

Supplementary Notes On the Diving Petrel.

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The present paper is supplementary to an earlier one on the Kuaka, or Diving Petrel (*Pelecanoides urinatrix* Gmelin) [1943 a, pp. 24-48, 97-107].* It covers the results of additional researches on Whero Island lasting a little over 14 weeks, undertaken from December 1, 1942, to January 26, 1943; from December 20, 1943, to January 3, 1944; and from January 13 to February 12, 1944. The total time that has now been spent on the island exceeds 35 weeks.

It will be noted that in 1942 I landed on December 1. As this date was prior to the hatching of several of the later chicks I was able to fill in a large gap in the life cycle of the chick. My earlier paper (p. 32) indicates that details given concerning the first week of life were largely assumption, which resulted in my over-estimating the age of the chick by three days.

Where it has been considered advisable, amplification of results previously published are included. For example, a further study of hatching dates demonstrates quite conclusively that the season 1941-42 was an early one for Diving Petrels. Three important aspects of the life history have been held over, however, for future consideration pending the acquisition of additional data. They are, the behaviour of what I call "unemployed" birds, the behaviour of young birds after they leave the nesting area for their first flight, and the subsequent matrimonial status of breeding pairs.

The procedure followed in this paper will be, as far as possible, the same as that in the earlier one. This will allow the reader, if he so desires, to follow more readily similar matter appearing in both papers.

THE PRE-LAYING PERIOD.

I have already announced (p. 24) that I had not found any evidence of the presence of Kuakas on the breeding grounds in the off season, but that the Maoris suspected that they had heard them. While on Herekopare during May, 1943, I discovered on the 9th a set of Kuaka wings joined by the breast bone, all that was left by a marauding cat the night before. The plumage was in beautiful condition, and the bird had undergone a moult since the previous season. During my six days' stay no more remains were found, although there were plenty that belonged to the Parara (*Pachyptila vittata*). The evidence would seem to indicate

* As I shall be frequently referring to my 1943 a paper, only the page number, in parentheses—e.g., (p. 32), will be given.

that the main body of Kuakas during the winter are sometimes within flying distance of their breeding grounds and that occasionally some make land.

Bright moonlight seems to affect the activities of the Kuakas at the pre-laying stage, at least, on the surface of the ground. In August, 1941, when on Herekopare, I had no trouble in catching 100 birds in three nights (p. 25). On August 26 and 27, 1942, with a bright moon shining, two of us, after considerable effort, caught a total of only 40 birds. At that time many were calling from the burrows. On the 28th the moon did not rise till 9 p.m., resulting in a considerable number being caught. The following night Kuakas were again plentiful, so that it is evident that, on the first two nights, the moon had been deterring normal surface activity so prevalent at this time of the year.

During the August visit of 1942, no eggs were found. In several burrows, however, both sexes were discovered in the daytime, and the dirty beak of each bird indicated that both had been digging. Further, there were other burrows containing a single bird.

Additional evidence is now available that Kuakas remain in their own particular part of the island. Of 31 pairs of birds which, to my knowledge, over three consecutive seasons, have shifted their nesting sites from one season to the next, the greatest distance moved was 31 feet, and the shortest only 18 inches. The average works out at 9 feet 6 inches, with nine cases under 5 feet, ten between 5 and under 10 feet, and six between 10 and under 15 feet, with only 6 between 15 and 31 feet. Further, on several occasions, at night I have picked up the same bird on the surface and always close to the same spot each time.

There is a tendency for pairs to remain together in subsequent seasons, but owing to their shifting propensities it is difficult to recover them from season to season. Some pairs have been found again after having been lost for one and even two seasons.

INCUBATION AND EGGS.

I can offer little further information concerning the duration of the incubation, and still believe as already stated (p. 29), that it is eight weeks. In 1943, I watched one nest from December 1 to 29 before the chick hatched. This sets a definite minimum period of 28 days. During the whole of this time I erected a palisade of sticks across the burrow entrance each day and regularly each night it was knocked down, indicating that a bird had entered the burrow. On the majority of days I felt the egg, but did not attempt to check up the ring of the bird for fear of desertion. This fact and information given in my earlier paper (p. 31) seems to make it safe to conclude that the Diving Petrel changes guard daily during the incubation period.

In 1942-43, it was noted that 60 eggs produced chicks, 7 were added, while 2 were deserted when found. This means that just over 10% of the eggs incubated failed to hatch, which seems rather a high percentage. In 1943-44, I did not arrive till December 20. Sixty-eight nests were discovered containing chicks, and there was

not a single infertile egg. There were, however, five deserted eggs in burrows visited for the first time, and it was not possible to say whether these had been fertile or not.

TABLE I.
Measurements and Weights of Kuaka Eggs on Whero Island.

Feature	Number.	Mean.	6	PE _m	Range.
Length in mm.	39	37.68	1.74	.18	34½ to 42
Depth in mm.	39	29.42	.99	.1	27½ to 31½
Weight in gms.	27	14.9	1.76	.23	11 to 18½

The above represents the total number of eggs I was able to measure since 1938-39, as I was averse to interfering with eggs under incubating birds. Most of them were added or found deserted, factors which must be considered in evaluating the weight figures. Eggs showing the extreme measurements, with one weight in parenthesis, are as follows: 42 x 29½, 34½ x 27½ (13½), 35 x 27½, 39 x 31½. In case it is thought I have confused the longest egg with that of a Titi Wainui (*Pachyptila turtur*) I point out that this was an added egg taken from underneath an incubating Kuaka in 1940-41. For the convenience of the reader for comparison purposes, statistics of eggs of the Titi Wainui are added below. These have already been published (1944 c, p. 36). It will be seen that there is an overlap between the two species.

TABLE II.
Measurements and Weights of Titi Wainui (*P. turtur*) Eggs on Whero Island.

Feature	Number.	Mean.	6	PE _m	Range.
Length in mm.	100	45.12	1.61	.11	40½ to 48½
Width in mm.	100	32.64	.99	.06	29 to 34½
Weight in gms.	56	24.2	2.61	.24	18½ to 29½

HATCHING.

It would appear that a chick, once it has chipped the shell, takes at least three days to emerge. At noon, on December 6, I found an egg for the first time, and it was only slightly chipped. Next day at 4 p.m. there seemed to be no further progress, but I could hear the chick tapping inside. At 2 p.m. on December 8 there was still no hole, but at 3 p.m. on the 9th a big hole was present and the point of the chick's beak was plainly visible. At noon on December 10 the chick was out and quite dry. The egg-shell, still containing the wet cord and afterbirth, had been removed from the nest. I should say the chick hatched late on the night of December 9, the whole process therefore occupying 3½ days.

In my earlier paper (p. 33) I have noted that ages of chicks given after a certain point have been over-estimated by three days.

These remarks, however, do not refer to the figures which are correctly titled. Below is given a revised table of data for estimating the age of a Kuaka chick from information gleaned from five chicks that were carefully watched from the time the eggs were chipping.

TABLE III.
Data for Estimating Age of Kuaka Chicks.

in Days. Age	Remarks	
5th	A white ring appears at base of protoptyle along back.	
6th	Mesoptyle first appears as white tips, along back.	
7th	Dark tips of mesoptyle now plainly visible along back.	
8th	Mesoptyle visible along posterior edge of forearm.	
10th	Mesoptyle now visible on hand.	
19th		$\frac{1}{2}$ mm. long
21st	Quills of longest primary.	3 mm. long
25th		9 mm. long
26th	Tail quills just appear.	
29th	Quills of longest primary.	20 mm. long
33rd		30 mm. long
40th	Tips of primaries, secondaries, and tail showing nicely through down of body.	

In the light of amended observations, Table VII of my last paper (p. 34) has been corrected in the table below. In addition, data collected for two further seasons have been added. It will be observed that the season 1941-42 was definitely early, and that the other three must be considered normal ones. The peak laying span of 19 days lies between November 22 and December 11 for normal seasons, but in 1941-42 it was between November 17 and December 6. The additional evidence, indicating that the span of egg-laying for Kuakas varies from 40 to 52 days over-rules my original statement (p. 34) that egg-laying is not very protracted.

For petrels such a span of 40 to 52 days ought to be considered as protracted. With Storm Petrels (*Pelagodroma marina maoriana*) it is also prolonged, for eggs appear over a lengthy period of at least 41 days (1943 b, p. 107). In the Parara and Titi Wainui it is much shorter, lasting about 21 days (1944 a, p. 210 and 1944 c, p. 37). In the Mutton-bird (*Puffinus griseus*) from my latest unpublished evidence covering 59 eggs in 1943-44 it appears to be only 18 days. For the Royal Albatross (*Diomedea epomophora sandfordi*), within my experience over eight seasons the range is 13 days (1942, p. 171; 1944 d, p. 99). Dr. R. A. Falla tells me that he believes that in the more sub-antarctic petrels this range is even shorter still.

TABLE IV.
Hatching Dates of Chicks Placed in Class Intervals of Five Days.

Dates of Class Intervals.	Number of Hatchings.				Total.
	1940-41	1941-42	1942-43	1943-44	
Nov. 7 to 11		3			3
Nov. 12 to 16		3		2	5
Nov. 17 to 21	2	15	3	4	24
Nov. 22 to 26	5	9	9	15	38
Nov. 27 to Dec. 1	11	6	21	24	62
Dec. 2 to 6	10	9	10	5	34
Dec. 7 to 11	3	0	9	9	21
Dec. 12 to 16	3	1	3	3	10
Dec. 17 to 21	1	1	2	3	7
Dec. 22 to 26	1	1	0	2	4
Dec. 27 to Jan. 1	1		3	0	4
Jan. 2 to 6				1	1
Total	37	48	60	68	213
Range of laying in days	40	45	42	52*	59
Range of laying	Nov. 17 to Dec. 27	Nov. 7 to Dec. 22	Nov. 20 to Dec. 31	Nov. 14 to Jan. 5	Nov. 7 to Jan. 5

* Range is prolonged by one chick, which hatched 14 days after the last of the other 67.

THE CHICK.

As already stated, in 1942 I arrived on the island on December 1 before many of the chicks hatched, and was therefore able to work out more accurately the early part of their life. Table 4 indicates that 27 of the 60 chicks under observation emerged after December 1.

When hatched the little chick is bright-eyed, though in the early stages it frequently keeps the lids closed. Being very inert, it offers no resistance to handling, nor does it squeak.

Shortly after leaving the shell the chick weighs about 13 grams, and some time during the next 12 hours it is fed, when its weight may rise to over 15 grams. Two examples will illustrate these remarks better. At 8.30 a.m. on December 5 the chick at 28y nest was just out of the shell, for it was very wet. It weighed $12\frac{1}{2}$ grams. At 8 p.m. it was thoroughly dry and weighed 14 grams, hence it had been fed. At another nest, 1bE, at 2 p.m. on December 6, the chick was almost dry, so had been hatched that morning. I did not weigh it then, but six hours later it was 15 grams, and must have been fed. Of the five chicks being weighed, this weight of 15 grams was the heaviest of all at this stage, yet chick 1bE was the smallest of all five. For example, on the morning when 24 days old it weighed 61 grams. The others were 94, 87, 91 and 85 grams respectively.

From hatching Kuaka chicks receive a meal every night, even though they may be fed in the daytime. For instance, the above two chicks which were fed during the day advanced on their first night from 14 to $16\frac{1}{2}$ and from 15 to $18\frac{1}{2}$ grams respectively.

Probably because young chicks are fed nightly and almost immediately the incoming parent arrives, feeding in the day time is not very prevalent. Of 5 chicks that were checked up for the first 10 days there were 19 occasions on which they received a day time supply, i.e., as well as feeding them the night before the parent in charge was able to nourish the chicks again the following day.

As the chick gets older it may be compelled to fast for an occasional single night, but this is a rare occurrence (p. 98). Table 5 indicates this phenomenon quite clearly. The figure 10.5% concerns chick 53, which was weighed only during its last 19 days ashore, when it remained unfed on its last two nights. It seems obvious from other data given in the table, that this proportion is greater than the true value, had the chick been weighed for its full period ashore. Chick 27R, for instance, which was weighed every night when ashore, did not miss a meal till its 42nd night, and in the last week missed the unusual number of three nights. Five additional chicks did not miss a meal at all, and four others missed only one when I was weighing them. The average number of nights, covering the 11 chicks, when no feeding occurred was 2.75.

TABLE V.
Data Relative to the Times 11 Kuaka Chicks Were Not Fed.

Chick.	Times weighed.	Times not fed.	Nights when not fed.	Percentage of nights not fed.
5m	34	1	25th last	3
14	29	0		0
35	32	0		0
40	32	1	9th last	3.1
49	34	1	Last	3
50	29	0		0
53	19	2	Last two	10.5
58	30	0		0
17R	14	0		0
27R	48	3	7th last, 3rd last, last	6.25
97R	22	1	11th last	4.5

I have already noted the death of a young chick left uncovered by its parent (p. 35). At another nest a 6-day old chick, in good health at 9 p.m. was, in the morning, found dead, having been scraped out of the nest. This is in great contrast to the fate of a Storm Petrel chick similarly treated (1944 b, p. 346). Events panned out quite differently at a further Kuaka nest. On December 9, at 10 a.m., a chick had not been long hatched, but its down was dry and it weighed 10½ grams. At 9 a.m. next day it had been scraped out of the nest and appeared dead. With the warmth of my hand it revived and was replaced in the burrow that night. As this burrow was situated in a sheltered part of the island, it seems that chicks can stand a certain amount of exposure.

In 1942-43 a more exhaustive study was made on the presence of the adult with the chick during the day time. In all, 27 chicks were under observation, but only 19 of these were watched from the day of hatching, while one of the latter died on the 7th day.

TABLE VI.

Number of Chicks Guarded by Parents Before Being Left Alone in the Daytime for the First Time.

Age of Chick in days.	Number of Chicks guarded by parent.	Age of Chick in days.	Number of Chicks guarded by parent.
1st	18	9th	15
2nd	18	10th	13
3rd	18	11th	12
4th	18	12th	7
5th	18	13th	4
6th	18	14th	1
7th	18	15th	0
8th	17		

From the foregoing table it will be seen that for the first seven days all 18 chicks were attended by parents for the whole 24 hours. Then gradually the chicks were left alone for the first time, until on the 15th day the last was left to itself in the day time. This means that one chick was guarded for 14 consecutive days, and it had a parent with it again on the 22nd day, which was four days beyond the next longest.

Once a chick was abandoned for the first time this did not mean that a parent was not again with its offspring during the day. Eight chicks were not again guarded, 12 were for one day only, 6 for two days, while one was guarded for three more separate days broken by unguarded days. This last chick, was left alone on the 8th, 10th, 12th, 13th, 14th and 16th before being finally deserted during the day.

TABLE VII.

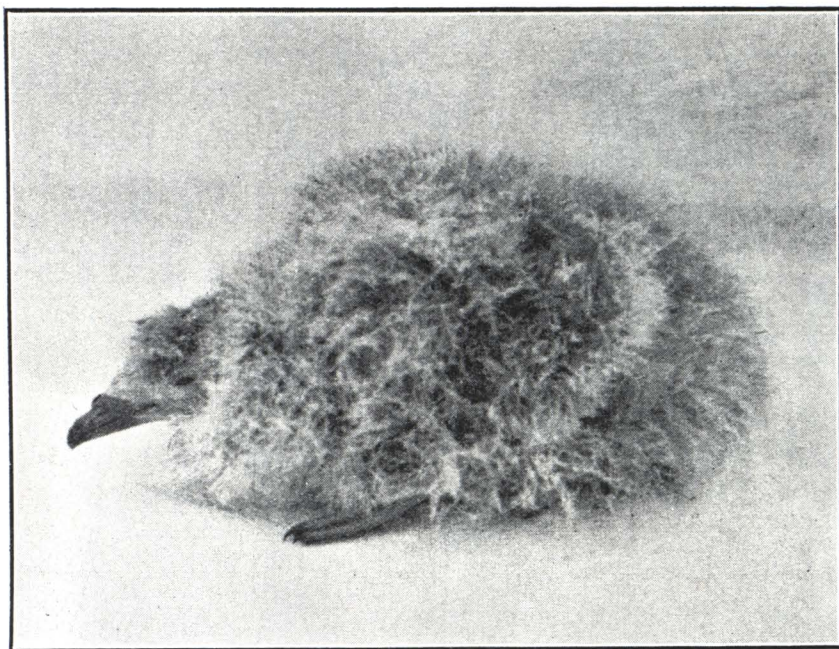
Data Relative to the Turns taken by the Parents in Guarding the Chicks during the Day Time.

Nest.	Day.														
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
1bE	R	L	R	L	R	L	R	—	R	—	R	—	—	—	R
100R	L	R	L	R	L	R	L	R	L	R	L	R	—	R	
80	L	R	L	R	L	R	L	R	L	R	L	—	L		
4R	L	R	L	R	L	R	L	R	L	R	L	R	L		
66	L	R	L	R	L	R	L	—	L						
28y	L	R	L	R	L	R	chick died.								
3bNW					R	L	R	L	R	L	—	L			
6m											R	L	—	L	
73R										L	—	L	—	L	

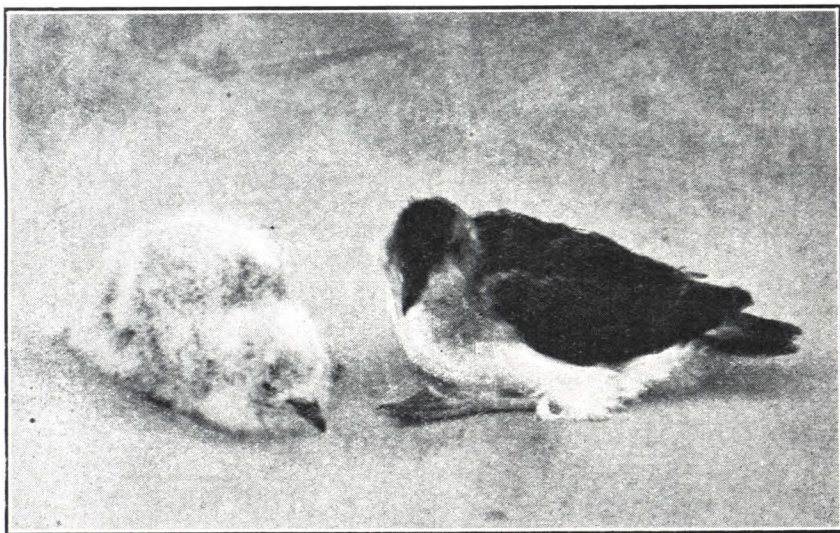
R means ring on right leg.

L means ring on left leg.

The above table indicates the behaviour of each parent after the chick has been hatched and deals with those nests where I actually identified the parent in charge. It was not necessary to extract the adult every time to read the ring, for each was ringed on opposite legs so that I could identify the bird by feel only. The



Chick 32 days old. The white primary down is still adhering to the more prominent dark secondary down.



Chicks 14 and 50 days old. In the first the dark secondary down is just visible through the white primary. In the second, the chick is fully-fledged.

first point to notice is that the birds regularly took turn about in guarding the chicks during the day time. Next, if a bird missed a turn, that did not upset the routine of the second bird, which took its turn on the correct day just as if nothing had happened. In this connection the behaviour at nest 1bE of bird R (No. 62) is most interesting. It returned twice after its mate had ceased attending the chick, each time in its proper order. Then No. 62 missed a turn, making three consecutive days when the chick was left unattended before No. 62 once more stayed with it on a routine day. This amply demonstrates the rigidity of routine behaviour.

TABLE VIII.
Age when Egg Tooth was lost in 30 Chicks.

Age in days	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th
No. of chicks	3	6	3	4	3	1	4	2	2	2

The egg tooth gradually wears smaller and smaller and finally the remnant falls off. The average is almost $13\frac{1}{2}$ days, and the range varies from the 10th to the 19th day.

At first the parent keeps the chick completely covered, but after the 10th day the adult may be found lying alongside the chick. The infant is now quite large, and will weigh about 30 grams.

In 1942-43, and again in 1943-44, as in previous seasons, mortality among the chicks was not very high. Where they nest in the Mutton-bird area there is always a risk of being scraped out. On December 18, a dead chick weighing 55 grams and about 16 days old was found on the surface, having been ejected by a Mutton-bird. At 11.30 p.m., on December 27, hearing the continuous call of another chick, I discovered it pushed into a corner and almost entirely covered with dirt. An unemployed Mutton-bird was hard at work excavating a new burrow. At 11 p.m. next evening there was no sign of the Kuaka chick, but two Mutton-birds were comfortably installed inside. Three days later, however, the chick was again back in its burrow, having successfully weathered the storm.

TABLE IX.

A Comparison of the Bill Measurements of Fully-fledged Chicks with Parents, 50 of each sex, all taken on Whero.

Feature.	Number.	Mean.	6	PE _m	Range.
		mm.	mm.		mm.
Adult					
Length	100	16.58	.66	.044	15 to $18\frac{1}{2}$
Width	100	7.75	.46	.031	7 to $8\frac{1}{2}$
Depth	100	7.00	.49	.033	6 to 8
Chick					
Length	62	16.01	.55	.046	15 to $17\frac{1}{2}$
Width	56	7.68	.29	.025	7 to $8\frac{1}{2}$
Depth	56	6.6	.44	.04	$5\frac{1}{2}$ to $7\frac{1}{2}$

Difference:

Length	.57	± .062
Width	.07	± .040
Depth	.40	± .051

When studying the above table, before allowing that a difference between means is significant, I have followed the ruling that it must be at least four times the value of the probable error of the differences. Applying this rule, the difference in length and depth of bill is significant, and is supported when a perusal of the range of measurements in both adults and chicks is made. The width of the bill is not significant. In life it is noticeable that the bill of the chick is slightly smaller, and that the hook at the end of the upper bill of the adult is far better defined, is sharper, and projects beyond the end of the lower bill in most cases. It is evident, therefore, that the bill of the chick does not reach adult size till after it has left the burrow.

TABLE X.
Departure Dates of Chicks Placed in Class Intervals of Five Days.

Dates of Class Intervals.	1940-41	1941-42	1942-43	1943-44	Total.
Jan. 2 to 6		4			4
Jan. 7 to 11		9			9
Jan. 12 to 16	4	14	6	7	31
Jan. 17 to 21	7	7	18	16	48
Jan. 22 to 26	12	7	14	20	53
Jan. 27 to 31	5	2	10	9	26
Feb. 1 to 5	3		5	7	15
Feb. 6 to 10	1	1	3	3	8
Feb. 11 to 15			2	4	6
Feb. 16 to 20	1	1		1	3
Feb. 21 to 25			2		2
Feb. 26 to Mar. 2				1	1
Totals	33	45	60	68	206
Range of Departures	Jan. 12 to Feb. 17	Jan. 2 to Feb. 17	Jan. 13 to Feb. 23	Jan. 13 to Feb. 28	
Range in days	36	46	41	46	
My departure from island	Jan. 31	Mar. 14	Jan. 26	Feb. 12	

The above table gives the departure dates of 206 chicks for four consecutive seasons. Actual dates of departure were estimated in a few cases, occurring after I left the island, whereas in one or two others death intervened. These estimated dates were worked out from the average time ashore (54 days) with the knowledge that the 5-day span used would reduce the margin of error. The time of my leaving the island is given so that the reader will be able to make any corrections he may deem necessary.

It will be noted that the season 1941-42 was definitely an early one. For the three normal seasons, the departure date of the first chick each year is remarkably uniform. The range of departure in 1940-41 is much less than in the others, but I was working with fewer chicks and, furthermore, this was my first season, when all burrows were quite new to me.

My earlier estimation of 57 days (p. 45) as the average time chicks remain in the burrow needs revision. During the 1942-43 and 1943-44 seasons the actual hatching and departure dates of

58 chicks were known. The average worked out at 54.26 days, and the range from 47 to 59 days. Another way to arrive at the average time ashore, when large numbers are available, is to find the difference between the peak hatching date and the peak departure date. My information, however, is in intervals of five days. The difference between November 27, the peak hatching date given in table 4, and January 22 the peak departure date given in table 10 is 56 days. It will be noted that 79 chicks departed in the two intervals prior to January 22, whereas only 41 set out in the two intervals after that date. This will have the tendency to bring the figure nearer that worked out arithmetically.

THE ADULTS.

As already stated (p. 98), I have always admired the Kuaka's ability to land so closely to the mouth of his burrow, and should like to add another example. On December 22, 1942, in clear full moonlight, while I was ringing a bird at 11.45 p.m. just outside its burrow, the second bird landed straight from the sea only nine inches from the burrow mouth, which it entered almost before I realised what had happened. This is indeed amazing accuracy.

Fifteen minutes earlier, while I was standing near another burrow, a Kuaka flew through a small gap in the Tete-a-weka (*Olearia angustifolia*) shrubs and, landing four feet from the burrow, it scuttled inside immediately. It is difficult to imagine how it managed to find that gap when everything must have looked black. Five days later this same bird again landed four feet from the nest, but on this occasion it approached in the opposite direction and had to fly across the island. In the first instance it had flown through the gap from the sea. Here is evidence that the birds do not always arrive from the same direction, and therefore do not rely on the same landmarks each time.

In my last paper (p. 99) I have noted that Kuakas were frequently observed round the island on windy days during 1940-41, but were practically non-existent in 1941-42. In 1942-43 they were seen again. Prior to December 9, only odd ones were noticed, but, on that day, when a heavy south-west wind was blowing, they were present in many hundreds, remaining numerous until December 11. A great reduction in numbers was noted for the next six days. From December 18 to 27 only odd ones were seen, but after that till January 26 not one was noted. During this latter period the weather was exceptionally fair, but prior to that a stormy patch with strong winds and heavy rain was experienced.

In the third season a breeding bird was found with the leg missing below the knee. At different times several have been noted with large swellings, often larger than a garden pea, on the webs and toes. Occasionally some of the webs have been split. Apart from these I have seen very little evidence of malformation.

In making out the table no bird, to my knowledge, is counted twice. For example, "Adults ringed" in 1942-43 are exclusive of those counted in the two previous seasons, and those noted for

TABLE XI.
Population Statistics of Kuakas on Whero, 1940-41 to 1943-44.

Type of Bird.	1940-41	1941-42	1942-43	1943-44	Total.
Adults ringed	59	89	99	37	284
Parents not ringed	27	23	14	24	88
Unringed parents of stray chicks ..	8	8	6	22	44
* Less already marked		-8			-8
Totals	94	112	119	83	408

* See 1943 a, table XXIV, p. 103.

1941-42 are not included in 1940-41. Actually 284 adult Kuakas have been ringed on the island in four successive seasons. Of the remaining 124 birds noted it is just possible that one or two may have been counted twice. These figures, I think, support my earlier contention (p. 103) that there are at least 400 Kaukas on Whero. Some idea of the chick population in all four seasons may be gained from table 10. Finally, eight birds ringed as chicks have been recovered in a subsequent season and are not included in table 11. These must now be counted as adults.

It will be observed that in 1943-44 the number of unringed adults found had dropped suddenly. This is particularly true of "adults ringed." My search of the island, as shown by the greater number of chicks found (table 10), was as intense as ever. It is apparent that the law of diminishing returns is beginning to assert itself, and I am finding it increasingly difficult to discover unringed adults.

TABLE XII.
Adult Population known to be present each Season from 1940-41 to 1943-44.

1940-41	1941-42	1942-43	1943-44
94	124	183	177

In making out the above table direct and indirect evidence was used. The majority of birds were actually ringed. The indirect evidence is gathered from parents not ringed and parents of stray chicks. The greater number of birds found in the last two seasons is due to my improved technique in locating and handling the birds. The total for 1942-43, which includes recoveries of chicks from an earlier season, is compiled of records from 84 burrows. Sixty of these produced a chick, 7 contained an addled egg which was still being incubated, 2 held a deserted egg, and 14 burrows sheltered either one or a pair of unemployed birds. The balance of the total was made up by birds caught on the surface and whose burrows were unknown. In 1943-44 the total number of burrows was 82. Sixty-eight of these produced a chick, none contained infertile eggs, 5 held deserted eggs, whereas 9 sheltered unemployed birds.

ACKNOWLEDGMENTS.

Once again I should like to thank Professor B. J. Marples, of the University of Otago, for having read and constructively criticised the manuscript of another of my papers. Further, I take this opportunity to place on record my debt to the Royal Society of New Zealand, whose liberal grants from the Hutton Fund have greatly assisted in carrying out my researches on the island of Whero. These remarks apply not only to the species involved in this paper, but also to four other species of petrels, observations on which have already been published.

LITERATURE CITED.

- RICHDALE, L. E., 1942. Supplementary Notes on the Royal Albatross. *Emu*, vol. xli, pp. 169-264.
- 1943 a. Kuaka or Diving Petrel, *Pelecanoides urinatrix* (Gmelin). *Emu*, vol. xliii, pp. 24-48, and pp. 97-107.
- 1943 b. The White-faced Storm Petrel, *Pelagodroma marina maoriana* (Mathews), Pt. I. *Trans. N.Z. Inst.*, vol. lxxiii, pp. 97-115.
- 1944 a. The Parara or Broad-billed Prion, *Pachyptila vittata* (Gmelin). *Emu*, vol. xliiii, pp. 191-217.
- 1944 b. The White-faced Storm Petrel, *Pelagodroma marina maoriana* (Mathews), Pt. III. *Trans. N.Z. Inst.*, vol. lxxiv, pp. 335-350.
- 1944 c. The Titi Wainui or Fairy Prion, *Pachyptila turtur* (Kuhl), Pt. I. *Trans. N.Z. Inst.*, vol. lxxiv, pp. 32-48.
- 1944 d. The Sooty Shearwater in New Zealand. *Condor*, vol. lxvi, pp. 93-107.