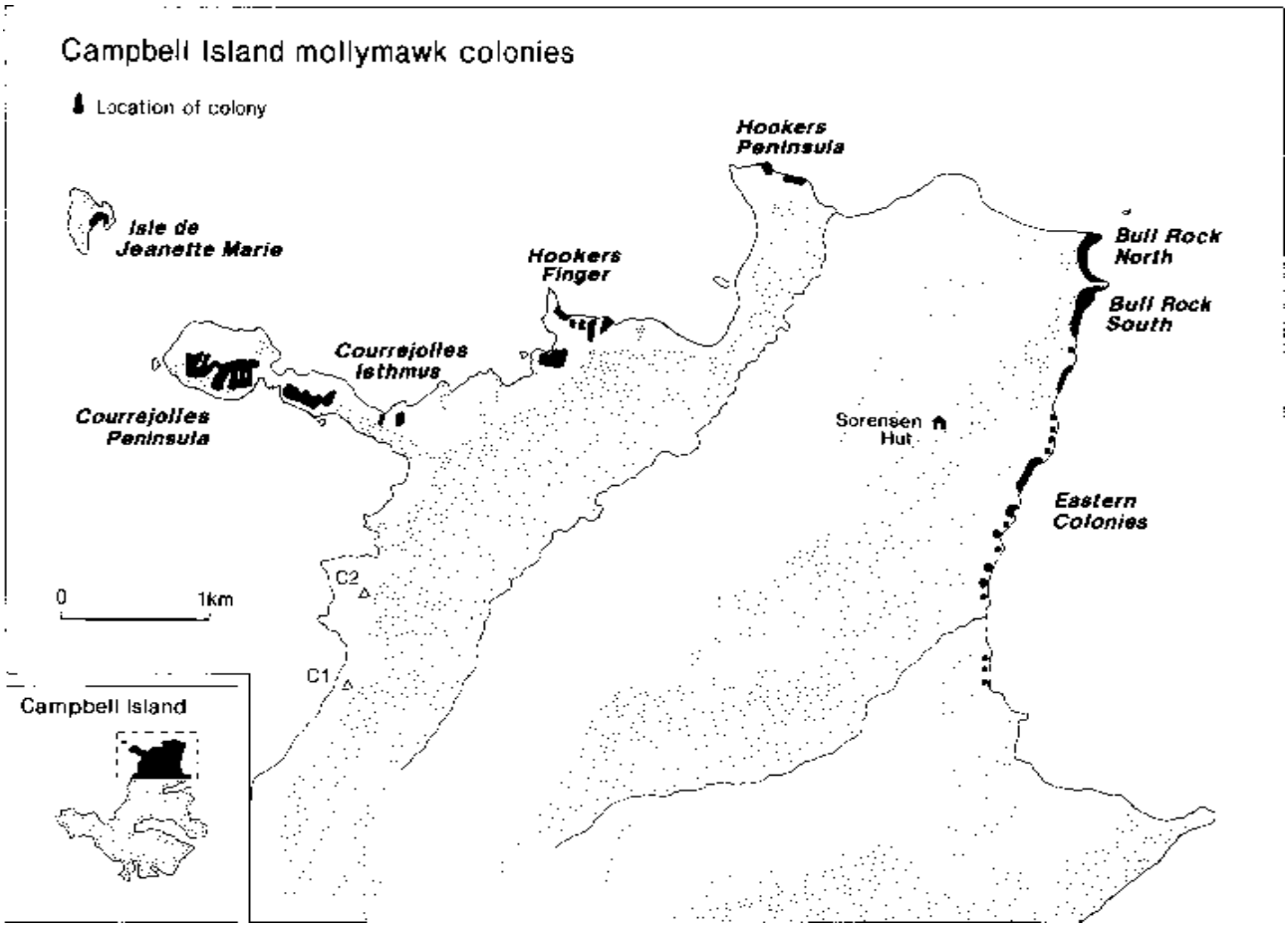

Figure 2. Location of mollymawk colonies in the northern part of Campbell Island. C1 and C2 mark the viewing positions for Courrejolles Peninsula.

Campbell and grey-headed mollymawks on steep slopes and ledges above sheer coastal cliffs (Bailey & Sorensen 1962; Robertson 1980; Moore & Moffat 1990). There are few historical accounts which indicate the former size of the population. In 1874 Campbell mollymawks were abundant around the island and grey-headed mollymawks nested in smaller numbers (Filhol 1885) and a photograph taken in 1895 (Pollock Collection, Alexander Turnbull Library; Moore & Blezard 1999a) of the central part of the Bull Rock South colony shows that the same ledges were occupied then as a century later. During the 1940s, mollymawks were in their many thousands (Bailey & Sorensen 1962) or hundreds of thousands (Sorensen 1951). In 1975 it was estimated from visual impressions of colonies that there were 74,800 pairs of Campbell mollymawks and 11,500 pairs of grey-headed mollymawks (Robertson 1980). In 1988, a count based largely on an incomplete mosaic of oblique photographs gave a combined species total of 29,000 pairs (Moore & Moffat 1990). None of these estimates give any basis for assessing trends.

In 1987, photopoints were established at most of the major mollymawk colonies on Campbell Island (Moore & Moffat 1990) to give good views of the colonies or to repeat views from historical photographs. Comparison of old and recent photographs suggested that numbers had declined since the 1940s by 38–57% (Moore & Moffat 1990). Colonies dominated by Campbell mollymawks declined during the 1970s to early 1980s, yet were stable or gradually increasing in number prior to and subsequent to this period (Waugh et al. 1999). In contrast, the grey-headed mollymawk colonies declined more continuously since the 1940s (Waugh et al. 1999). Because the species could not be distinguished in photos, coverage of colonies from the photopoints was incomplete and the historical series was haphazard and sporadic, it was necessary to conduct ground counts to establish a population baseline.

From 1992 to 1995, part-time Department of Conservation staff stationed at the Campbell Island Meteorological Station (decommissioned in 1995) censused the mollymawks and repeated the photopoint series. With little guidance as to methodology, they conducted counts of occupied nest bowls at all accessible colonies during the periods 24–27 September 1992 (J. Amey and G. McAllister), 25 October 1993 (partial count; J. Henderson), and 19 September–5 October 1994 (J. Henderson).

In 1995–96, the current investigation began. It was hoped to more accurately census the accessible colonies of mollymawks, estimate numbers at inaccessible sites and compare the results of ground counts and counts from photographs. Census time was at the end of the laying period, so that nest occupancy was at its peak. For Campbell mollymawks the laying period was thought to be 18 September–8 October and for grey-headed mollymawks, 26 September–9 October (Robertson 1980), although some grey-headed lay later (pers. obs.). The censuses were conducted 9–22 October 1995 (PJM and N. Parker), 7–16 October 1996 (PJM, A. Wiltshire, and M. Charteris), and 8–15 October 1997 (A. Wiltshire, S. Hamilton, and B. Evans). The inaccessible Courrejolles Peninsula was viewed by telescope and photographed on 19 October 1995, 18 and 26 October 1996, and 18 and 19 October 1997.

3. Methods

3.1 COLONY COUNTS

3.1.1 Count categories

Within mollymawk colonies birds were considered to be in one of two categories, which were subdivided for more intensive count methods:

1. OCCUPIED NEST

   Birds occupying a nest bowl (Figs 3, 4): birds incubating eggs, those sitting or standing on failed nests, and non-breeders occupying bowls or making play nests. All these categories were indistinguishable from a distance. For example, on cursory inspection, if the birds in Figs 3b and 3c were sitting down, they could easily appear to be incubating eggs. Birds sitting or standing on the nest were not distinguished in this category to make it consistent with all types of views (near or far). Defining a nest has an element of subjectivity since some are of minimal construction (Fig. 4a), non-breeders may be building or destroying nest bowls (Fig. 4b), or birds on mounds may appear to be on nest bowls. However the majority of nests were self-evident;

For 'nest visit' counts (see below section 3.1.3) the occupied nest was divided into:

ON EGG—occupying a nest and incubating an egg;

ON EMPTY NEST—occupying a nest without an egg.

2. EXTRA

   Other birds not occupying nests, including partners, non-breeders and juveniles sitting or standing in the colony (Fig. 4c).

3.1.2 Species

Campbell and grey-headed mollymawks were counted separately and the small numbers of black-browed mollymawks were also noted, but for colony totals these were combined with the Campbell mollymawk. This was because the subtle distinguishing features of black-browed mollymawks (e.g., black iris, less extensive dark brow) were likely to have been overlooked during single visits to colonies and coarse counts, and many had Campbell mollymawk partners.

3.1.3 Count types

Six types of counts were conducted at mollymawk colonies:

1. NEST VISIT (*Visit every nest to mark birds which have eggs*)

   Every nest was visited and, if the bird was incubating an egg, a patch of agricultural stock marker was sprayed on its chest to prevent counting the bird twice, and a tally was kept on a mechanical counter. Birds on empty nests were similarly marked and counted (usually on a second counter, or as a notebook tally). Non-nesting birds were counted prior to moving onto a

Figure 3. Campbell mollymawks occupying nests.
(a) *(Above)* Sitting on a well-formed nest pillar and probably incubating an egg.
(b) *(Right)* Occupying an empty nest.
(c) *(Below)* Occupying a worn nest bowl.
All photos: P. Moore

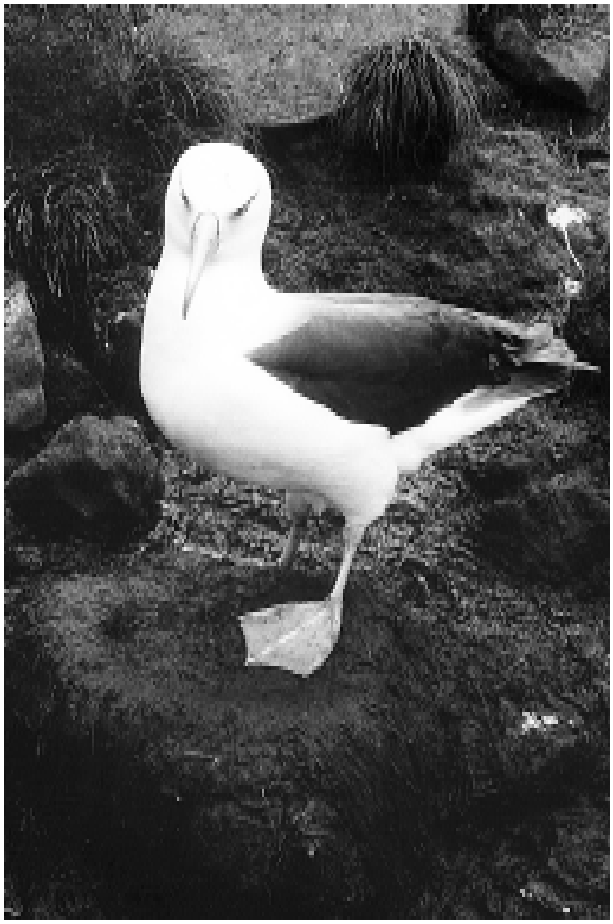

Figure 4. Rudimentary nests and non-breeding Campbell mollymawks.
(a) *(Above)* Incubating an egg on a shallow nest bowl.
(b) *(Left)* A juvenile building a rudimentary nest. This would still be classified as an occupied nest for counting purposes, since for any count other than a 'nest visit' it would appear similar to the type of nest shown in the top photograph. Non-breeders sometimes make play-nests or sit on nests that have been abandoned by breeders.
(c) *(Below)* An 'extra' bird in the foreground is easily picked out from breeders at a distance by its posture (e.g. raised wing tips and tail).
All photos: P. Moore

colony ledge, and an eye was kept on their movements if they were disturbed by the observer. In 1995 nest visit counts were used only in sectors which were to be counted regularly, but in 1996 and 1997 (Table 2) it was used as the principal census method for all accessible colonies.

TABLE 2. METHODS USED TO COUNT MOLLYMAWKS AT ACCESSIBLE COLONIES OF CAMPBELL ISLAND, 1995–1997, AND A COMPARISON OF COUNTING SPEED USING THE DIFFERENT METHODS IN 1996.

COUNT METHOD	% OF NESTS COUNTED			NO. OF NESTS COUNTED PER MINUTE IN 1996 USING DIFFERENT COUNTING METHODS			
	1995	1996	1997	Mean	s.d.	no. counts	no. nests
Nest visit	18	78	73	6.7	1.6	20	4219
Ledge	45	11	6	17.8	3.8	4	672
View down	10	0	2	22.1	6.3	5	1727
Binocular view	27	10	19	21.3	4.6	2	2255

Some peripheral nests on soft ground at the bottom edges of colony ledges were not marked with spray for safety reasons. Usually, the proximity of the observer, or waving the arms, stimulated the birds on empty bowls to stand up. Posture was also a useful guide for determining that a bird had an egg, as incubating birds tended to have a more streamlined appearance (cf. Fig. 4c).

Nest visit counts were inherently the most accurate count method, since there was no chance of counting birds twice, and a low chance that groups of birds would accidentally be missed. The method was very useful for large dense colonies and wide ledges which were otherwise very confusing to count because of the constant need to identify terrain features throughout the count. It gave an exact measure of the proportion of eggs per occupied nest. Also, by obliging the observer to visit every part of the ledge, nesting areas were revealed which otherwise might have been obscured from vantage points or even from one side of the ledge.

Disadvantages of the method were that it was more time-consuming than the other methods (about three times as slow, Table 2), all parts of a ledge had to be visited and therefore disturbed, non-breeders were hard to keep track of as they moved ahead of the observer before settling again and some parts of colonies or routes between ledges were easily damaged by human traffic.

If it was not safe to visit a whole colony sector because of underfoot conditions, or there was less time available, a ledge count was conducted instead.

2. LEDGE (*Visit the ledge to count birds by eye*)

Occupied nests were counted while walking through a colony ledge, or by viewing small pockets of nests from one side. The observer used landmarks, rocks and spots of spray paint to limit the potential for mistakes. This was used as the principal census method in 1995 (Table 2). Two tally counters

were used (one for nests and one for extras) or extras were noted by tally marks in the notebook.

This was quicker than the previous method (Table 2), less disturbing to the colony and relatively easy to conduct on narrow ledges. It is assumed though that ledge counts were less reliable than nest visit counts (see below for count replication), especially on bigger terraces, as there was a chance of missing birds or counting them twice. It relied on the observer being able to keep high levels of concentration and recognise small terrain features to orient the counts. Hence there was the possibility of gross errors caused by lapses in concentration or failure to recognise whether a patch of birds was counted or not.

3. VIEW DOWN (*View a ledge from the next ledge above*)

   Similar to the previous method except it was conducted by walking along the outer edge of the next ledge up. The method was used for inaccessible ledges, usually at the lower part of colonies or to avoid having to visit a ledge. However, it was only slightly quicker than a ledge count (Table 2). The main disadvantage was that some nests were obscured by terrain features.

4. BINOCULAR VIEW DOWN (*Binocular view down from a more distant vantage point*)

   Inaccessible parts of colonies (usually the bottom ledges and slopes) were viewed from vantage points. To some extent this was similar to the view down but because visibility of the ledges was difficult and they were further away, one or more viewpoints had to be found. Again, some nests tended to be obscured, and the observer had to ascertain which nests had been seen from the different viewpoints, so as not to count them twice.

5. BINOCULAR VIEW ACROSS (V*iew from a suitable vantage point across to the colony slopes*)

   This method was used where there were relatively unobscured views of a colony, for example from a prominent headland. The aspect is more horizontal than the previously mentioned views. Usually the observer did an initial exploratory count to get a feel for the count zone, then two careful counts of the occupied nests and a further count of the non-nesting birds.

   Advantages of this method were that the whole colony could be counted without visiting it, repeat counts were easily obtained and better counts of the inaccessible lower ledges could be made than with closer, more oblique views. However, areas could still be obscured or birds hidden on the flatter ledges. Because of the need to take care which birds had been counted, it was of similar speed to most of the counting methods used at the colony itself (Table 2). Even in good viewing conditions, it was likely that non-breeders were categorised incorrectly as nesting birds and the two species misidentified. In reality, because of the lack of suitable vantage points, there were few areas where it was possible to use this method.

6. TELESCOPE VIEW

   Inaccessible colonies were viewed from a vantage point by using a telescope. This was a compromise between being too far away to distinguish

the species or the breeders and non-breeders and being too close and having areas obscured by ridges. Light conditions were critical—preferably clear and overcast, and in the morning. They were unsuitable when the air was hazy or if it was sunny, which accentuated the haze, caused shadowing in the colonies or interfered with the telescope optics. In large colonies it was too difficult to count birds because of the inability to determine reference points, but it was usually possible to count the least numerous species (usually the grey-headed mollymawks) or mark on reference photographs which areas were occupied by one or other species. Subsequently the numbers of the two species could be estimated from counts of the dots on photographs. Because of the distance and above-mentioned difficulties, it was a slow method (e.g. an average of 6.7 grey-headed mollymawk nests per minute were counted during part of the Courrejolles viewing in 1996).

Because of time and logistical constraints (e.g. only one observer conducted the census in 1995), most counts were conducted with the less time-consuming methods (Table 2). In 1996 and 1997, three observers were available for counting during the census period, hence more time was available to find all accessible parts of colonies, and use the most intensive nest visit counting method (Table 2).

3.1.4 Count comparisons and replication

It was hoped that as an adjunct to the censuses the counting methods would be tested for count variability and accuracy. In most years this was done in only a limited way because the census itself took up most of the available time. This should be given a high priority in future censuses because observers will differ in how they use the above counting techniques.

Some methods are easier to replicate than others. Although nest visit counts intuitively should be more reliable, there was high variability between observers in 1997 (data yet to be analysed). It is probable that ledge counts would be more desirable to future workers because of speed and convenience, hence the variability should be tested fully.

Some comparisons of methods were made in 1995 (33% of nest visit counts were repeated using the ledge count method, and 5% of binocular views were repeated as ledge counts), however it was not possible to do all the comparisons on the same day. In 1996, 33% of all nest visit counts were compared with the other methods (7% by ledge counts, 13% by views down and 13% by binocular views), and comparisons were on the same day. In 1997 observer variation for nest visit counts was tested at selected colony sectors.

A series of comparisons should illustrate variation of observer, time of day, day and comparisons of different count types. Instructions were suggested for comparisons of methods in 1997 (only some were completed), and are provided in Appendix 1 as a possible guide for future tests.

3.1.5 Seasonal counts

Some sectors that were counted using the nest visit count method were subsequently re-counted for a measure of nest failure in different colonies and within colonies. These were Bull Rock South areas a, b, c, d, 9, 11 (not 1995), 12, 14 (not 1995), 22, Bull Rock North areas 13a, 14, 15, Hookers Finger Colony

5 area c, d, Colony 3 areas a, b, c, Colony 2 areas b, h, i (f was counted instead in 1995), Courrejolles Isthmus Colony 1 areas a, f, JDK (and b, c, d, e in 1995). The areas were counted 3–4 times between late September–mid October and mid November 1995, four times between mid October and mid December 1996 and twice in October 1997.

3.2 COUNT ZONES

Sorensen Hut is the closest field hut to the mollymawk colonies, comfortably sleeping three people, with nearby space for tents if another field party is present.

Colonies generally do not have official names, but the ones used here are based on names that were in common usage by Campbell Island researchers and meteorological station staff over the last 20 years or so (previously there may have been other local names used). Subcolonies were numbered by Peter Moore, often for convenience based on the photopoint series. Sectors within colonies were numbered or lettered arbitrarily in 1995 (see Appendix 2 figures).

In many cases count sectors were chosen for good reasons; e.g., to delimit a previous study area, the edge of a view in an historical photograph or because there was an obvious geographical feature to delimit sectors. Some boundaries may seem more obscure, such as those chosen at Bull Rock North when doing a binocular counts, or those chosen more for convenience to complete a count. The count zones are useful for dividing up the work and to look at changes in different parts of the colony. *Therefore the boundaries should not be changed during future censuses*. In contrast, the results of counts conducted in 1991–1994 came as whole-colony totals, which do not allow for fine-scale comparisons.

On the first visit to a colony, field teams should spend some time familiarising themselves with the colony make-up and how to approach each type of count. They must make sure that they can pick out the boundaries satisfactorily by using maps and photographs with boundaries marked on them (see figures in Appendix 2).

Colonies should be counted in the order indicated below, and on the same time schedule (Table 3), so that the results are comparable between years. The methods used for each colony sector (see below) are based on the 1996 census. Nest visit counts could be replaced by ledge counts if there were time constraints, however this may decrease the overall accuracy of the census.

3.2.1 Bull Rock South

Map grid* 379,500 m E; 4,184,650 m N
Figures A1–A12, A40

Bull Rock South is the largest accessible colony on Campbell Island and comprises mainly of Campbell mollymawks. The Bull Rock colonies are named

---

* Publication details of Campbell Island map are given in the References (Lands and Survey 1986).

TABLE 3. SUGGESTED SCHEDULE FOR MOLLYMAWK CENSUS ON CAMPBELL ISLAND, BASED ON 1996 SURVEY.

DATE	COLONY	ACTIVITY
7 October	Bull Rock South	Begin count tests
8–10 October	Bull Rock South	Census, continue count tests
11 October	Bull Rock South	Finish count tests
12 October	Bull Rock North	Census
13 October	Hookers Peninsula	Census
14 October	Hookers Finger	Census
14 October	Courrejolles Isthmus	Census
15–16 October	Eastern Colonies	Census
18–26 October	Courrejolles	Telescope count
18–26 October	Isle de Jeanette Marie	Telescope count
30–31 October	Main colonies	Recount index sectors
19–20 November	Main colonies	Recount index sectors
21–22 December	Main colonies	Recount index sectors

after the rock stack to the north-east of North Cape. A 20 minute walk on a track to the north-east from Sorensen Hut leads directly to the colony at the study square (Fig. A1), with an northern extension to area 22, below Sorensen Tarn. The colony was the main area for visiting mollymawks on the island after Sorensen Hut was constructed in the late 1960s, hence there are now large numbers of banded birds present. There are also small numbers of black-browed mollymawks, known colloquially as 'black-eyes', and most are found on the 'bb terrace' (or 'black-eye terrace') interbreeding with the more numerous Campbell mollymawks.

Census

Nest visit counts (square, a, b, c, d, GH1–3, 5a, 9, 11, 12, 13, 14, 16, 17, 19, 21a, 21b, 22, bb terrace);

Ledge counts (1, 1a, 2, 3, 4, 5b, 15, Sor tarn, 18: side view)

Binocular view down (6, 7, 10, 20)

Note there is no area 8

3.2.2 Bull Rock North

Map grid* 379,450 m E; 4,185,000 m N

Figures A13a–18, A40

Bull Rock North is a large colony just north of Bull Rock South colony and is comprised mainly of Campbell mollymawks. It is easier to approach the Bull Rock North colony from near Sorensen Tarn of Bull Rock South by crossing the tussock/scrub valley to the top ledges (areas 14, 15). The easiest access to the rest of the colony is from area 6.

* Publication details of Campbell Island map are given in the References (Lands and Survey 1986).

Census

Binocular view across counts from near the MP11 photopoint at the northern end of Bull Rock South colony (areas 2, 3, 4, 8, 9). From the top of the main colony count areas 16, 17 and 18 from the top of the main colony (they are accessible and were done by nest visit counts in 1996, but the ground is steep and probably not worth the extra care and effort required);

Nest visit counts (1, 5, 6, 7, 10a, 10b, 11, 12, 13, 13a, 14, 15).

3.2.3 Hookers Peninsula

Map grid* 377,500 m E; 4,185,475 m N
Figures A19–24

Hookers Peninsula is a colloquial name of the promontory close to the Hooker Stream falls. From Sorensen Hut, head down Bull Rock track some distance before heading along a scrubby ridge towards the Hookers Falls area. Often it is hard to pick the best line of travel and there are several scrubby gullies to negotiate. Cross the stream and climb up to the high point of the peninsula. Alternatively you can walk along the coast from Bull Rock North. All the colonies are accessible, the main entry point being further down the ridge from the MP9 photopoint marker (Fig. A19).

Census

Nest visit counts (all sectors).

3.2.4 Hookers Finger

Hookers Finger is a promontory with a tall rock stack just offshore between Courrejolles and Hookers Peninsulas (Figs 2, A25). The best route to Hookers Finger from Sorensen Hut is to walk half-way up towards Faye Bump on the poled track, sidle across the west side of the bump, head down a prominent slip, cross the valley floor and climb up the other side to the high-point above Hookers Finger (takes about 1.5 hours). Alternatively, you can walk along the cliff-tops above Borchgrevink Bay from Hookers Peninsula to the ridge above Hookers Finger.

As you head down the side-ridge towards Hookers Finger you will see Colony 2 on your left (south-west side; Fig. A25), and this is best accessed at the lower level of the main subcolonies. Colony 3 is near the end of the promontory (Fig. A25). To access the other colonies, walk part way down the side ridge to below the MP4 marker peg, turn right (east side) and sidle around to the small gully of Colony 5d. The next valley has the larger Colony 5 in it. At the bottom of Colony 5 head round further to the east again and you will find Colony 6.

Because the colonies are small, it is generally easier for the field team to conduct counts in different areas. Make sure you communicate well and know where each person is going to be at a given time and agree where and when to meet up.

Hookers Finger 6	Map grid* 376,330 m E; 4,184,500 m N Figure A26
Hookers Finger 5	Map grid* 376,250 m E; 4,184,450 m N Figures A27, A28, A40

Hookers Finger 3	Map grid* 376,000 m E; 4,184,550 m N Figures A29, A40
Hookers Finger 2	Map grid* 376,000 m E; 4,184,250 m N Figures A30, A31, A40

Census

Nest visit counts (all sectors; N.B. its a bit of a scramble down to the Colony 2 areas j, k, l, but not as bad as it looks).

3.2.5 Courrejolles Isthmus

Map grid* 375,000 m E; 4,183,800 m N
Figures A32–34, A40

This colony is the only accessible part of the Courrejolles Peninsula complex. It has been known by a variety of other names (e.g. Courrejolles Base colony) but to reduce confusion I have called it Courrejolles Isthmus or Colony 1. In the days before Sorensen Hut it was the main place to visit mollymawks on the island, hence there were a lot of very old aluminium bands from the 1960s. These have been rebanded when encountered, but many must have been lost through wearing out or falling off.

Usually it is possible to count this area on the same day as Hookers Finger by carrying on along the ridge track until Denver Peak, the hill which connects the Courrejolles Peninsula ridge to the Switchback Ridge (N.B. 'Denvor Peak' is incorrectly marked on the peninsula on the Campbell Island map). Walk out to the isthmus from the main ridge, taking care not to walk too close to the cliffs. On the north side when you see the first gully of birds below, climb down this gully, or preferably, the next one along. Turn left on this level to find the MP1 photopoint peg. Identify the sectors of Colony 1 from here. To find JDK colony (named after an historical photograph by J.D. Knowles), drop down a level from the MP1 photopoint peg and walk round the corner (Fig. A32).

Census

Nest visit counts (all sectors).

3.2.6 Eastern Colonies

Map grid* 379,425 m E; 4,184,300 m N to 378,850 m E; 4,182,125 m N
Figures A35–37

A scattering of mostly small colonies is found between Bull Rock South and south of Buchanans Stream (Figs 2, A35). Previously we have counted the majority of these on one long, horrible bush-bash day working from south to north. Climb up behind Sorensen Hut and cross the tussock country towards Buchanans Stream. Drop down into the stream and head for the peat blow hill on the other side and then to the coast. Use the photographs (Fig. A36a–l) and maps to find each colony—they are not easy to find because of the terrain and vegetation. In some areas it is best for observers to split up and cover separately the three scrubby/tussock ledges to efficiently cover the ground, but it is important to stay in close contact with each other. Normally, time and energy has

---

* Publication details of Campbell Island map are given in the References (Lands and Survey 1986).

been exhausted by the time Colony 15 has been counted, so return to the hut from behind the colony. Check the direction of the hut visually, then head into the scrub, either in a direct line to the track below the hut, or to the east of the hut. On another day finish the short section of coast from Colony 15 to finish near Bull Rock South.

Census

Eastern Colonies should be censused by nest visit counts, but most small areas could be counted quite accurately with ledge counts. Area 1 is low down and can't be seen properly from above, but can be approached down the scrubby slopes. Areas 2 and 3 are easily accessed from above. Area 4 is the first patch of mollymawks north of Buchanan Stream and is hidden by the scrub below the main line of rocky bluffs. Areas 5 and 6 tend to have two to three patches of nests, so care is needed to avoid missing birds, especially the highest tier of 5a. The lowest tiers of area 6 are best viewed from the side as a ledge count. Area 8 is low down below a waterfall in the main bluffs and is easily missed if travelling on the ledge above. Area 7 is the most obvious colony of the bay, and the lower tier can be viewed from the side. A scattering of nests on two ledges constitute area 12 before the next main concentration of nests in area 13a. Nests are then scattered on three different levels in areas 13b/14 and 9. Apart from a few nests on the upper level of areas 10 and 11, the main concentrations are on the level which leads into the large Colony 15. Do binocular view down counts of the inaccessible lower ledges from the main colony (half way along) and the northern point (Appendix 37). Areas 16–20 are easy to find at the top edge of the cliffs and 23–24 are viewed from the top (the latter with some difficulty—be careful).

3.2.7 Courrejolles Peninsula

Colonies ranging from:

Map grid* 373,550 m E; 4,184,150 m N to 374,500 m E; 4,184,000 m N
Figures A38, A39

The standard viewing and photograph position (position 1 or C1) that was often used in the past is on the Switchback Ridge some 2 km south from the peninsula along the coast (see southern triangle marked on Fig. 2 and more detail in Moore & Blezard 1999a). A small hollowed peat blow provides some shelter for this viewing point (there is no marker peg). There is a second closer viewpoint (position 2 or C2) on the promontory between C1 and the peninsula, which is better for picking out the grey-headed mollymawks with minimal obscuring of birds in gullies. Use photograph examples to work out where you are on the ridge by looking at how much of Isle de Jeanette Marie is obscured, the angle of the ridges and which features are visible behind the left-hand ridge of area 4 (Fig. A39d). For example, Isle de Jeanette Marie is partly obscured at C1 (as in Fig. A38), or almost fully obscured at C2—the white rock pillars at the left-hand end of the island should just be visible above the peninsula, in line with the top of count zone a2.

Travel from the field base at Perseverance Harbour (about 1.5–2 hours walk to position 1) when you are confident of good viewing conditions—counting is best in the morning or in clear overcast conditions, but it may take a few attempts before the viewing conditions are appropriate. *Caution: this is often a very cold job*

and if you are wet from rain or sweat you may risk chilling or even hypothermia, hence it is best to change into dry warm clothes right at the start.

Census

Telescope count. Count the number of grey-headed mollymawks from C2 (divide up the total GH dots into occupied nests and extras, at least at the closer parts of area 4). Telescope viewing in 1992, 1995 and 1996 gave indications of the predominant areas of grey-headed mollymawks, and in 1996 smaller zones were established as a standard (zones a1–37 in areas 1–3a, zones p1–41 in areas 3b–4. Telescope counts of grey-headed mollymawks can be used to subtract from the total dots in each zone to arrive at a Campbell mollymawk figure.

3.2.8 Isle de Jeanette Marie

Map grid* 372,875 m E; 4,185,125 m N

Census

Telescope count from north side of Mount Azimuth, near the tarn in the saddle. The other site counted from previously was on the approach to the Courrejolles Isthmus from Denver Peak. This is a closer viewpoint, but a gully is obscured from there.

3.3 AREA DIMENSIONS

Some colony areas, at which regular counts were made, were measured. This was to estimate nesting density but the diagrams are provided here (Fig. A40) to help in their recognition. Also, the size of areas might be a point of comparison in the future if colonies expand or contract.

In 1995, measurements were mostly perimeter or length by width distances taken with a tape measure. In 1996 some were repeated, and further areas measured more accurately by delimiting triangles between 'corners' of the area. Other areas were measured by taking distance and compass bearings around the perimeters (Fig. A40). Shapes and sizes in Fig. A40 are approximate, because of sloping and convoluted ground affecting measurements and the transfer of data to a two-dimensional plane sometimes distorted the shape. The extent of some formerly large colonies (e.g. Hookers Finger 2 and 3, Courrejolles Isthmus) were measured roughly by measuring uphill and across-slope distances.

3.4 INTERNEST DISTANCES

Internest distances were measured in areas where regular counts were made to estimate density. This was the distance between the centre of nest bowls of the same species. Usually, it was measured with a small retractable tape measure slightly to one side of the nests, to limit disturbance to the birds, from one side of one nest to the opposite side of the other nest. This was done semi-randomly,

* Publication details of Campbell Island map are given in the References (Lands and Survey 1986).

in the sense of wandering through an area and measuring between the nests encountered, and varying between measuring uphill, across or down between neighbours. By including birds in the middle of a ledge and near the edge it was hoped to cover the range of density within the area.

3.5 DISTURBANCE OF WILDLIFE

Work in mollymawk colonies involves walking through crowded colonies which can cause disturbance to birds on nests. Below are some suggestions to limit the effect of human disturbance on the colonies.

Try to walk slowly and carefully at all times, taking note of agitation of birds on nests. Avoid loose clothing or open rain coats as birds may grab with their beaks and be accidentally pulled off the nest as you walk past. If a bird hops off its nest, usually as soon as you have walked on it will hop straight back on. Very upset birds may walk away from the nest (although this is unlikely unless it was physically handled). Sometimes they can be herded back carefully by cutting their escape route off. If they fly away they will return when the person has moved on. Covering abandoned eggs with grass is the best way of disguising the egg to prevent predation.

Exposed eggs can attract the ever-vigilant brown skua *Catharacta skua*. Skuas are very quick to spot eggs, as they frequently fly along colonies or watch from vantage points. They are generally unafraid of humans and I have even seen one fly between a person's legs to get at an egg when the adult bird was removed for banding. It pays to keep an eye out for vigilant skuas so that you know when to be extra cautious or to protect a nest. Fortunately, human presence in a colony is unusual and skuas do not usually learn to follow you.

Take care when measuring colonies with tape measures. The birds do not like the noise caused by wind vibrating the tape, nor do they like a tape passed over their heads—there is a risk that they will grab the tape or watch it going over and topple off the nest.

If the weather is more inclement than usual, avoid exposing eggs or young chicks to the weather, or the risk of desertion from the parents. Always remember that the birds' welfare comes first. At the same time it must be remembered that losses of eggs and chicks do happen naturally, and in some years the losses will be higher than others. Some areas, probably the lower density ledges, are more prone to skua predation than others. Watch any colony for a while and you will see them at work.

It takes time to build up experience in working with a species, so that losses are a rare event. Inexperienced workers should be very cautious and not try to achieve everything on their list of instructions on the first day. If you strike a problem or potential problem, back off to assess your impact or re-evaluate a technique. Seek advice by radio to New Zealand if necessary. Always move quietly through a breeding area and be calm, but firm if it is necessary to handle a bird for some reason (e.g. rebanding, tightening bands). Do not react to bites or other aggression. Usually if you are calm and the bird is not able to struggle then it does not get overly stressed.

4. General notes on field work on Campbell Island

The following sections are notes or instructions that have been used to assist recent field parties to Campbell Island. More detailed documentation is held on Science & Research Unit and Southland Conservancy files and island protocols are outlined in the subantarctic guidelines supplied by Southland Conservancy of DOC.

4.1 TEAM RESPONSIBILITIES

4.1.1 General duties of team and team leader

- Record data in notebooks
- Collate data
- Enter data into computer
- Write a summarised daily diary
- Write a short summary report of activities, comments on huts and boardwalks, transport, radio-communications and logistics of the trip
- Provide Science & Research Unit, DOC, with all field notebooks, data compilations and reports on completion of field trip

The temporary employees will be responsible to a scientist from the Science & Research Unit, DOC for matters pertaining to the investigation and to the Operations Manager, Southland Conservancy for matters pertaining to island management.

Keeping good records of the results is very important. Double check entries in the field to avoid mistakes, especially for band records. Clearly written notes by pencil in waterproof notebooks are essential in the long-run, especially if someone else is to decipher it all in the end. Try not to cram so much into each line or page that it will be indecipherable later on—gaps between each batch of work help. Always write the full date (day, month, year) at the top of each day's work, note the time for important observations, e.g. counts or photos. Also include useful notes on weather conditions, incidental observations at a nest, etc. Your observations will be more useful the more thorough they are.

Transcribe important results such as counts, nest monitoring, etc., onto summary sheets or tables each night and update data on computer files when back at base. *Caution: notebooks can easily be mislaid in the field and valuable data lost.*

At all stages of transcription and making of summaries check the entries. Everyone, even the most careful observers, make mistakes but is more difficult for someone else who receives this data to pick them up. Include the original notebooks with the data sheets.

4.1.2 Required knowledge, skills, and experience

- Experience with field work in isolated environments, particularly subantarctic islands.
- Have a high standard of physical fitness and familiarity with outdoor survival techniques and orienteering skills, and confidence on uneven terrain.
- Experience with wildlife research and monitoring studies.
- Previous experience on surveys of Campbell Island mollymawks is desirable.
- Work well in a small isolated team, but it is essential for team dynamics and morale that a democratic approach to daily decisions be used.
- Knowledge of radio telecommunications theory and practice.

4.2 HEALTH AND SAFETY

4.2.1 Responsibilities

The party will comply with the Department's Health and Safety policy and guidelines and supervisor's instructions and will take all practicable steps to ensure their own safety. They will be familiar with the information provided on hazard identification, permit requirements/restrictions, subantarctic protocol, evacuation procedures.

The employees shall have current medical clearances for work in isolated subantarctic islands from a general practitioner, and a current general or outdoor first aid certificate.

4.2.2 Hazards arising directly from field work tasks

Injury from falling small distances (<5 m) could occur while surveying or visiting mollymawk colonies or walking in steep and rugged terrain to and from field areas. When standing near edge of a colony ledge above other ledges, the substrate may give way and result in a fall of a few metres. Short falls have happened on Campbell Island (as evidenced by entries in hut books and personal experience), but injuries were either minor or non-existent because of the soft ground.

Major falls have occurred on Macquarie Island (Australian territory) apparently resulting in severe injuries and even death on a few occasions. If a fall from the northern sea cliffs occurred on Campbell Island, it is possible the person would fall directly into the sea, but death is still likely because of the height of the cliffs. Drowning and or death by hypothermia is likely because of rough seas and sheer, unscalable cliffs.

Avoiding risk is the key method of minimising the chance of falls or injury. No attempt should be made to access colonies or ledges in hazardous areas. Access to colonies or particular ledges on any given day, will be at the discretion of the team leader, who will take into account local weather and under foot conditions. However, it still comes down to personal safety decisions and general common sense. A prudent worker will limit the possibility of accidents occurring by taking more care when there is a greater perceived risk (e.g. from

bad weather, more difficult terrain). People who are nervous, unsteady on their feet, or tired should not be in the colonies. It is essential that field personnel have a sound experience with Campbell Island conditions or similar terrain before embarking on this work.

Great care is to be taken at all times when working in mollymawk colonies. The safest possible route should be taken when walking across slippery or potentially slippery areas (e.g. water soaks on rock), overhanging vegetated areas are avoided. Usually, adjacent ledges are accessible with some scrambling or from a different part of a colony. The Team Leader must assess the weather and under-foot conditions before travelling on particular routes or visiting ledges. When it is necessary to move to the edge of a ledge, especially near the main cliff, movement must be slow and steady. For viewing from near the edge, a solid, level, rocky area must be used rather than soft ground. No-one is to perform tasks near the edge if they are at all nervous about the situation (because of ability, ground conditions, or wind and rain). Wherever possible work is to be avoided in rain and high winds, and walking routes near the cliffs are to be avoided in severe weather (alternative routes and sidles may have more difficult terrain or vegetation, but are likely to be more sheltered). Although the main north-western walking route is above steep slopes and sea cliffs and weather conditions often change rapidly and unpredictably, the route is safer than it might seem as the wind tends to shoot vertically up the cliffs, creating a calm eddy at the top.

Teams will be a minimum size of three, and at least two will have recent first aid experience (certificates to be supplied prior acceptance on expedition). If party members split up in a colony (e.g. for counting purposes) other party members must know where they are and have a meeting time and place arranged. An extensive first aid kit will be held at the base, a good field kit held at Sorensen Hut and personal kits carried by each person.

No ropes or climbing gear are kept on the island, nor are personnel trained in cliff rescue. Rescue attempts by other team members is not practical, and would be dangerous particularly without extensive training. Future island programmes could consider training personnel in rope rescue techniques for access to patients that have fallen small distances to inaccessible sites. This would have to be an annual training programme to account for the high turnover of staff/ volunteers involved.

Buoyant safety jackets, inflatable life jackets and climbing helmets were supplied in 1997 for wearing when working at the edge of sea cliffs, and at other times, at the discretion of the Team Leader. This may increase the chance of surviving to swim to an accessible cliff or until rescue by helicopter; i.e. immersion in 6–8° C water for 12 hours minimum.

4.2.3 Communications

The risk of injury and the need for patient care have greater importance on Campbell Island than standard field work because of the isolation. Communication problems with the mainland and the distance to potential rescue craft will influence the speed of any rescue.

Personal locator beacons (PLB) are carried at all times by each person. They will activate once immersed, if the aerial is attached and the water switch on at all times. Each member will be familiar with PLB use and testing and follow the principle of use only as a last resort.

Sorensen Hut (0.5–2 hours walk from any mollymawk colony) will have a 25 Watt radio (Codan 8332) tuned to DOC mainland frequencies. Reception is generally good from this location. Beeman Base (2–4 hours walk from any mollymawk colony) will have a fully programmable 150 Watt marine radio (Codan 30-6924), and each person will be familiar with radio operation and emergency procedures (from previous experience and updated briefing by Southland Conservancy staff). Smaller field radios are unlikely to reach the mainland, but are useful for communication between field teams. Radios will be tested by Southland Conservancy prior to use in the field. A daily radio schedule will be operated with DOC Te Anau (ZKSD 5) or Stewart Island (ZKSD 4) on pre-arranged frequencies. Emergency action will be initiated after missing two morning radio schedules (unless a gap is pre-arranged). The DOC radio base will operate a scanning function for unscheduled communications but may not hear Campbell Island. Lists of backup stations will be supplied for emergency contact. As an overall communication backup, a satellite phone will be supplied to keep at base. N.B. care must be taken with batteries to keep their charge level up or the phone will be inoperable. Make sure the charging system is adequate for the number of appliances to be used.

Rescue contingency is to be assessed at the time of injury (an emergency plan will be supplied with the safety documentation and equipment). Long-range helicopter rescue is possible within 24 hours (aviation fuel dumps are kept on Auckland Islands and Campbell Islands), and this has already been tested in a rescue situation.

4.3 NOTES ON CAMPBELL ISLAND FOR PROSPECTIVE FIELD STAFF

4.3.1 General

Campbell Island is our southern-most subantarctic island, 600 km south of NZ. Transport is often by tourist ship or charter vessel and takes 3–8 days, depending on the route via other islands (N.B. a passport is required for boats that end up in Australia). Ships can be cancelled at short notice, although this is rare, which may strand people for up to 4 weeks until the next ship arrives.

The climate is very maritime and subantarctic, i.e. it is usually windy, cloudy, with frequent squalls. The average temperature is about 6° C, and a warm day in summer is about 13° C, although the record is 21° C. Field work can be unpleasant, particularly with constant wind and wind-chill, so good warm weather gear and rain gear (coat, leggings and mitts) are essential. Breathable fabrics are best as it can get very warm when walking. You can work on most days by juggling the tasks to suit the weather conditions, and periods of fine, calm weather do occur.

Although the terrain is fairly easy, rolling, dissected hill country (max. height 560 m), the field work can be physically demanding. This particularly applies to

the royal albatross census work, mainly because of the long hours walking up hill and down dale searching for nests, for several consecutive days at a time. It is mentally demanding because of the repetitive nature of the work, the often inclement weather, and the fact that the body the body gets tired. Usually though, there are enough high-points to keep one's enthusiasm going.

4.3.2 Accommodation

Accommodation is at the now disused weather station. Currently the Met. Service part of the hostel is unavailable, so expeditions use the DOC annex, where there are bunkrooms for about 11 people. There is no power or proper heating as the old generating system was dismantled. We are reasonably comfortable with a gas stove for cooking and gas-heated water for a shower, but water must be pumped to some tanks up hill of the annex. Kerosene lamps or candles provide the lighting. Solar panels keep batteries charged for the radio, satellite phone, and computer. It can seem quite cold on the days that we choose (or are forced by the weather) to spend at base. It is possible that bad weather during the winter will have damaged the buildings, water system or huts and that rats will have invaded—running repairs will be necessary. Clothes are washed by hand, and usually drying outdoors or on verandas is reasonably quick (plenty of spares is a good idea though).

4.3.3 Social

People joining field teams need to be easy to get on with. The isolation and long periods spent working and living in small teams create unusual social dynamics, and not everyone copes with this. Small tensions can create big problems, especially if the field work is demanding and people get tired, and consequently do not communicate well. Where possible, communicate about problems readily and in a friendly, open manner, but above all it is necessary to be tolerant and keep a good sense of humour.

Everyone needs to pitch in and share cooking, cleaning, maintenance, data collation duties, but be flexible enough to change duties if other party members are busy on other tasks.

Work hours can be long (up to 10–12 hours) because walking times of typically 2–4 hours are required to the field areas. There is always time for photography, viewing scenes and wildlife and side-trips to points of interest or major wildlife colonies during the course of the work to take advantage of being in the vicinity of these areas. Usually, every week or so, it is important to give the body a rest from walking, for recreation and data collation. One needs to flexible enough, though, to take advantage of good weather periods to complete the priority tasks.

Swimming or diving are not permitted for safety reasons (a shark attack has occurred once on the island, requiring a major helicopter rescue). There is a non-smoking policy.

4.3.4 Suggested gear list

large tramping pack and pack liners
large day pack
gumboots × 2 (boots if you prefer)
gaiters
wool socks × 4
long-johns × 2
shorts
thermal tops
thermal jacket
glove, overmitts, hat
sun cap
light and/or heavy waterproof overtrousers
good waterproof coat (breathable)
clothes for base camp
underwear
toiletries
sun cream
torch
pocket knife
mending gear
compass
sleeping bag + inner
a second sleeping bag can be handy for leaving at a hut
sleeping mat
books
watch
camera gear
binoculars

5. Acknowledgements

Several Department of Conservation staff members (permanent and temporary employees) and volunteers have conducted or assisted me on censuses of Campbell Island mollymawk colonies from 1992 to 1997. They were: Jacinda Amey, Matt Charteris, Kerri-Anne Edge, Brent Evans, Sheryl Hamilton, Jim Henderson, Gus MacAllister, Gary Mitchell, Roger Moffat, Nadine Parker, Alan Wiltshire, They and their photographs have assisted me greatly in becoming familiar with almost every nook and cranny of the colonies. Drafts of this report were commented on by Reg Blezard, Peter Dilks and Alan Baker.

6. References

Bailey, A.M.; Sorensen, J.H. 1962. Subantarctic Campbell Island. Proceedings No. 10, Denver Museum of Natural History, Denver, Co.

Croxall, J.P.; Gales, R. 1998. An assessment of the conservation status of albatrosses. Pp. 46–65 *in* Robertson, G.; Gales, R. (Eds) Albatross Biology and Conservation. Surrey Beatty & Sons, Chipping Norton.

Croxall, J.P.; Rothery, P.; Pickering, S.P.C.; Prince, P.A. 1990. Reproductive performance, recruitment and survival of wandering albatrosses *Diomedea exulans* at Bird Island, South Georgia. *Journal of Animal Ecology 59*: 775–795.

Croxall, J.P.; Prince, P.A.; Rothery, P.; Wood, A.G. 1998. Population changes in albatrosses at South Georgia. Pp. 69–83 in Robertson, G.; Gales, G. (Eds) Albatross Biology and Conservation. Surrey Beatty & Sons, Chipping Norton.

Filhol, H. 1885. Oiseaux. Mission de l'Ile Campbell, passage de Venus sur le soleil tome III IIe partie, Academie des Sciences, Paris: 35–64.

Gales, R. 1993. Co-operative mechanisms for the conservation of albatrosses. Australian Nature Conservation Agency; Tasmanian Government Printer, Hobart.

Gales, R. 1998. Albatross populations: status and threats. Pp. 20–45 in Robertson, G.; Gales, R. (Eds) Albatross Biology and Conservation. Surrey Beatty & Sons, Chipping Norton.

Lands and Survey 1986. NZMS 272/3 Campbell Island. Scale 1: 25 000. (Aerial photography: RNZAF 1984). Department of Lands and Survey and Government Printer, Wellington.

Marchant, S.; Higgins, P.J. (Eds) 1990. Handbook of Australian, New Zealand and Antarctic birds. Volume 1, Ratites to ducks. Oxford University Press, Melbourne.

Moore, P.J.; Blezard, R. 1999a. Photographs of Campbell Island mollymawk colonies. A guide to photopoints, historical comparisons and counting mollymawks. *Department of Conservation Technical Series 17*.

Moore, P.J.; Blezard, R. 1999b. Counting Campbell Island mollymawk colonies from photographs. Data supplements. *Science & Research Internal Report 169*.

Moore, P.J.; Moffat, R.M. 1990. Mollymawks on Campbell Island. *Science & Research Internal Report 59*. Department of Conservation, Wellington.

Moore, P.J.; Scott, J.J.; Joyce, L.J.; Peart, M. 1997a. Southern Royal Albatross *Diomedea epomophora epomophora* census on Campbell Island, 4 January–6 February 1996. *Science & Research Series 101*.

Moore, P.J.; Taylor, G.A.; Amey, J.M. 1997b. Interbreeding of black-browed albatross *Diomedea m. melanophrys* and New Zealand black-browed albatross *D. m. impavida* on Campbell Island. *Emu 97*: 322–324.

Murray, T.E.; Bartle, J.A.; Kalish, S.R.; Taylor, P.R. 1993. Incidental capture of seabirds by Japanese Southern bluefin tuna longline vessels in New Zealand waters, 1988–1992. *Bird Conservation International 3*: 181–210.

Prince, P.A. 1985. Population and energetic aspects of the relationship between blackbrowed and greyheaded albatrosses and the southern ocean marine environment. Pp. 473–477 *in* Siegfried, W.R.; Condy, P.R.; Laws, R.M. (Eds) Antarctic nutrient cycles and food webs. Springer-Verlag, Berlin, Heidelberg.

Prince, P.A.; Rothery, P.; Croxall, J.P.; Wood, A.G. 1994. Population dynamic of black-browed and grey-headed albatrosses *Diomedea melanophris* and *D. chrysostoma* at Bird Island, South Georgia. *Ibis 136*: 50–71.

Robertson, C.J.R. 1980. Birds on Campbell Island. Pp. 106–116 in Preliminary reports of the Campbell Island expedition 1975–76. *Reserves Series 7*. Department of Lands and Survey, Wellington.

Robertson, C.J.R.; Nunn, G.B. 1998. Towards a new taxonomy for albatrosses. Pp. 13–19 in Robertson, G.; Gales, R. (Eds) Albatross Biology and Conservation. Surrey Beatty & Sons, Chipping Norton.

Sorensen, J.H. 1951. Wild life in the subantarctic. Whitcombe and Tombs. 85p.

Turbott, E.G. (Conv.) 1990. Checklist of the birds of New Zealand and the Ross Dependency, Antarctica. Random Century in association with Ornithological Society of New Zealand Inc.

Waugh, S.M.; Weimerskirch, H.; Moore, P.J.; Sagar, P.M. 1999. Population dynamics of Black-browed and Grey-headed Albatrosses *Diomedea melanophrys* and *D. chrysostoma* at Campbell Island, New Zealand, 1942–96. *Ibis 141*: 216–225.

Weimerskirch, H.; Jouventin, P. 1987. Population dynamics of the Wandering Albatross, *Diomedea exulans*, of the Crozet Islands: causes and consequences of the population decline. *Oikos 49*: 315–322.

Weimerskirch, H.; Zotier, R.; Jouventin, P. 1989. The avifauna of the Kerguelen Islands. *Emu 89*: 15–28.

Weimerskirch, H.; Brothers, N.; Jouventin, P. 1997. Population dynamics of wandering albatross *Diomedea exulans* and Amsterdam albatross *D. amsterdamensis* in the Indian Ocean and their relationships with long-line fisheries: conservation implications. *Biological Conservation 79*: 257–270.

Continue to Appendices file: docts16a.pdf