Photographs of Campbell Island mollymawk colonies

A guide to photopoints, historical comparisons, and counting mollymawks

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CONTENTS

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 *T. chrysostoma*. Comparisons of photographs suggest that populations have declined since the 1940s. This report outlines the techniques used for photographing colonies on the island, comparing historical views and counting mollymawks from the photographs. Photocount data are appended as a data supplement to this volume.

1. Introduction

Campbell Island lies at 52°32′ S, 169°10′ E, about 660 km south of New Zealand's mainland. There are three species of mollymawk on the island. The most numerous is the Campbell mollymawk (*Thalassarche impavida*), which is endemic to the island (Bailey & Sorensen 1962; Robertson 1980). There are also a few members of the closely related black-browed mollymawk, *T. melanophrys* (Moore et al. 1997), which has a widespread subantarctic breeding distribution and may number 680,000 breeding pairs (Marchant & Higgins 1990; Gales 1998). The other species is the grey-headed mollymawk (*T. chrysostoma*), which also has a widespread breeding range but numbers about 92,300 pairs annually (Gales 1998). Campbell and black-browed mollymawks are annual breeders whereas grey-headed mollymawks generally breed biennially (Rothery & Prince 1990). The nomenclature in this report follows the taxonomy proposed by Robertson & Nunn (1998), where 14 species have been reclassified into four genera and 24 species. Under the old classification the three Campbell Island mollymawks were known as NZ black-browed mollymawk *Diomedea melanophrys impavida*, black-browed mollymawk *D. m. melanophrys* and grey-headed mollymawk *D. chrysostoma* (Marchant & Higgins 1990; Turbott 1990).

There are many mollymawk colonies of various size on the northern coast of Campbell Island (Fig. 1). Most are mixed species associations 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 mollymawk populations. In 1874 Campbell mollymawks were very abundant in waters around the island and were said, perhaps spuriously, to nest on southern cliffs (Filhol 1885). Grey-headed mollymawks nested in smaller numbers (Filhol 1885). During the 1940s, mollymawks were thought to number many thousands (Bailey & Sorensen 1962) or hundreds of thousands on Campbell Island (Sorensen 1951). In 1975 it was estimated there were 74,800 pairs of Campbell mollymawks and 11,500 pairs of grey-headed mollymawks (Robertson 1980), based on visual impressions of the colonies (C. Robertson pers. comm.).

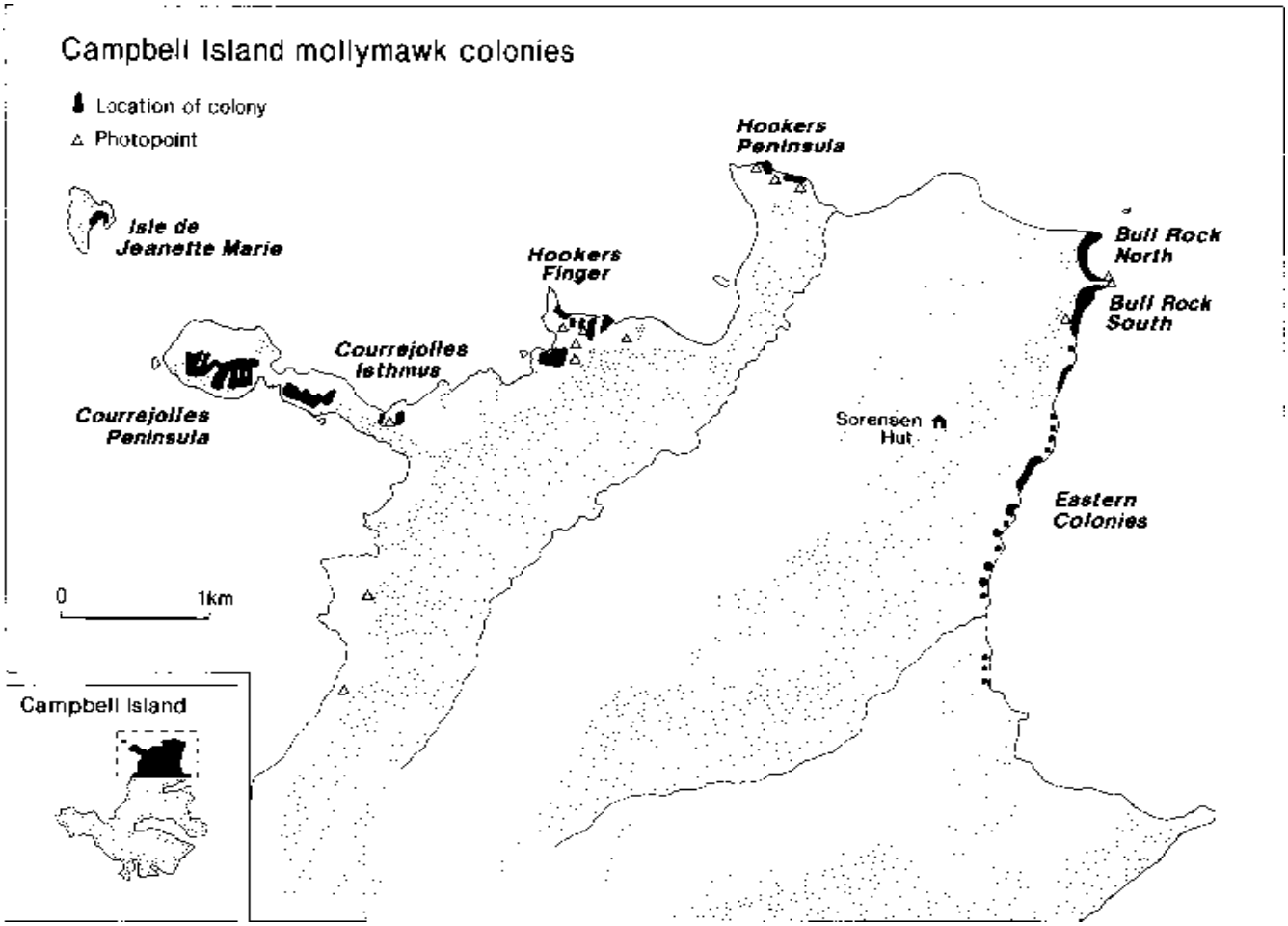

Figure 1. Location of mollymawk colonies and main photopoints on Campbell Island.

Several historical photos of mollymawk colonies were gathered during the 1980s, as part of a search for photographs of rockhopper penguin *Eudyptes chrysocome* colonies, by Duncan Cunningham of the NZ Wildlife Service. During work on the island for the Ecology Division of the Department of Scientific and Industrial Research, Graeme Taylor (now of Department of Conservation) also became interested in the mollymawks. Their comparisons of old and new photographs suggested that declines had occurred in colony size since the 1940s. In 1987, Roger Moffat marked 12 photopoints near most of the major mollymawk colonies (Fig. 1) to standardise comparisons and allow future trends to be assessed (Moore & Moffat 1990). These were positioned to give good views of the colonies, and in five instances, repeated views from historical photographs taken by J. Sorensen in the 1940s. The large inaccessible colonies of Courrejolles Peninsula were also photographed from a position 2 km south along the coastal ridge (southern-most triangle in Fig. 1) using telephoto lenses. The photopoint sites were marked with labelled aluminium or wooden pegs. Peg positions were recorded on a 1:10,000 map series (Lands and Survey 1986), copies of which are held by P. Moore and the Southland Conservancy of the Department of Conservation.

The photopoint series were repeated monthly from September to April 1987/88 (Moore & Moffat 1990) and 1991–1993 (J. Amey), so that they could be

compared with historical photographs taken at an equivalent time of the breeding season. Further photographs were taken by Meteorological Service employees in 1989–1990 (R. Moffat) and DOC staff in 1993–1997 (J. Henderson, G. Mitchell, P. Moore, A. Wiltshire) in a monitoring programme coordinated by P. Moore. The Courrejolles telescopic views were repeated at least once in most of these years.

There are two preliminary analyses of photograph comparisons for the estimation of mollymawk population change: Moore & Moffat (1990) and Waugh et al. (in press). A three-year study commenced in 1995/96 to assess the status and population trend of the mollymawk population, involving ground counts and photographs. As part of this process, photograph-counting techniques were reviewed in 1997, for comparison with the new ground counting methods (see Moore 1999), and counts were made from historical photographs (1942–1987), selected photos that had been counted previously (1988–1993) and new photos (1994–1997).

The present report summarises the photographic methods employed in the study since 1987. It describes the locations of standard photopoints and other historical photographs and provides examples of photographs taken at these points. It outlines the methods of counting birds, with emphasis on the 1997 assessment. The purpose of the report is to make it easy for future mollymawk workers to repeat and/or interpret the results of the photograph analysis. Although there is overlap with the illustrative material provided in the report of ground counting mollymawk colonies (Moore 1999), the main descriptions of methods have been separated to save confusion—often views and comparisons of photos are oblique or partly obscured, requiring slightly different counting areas or subdivision.

2. Photographic equipment

Black-and-white film (125–400 ASA for standard work, 400-800 ASA for telephoto) was used for most mollymawk colony photography because the original historical photographs were also black-and-white and it meant that developing and printing could be done on the island or in the Conservation Sciences Centre darkroom. It also meant that photographs tended to be all together on the same negative series rather than mixed up with personal photographs. Colour film (e.g. prints taken from 400–800 ASA slides) was found to be more suitable for distinguishing birds from rocks and tussocks for the long-distance views of Courrejolles Peninsula.

Camera equipment used depended for the most part on what personal gear the observer had, usually single-lens reflex 35 mm film format cameras. These were generally adequate for standard photography, but more problematical for telephoto work. Some of the 1987–1990 photographs by R. Moffat were of the best quality, using a 55 mm format Pentax for some of the photopoint series and a 500 mm mirror lens and 35 mm format SLR camera for the Courrejolles photographs. One of the best Courrejolles series was by S. Freeman with a

55 mm format camera and long lens (c. 500 mm). The 1995–1997 photographs were taken with an Olympus OM-2 camera, and 35, 50 mm lenses for standard photopoints and 200 mm lens with 2× converter for Courrejolles photos. Normal skylight filters were used. A red filter used in 1997 did not improve contrast and only reduced the amount of light reaching the film.

3. The photograph collection

The mollymawk photograph collection, including images from the 1940s to the 1990s, is held by DOC (P. Moore). In due course they are to be lodged in the DOC photo library or an appropriate public museum. Most photographs are filed as black-and-white negatives and the useful shots as 205 × 297 mm (8″ × 10″) black-and-white prints. There are also colour slides and prints from slides. Some photographs are copies of originals held by museums or individual photographers.

3.1 MOLLYMAWK PHOTOPOINT SERIES

The mollymawk colonies of Campbell Island are located on the northern coast at 52° 28–30′ S 169° 8–14′ E. Mollymawk Photopoints MP1–12 are located at Courrejolles Isthmus, Hookers Finger, Hookers Peninsula, Bull Rock North and Bull Rock South (Figs 1–12), and two telephoto sites south of Courrejolles Peninsula (Figs 1–2). The photopoints (but not the telephoto sites) have labelled aluminium marker pegs, and some also have labelled wooden indicator pegs to lead the observer off the main ridge to the aluminium peg. In some instances we were able to pinpoint the exact site of a photopoint on a map or photograph but in other cases the position was marked approximately from memory of the site. Future parties should use the photopoint view examples to verify their position if a peg is missing.

Sorensen Hut, at about 2.5–3 hour's walk from the Beeman Base field station, is a good place from which to commence the photopoint series. If no other field work is planned, a day-trip from the hut (either as a round trip or to the main base) around the northern coast encompases all the main colonies from Bull Rock South to Courrejolles Isthmus. Hence the photopoint series is covered in reverse order from MP12 to MP1 between 0900 and 1700 hrs. Although there has been no attempt to standardise the time that photographs are taken, they are done within that 8-hour period, rather than earlier or later. The Courrejolles telephoto view generally has to be done opportunistically on a separate day-trip from base in order to obtain the best weather and light conditions for the view, normally in the morning.

Photograph examples of the 12 standard photopoints, with counting boundaries marked, are provided in the Appendix 1 (Figs A1–A12). Where possible, counting areas were chosen to be equivalent to boundaries used when conducting

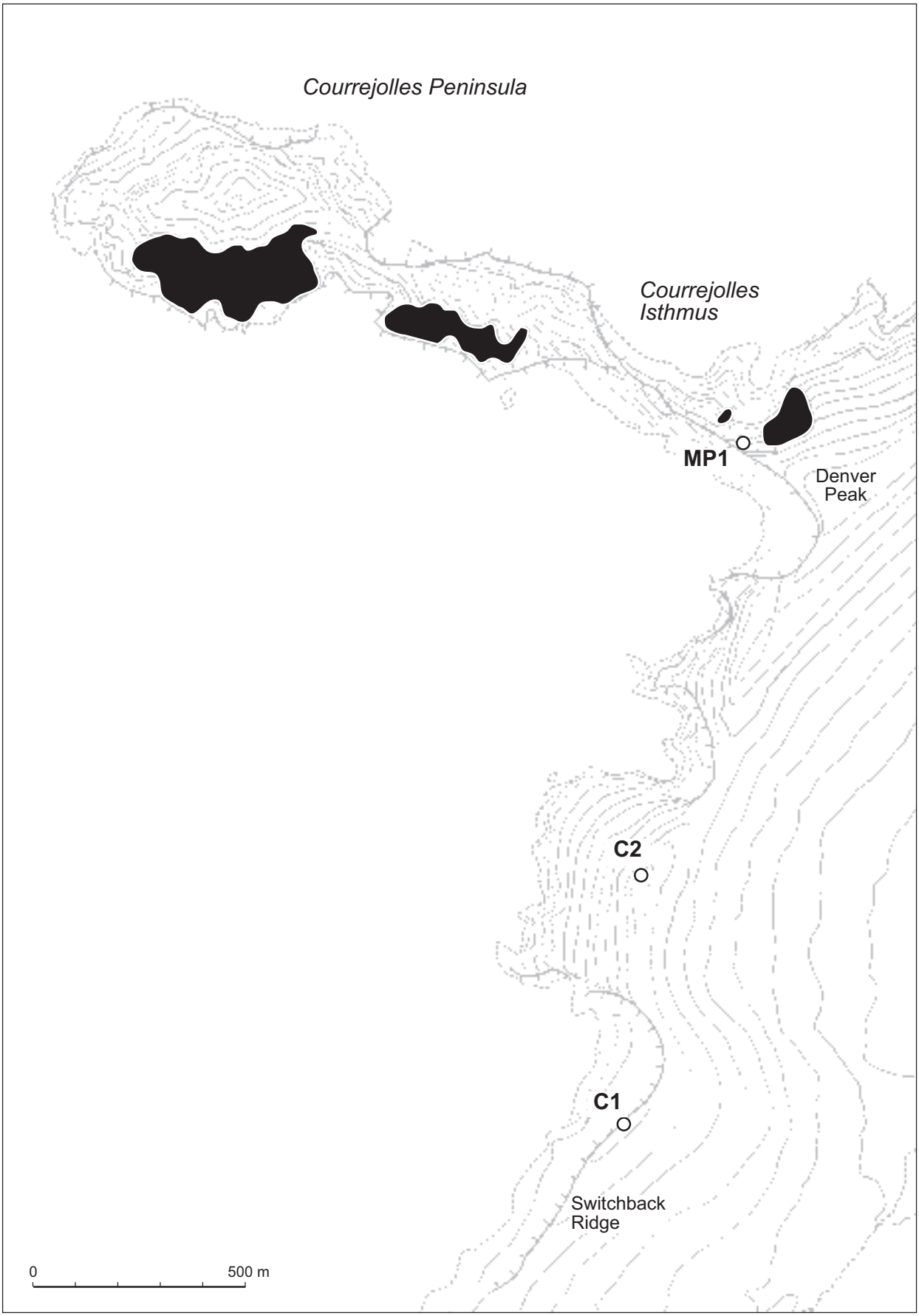

Figure 2. Map showing approximate locations of mollymawk photopoints for Courrejolles Peninsula and Isthmus and the mollymawk colonies. Position 1 (C1) and position 2 (C2) are unmarked sites for taking telephoto photograph series of the peninsula colonies. MP1 is part of the series of 12 standard photopoints with aluminium marker pegs.

censuses on the ground (Moore 1999). However, particularly prior to the photopoint series being established, photographs sometimes varied in their field of view. In order for comparisons to be made, it was therefore necessary to further subdivide areas and/or use different count boundaries. Marking of boundaries on photographs was done in the laboratory, hence it relied on the ability of P. Moore to recognise ground features in photos taken from different angles and later for R. Blezard to correctly transfer the same boundary lines onto other photographs. Photographs in the print collection which are of good quality for picking out zone boundaries and geographic features are provided in Table 1 (refer also to the first photograph in each series).

TABLE 1. EXAMPLES OF MOLLYMAWK COLONY PHOTOGRAPHS WHICH CAN BE USED AS REFERENCE PHOTOS FOR DETERMINING COUNT BOUNDARIES.

LOCALITY	PHOTOPOINT OR VIEW	REFERENCE PHOTO
Courrejolles Isthmus	MP1	19 Oct. 1995
Hookers Finger	MP2 MP3a MP3b MP4 MP5 MP6	29 Oct. 1987, 12 Oct. 1994 12 Oct. 1994 14 Oct 1996 31 Oct. 1996 12 Oct. 1994 12 Oct. 1994
Hooker Peninsula	MP7 MP8 MP9	27 Sep. 1988, 12 Oct. 1994 23 Dec. 1993, 21 Sep. 1995 16 Oct. 1995, 13 Oct. 1996
Bull Rock North	MP11	30 Nov. 1992
Bull Rock South	MP10a MP10b MP12	30 Oct. 1995 25 Sep. 1995 25 Sep. 1995
Courrejolles Peninsula	C1, C2	Oct. 1994, 1995, 1996

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 (1999). The following sections outline details of the photopoint views, boundaries for counting purposes, and the subtotals used in Moore & Blezard (1999).

3.1.1 MP1 (Courrejolles Isthmus: colony 1)

The aluminium peg marking MP 1 photopoint is found on the top ledge of the first colony at Courrejolles Isthmus as you walk out on the side ridge from Denver Peak (Figs 2 and 3). The view looking north-east on 2 October 1945 (Appendix 1, Fig. A1a) is repeated from a similar, but not identical site at MP1, usually as a two-photo standard lens panorama (Figs A1e, f). The count zones allow comparisons of different historical photos with incomplete views of the

Figure 3. Aerial photograph of Courrejolles Isthmus showing the approximate location of MP1 photopoint and other historical photographs (1-west and JDK). *Photo: C. Robertson, 12 February 1985.*

area. The photo from 1942 (Fig. A1b) has been added to the sequence and estimates for partial or missing zones were made to make the totals compatible with the other photos. Some photos appear to be from one ledge down from the standard position (e.g. Fig. A1c, the 1994/95 series), but quite big differences in what is visible are possible simply by standing on top of a rock behind the photopoint marker (e.g. Fig. A1d). This wide-angle view allows checking for the presence of nests in the upper and foreground ledges that were occupied by birds in the 1940s. Zones 10–16 are not particularly meaningful divisions and are combined at the data stage (see below). The total views in the 1945 (Fig. A1a) and 1961 (Fig. A1c) photographs were used for comparison in both datasets (totals T6 and T8, in Moore & Blezard 1999).

Datafile subtotals (Moore & Blezard 1999)

T1 = tier 1 (areas 1, 2, 5; see Figs A1a–f for area boundaries)
T2 = tier 2 (areas 3, 4, 6)
T3 = tier 3 (areas 7, 8a)
T4 = tier 4 (areas 8b, 9)
T5 = zones 10–16
T6 = 1945a: tiers 1–4 (including area 5) for comparisons with 1945 photo
T7 = 1945b: tiers 1–4 (excluding area 5)
T8 = 1961: all zones (excluding area 5) for comparison with 1961/64 photo
T9 = 1942: tiers 1–4 (part zones of areas 3, 8a, 9)

3.1.2 MP2 (Hookers Finger)

Colony 2 is located on the south side of Hookers Finger (Fig. 4). There is a wooden striped marker post on the main ridge indicating that the aluminium peg is about 40 m downhill (Figs 5–6). The view west on 30 October 1942 (Fig. A2a) is repeated at MP2 (Fig. A2b). The count areas are for comparison with ground count areas and are equivalent to those used in MP3a (Fig. A3a, b), a view of the same colony. Although the view is closer than in MP3a, it is oblique and the foreground zones are partly obscured. The total view (T13) is equivalent in the photo counts conducted in 1990, 1993 (Moore & Blezard 1999, part 1) and 1997–98 (Moore & Blezard 1999, part 2) (see sections 4.1–4.3).

Datafile subtotals (Moore & Blezard 1999)

T10 = top tiers (areas g, d, f, h; see Figs A2a, b for area boundaries)
T11 = middle tiers (o, p, q)
T12 = bottom tiers (i, j, k, l)
T13 = all areas

Figure 4. Map showing approximate locations of mollymawk photopoints and colonies at Hookers Finger and Hookers Peninsula.

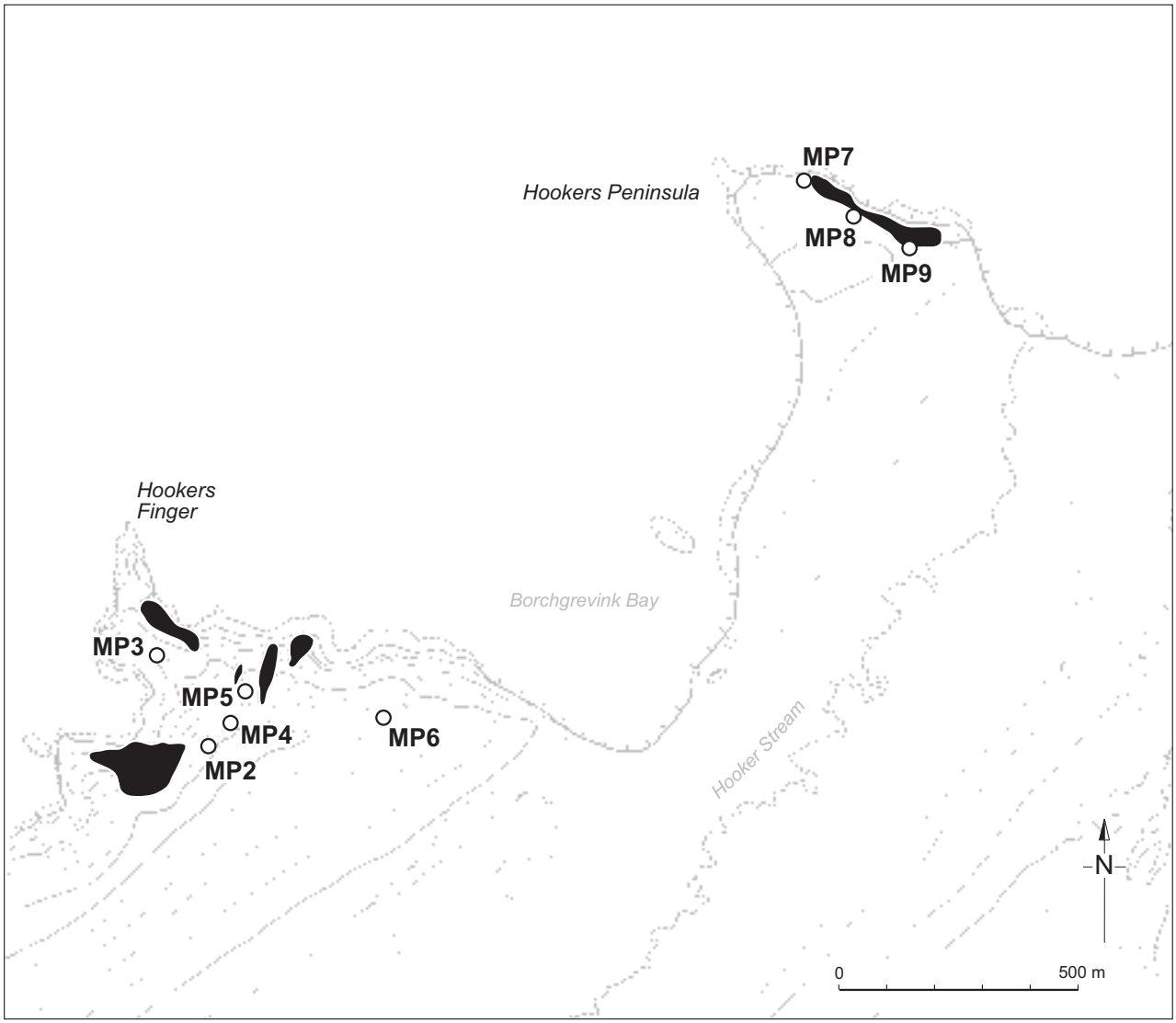

Figure 5. Aerial photograph of Hookers Finger Colony 2 showing approximate location of MP2 photopoint and historical photograph (HF1). *Photo: C. Robertson, 12 February 1985).*

3.1.3 MP3 (Hookers Finger)

MP3a

A view of Colony 2 from Hookers Finger on 19 October 1943 (Fig. A3a) is repeated at MP3 (Figs 4, 6). The aluminium marker peg is near the flat part of the Hookers Finger ridge (Figs 4, 6) and is on the uphill side of a rocky outcrop. The photographs taken in a southerly direction are referred to as MP3a, and are a two-photo panorama (Fig. A3b). Note the top left-hand corner of the 1943 Sorensen photo is supplemented in the data by a photograph taken by J.D. Knowles on the same day. The photo count totals T17 and T18 are slightly different because area a was not visible in all photographs.

Datafile subtotals (Moore & Blezard 1999)

T14 = top tier (areas a, bc, d, e, f, g, h; see Fig. A3a, b for area boundaries)
T15 = middle tier (n, o, p, q)
T16 = bottom tier (i, j, k, l, m)
T17 = all zones
T18 = all zones (except area a)

MP3b

The view to the north from MP3 of Hookers Finger Colony 3 is referred to as MP3b (Fig. A3c). There is no historical photograph from this position. This could be superfluous data, as MP4 covers a bigger view of the same colony, and area d tends to be out of view or partially obscured in many photos. The total count (T21) is equivalent in both datasets (Moore & Blezard 1999).

Figure 6. Aerial photograph of Hookers Finger colonies and photopoints (MP 2–5). *Photo: C. Robertson, 12 February 1985.*

Datafile subtotals (Moore & Blezard 1999)

T19 = areas a, b (see Fig. A3c for area boundaries)
T20 = c, d
T21 = all areas

3.1.4 MP4 (Hookers Finger)

A view from near the top of the Hookers Finger side-ridge on 30 October 1942 (Fig. A4a) is repeated at MP4 (Fig. A4b). There is a wooden marker peg at the highpoint of the ridge intersection to indicate where to turn down off the main ridge to find the aluminium pegs for MP3–5, and MP4 is the first one encountered, about 50 m downhill (Figs 4, 6). The total count (T24) is equivalent in both datasets (Moore & Blezard 1999).

Datafile subtotals (Moore & Blezard 1999)

T22 = areas a, b (see Fig. A4a for area boundaries)
T23 = c, d
T24 = all areas

3.1.5 MP5 (Hookers Finger)

Marker peg MP5 overlooks the Colony 5 gully and is downhill and east of MP4 marker peg, i.e. two side-ridges over from the Hookers Finger ridge (Figs 4, 6, and 7). There is no historical photo for this area. Generally photographs have been a standard lens three-photo panorama, and the earlier photographs and counts (1987–93) referred to 5a (bottom photo), 5b (middle) and 5c (top photo). This was rationalised in recent counting to match the ground count zones 5a, b, and c (Fig. A5a). A small pocket of nests (referred to as 5c-top) at the very top of the gully is visible in some photographs (not Fig. A5a) but this data was not used. The photo count total T25 is equivalent in both data sets (Moore & Blezard 1999)

Datafile subtotals (Moore & Blezard 1999)

T25 = 5a, b, c (see Fig. A5a for area boundaries)

MP5d

There is also an un-labelled peg a few metres downhill and west of MP5 peg which looks directly down on a small gully of birds known as Colony 5d (Fig. 6). This photograph is only occasionally repeated (Fig. A5b). The total area was used for the photo counts (Moore & Blezard 1999).

3.1.6 MP6 (Hookers Finger)

Colony 6 lies one gully over and downhill from Colony 5 (Fig. 6). MP6 photopoint is a relatively long-distance view (Fig. A6) from a turn in the main ridgeline to the south-east of the colony (Figs 4, 8b). All parts of the colony were used in the total photo counts (T26, Moore & Blezard 1999).

Datafile subtotals (Moore & Blezard 1999)

T26 = all zones

3.1.7 MP7 (Hookers Peninsula)

A scattered group of colonies lie on the north side of Hookers Peninsula (Figs 4 and 9). MP7 is one of three photopoints in the area and its peg is on the edge of

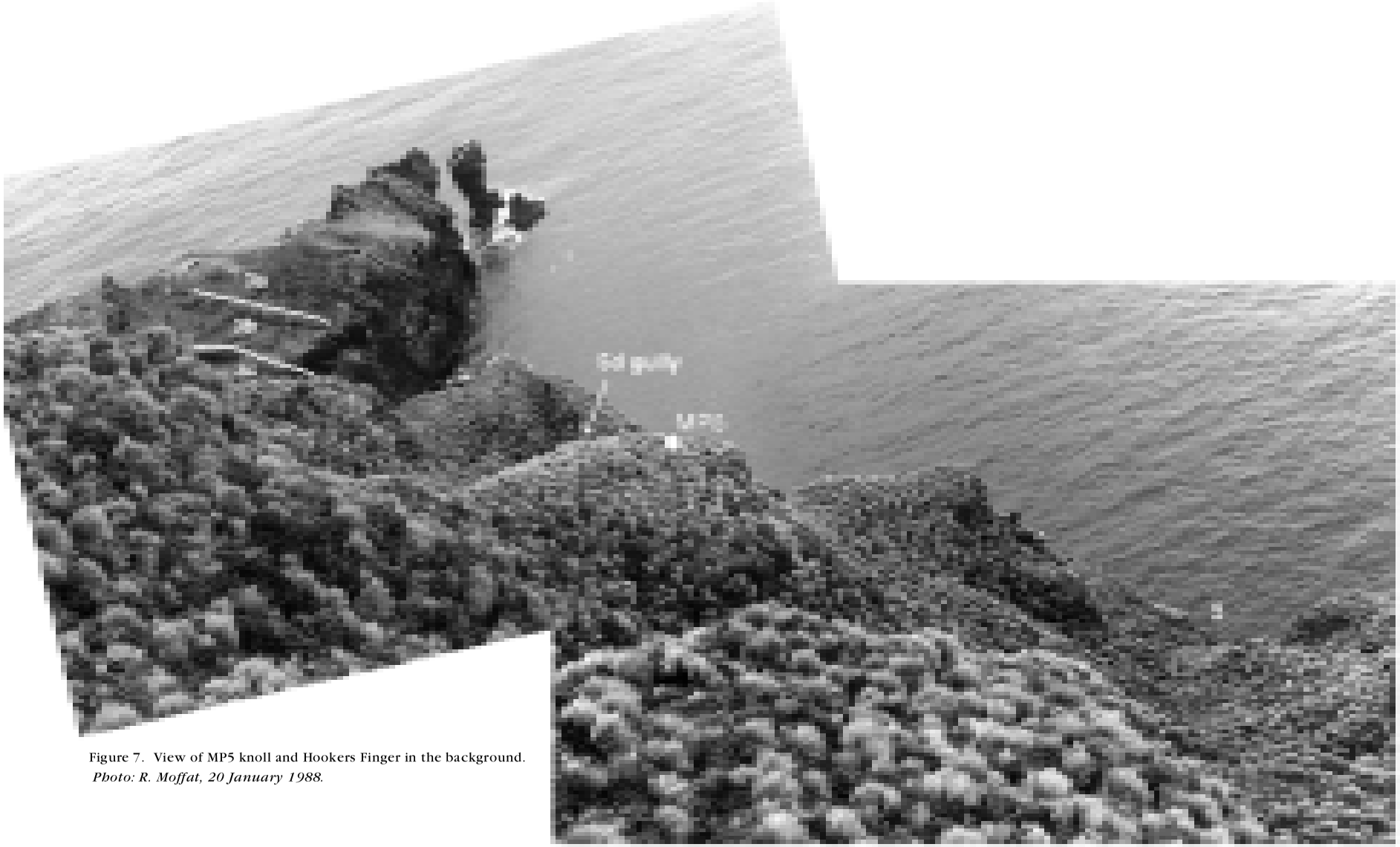

Figure 7. View of MP5 knoll and Hookers Finger in the background. *Photo: R. Moffat, 20 January 1988.*

the cliff looking directly down on the western part of the colony (Fig. 9, and Fig. A7). Some care is required to keep one's balance in windy conditions, hence some photographs cut off some of the view of area 1a with tussocks. Consequently the photo count total (T27) used for comparison purposes does not include the top part of area 1a (Moore & Blezard 1999). Photo count areas correspond to those used for ground counts.

Datafile subtotals (Moore & Blezard 1999)

T27 = all areas (except 1a-top)

T28 = all areas

3.1.8 MP8 (Hookers Peninsula)

A wooden striped marker peg locates the less visible aluminium peg for this view east (Figs 8–9, and Fig. A8). Some of the central view is visible in MP9, hence the main photo count total for comparison is T29, the outer areas (Moore & Blezard 1999).

Datefile subtotals (Moore & Blezard 1999)

T29 = 2a,d, 4, 5

T30 = all zones (except 2bx–not visible in most photos)

3.1.9 MP9 (Hookers Peninsula)

A wooden striped marker peg directs the photographer downslope to the aluminium peg for this view west (Fig. 9, and Fig. A9). The count zones of area 3 are included in the totals T31 and T32 (Moore & Blezard 1999).

Datafile subtotals (Moore & Blezard 1999)

T31 = area 3 (except 3a)

T32 = area 3

3.1.10 MP10 (Bull Rock South)

MP10a

The marker peg for MP10 is on a tussocky knoll at the northern end of the Bull Rock South colony, below Sorensen's Tarn (Figs 10–12). A two-photo panorama is taken, the left-hand view of the lower terraces being referred to as MP10a (Fig. A10a) and the right-hand view as MP10b (Fig. A10b). The general foreground of MP10a was counted in earlier photographs (T34, Moore & Blezard 1999, part 1), but this was changed in later counts to encompase only the count area 21a (T33, Moore & Blezard 1999, part 2), to relate to the ground count zone. The background areas 3–6 were counted for comparison with View H historical views (see section 3.3.4).

Datafile subtotals (Moore & Blezard 1999)

T33 = area 21a (see Fig. A10a for area boundary)

T34 = general foreground of ledge

MP10b

View MP10b (Fig. A10b) is of the upper terrace (area 22) from the MP10 photopoint peg. Zone 22a refers to the area common to most photographs throughout the series (T35, Moore & Blezard 1999). The remaining nests (T36) are visible in a wide-angle view (Fig. A10c) which was taken occasionally.

Figure 8a–c. (a) *(Above)* MP9 marker peg, Hookers Peninsula, before placing the peg in the ground. (b) *(Right)* MP6 marker peg, Hooker Finger. *Photos: R. Moffat, 19 November 1987.* (c) *(Below)* Position 1 (C1) for viewing and photographing Courrejolles Peninsula, and approximate locality of position 2 (C2) is shown also. *Photo: R. Moffat, 27 September 1988.*

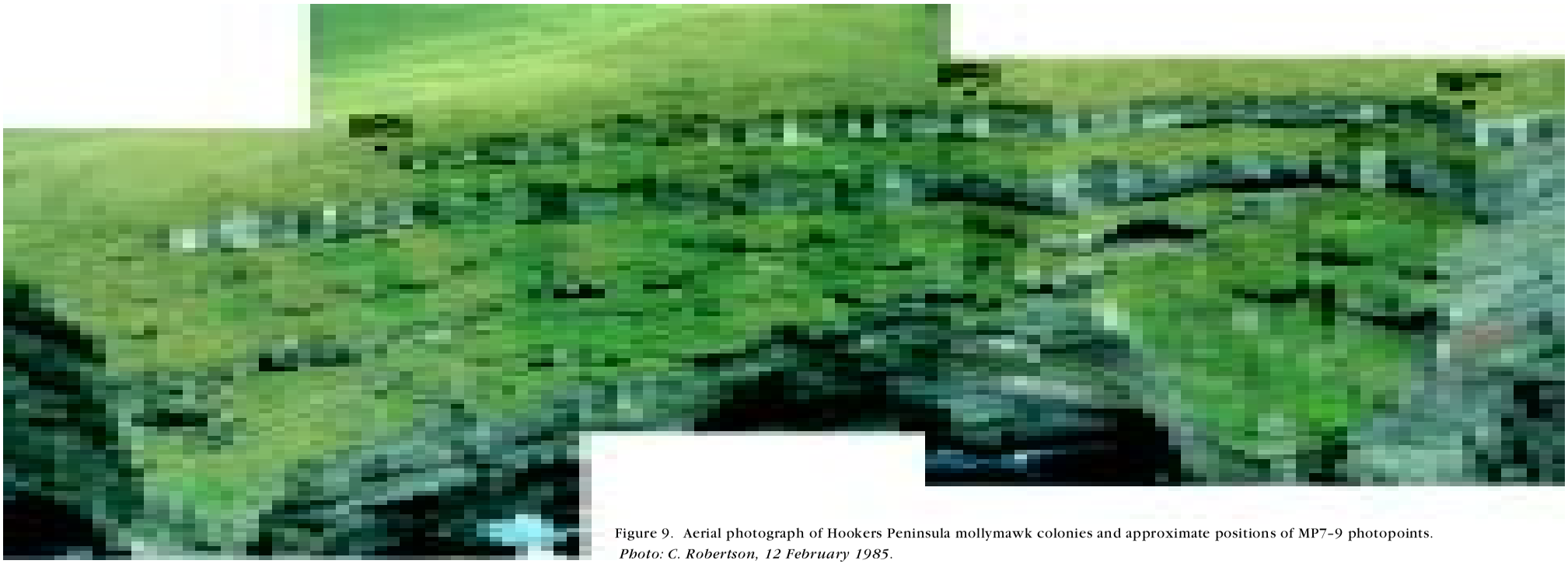

Figure 9. Aerial photograph of Hookers Peninsula mollymawk colonies and approximate positions of MP7–9 photopoints. *Photo: C. Robertson, 12 February 1985.*

Datafile subtotals (Moore & Blezard 1999)

T35 = area 22a (see Fig. A10b for area boundary)

T36 = area 22b (the periphery)

3.1.11 MP11

Views of Bull Rock North colony from near the end of Bull Rock South on 11 December 1942 and October 1966 (Figs A11a, 11b) is repeated from the MP11 peg (Fig. A11c). This is found at the end of a row of bluffs below Sorensen tarn, several metres from MP10 (Figs 10–12). This viewpoint has a very good historical photo series, although some views offer only partial zones, hence the various subdivisions of counting zones (Moore & Blezard 1999).

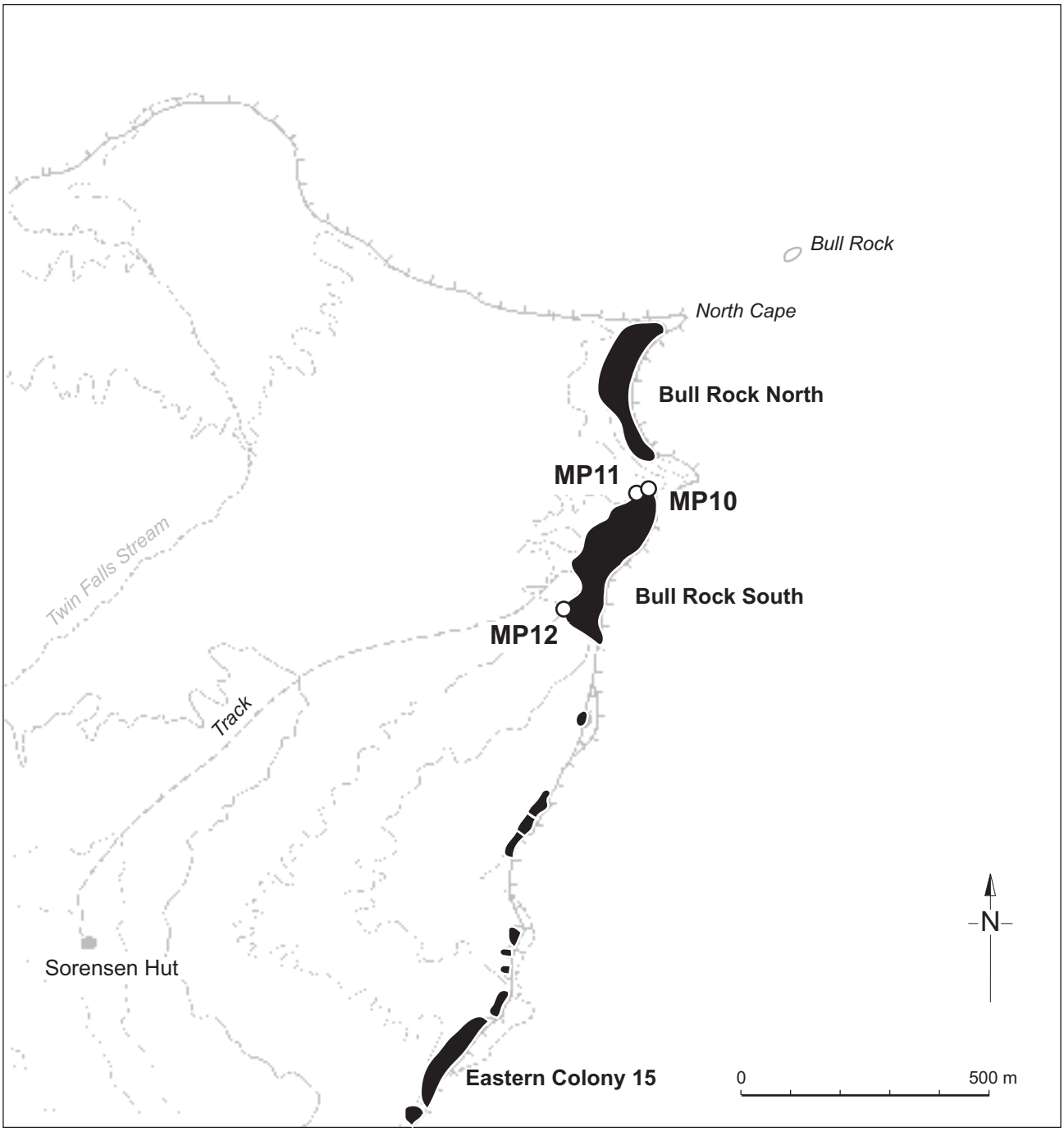

Figure 10. Map showing the location of the Bull Rock mollymawk colonies and photopoints MP10–12.

Datafile subtotals (Moore & Blezard 1999)

T37 = top two tiers (areas 13, 14, 15; see Fig. A11a for area boundaries)
T38 = middle tier (1a, 1b, 5a, 6, 10a, 10b, 11, 12a, 12b, 12c)
T39 = bottom tier (3, 4, 5b, 5c, 7a, 7b, 8a, 8b, 9)
T40 = foreground (1c, 2, 16a, 16b)
T41 = 1942: all zones (excluding 1c, 2, 16) for comparison with the 1942 photograph
T42 = 1975 box (13, 14, 15, 1a, 4a, 5a, 5b, 6, 7a, 8a, 10a, 10b, 11, 12a, 12b) for comparison with the 1975 photo
T43 = 1981 view

3.1.12 MP12 (Bull Rock South)

MP12 marker peg is close to the top periphery of ground count area 3 (Figs 10 and 11) and looks north along Bull Rock South terraces. In 1999 the peg was repositioned slightly after having fallen over—photos should be taken from about 1 m below the peg. Most recent photographs have been taken as MP12a (Fig. A12a; top terraces) and MP12b (Fig. A12b; bottom terraces) but others were wide-angle shots. Photo count area c does not extend as far up hill as in the ground counts as it is partially obscured from the viewpoint, and cut off in some photographs. Photo count total T49 is the main total used for comparison (Moore & Blezard 1999, part 2), but a larger area was used for comparison in earlier counts (T50, Moore & Blezard 1999, part 1).

Datafile subtotals (Moore & Blezard 1999)

T44 = top (areas c, d; see Figs A12a, 12b for area boundaries)
T45 = middle tier (9, 12)
T46 = bottom tier (11, 13, 14)
T47 = areas 9, 12, 13, 14 for photos that have area 11 missing
T48 = areas 9, 11, 12, 13, 14
T49 = areas c, d, 9, 11, 12, 13, 14
T50 = general view
T51 = 1975 view

3.2 TELEPHOTO VIEWS OF COURREJOLLES PENINSULA

The largest aggregation of mollymawk colonies on Campbell Island occurs on the inaccessible Courrejolles Peninsula. Photographs taken during the 1940s do not show enough detail. A photograph taken on 11 January 1965 (Fig. A13a) from somewhere north of position 2 (C2, Fig. 2) is the earliest useable view of the area.

In 1987, position 1 (C1, Figs 2, 8, and Fig. A13b) on the Switchback Ridge was chosen as the standard viewing and photograph position for the peninsula. Although some 2 km away from the colonies, it was the best compromise between distance and ability to see birds in the gullies. In 1987/88 R. Moffat used a 500 mm lens from C1 but subsequent observers often only had a 300 mm lens or 200 mm with a 2× converter, so photos tended to be taken from closer to position 2 (C2, Figs 2, 8, and Figs A13c–h). In 1995–97, photographs were taken from both positions (and a third much more oblique site in 1995) and repeats

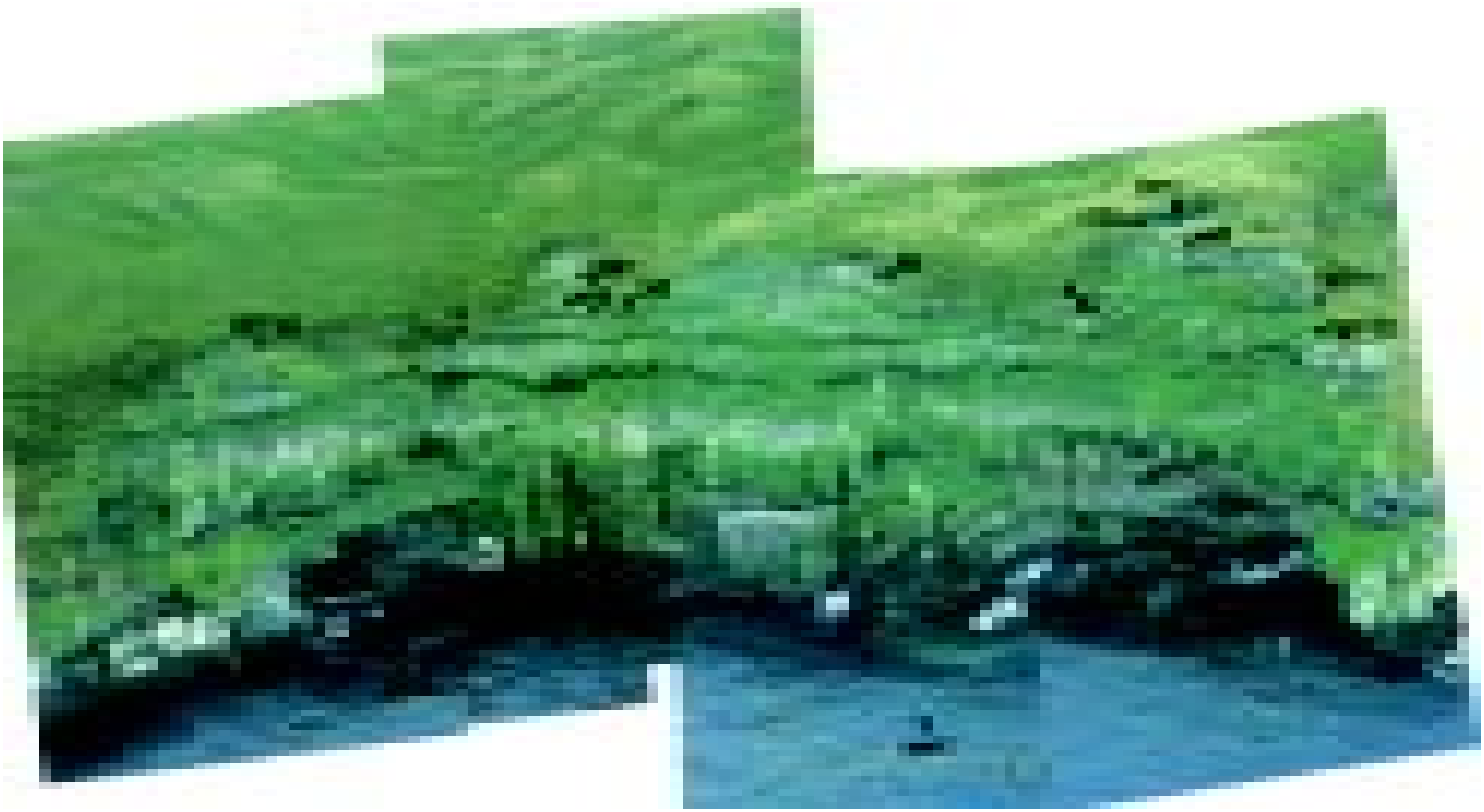

Figure 11. Aerial photograph of Bull Rock South mollymawk colony and approximate locations of MP10–12 and other historical photographs (SS1, H1–3, ST1–2, P, sea-1). *Photo: C. Robertson, 12 February 1985.*

were made in different light conditions, with different film types and with or without a red filter. Position 2 was the better option for the main photo series, as it was close enough to pick out more detail with 300–400 mm-sized lenses and for telescope counts of grey-headed mollymawks. Supplementary photograph series taken from C1 enabled birds to be counted that were obscured by ridges from C2. Light conditions were critical to good photographs—bright overcast conditions with no haze gave the right amount of diffuse light, as shown in Figs A13c–h, rather than direct sunlight which caused shadowing in Figs A13a–b. The photo count total T57 is the core area visible in the 1965 photograph (Fig. A13a), and is comprised of areas 2 and 3, except for zones A24a (area 2) and P29, P30 (area 3). Total T58 includes some zones of area 1(A7–10, 12–14) and was the total counted in 1990 and 1993 (Moore & Blezard 1999, part 1).

Datafile subtotals (Moore & Blezard 1999)

T52 = area 1 (see Figs A13b–13h for area boundaries)
T53 = area 2
T54 = area 3
T55 = area 4
T56 = areas 1-4
T57 = 1965 core
T58 = 1965 total

3.3 OTHER HISTORICAL PHOTOGRAPHS OR VIEWPOINTS

A few other historical photographs were repeated opportunistically when mollymawk workers were on the island, and the sites for others were found for the first time in 1997/98. Some of these still require photographs re-taken at the appropriate time of year, but have been included here for reference purposes. None have marker pegs.

3.3.1 1-West (Courrejolles Isthmus)

A photograph taken on 30 October 1942 (Fig. A14a) of the western part of Colony 1, Courrejolles Isthmus was repeated in the 1980s and again more recently (Fig. A14b). This was taken from the centre of the colony (at the bottom of the ground count zone boundary c/d), approximately as indicated in Fig. 3 (maybe at the next rock to the right), and looks up to the MP1 photopoint peg. Photo count areas were chosen for comparison between different photographs and do not relate to ground count zones.

Datafile subtotals (Moore & Blezard 1999)

T59 = 1942 view (areas 1–4; see Fig. A14a for area boundaries)

3.3.2 JDK (Courrejolles Isthmus)

A view of the western subcolony at Courejolles Isthmus, known as JDK colony, after the 19 October 1943 photo by J.D. Knowles (Fig. A15a), has been repeated

in recent years (Fig. A15b). Photo count zones allow comparison of different parts of the colony around the current core of birds.

Datafile subtotals (Moore & Blezard 1999)

T60 = 1943 (areas 1–5; see Fig. A15a for area boundaries) for comparison with the 1943 view. Zones 6–7 are not used for comparison.

3.3.3 HF1 (Hookers Finger)

A photograph taken on 19 October 1943 (Fig. A16a, Bailey & Sorensen 1962: p.176) was repeated in 1997 (Fig. A16b). Boundaries are the same as for the ground counts and photos from MP2 and MP3a.

Datafile subtotals (Moore & Blezard 1999, part 2)

T61 = whole view in 1943 photo

3.3.4 View H (Bull Rock South)

There are several views of the southern end of Bull Rock South colony taken from different viewpoints, none of which are strictly comparable. Until recently the only similar view was from MP10a (Fig. A10a), which are most comparable with H1 and H2 views. This was rectified to some extent in 1997/98 and 1999, however some comparisons are still required at the appropriate time of year.

H1

A photograph from Sorensen Tarn in October 1966 (Fig. 11, Fig. A17a) was repeated in 1997 (Fig. A17b). Photo count zones are subdivided for comparison with the other View H photographs from different positions. Closest comparisons are from H2 and MP10a.

H2

Views from 'bb terrace' (Fig. 11) still require some rationalisation as they are from slightly different positions in each case, which affects the background view, and they are yet to be repeated in October. Earlier views in April 1944 and c. October 1950 are not as clear or extensive as the October 1966 view (Fig. A18a), which was repeated in January 1999 (Fig. A18b). This viewpoint is from the bank behind the terrace. The most comparable views to H2 are from H1 and MP10a. The photographs in Figs A18a and A18b are part of panoramas of the 'bb terrace' (Figs A18c, A18d), and although they are not taken at the same time of the year, they allow comparison of the colony periphery.

H3

Another example of View H is the October 1984 photo (Fig. A19a) from the southern end of 'bb terrace' (Fig. 11). The same view was repeated in January 1999 (Fig. A19b) and is most similar to views from H4.

H4

A view not far from H3 (Fig. 11), from the tussock bank at the bottom edge of area c, was taken in January 1951 (Fig. A19c) is similar to photographs taken in January 1969 and 1995, and March 1988. The same view was taken in January 1999 (Fig. A19d).

Datafile subtotals (Moore & Blezard 1999)

T62 = View H1 (areas 2a, 3, 4, 5a, 5b, 5c, 6, 10a) from Sorensen's Tarn
T63 = View H2 (areas 2a, 3, 4, 5a, 5b, 6) from back of bb terrace
T64 = View H3 (areas 2a, 2b, 3, 4, 5a, 5b, 5c, 5d, 10a) from edge of bb terrace
T65 = View H4 (areas 2a, 3, 4, 5a, 5b, 5c) from below study square
T66 = View H (areas 3, 4, 5a, 5b, 6) from MP10a (see Fig. A10a)
T67 = View H (areas 3, 4, 5a, 5b) from MP10a as defined for 1990 counts
T68 = View H as defined for 1993 counts
T69 = view of bb terrace common to 1966 and 1984 photos

3.3.5 Panorama P (Bull Rock South)

A panoramic view of the northern ledges of Bull Rock South from below Sorensen tarn (Fig. 11) was taken in October 1966 (Figs A20a–c) and repeated in January 1998 (Figs A20d–f) for comparison of the colony periphery.

3.3.6 Study Square S1 (Bull Rock South)

A view in October 1966 (Fig. 11, and Fig. A21a) of the top pocket of nests at Bull Rock has a comparable photograph in November 1984 and January 1995 (Fig. A21b). This area contains the study square from the 1980s to 1990s.

Datafile subtotals (Moore & Blezard 1999, part 2)

T70 = whole view

3.3.7 Sorensen Tarn (Bull Rock South)

ST1

The photograph from 11 December 1942 (Fig. A22a) was taken from the west bank of Sorensen Tarn (Fig. 11) and was repeated in 1997 (Fig. A22b). A similar photograph was taken in 1966 from a different angle.

ST2

A photograph taken in October 1966 (Fig. A23a) from the southern end of the tarn (Fig. 11 was repeated in 1997 (Fig. A23b).

Datafile subtotals (Moore & Blezard 1999)

T71 = view from ST1 equivalent to the area visible in 1942
T72 = view from ST2 equivalent to the area visible in 1966

3.3.8 BRN1 (Bull Rock North)

A photograph of Bull Rock North (Fig. A24a) was taken in 1950 from about 100 m away from the top ledges (Fig. 12) and repeated in 1997 (Fig. A24b). The boundaries relate to ground count zones but some are subdivided because the whole area is not visible.

Datafile subtotals (Moore & Blezard 1999)

T73 = all areas (main view except forground areas of 7, 10b and part of 11)
T74 = whole view

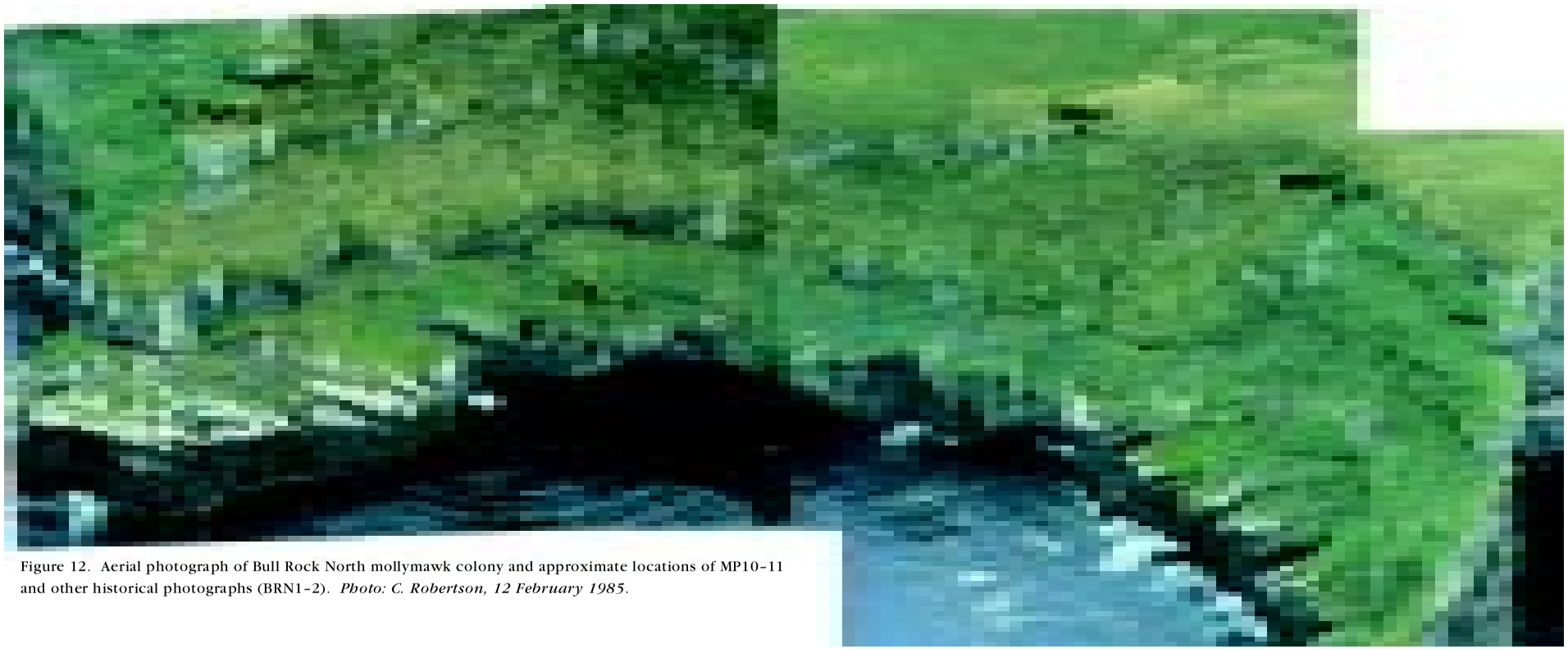

Figure 12. Aerial photograph of Bull Rock North mollymawk colony and approximate locations of MP10–11 and other historical photographs (BRN1–2). *Photo: C. Robertson, 12 February 1985.*

3.3.9 BRN2 (Bull Rock North)

An oblique view of the lower terraces from the upper terrace of Bull Rock North was taken in 1950 (Fig. A25a) and a comparable photo taken in 1997 (Fig. A25b).

Datafile subtotals (Moore & Blezard 1999, part 2)
T75 = whole view

3.3.10 E15 (Eastern Colonies)

There are few photographs of eastern colonies because of the difficulty of access by foot. Part of the panorama from the promontory at the north end of Colony 15 taken in 1988 (Fig. A26a) was repeated in 1997 (Fig. A26c), although the upper terrace was photographed from a position further inland (Fig. A26b).

Datafile subtotals (Moore & Blezard 1999, part 2)
T76 = whole view

3.4 NAUTICAL PHOTOGRAPHS

Photographic series were taken of mollymawk colonies of Campbell Island by C. Robertson on 12 November and 17 December 1975. Generally, because of their oblique nature, they are not as useful as aerials for counting purposes, but some colonies on steeper faces were counted (photo counts 1990, 1993).

3.4.1 Sea-1 (Bull Rock South)

The earliest known photograph of a Campbell Island mollymawk colony was taken during a visit by the Governor of New Zealand, the Earl of Glasgow, on 14 February 1895. The photograph was a small print in a photo album from the trip (Fig. A27a, Pollock Collection, Alexander Turnbull Library), and was taken offshore of the Bull Rock South colony (Fig. 11). The view was repeated 103 years later at an ealier stage of the breeding season (Fig. A27b). Because the earlier photo is not a clear image it cannot be used for counting purposes, but provides an indication of occupancy of the ledges which form the colony today.

3.5 AERIAL PHOTOGRAPHS

Three series of aerial photographs of mollymawk colonies have been taken from naval helicopters. Because of the lateness in the season, the February 1985 (C. Robertson) photographs were not so useful for counting purposes, although some colonies were counted (during 1990, 1993) for seasonal comparisons. Several 1985 aerials are shown in Figs 3–12. The December 1989 and November 1990 series (both R. Moffat) were counted in 1993 to obtain total estimates of the mollymawk population, although there are gaps in coverage of the eastern colonies (Moore & Blezard 1999, part 1).

4. Counting mollymawks from photographs

Counts of nests, birds or the white dots that represent them in distant photographs, can be used to estimate the population size of a colony.

In distant views of colonies, some nests might be obscured. Yet the proportion of nests per total number of birds seen will be overestimated, as nesting and non-nesting birds cannot be distinguished (i.e. it will be a count of total dots, rather than nests). By using the same count zones as for ground counts in 1995–1997 it is possible to compare results of a photo count with a census conducted on the same day (data not analysed). This essentially provides a ground-truthing of photo counts for years when photographs only were taken.

Regardless, it is assumed that counts of nests in photographs, taken during the same month in different years from the same viewpoint, can be used to estimate trends in nest numbers (the main objective of the photopoint series).

Numbers of photos counted by three observers are tabulated in Table 2. To account for variation between observers and count boundaries, some photos, particularly the historical series, were re-counted. Data for photo counts are summarised in Moore & Blezard (1999).

4.1 COUNTS CONDUCTED BY PETER MOORE

Most counts for an historical comparison (Moore & Moffat 1990: appendix 2) and Courrejolles (Moore & Moffat 1990: table 1) were done by Peter Moore in 1990, and are included in Moore & Blezard (1999, part 1). Additional photographs from 1987/88 were were counted by Roger Moffat while stationed on the island for colony total estimates in September 1988 (Moore & Moffat 1990: table 1, total column). These have not been included in the data of Moore & Blezard (1999, part 1) as they are not comparable with subsequent counts. Many blue lines and annotations on photographs from the collection date from Moffat's counts.

The number of nests in each photograph was estimated by counting the birds on nests (for close views), or counting the dots (for distant views), in the photographs, usually using a binocular microscope and marking the birds on the photograph or on a transparent overlay. Colour slides taken in 1975 and 1985 were counted by marking the birds on the projected image.

In all photographs the basic unit for counting purposes was a bird on a nest. Where it was possible to distinguish standing birds or partners at a nest, these extra birds were omitted from the count. Generally, whole photographs were counted, or large sections of photo views for comparison between years. Data were summarised in Moore & Moffat (1990) and added to a spreadsheet in 1993. Note that most of the counts were repeated by subsequent counters (see below).

TABLE 2. NUMBERS OF PHOTOGRAPHS COUNTED BY PETER MOORE (DURING 1990), ALASTAIR MCLEAN (1993) AND REG BLEZARD (1997–99). NUMBERS IN BRACKETS ARE THOSE PHOTOS INCLUDED IN THE TOTAL THAT WERE ALSO COUNTED PREVIOUSLY BY ONE OF THE OTHER COUNTERS

VIEWPOINT	PHOTOS IN VIEW, PANORAMA OR SERIES	PHOTO SERIES COUNTED BY PETER MOORE	PHOTO SERIES COUNTED BY ALASTAIR MCLEAN	PHOTO SERIES COUNTED BY REG BLEZARD
MP1	2	5	26 (5)	24 (7)
MP2	1	2	23 (2)	23 (5)
MP3a	2	4	24 (2)	23 (5)
MP3b	1	0	19	22
MP4	1	4	20 (2)	21 (5)
MP5	3	0	21	21 (3)
MP5d	1	0	6	21 (6)
MP6	1	0	22	14 (3)
MP7	1	1	22 (1)	14 (3)
MP8	1	1	23 (1)	14 (3)
MP9	1	1	20 (1)	16 (3)
MP10a	1	0	19	23 (6)
MP10b	1	0	23	19 (2)
MP11	1	14	26 (10)	27 (8)
MP12	1-2	4	27 (3)	27 (7)
Courrejolles	10-30	4	8 (1)	6 (3)
1-West	1-2	0	0	5
JDK	1	0	2	9 (2)
HF1	1	0	0	2
H	1	4	5 (3)	34 (4)
SS1	1	0	0	2
ST1	1	0	0	3
ST2	1-2	0	0	3
BRN1	1	0	0	3
BRN2	1	0	0	2
E15	2	0	0	2
1975 sea		12	0	0
1985 aerial		50	0	0
1989 aerial		0	55	0
1990 aerial		0	47	0
Total		106	438 (31)	379 (75)

4.2 COUNTS CONDUCTED BY ALASTAIR MCLEAN

In 1993 Alastair McLean printed and counted the backlog of photographs from 1988 to 1993, and the historical series of photos was recounted for comparison with the previous counter (Peter Moore). No attempt was made to rectify any observer differences. A tally sheet was used and data were summarised on a spreadsheet which is further summarised in Moore & Blezard (1999, part 1). Because of different interpretations by observers and count boundaries, the McLean and Moore counts are separated for each photopoint and kept distinct from the Blezard counts in Moore & Blezard (1999, part 2).

As previously, the basic counting unit was a bird on the nest, however where possible, the species, extra birds (standing birds, partners, etc.) and numbers of chicks were also recorded. Transparent overlays were used during counts, however they were not retained as a permanent record.

4.3 COUNTS CONDUCTED BY REG BLEZARD

In 1997 Ruth Oliver printed much of the back-log of mollymawk photos, and the remainder were printed commercially.

From 1997 to 1999 Reg Blezard counted the 1993–1999 photographs and repeated some counts by Peter Moore and Alastair McLean, particularly for the historical photos.

4.3.1 Counting materials and equipment

Each print was covered with a transparent film sheet for marking on count boundaries with a permanent marker pen. Boundaries were designed to be comparable throughout a viewpoint's photo series, and, where possible, to correspond to the zones used for ground counts in 1995–1997.

Some Courrejolles Peninsula photographs were compiled into montages and the four broad areas (1–4) marked on. Telescope viewing in 1992, 1995, and 1996 gave indications of the predominant areas of grey-headed mollymawks and minimum counts. In 1996 photo count zones were established, based on areas marked on the photographs in the field. The telescope counts of grey-headed mollymawks can be used to subtract from the total dots in each zone to arrive at the figure for Campbell mollymawks.

Counts were made using a binocular microscope (6.4× magnification) or half-lens reading glasses (3.5× magnification). Birds were marked on the overlays with fine permanent marker pens, or for dense concentrations, with a pin-prick (see below for colour coding). Observer differences were limited by thorough checking by P. Moore of many photo overlays made by R. Blezard, so that we could discuss interpretation of the dots (e.g. indistinct birds might be missed by the first observer or white rocks, empty nest bowls, non-nesting birds or flying birds misinterpreted as nesting birds). Keeping a permanent hard copy in the form of the transparent overlay of each count attached to the photographs will allow future workers to compare results or interpret our counts.

4.3.2 Counting definitions

Species

Unknown: Where it was too difficult to distinguish grey-headed from Campbell mollymawks, all birds were referrred to as unknown mollymawks (species undetermined). This was particularly the case for the more distant views.

Campbell: Where there was some confidence that the species could be separated, the whitest looking birds were categorised as Campbell mollymawks (Note: In the original data sheets (see Figs A28a, b), the abbreviation NZBB

refers to the old name: NZ black-browed mollymawk). In close views and photographs with good contrast, the two species were separated.

Grey-headed: Not surprisingly, grey-headed mollymawks (GH in Figs A28a, b) were distinguished from Campbell mollymawks by their grey heads, but light conditions and exposure of the photograph were critical, so that the greys were not bleached out. Even in good quality photographs of Courrejolles Peninsula, at least some of the grey-headed mollymawks were distinguishable. The dark bill of the grey-headed mollymawk was also a salient feature. Posture (e.g. sleeping birds usually tuck the bill into the back feathers) and orientation of the bird to the camera made species separation difficult. Therefore, even in good photographs, grey-headed mollymawks were undoubtedly underestimated in favour of the more numerous Campbell mollymawks.

Breeding status

Nest: A bird occupying a nest. This included most birds that were in sitting posture, but also any that appeared to be standing on nest bowls (i.e. still occupying a nest site), as in the occupied nest category for ground counts. Sitting birds that appeared to be close to nests were assumed to be partners of nesting birds.

Extra: All apparently non-nesting birds, including partners sitting beside nests and birds that were sitting or standing between nests, in loafing areas, or at the edge of colony ledges were tallied as 'extras'.

Chick: In close views in January–February, unguarded chicks were counted separately from adults that were also sitting on nests. The adults in this case were probably failed breeders but were still tallied in the 'nest' category for compatibility with the counts earlier in the breeding season, and for the more distant views.

Total dots: Assigning birds to the above categories depended on the quality of the image, which might vary even at the same photopoint; in many of the more distant views it was only possible to count the birds as the total number of visible white dots. At the data stage, all nests, extras and chicks were added together to give the total number of birds. Subsequent estimates of the proportion of nests per total dots can be made from counts of close viewpoints or from ground counts.

4.3.3 Count key

The following colours were used on the overlay sheets in 1997.

Mapping linework:

Blue = Counting boundary margins marked directly on photos prior to the 1997 photo counts

Red = Zone boundaries, area divisions and descriptors marked on the overlays

Green = Overlap boundaries in zones between prints of a panorama or for historical comparisons of partial zones

Species identification:

Blue = Campbell mollymawk

Red = Grey-headed mollymawk

Yellow = Mollymawk (indeterminate species)

Status:

Dot (or pin-prick) = Nest
Vertical stroke = Extra
Yellow dash or dot = Chick

Corrections:

Green dash or dot = Expunged error during checking
Mark in appropriate colour = Correction of errors

4.3.4 Photo count problems

Counting mollymawk nests accurately depended on a number of factors. Some were problems inherent in the particular view, or transient factors which added variability to photos or counts of the same view.

On-site variables

Proximity of photopoint to the colony: Greater distance made birds harder to distinguish from each other, tussock or rocks. Birds facing away from the camera may not have shown up because of the dark plumage of the wings, especially in shadowy parts of the colony. All birds sitting on nests or standing around in the colony appeared as dots in the more distant views, hence the numbers of nests was overestimated and the species could not be separated.

Angle of view: Birds were obscured by other nests, rocks or ridges in the more oblique photos.

Light conditions: Bright diffuse light is the most ideal, but for most photographers there was little choice other than to operate in whatever conditions were available. Hence the full range of conditions from too bright and shadowy to too dull or misty was apparent from the photograph collection.

Weather: High wind was a problem and sometimes caused blurring of the image.

Time of breeding season: At different times of the season there were differing numbers of occupied nests (maximum just after peak laying, thereafter declining with egg loss) and numbers of extra birds in the colonies (partners and nonbreeders) which still created dots on the images.

Time of day: Numbers of nonbreeders sitting on empty nest bowls and standing/sitting in the colonies may have changed with the time of day. Unfortunately, few photographers recorded the time.

Photographs

Film type: Variation from different types of black-and-white film was not readily noticeable. However, judging from recent comparisons of photographs of Courrejolles Peninsula, birds are probably more easily distinguishable in colour photographs.

Camera and lens quality: Although a variety of camera types were used for mollymawk colony photography, most single-lens reflex 35 mm film format cameras were adequate. Quality was more critical for Courrejolles photographs and magnification has varied from 200–500 mm lenses.

Field of view: Some photos were taken at different times with standard (e.g. 50 mm) or wide-angle (e.g. 28–35 mm) lenses. This makes little difference for

close-proximity photos but birds on background ledges were difficult to discern from distant viewpoints. Occasionally the photographer cut off the edge of the normal field of view.

Printing quality: Clarity and contrast varied widely depending on the experience or patience of the printer, quality of the enlarger and paper type or age of chemicals, etc.

Viewpoint

The position from which a photograph was taken influenced what part of colonies were visible or obscured. This varied widely, even at some of the standard photopoint sites (e.g. MP1, 7). Photographs at other sites were collected together because of their obvious similarities (e.g. View H) but there may have been enough differences in angle of view to make comparing the numbers of nests inappropriate (e.g. photo from offshore, compared with an aerial photo or an oblique land-based photo).

Photo counter

Individual variability in counters influenced results. This may have related to the amount of care taken or experience with birds on the ground (and/or the magnification used). In 1990 and 1993, counters attempted to separate out the obvious non-nesting birds from the count, which was more difficult for the more distant views. The 1993 counter (A. McLean) consistently counted more nests than the 1990 counter (P. Moore), who in turn had counted consistently more nests than a 1988 attempt (R. Moffat). In 1997 we tried to reduce this problem by P. Moore checking some counts by R. Blezard to establish consistency.

4.3.5 Data

During 1997–1999, a rough tally sheet was used for each photograph and data transferred onto the standard data sheet (Figs A28a, b). Any unusual aspects to particular photo comparisons were annotated on the data sheets or separate sheets attached to the data sheets.

Data were then transferred to an Excel spreadsheet for each photopoint (held by Peter Moore). Total summaries from these spreadsheets are provided in Moore & Blezard (1999, part 2) to be analysed separately.

5. Priorities for mollymawk colony photographers

Priority tasks for mollymawk colony photographs are:

- Take black-and-white photographs at the mollymawk photopoint series MP1–12 during early incubation (early to mid October). If it is not possible to be on the island at that time, photos taken later in the season can still be compared with those taken in previous years. The most useful period is October to December.
- Take one set of telephoto (400–500 mm lens) black-and-white photographs and one set of colour slides (400–800 ASA) of Courrejolles Peninsula from C2 viewing site in early to mid October.
- Repeat historical photographs (of the photopoint series and other views) at the same time of year as the original. If that is not possible, photos taken at other times can still be compared with those taken in previous years.
- Repeat photographs of the mollymawk photopoint series MP1–12 during each month of the breeding season (October to May). For a measure of breeding success, the most useful times are:

  5–15 October (early incubation)
  20–30 December (early chick period)
  15–25 March (late chick period for Campbell mollymawks)
  20–30 April (late chick period for grey-headed mollymawks)

6. Acknowledgements

Many thanks to staff of the Department of Conservation who over the years have helped build up a collection of photographs of mollymawk colonies on Campbell Island. Particular thanks go to Duncan Cunningham, Graeme Taylor and Chris Robertson who either found historical photographs or supplied their own. Some other individuals loaned us photographs to take prints from, e.g. Alan Guard, Peter Dilks, and the staff of the Alexander Turnbull Library kindly gave permission to publish the 1895 photograph from their collection. Thanks are also extended to Roger Moffat who did the ground work for setting up the twelve photopoints prior to Peter Moore's arrival on the island in 1987, and when employed both by DOC (1987/88) and the Meteorological Service (1989–1991), took many photographs of the colonies, including aerial shots. Other DOC staff have helped with the photograph monitoring programme since 1988, namely Jacinda Amey (1991–1993), Jim Henderson (1993–1994), Gary Mitchell (1994–1995) and Alan Wiltshire (1997), putting a lot of time and effort into getting good photographs and often printing them in the island's dark room. Meteorological staff occasionally took the Courrejolles photos, e.g. Mike Fraser (1 December 1991) and Scott Freeman (October 1992). Alastair McLean undertook the unenviable task of printing and counting from the photographs in 1993

and Ruth Oliver printed much of the backlog of photographs produced by 1997. Helpful comments on the manuscript were made by Ralph Powlesland, Peter Dilks and Alan Baker.

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