

Zealand waters, and that observations have been made in sub-Antarctic seas to the south of New Zealand; no dates were furnished. K. A. Hindwood (1940) states that the only definite record for New South Wales was of a bird collected in Port Jackson in 1931.

DISTRIBUTIONAL DATA: RANGE OF GREY-HEADED MOLLYMAWK

Month & Year	Position	Authority
April 1931	33° 51' S 151° 15' E	K. A. Hindwood (1940)
May 1955	32° 26' S 152° 35' E	Own Observation
September 1954	32° 53' S 151° 52' E	Ditto
*—	36° 10' S 175° 18' E	W. R. B. Oliver (1930)

*Position approximate but correct to 30'

SUMMARY

This paper constitutes a survey of *Diomedea* along the eastern coast of Australia, north of Sydney. The northern limits of the five species during the different months of the year have been emphasised by means of graphs and tables; the possible effect of the reputed breeding seasons on their northerly dispersal has been discussed, and comments have been made on some unusual occurrences within the area of review.

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THE WESTLAND PETREL

By R. JACKSON

During the three seasons 1954-56 I had the opportunity to study the Westland Petrel (*Procellaria westlandica*) in the colony at Barrytown, 22 miles north of Greymouth. This petrel (¹), closely related to *P. parkinsoni* and *P. aequinoctialis*, is peculiar in that it begins nesting in the autumn.

BREEDING CYCLE: In late March and early April the petrels return to the colony, occupy and clean out the burrows. The extent of this preliminary cleaning work may be gauged by the example of a burrow which was opened to gain access to the nest in 1955 and which was extended four feet in 1956. Another burrow was extended two feet in May, 1956. On 8/4/56 half the burrows could be recognised as occupied by the fresh soil at the mouth; and in many of them a single petrel or a pair could be found resting during the day.

Every evening during April many petrels noisily return. Throughout the night birds may be heard on the wing, and many, single or paired, wander about the colony. This activity reaches its peak in early May. At 8 p.m. on 5/6/56, two hours after dark, I saw copulation take place, and I now think I can interpret events which I noted on 30/4/55 as those of a similar night. Calls and cackling from across the valley and the cries of petrels in

the air were answered after a lapse of half a minute by the petrels about me. Occasionally calls were initiated by a pair in their excitement. On a small bench I found a pair sitting three yards apart and with the male slightly uphill. Their posture with heads down and neck outstretched caught my attention. The male cackled and the female joined in, squawking. When the noise had lasted for about a minute the pair relapsed into silence. Within another two minutes they had been stirred to further calling by the calls of neighbouring petrels. During 20 minutes the male moved gradually towards the female until he was one yard downhill. Then she ran forward, thrusting her body across his and her neck under his beak. For some minutes he searched among her neck feathers, as if looking for lice. My torch, which I switched on whenever they called or moved, disturbed them and they separated. Soon they had been stirred to call again, and now his call changed. It now began with a squawk, became a shrill shriek for two or three syllables and continued as an ecstatic cackle. He moved alongside her and began searching again among her neck feathers. He mounted, once or twice biting her neck feathers to gain a firm grip, and remained mounted for three minutes. After dismounting he went five yards away down a steep bank, sat down and remained quietly for half an hour. She remained quietly on the bench. Now they took no notice of the calls of the other petrels. She was not disturbed by my moving forward to within six inches of her. Ten minutes later she went and sat down two yards beyond her mate. He moved back, taking frequent spells, on to the bench near me and continued to wander uphill so that in 20 minutes he had passed from view, while she remained seven yards below me. Then she wandered away in the opposite direction and was lost too.

I looked for other pairs in the open and found one pair which retreated into a burrow, and many single birds sitting quietly or wandering about. In the burrows were many excited pairs, and overhead many petrels, single or paired, calling loudly. The ecstatic cackle came from all sides, and a similar call is common at all periods of excitement, particularly at the time of departure. On this basis I tentatively sex these petrels.

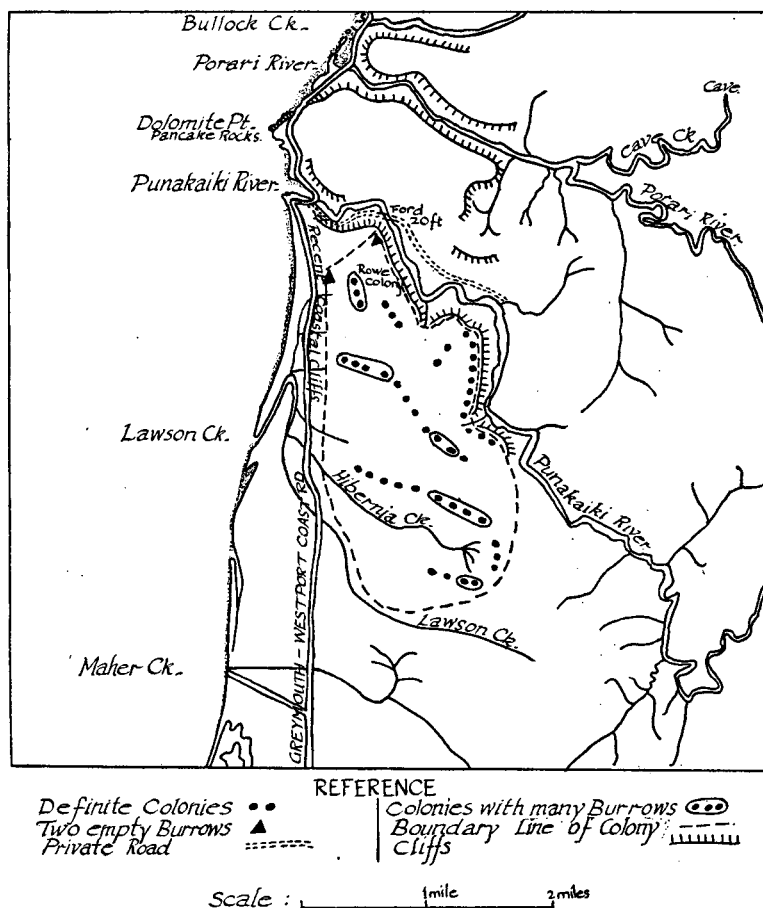
The single large egg is laid between late May and the end of June. After more than two months' incubation, the egg hatches between early August and mid-September. The chick is brooded for a fortnight; then for about three months it remains in the burrow alone by day before flying, usually in early December, though a few remain till the end of that month. By August and September the parents have worn tails and are less vigorous than in April.

HEALTH AND MORTALITY: Westland Petrels seem to be a healthy species. Skeletons and bones do not litter the breeding ground, as seems to be usual in most Westland colonies of Sooty Shearwaters (*P. griseus*). All the petrels are infested with *Halipeurus* lice and have occasional *Saemundssonina* lice, but these parasites seem to cause them no harm. In the nests are many beetles and some chernetine pseudo scorpions.

Mortality among the early chicks may be heavy. The earliest egg found, 25/5/56, was broken and out in the open, where it may have been pushed during further excavation of the burrow. The shell was still damp with egg-white, and there was no sign of the development of the allantois. An early-hatched chick found on 22/7/56 was left by its parents after being brooded a week instead of the usual fortnight, perhaps because the burrow had been disturbed by a human visitor. A week after it was abandoned I found the chick's legs, the remnant left by a rat or stoat. Penniket⁽²⁾ has found a high stoat density in the colony; rats also are common, but this is the only instance of predation I have met. A late chick found on the main road at 11 p.m. on 26/12/56 died two weeks later. It was put in the paddock over the fence. Next morning after a stormy night it had moved only a yard or two, so it was picked up and released in the muttonbird colony on the top of the cliffs at Twelve Mile in the hope that there it might get airborne.

After a week it had moved three yards and in another nine days had moved 25 yards diagonally downhill and across several muttonbird runways. It was dead. The whole fortnight had been stormy and the chick never strong. Five other deaths in my knowledge have been accidents; an adult trapped with its wing between three roots; an egg lost when the floor of its burrow collapsed into the burrow below; another egg lost from a flooded burrow, and two dead adults by the road. As discussed below, the population may have decreased slightly in recent years.

WESTLAND PETREL COLONY



HABITAT: The colony consists of sub-colonies of between 20 and 200 burrows, distributed over six square miles between the tops of the 300-foot limestone bluffs along the south bank of the Punakaiki River and a geologically Recent coastal cliff, separated from the sea by a coastal plain a quarter of a mile wide. Close to the sea the rock is a soft mudstone. Both mudstone and limestone support a luxuriant forest cover. The lowest levels are covered with a very dense growth of kie-kie, the middle levels with a

typical more open Westland forest of podocarps, kamahi and rata, and the highest levels with an open beech forest. Most of the petrels favour the Westland forest, where they are found on top of most slips and bluffs and under some. Some big sub-colonies are on the sides of wide, comparatively dry spurs. Those birds near no bluff have no difficulty in becoming airborne as they use the many creepers to climb sloping trees and so to launch themselves from near the treetops. The Barrytown colony of Westland Petrels is the only one known, and I am confident that no other exists between Westport and Paringa.

POPULATION: By counting returning birds in April, 1955, and later by estimating the number of sub-colonies in order to obtain an estimate of burrows and pairs, I judge the population to be between 3,000 adults and 3,000 pairs. During the last 80 years the colony may have decreased, for there are numerous unoccupied burrows. The burrows which are furthest downstream near the Punakaiki Road are now disused. On the next bluff there are no burrows. Further inland, one on each bluff, are most of the Punakaiki sub-colonies. In the Rowe colony, which is just inside the bush on top of a terrace north of Hibernia Creek, are 200 burrows with about 30 unused. During the three years I watched this colony it has declined rapidly, possibly as the petrels moved to other sub-colonies. On the spur up to the terrace and between the creek and the Recent coastal cliffs are more derelict burrows in cleared ground. It is likely that before clearing the petrels had burrows all along the tops of these coastal cliffs.

HISTORY: I was struck by the fact that the burrows on top of the limestone bluffs along the Punakaiki would have been in a more typical petrel site, almost overhanging the sea, if the sea were covering the wide flat valley floor below. Eighty years ago the western boundary of the colony may have been along the top of the Recent coastal cliffs; and 5,000 years ago, when there was a sea-level maximum, 20 feet above the present sea-level on the West Coast, as is known by carbon dating ⁽³⁾, the foot of these cliffs would have been 10 feet below sea-level. The sea would have extended up the Punakaiki nearly to the first ford and the foot of the bluffs where the lowest deserted burrows are. Furthermore, since the seaward boundary of the colony may now be retreating inland, the petrels at that time may have nested closer to the sea than they do now on the bluffs along the lower Punakaiki.

On this evidence it seems that the site of this colony may have been selected about the period of the sea-level maximum some 5,000 years ago; and the petrels have remained there since and expanded over the whole block between the Punakaiki River and the Recent coastal cliffs. Perhaps this is the period for *Procellaria westlandica* to have become specifically distinct.

LITERATURE

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- (³) Geological Survey, Greymouth, on open file.

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